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Preferred Route Design Development Report

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MetroLink

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Contents

Executive Summary

The NTA/TII commissioned Arup Consulting Engineers to undertake a Route Alignment Options Study for the MetroLink scheme in 2016. The objective of the study was to carry out a route option selection process to identify an Emerging Preferred Route (EPR). The study was completed at the end of February 2018 and it included a Concept Design for the EPR.

Subsequently, in January 2018, the NTA/TII commissioned Jacobs and Idom JV (Jacobs/Idom) to provide ongoing engineering design services to develop the scheme from concept stage, through Preliminary design, preparation of documents for a Railway Order submission including environmental appraisal of the scheme and subsequent support through to scheme completion.

A programme of public consultation led by the NTA/TII was conducted between 22nd March and 11th May 2018, during which members of the public and other stakeholders were invited to submit their views and observations of the EPR. Many submissions were made during this process, including suggestions for alterations to the scheme or expressing concerns about different aspects.

The NTA/TII and Jacobs/Idom have carefully considered the many statements and submissions made from the stakeholders along with other proposed route developments and a multi-discipline analysis of these has fed into the developing preliminary design and defined the revised Preferred Route. This process has resulted in several significant route developments and changes to proposed construction methods, as well as more defined proposals for works at particular locations. Due to the number and scale of change, a further round of Public Consultation has been arranged to enable further stakeholder input to the developing proposals.

This report and supporting appendices present the changes leading to the current Preferred Route and identifies the next steps following this current consultation.

1. Introduction

1.1 Background

The National Transport Authority (NTA) and Transport Infrastructure Ireland (TII) are promoting MetroLink as part of an integrated transport solution to satisfy current and future travel demand in the Greater Dublin Area (GDA). MetroLink will serve a fast-developing transport corridor encompassing Fingal and Dublin Airport and it will deliver a high speed and high capacity underground railway system linking Swords and Dublin Airport to the city centre.

MetroLink and other major transport initiatives including DART Expansion and Bus Connects projects are included in the GDA Transport Strategy 2016 – 2035 as well as the Government's Project Ireland 2040 planning document. MetroLink will provide interchange with Irish Rail (IÉ) and DART services, as well as Luas and Dublin Bus services.

1.2 The Benefits of MetroLink

There will be many benefits of the MetroLink project which will support the future development and growth of Dublin's capital city.

- It will greatly enhance public transport capacity and accessibility to the city centre and the surrounding corridor for commuters, businesses, retail, education, tourism and the overall sustainability of the city;
- There will be an improvement for domestic and international travel connections provided by access to and from Dublin airport and through the national rail and road network;
- There will be decreased road traffic congestion on journeys to and from the Airport and crossing the city from North to South. MetroLink will include a park and ride for 3,000 vehicles at Estuary, Swords;
- There will be faster journey times with high frequency and high reliability MetroLink services between Swords, the airport and the city centre, with connection towards Sandyford through increased LUAS services or future upgrade to Metro;
- There will be a more integrated and improved quality of interchanges with Luas, DART, Irish Rail and bus transport hubs across the city with more direct journey opportunities;
- MetroLink can enhance social inclusion, providing new links from urban areas of Dublin to jobs and services in the city and across the suburbs;
- The project will support both the regeneration of existing areas and the development of new areas;
- It will generate employment during construction and operation and will support economic growth once operational; and
- The metro system will support the environment by promoting a modal shift from car to public transport. This will help reduce emissions and energy consumption in addition to improving air quality and reducing road congestion.

As with all projects of the scale of MetroLink, there are issues and challenges that need to be addressed including:

- **Property Acquisition** - NTA and TII are committed to ensuring that acquisitions are managed in a fair and equitable manner and will help affected parties.

- **Scheme Traffic Management** - a scheme traffic management plan will be developed to achieve regular engagement with affected stakeholders and the communication of planned works will be ensured.

- **Noise, Vibration and Ground Settlement** - NTA and TII appreciate the concerns that residents, businesses and other stakeholders may have and shall prepare an Environmental Impact Assessment Report (EIAR).

- **Materials and Recycling** - construction works will generate significant volumes of soil, stone and waste materials and effective waste management will be managed through a Construction and Demolition Waste Plan contained in the EIAR.

- **Cultural Heritage** – the project has the potential to impact sites of archaeological and architectural heritage significance and this risk will be managed through the EIAR process including adherence to the Code of Practice with the Department of Arts, Heritage and the Gaeltacht.

1.3 The Emerging Preferred Route (EPR)

The NTA/TII commissioned Route Alignment and Tunnel Configuration studies in 2017 that helped to develop an Emerging Preferred Route (EPR) for MetroLink. This was designed as an entirely segregated system so that it could reliably deliver high frequencies and speeds unimpeded by road traffic and pedestrian junctions.

The EPR commenced at Estuary Station (the location for a proposed 3,000 car spaces park and ride site) and ran west of the R132 initially at surface level. Approaching Swords, the EPR rose onto an elevated structure located in the centre of the R132 dual carriageway to pass over Estuary, Seatown, Malahide and Pinnock Hill roundabouts, with stations located at Seatown and Swords Central. The route then returned to existing ground level approaching Fosterstown Station, before passing beneath the R132, rising briefly to surface level before then going underground in tunnel just north of Dublin Airport. The EPR then continued southwards in tunnel, passing beneath Dublin Airport, the M50 and on to the city centre, with the tunnel ending at a new station at Charlemont. Intermediate underground stations were included at Dublin airport, key interchange locations such as Glasnevin and Tara Street and other locations where demand for access to the metro was expected. From the proposed Charlemont Station the route rose again to connect to the existing Luas Green Line near Ranelagh to enable through running of Metro services to Sandyford.

In March 2018 a Public Consultation was held so that the public and other stakeholders could have the opportunity to make comment and submit their ideas and concerns on the Emerging Preferred Route (EPR) at that time. Almost 8000 submissions were received including those expressing support for the scheme, but around 67% related to concerns about the use of lands at CLG Na Fianna, Glasnevin. Other concerns related to the construction impact at Our Lady of Victories Church and School, as well as the proposed closure of Dunville Avenue and potential segregation issues arising from the Green Line upgrade. This latter issue continued to be a matter of debate, which included discussion on the likely closure period of the Green Line during construction.

1.4 Development of Preferred Route

Separately, in January 2018, the NTA/TII commissioned Jacobs/Idom to provide ongoing engineering design services to support and develop the EPR through to scheme completion. This includes further developing the EPR scheme to Preliminary Design, preparation of an Environmental Impact Assessment Report and progression of the scheme to obtain a Railway Order, allowing construction to begin.

The MetroLink design and planning team has reviewed the EPR proposals and taken account of the consultation submissions. Several important changes have been proposed to the EPR leading to the current Preferred Route and type of metro operation, which is the subject of a second round of Public Consultation events to be held in Spring 2019.

This report provides an update on the Preferred Route design development, highlighting changes from the previous EPR and providing explanation of the changes proposed. It provides a summary of the earlier EPR route and consultation before describing the proposed changes and further development of the route.

The Preferred Route now developed retains the earlier EPR Corridor. Key design developments to-date incorporated and described in this document include:

- A proposed single-bore tunnel configuration;
- A different tunnel construction proposal, with two separate tunnels proposed, one under the airport and one driven southward from Northwood into the city;
- Relocation of the Depot from Estuary to Dardistown;
- Automatic Train Operation (ATO) – making it possible to run a high frequency train service using shorter trains and platforms while still delivering the required passenger capacity;
- A revised alignment alongside the R132 in cutting, rather than on elevated structures with some associated changes to station locations;
- Removal of the proposed upgrade of the LUAS Green Line to metro standard from the present scheme, with Charlemont Station proposed as the present Metro terminus in the city; and
- The potential relocation of O'Connell Street Station (off O'Connell Street) with an associated short alignment change and changes to other station layouts.

Ongoing development of the Preferred Route will consider further suggestions and comments arising from this second round of public consultation.

In the development of this report and supporting appendices, due cognisance has been taken of the requirements of the European Union's EIA Directive (85/337/EEC) to the extent of the information available at this time.

2. The Emerging Preferred Route (EPR)

2.1 EPR Development

The EPR route was established through the completion of three specific studies:

- **Alignment Options Study** to determine the optimum route for MetroLink. A total of thirty-four feasible routes were identified over the length of the corridor from Swords to the city centre. A single option was identified as the Emerging Preferred Route.

- **Green Line Tie-in Study** to establish the optimum location to join MetroLink to the existing Luas Green Line. The study identified ten possible tie-in locations on the existing Green Line between St. Stephen's Green and Milltown and the preferred tie-in location was identified as immediately south of the Charlemont Luas Station.

- **Green Line Metro Upgrade Study** proposed several modifications and enhancements including changes to existing road junctions, vehicular and pedestrian access across the Luas Line and Luas stops.

Interchange with commuter rail services at Tara Station and Glasnevin Station was proposed and the route also linked with Luas and key bus routes and the future Bus Connects project. A park and ride facility for 3,000 cars at Estuary was included to allow for commuters to leave their cars and use the metro service to access the city, reducing overall road congestion.

2.2 Description of the EPR

The EPR for MetroLink commenced at Estuary Station which was located immediately north of Swords. This was also the location for the proposed 3,000 park and ride car spaces. From Estuary the route proceeded south on lands adjacent to the western boundary of the R132, rising onto an elevated structure which passes over Estuary and Seatown, Malahide and Pinnock Hill roundabouts, with stations located at Seatown and Swords Central. The route returned to existing ground level immediately south of the Pinnock Hill roundabout and travelled east of the R132 by Fosterstown Station.

From Fosterstown Station the route entered a short tunnel beneath the R132, rising to travel at surface level on lands adjacent to the western boundary of Swords Road until it went underground immediately north of Dublin Airport.

The route, now in tunnel, passed beneath Dublin Airport where an underground station was proposed at the designated ground transportation hub. Continuing south, a possible future station at Dardistown was included before the route passed in tunnel beneath the M50 motorway to a station at Gulliver's Retail Park.

The route continued southwards in tunnel beneath the R108 to Ballymun Station, which was located just south of the junction with Shangan Road. From Ballymun Station the route continued to Collins Avenue Station, located on the eastern side of the R108 in front of the Church of Our Lady of Victories, and then onwards to Griffith Park Station, located adjacent to St. Mobhi Road. This location was a key component of the EPR route, providing both a tunnel reception site for the tunnel boring machines travelling southwards from Dublin airport as well as the launch site and construction compound for the separate tunnel boring machines tunnelling southwards to the city centre.

From Griffith Park the EPR continued south, generally following the R108 to Glasnevin Station where a major interchange station connecting with the Maynooth and Kildare mainline rail services was proposed. The route then traveled southeast to Mater Station located in the public park fronting St. Joseph's Church and onwards to O'Connell Street Station which was located at the junction of O'Connell Street and Parnell Street East.

From O'Connell Street Station the route continued south to Tara Station where a major interchange station providing connections to the Irish Rail Tara Street Station and DART system was proposed. From here, the tunnel continued to St. Stephen's Green Station, located on east side of the Green and then continuing under the Grand Union Canal to finish tunnelling at Charlemont Station, located to the rear of No. 2 Grand Parade.

The route exited Charlemont Station and rose to connect to the existing Luas Green Line to facilitate through running of Metro services onwards to Sandyford. Direct passenger interchange with Luas Green Line services between Broombridge and Charlemont, would be provided at Charlemont Station.

2.3 Alternative Options for the EPR

The EPR contained two locations along the route where an alternative route alignment option for MetroLink was under consideration. In addition, for the EPR it was noted that the tunnel arrangement remained under consideration. These are summarised below.

2.3.1 EPR Route Options

There were two locations identified along the route where alternative options for MetroLink were under consideration. These were:

- *R132 - Fosterstown to Estuary Station. As an alternative to the EPR considered route that was on an elevated structure along the central median of the R132, further consideration was to be given to the route running at surface level along the central median of the R132, with grade separation at Estuary, Seatown, Malahide and Pinnock Hill roundabouts.*

- *M50 Crossing - Northwood and Airport Station. As an alternative to the EPR route, which was in tunnel beneath the M50, further consideration was to be given to a route which emerges from tunnel at Northwood Station, passes over the M50 on the surface to the proposed future station at Dardistown and re-enters a tunnel immediately south of the old Airport Road to pass under the airport.*

2.3.2 Tunnel Configuration Options

The EPR was developed for a twin tunnel arrangement – one tube for the northbound metro and a second tube for the southbound metro. Cross passages would connect the two tubes at regular intervals for emergency purposes. However, an alternative arrangement was also under consideration, where both the northbound and southbound metros would run in a single, larger tunnel. The single tunnel option was not discounted for the EPR and was to be further assessed to establish its cost and construction advantages.

2.4 Public Consultation Process

MetroLink will affect many people during its planning, development and construction stages. NTA/TII are committed to working proactively with all stakeholders to ensure their concerns are listened to and acted upon where feasible and practicable. It is only through active engagement with the whole community that the NTA/TII can ensure the project is delivered successfully through all stages of its development.

The purpose of the Public Consultation process is to engage the public in the scheme delivery process, inform the public of the statutory process and the likely timescales, seek the public's cooperation and understanding of the project and to capture local knowledge to inform the Environmental Impact Assessment (EIA) process.

As part of this process, an initial public consultation was held following the development of the EPR. This section provides a summary of this previous consultation, highlighting key issues which have led to the current changes to the route now proposed as part of the Preferred Route.

Fuller information on the EPR public consultation can be found in the MetroLink Public Consultation Report 2018, which is available on www.metrolink.ie.

2.5 Extent of Public Consultation for the EPR

Consultation was undertaken on the entire length of the MetroLink project. The consultation period ran from 22nd March to 11th May 2018 to ensure maximum visibility and opportunity for the public to engage. Venues at key locations were chosen to facilitate access to all members of the public over the 26km scheme length. Staff were available at these venues to address any queries.

A dedicated project website was available during the consultation period and this continues to operate on www.metrolink.ie. Supporting documentation and reports were uploaded to this website at the commencement of the consultation period. A dedicated team were also assigned to answer the phone lines during the consultation period to assist the public with queries.

An advert was placed in national and local newspapers publicising the public meetings and a colour information brochure and comment sheet was prepared, in both Irish and English. The brochure gave a brief introduction to the scheme including details on the status of the previous scheme. It also highlighted the need for a new scheme and invites submissions from the public. Seven public consultations sessions were held to facilitate residents from all areas along the route including the Green Line tie in and Green Line upgrade sections as well as the EPR for the northern section.

The MetroLink Route Map was displayed in full length on aerial mapping at a scale of 1:10,000 along with individual display boards covering each of the proposed stations, the intervention shaft, portal, elevated sections and station upgrades. Each of these individual display boards were numbered with a key plan provided on the full-length map guiding the public to the boards.

2.6 Review of Public Consultation Responses

The public consultation process resulted in a total of 7,929 submissions were received from members of public via email, phone, letter and comment sheet at the public displays. These submissions covered a wide range of topics including general interest in the scheme, outright support for the scheme or support in principle subject to specific concerns related to various locations along the length of the route, including positive support from the St.

Mobhi Road area. Almost 60% of these submissions were templates copied and signed by multiple individuals or were petitions.

See Figure 1 below for the split in type of response.

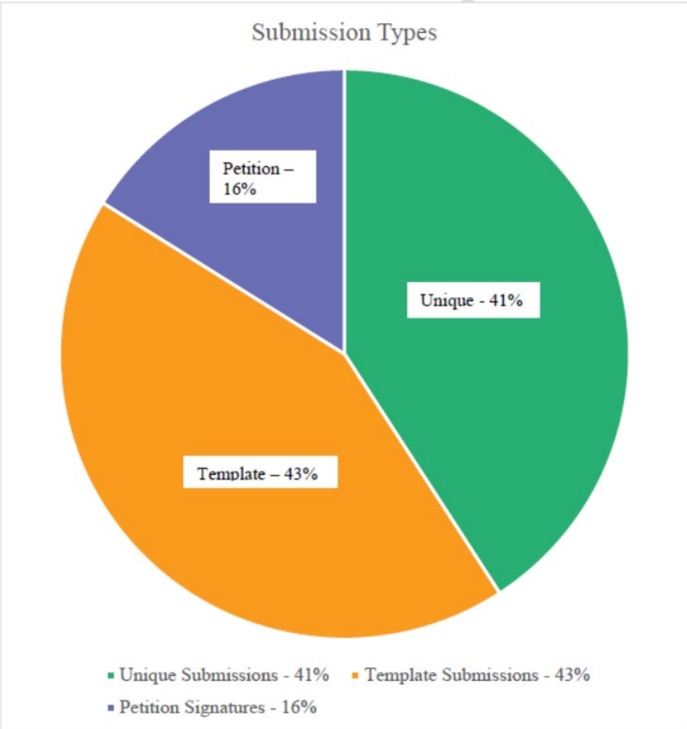


Figure 1 - Submission Types and Proportion (Public Consultation Report 2018, Arup)

Figure 2 below shows the total split of these submissions per station location. General submissions which were not attributed to any particular station were grouped into the category of 'Scheme-Wide'.

The largest number of submissions with a total 5,297 related to the proposed Griffith Park station location, all of which are associated with impacts on Na Fianna GAA club and the adjacent schools. The second largest number of submissions with a total number of 1,249 are in relation to impacts at the proposed Collins Avenue Station, all of which are associated with impacts on Our Lady of Victories church and the adjacent school. The other significant number of submissions, 433 in total, are in relation to impacts at the proposed upgrade of the Beechwood Station.

The remaining unique submissions were spread across all other stations or related to scheme wide issues.

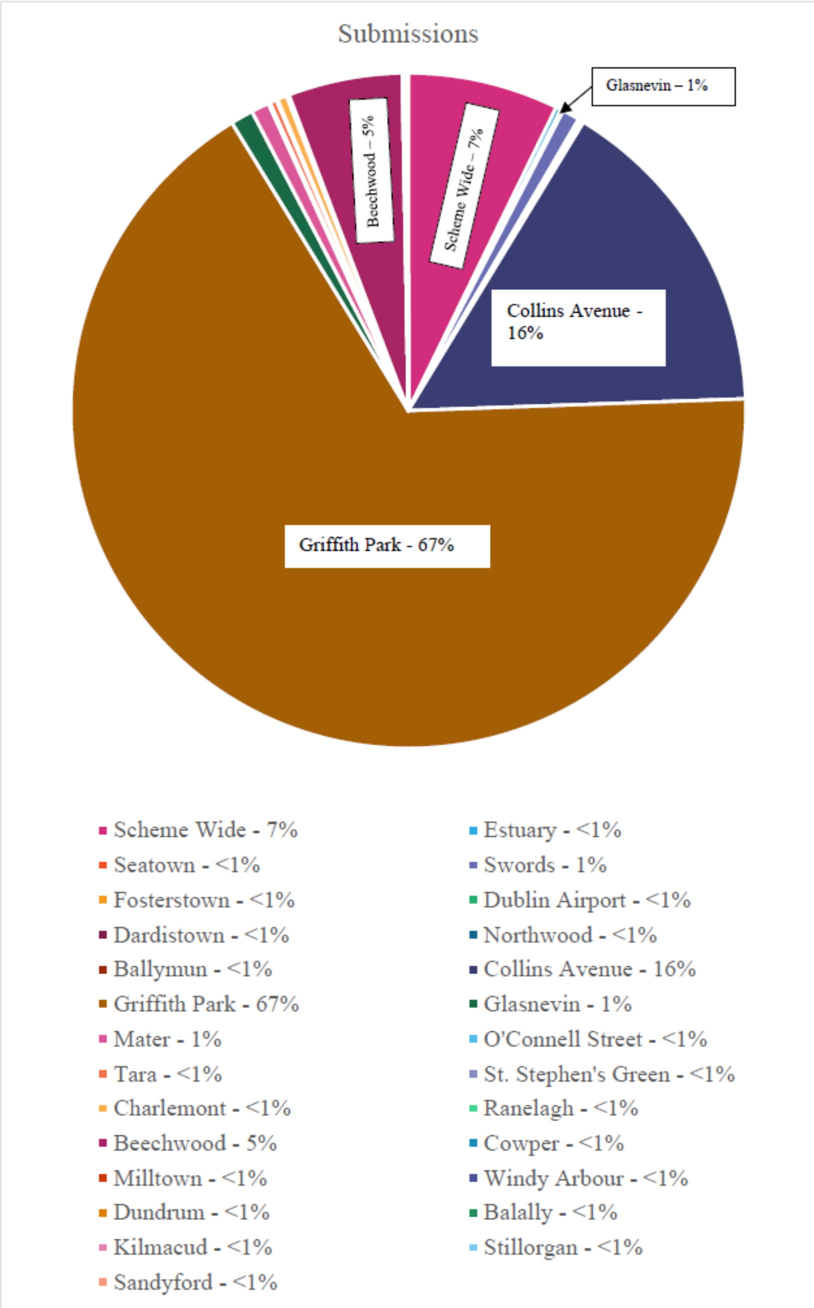


Figure 2 – Proportion of Submissions by Location

2.7 Key Issues and Concerns

The areas of key concern generally reflect the volume of submissions as shown in Table 1 below.

Location	Number of Submissions
Griffith Park	5297
Collins Avenue	1249
Beechwood	433
Glasnevin	86
Mater	68
Swords Central	66
Charlemont	35
Tara	26
Estuary	20
Milltown	13
Ranelagh	10
Seatown	9
Northwood	8
O'Connell Street	7
Fosterstown	6
Dublin Airport	5
St Stephen's Green	5
Cowper	5
Scheme Wide	573
Total	**7929**

Table 1 – Location and Submissions

The Scheme Wide category submissions covered issues relating to multiple locations along the route or the project as a whole. The main Scheme Wide concerns related to:

- Proposed developments or planning application;
- Integration with the cycling, walking and bus networks;
- Park & ride locations should be considered;
- Impacts on surrounding properties during construction
- Increases traffic movements from construction traffic accessing the site;
- Health and safety concerns
- The route should be serving Swords Village main street;
- Additional station in Lissenhall;
- Depot should be moved further north
- Relocate the Estuary Station south of Lissenhall Bridge;
- Visual impact of the elevated section in Swords on residential areas located along the R132;
- The route should be extended to serve Donabate;
- Dardistown Station should be built and an underground option is preferred;

There were also several submissions relating to the Green Line and alternative route design options, with the main points summarised below:

a) **Swords**: Move the route underground via Swords Main Street rather than along the R132; Move the Fosterstown Station and approach route to the western side of the R132; and Extend the project north to service Donabate.

b) **Griffith Park**: Move both the TBM launch site and Griffith Park Station away from the Na Fianna GAA pitch and adjacent schools; Consider alternative locations for the launch site while giving due consideration to the high amenity value of Albert College Park for a wider sector of the community.

c) **Collins Avenue**: Move the station south to the original location proposed for old Metro North in Albert College Park.

d) **Glasnevin:** Move the station back to the original location at Drumcondra as per the previous scheme; Move the station box under the road to avoid property acquisitions; move the station box west to CIE lands to avoid property acquisitions.

e) **Tara**: Move the station north to avoid acquisition of College Gate apartment building.

f) **Green Line Upgrade:** Do not upgrade the existing Luas Green Line; Relay the existing line in a depressed cutting; Grade separate Dunville Avenue; Construct a new route instead to the south west to serve Terenure and Rathfarnham; Construct a new route instead to the south east to serve UCD.

NTA/TII has worked with Jacobs/Idom to address the submissions and concerns raised during Public Consultation and the following chapters present the Preferred Route as currently developed.

3. Development of the Preferred Route

3.1 Introduction

The NTA commissioned Arup Consulting Engineers to undertake a Route Alignment Options Study for the Scheme. The objective of the study was to carry out a comprehensive route option selection study to identify an Emerging Preferred Route (EPR). The study was completed at the end of February 2018 and it included a Concept Design for the EPR.

Separately, in January 2018, the NTA/TII commissioned Jacobs/Idom to provide ongoing engineering design services through to scheme completion.

Jacobs/Idom has carefully considered the submissions made by the stakeholders during the Public Consultation period in 2018. Together with other proposed route alignment and design improvements this work has resulted in a Preferred Route that includes several proposed changes to the MetroLink scheme. Each change was subjected to an engineering and environmental assessment before a recommendation was made.

While staying within the EPR Corridor, the Preferred Route includes a change in the tunnel configuration from twin bore to single bore and the introduction of a surface running section each side and over the M50, which results in two separate tunnel drives. Other key developments include the siting of the MetroLink Depot at Dardistown rather than at Estuary and the introduction of Automatic Train Operation, which makes possible a high frequency train service with shorter trains and platforms while still delivering the required passenger capacity.

A summary of all design developments made to the EPR that have led to the Preferred Route are discussed in the following sections, with further details provided in supporting appendices to this report.

3.2 Key Design Developments for the Preferred Route

The Preferred Route presented in this report builds on the earlier EPR, developing and improving on earlier design considerations and looking to address the key areas of concern arising from the EPR consultation process.

Key areas of development that have a wider impact on the route or MetroLink operations are:

- Tunnel Configuration, Single Bore Tunnel;
- Tunnel Launch Sites;
- Depot Location;
- Crossing of M50;
- Alignment along R132;
- Full Train Automation (ATO);
- Train Type and Capacity; and
- Greenline Line Deferral.

Other locations along the route where changes have been made to the earlier EPR proposals, either to address concerns raised or to accommodate wider route design development, are as follows:

- Estuary to Lissenhall;

- Northwood Station;
- Ballymun Station;
- Griffith Park Station;
- Glasnevin Station;
- O'Connell Street Station;
- Tara Street Station;
- St. Stephen's Green Station; and
- Charlemont Station, turnback and end of tunnel section.

The following sections summarise the specific development of the current Preferred Route at the above locations. Supporting information is provided in associated Appendices in which the EPR proposal and EPR Public Consultation submissions are described, alternative options explained and assessed and the Preferred Route proposals are set out.

Other locations along the route where the Preferred Route proposals remain similar to the EPR proposals, include Dublin Airport Station, Collins Avenue Station, and Mater Station, though design development continues on these and other proposed underground stations to achieve the best combination of station size, safety, capacity, passenger experience and constructability, to minimize local construction disturbance as much as possible.

3.2.1 Tunnel Configuration, Single Bore Tunnel

The Emerging Preferred Route (EPR) envisaged the construction of twin-bore tunnels, each with their own separate track, although further assessment of alternative arrangements including a single bore with twin tracks was recommended.

Based on further research and development, the Preferred Route design is now proposed as a single bore twin track tunnel. This is an approach that is becoming increasingly implemented for the new Metro Lines worldwide, particularly where automated trains are being specified. This decision has significant advantages across the entire scheme and the comparison between the two options is summarised below:

- **The Twin Bore Proposal**: The EPR proposed that the two tunnels would be constructed by four tunnel boring machines (TBMs). The first pair would be launched north of Dublin Airport, and bore two tunnels southwards to the route's half way point at the playing fields of CLG Na Fianna and Home Farm FC on St Mobhi Road in Glasnevin, from where they would be extracted. This is also the point where the Griffith Park Station was to be located. At the same time, a second pair of TBMs would be launched from the CLG Na Fianna station site and tunnel southwards to Charlemont from where they would be extracted. The tunnel would rise out of the ground here to come up to the level of the Green Line.

  This meant there would have been an extensive construction site on the CLG Na Fianna/Home Farm FC grounds for up to seven years. There would also be significant HGV traffic carrying the extracted material from the tunnels at Griffith Park.

- **The Single Bore Proposal:** It is now proposed to bore a larger diameter single bore twin-track tunnel in two phases. A TBM will enter the ground south of Dublin Airport and tunnel northwards under the airport. Then it will be extracted and relaunched at Northwood and tunnel the whole way southwards to Charlemont. The new launch site at Northwood is further out of the city and nearer to the M50, so this takes much of the HGV activity out of the city. The launch site for the Dublin Airport section is also nearer the M50. The trucks carrying the excavated material will thus have a lesser impact on the roads and the environment.

The single bore tunnel eliminates many complexities of the twin bore making construction simpler and faster, which reduces costs. Reducing the number of TBMs offers the potential for cost savings. In addition, in a twin bore tunnel cross-passages must be constructed between the tunnels to allow for evacuations in an emergency. As these must be mined manually after the TBMs have passed it means that no work can start on the tracks until after they are completed. This restriction does not apply to the single bore design because there are no cross passages.

There are further advantages in terms of safety that apply to the single bore configuration when combined with the use of ATO. In the rare instance of a between station incident and because there is no train driver cab, passengers can exit the train from the front or rear onto the slab track and move away from the train quickly in a wider environment, which is also more accessible to the emergency services.

The single bore tunnel is considered preferable to the twin bore situation where in the rare evacuation incident between stations, the passengers must exit trains from side doors onto narrow walkways with possible congestion problems for them and emergency services.

Further details on the single bore tunnel proposal can be found in Appendix A.

3.2.2 Tunnel Launch Sites

The Emerging Preferred Route (EPR) was developed for a twin-bore tunnel from the city centre to just north of the airport. The construction methodology split the tunnelled section route into two almost equal halves for construction, with one tunnel launch site by the Naul Road, north of the airport running south to Griffith park; and one tunnel launch site at Griffith Park, running south to Charlemont.

The Preferred Route is proposed as a single-bore tunnel design with surface running each side of the M50. The tunnel to the south of the M50 will run through the city centre and has a proposed launch site for the Tunnel Boring Machine (TBM) at Northwood, which will drive all the way south towards Charlemont Station. The tunnel to the north of the M50 will run under the Airport and has a proposed launch site at Dardistown, south of the Old Airport Road, with the TBM driving northwards under Dublin Airport to a portal north of the Naul Road.

Further details on the two required tunnel launch sites can be found in Appendix B

3.2.3 Depot Relocation: Estuary to Dardistown

For the EPR route the MetroLink Depot was proposed at Estuary, at the northern end of the route. As advised previously, the Preferred Route now has two separate tunnel sections each side of the M50, with a bridge crossing the motorway and surface running between portals located at Northwood in the south and facilitating the location of the Depot at Dardistown in the north. This more central location on the MetroLink route delivers improved accessibility for train maintenance, stabling and supports efficient operational services.

Further details on the depot relocation can be found in Appendix C.

3.2.4 Crossing of M50

The EPR was developed for a twin-bore tunnel all the way from the city centre to just north of the airport. To facilitate the inclusion of the depot at Dardistown rather than at Estuary, the Preferred Route has two separate tunnel sections each side of the M50, with a bridge crossing the motorway and surface running between portals located at Northwood in the south and by the Old Airport Road in the north. The motorway crossing is to be achieved using a dedicated Metro railway bridge located to the east of the R108/M50 Junction.

Further details on the M50 crossing can be found in Appendix D.

3.2.5 Alignment along the R132

The EPR identified a route past Swords running as an elevated structure along the R132 median which passed over Estuary, Seatown, Malahide and Pinnock Hill roundabouts. It suggested also an alternative solution identified as ‘Alternative Option A: Fosterstown and Estuary Station’. This considered running the majority of the route at surface level along the central median of the R132, with grade separation at the roundabouts.

The Public Consultation process raised concerns related to the route section north of Dublin Airport and within the R132 road corridor, including visual intrusion and station accessibility.

Further consideration has been given to the route in this area and more detailed assessment of the route alignment past Swords. This looked at a number of options, including variations on the elevated viaduct, an alignment in cutting in the road median and development of an alternative alignment in a mix of open cut and cut and cover structure along the eastern side of the R132. This latter option would mean MetroLink would run below the road level along the R132, alleviating concerns raised about the visual impact of an elevated structure. A multi-disciplinary assessment has been undertaken of these alternative options, with a recommendation that the option providing a route along the eastern side of the R132 should be progressed as part of the Preferred Route. This is now being progressed in more detail as part of the on-going preliminary design development.

Arising from this Option choice, the R132 alignment change also requires changes to the station proposals in the EPR. (Seatown, Swords Central and Fosterstown Stations).

Seatown Station is moved from the central median to the east of the R132 in cutting and is now in an improved location beside the junction of Seatown Road and the R132.

The proposed Swords Station was previously located in the median of the R132, south of the Malahide Road roundabout – across the road from the Pavilions Shopping Centre. The Preferred Route moves it off the road to the east and a footbridge will provide better and safer connection to the shopping centre, bus stops and Swords town centre.

The Fosterstown Station was located just north of Airside Retail Park on the R132. It is now relocated south and closer to the retail park. We will construct a footbridge for pedestrians and cyclists so that people in the Boroimhe development will have easy access.

Further details on the R132 alignment proposal and associated station proposals can be found in Appendix E

3.2.6 Full Train Automation

The proposed train operating system for MetroLink is designed to minimise future passengers overall journey times within the Greater Dublin Area whilst minimising both capital and operation costs, personnel, energy consumption, and maintenance. The Metro system should offer passengers a service of the highest safety and quality, and one that is capable of delivering the transport capacity required in the future.

MetroLink is now proposed to be an automated (driverless) system to help achieve the above requirements. This is possible as MetroLink will be segregated from all other traffic, including pedestrians and cyclists, thus creating the opportunity to make it a driverless system. Automatically controlled trains can travel at shorter headways, allowing shorter but more frequent trains to be used with correspondingly shorter station platform requirements.

MetroLink will model itself on the Copenhagen Metro and the fully automated lines on the Barcelona Metro, which utilise proven automated train control systems. The trains are supervised from a control centre run by operational, security and safety staff who can monitor every carriage, station and platform through CCTV and communicate with passengers by public address. Passengers can contact controllers directly from their carriage.

Automated systems are extremely safe as the capacity for human error is eliminated and advanced signalling technology improves safety during operation of the trains in normal operation, in the case of disruption and during emergencies. The platform edge at stations is blocked by screens (platform screen doors) to prevent anyone falling onto the tracks and which line up and open simultaneously with train doors to provide safe train access.

Automated systems also allow timetables which are both more flexible and reliable as trains can adapt to changing circumstances quickly.

3.2.7 Train Type & Capacity

The Preferred Route design is based on 64m long high-floor trains with stations sized accordingly to meet train and passenger demands, instead of the 90m long trains originally considered during EPR development.

High floor trains have more capacity than low floor trains and this combined with the proposed 90 second peak headway made possible by the planned use of (GoA4) Automatic Train Operation (ATO) technology, enables the scheme to satisfy the target peak hour demand in 2057 of 20,000 passengers per hour per direction (pphpd) with the shorter trains and a ‘comfort level’ of AW2 – signifying a good level of comfort.

The proposed system will allow for capacity increase if required in the future. This can be accommodated by either a decrease in the comfort level, at peak times, or increasing train frequency slightly. Under these circumstances, the system could typically increase its peak hour capacity by up to 40% if required.

Further details on the train capacity can be found in Appendix F.

3.2.8 Green Line Deferral

The MetroLink proposals published in 2018 envisaged a metro service operating from Swords through the city centre to Sandyford. Between Sandyford and Charlemont the existing Luas Green Line would be upgraded to metro standard and the metro service would replace the existing Luas trams along this section.

The need to upgrade the Green Line arises from the expected passenger growth at key locations along this corridor – in particular, Cherrywood, Sandyford and Dundrum - and the planned extension of the line further southwards to Bray. Taking account of those developments, the number of people seeking to travel on the Green Line in future years will exceed the carrying capacity of the Luas system, requiring its upgrade to a metro service. However, the need to upgrade the Green Line to metro standard will not arise for up to twenty years and many people are concerned about the need to close the Green Line soon for a prolonged period to allow its conversion to a metro system.

An alternative approach is proposed that allows the new section of metro line to be built now and the Green Line conversion to occur at an appropriate point in the future.

Under this arrangement the overall metro system from Swords to Sandyford would be delivered on a phased basis. The first phase - the current phase - would comprise the development of the section from Swords to Charlemont, without connecting to the Green Line. But, crucially, the required tunnel boring works to allow the future connection to the existing Luas line would be completed as part of this phase. While the last station would be Charlemont, the bored tunnel would continue to, and terminate south of Ranelagh, aligned to facilitate a future connection onto the Luas line.

A separate phase, potentially two decades from now, would see the connection made from the MetroLink tunnel termination point onto the Green Line. Because the tunnel boring works would have been completed as part of the first phase, the tie-in works would all be constructed from the surface and no bored tunnelling work would be required. All of the details regarding that tie-in and conversion of the existing line would be worked out at that future point and do not need to be developed now.

During the period between the completion of the metro from Swords to Charlemont and the ultimate tie-in to the Green Line at a point in the future, there will be a need to increase the carrying capacity of the Luas Green Line. This will be dealt with as a separate project and will deliver capacity enhancements on an incremental basis over this period.

The MetroLink project will now comprise the delivery of a metro system between Swords and Charlemont with a short tunnel continuation to Ranelagh facilitating a future tie-in to the Green Line. This tunnel extension south of Ranelagh will enable trains to cross-over between tracks and turn back for their return journeys in addition to allowing storage of trains for service commencement at the start of daily operations.

The Green Line route will remain open throughout the development of the route now proposed. When MetroLink is completed, Green Line passengers can connect with MetroLink at Charlemont, St Stephens Green and O’Connell Street for a fast service to Dublin Airport and Swords.

3.3 Specific Route/Station Developments

3.3.1 Estuary to Lissenhall

The EPR placed the alignment of MetroLink across the existing Lissenhall bridge on the approach to Estuary Station. The location of Estuary Station and the proposed Park and Ride facility would have required the demolition of a farm house and buildings and also conflicted with the alignment of the Swords Western Distributor Road (SWDR) proposed by Fingal County Council.

The Jacobs/Idom design team has reviewed the various constraints in this area and the likely environmental impact of the EPR. The desire to accommodate and avoid conflict with the SWDR has also been considered.

An alternative design layout for the Estuary northern terminus at this location has been developed which seeks to minimize environmental impacts and avoid any major conflict with the SWDR. This revised layout now forms the proposed Preferred Route in this location.

Further details on the development of the Estuary to Lissenhall section of the route can be found in Appendix G.

3.3.2 Northwood Station

The development of a revised tunnel strategy for the Preferred Route incorporates an elevated section of route over the M50 facilitating a depot location at Dardistown. Associated with this change is a revised rail alignment as the route runs southwards from the M50 towards Northwood, Ballymun and on southwards to the city. This changed alignment requires a new location for the Northwood Station.

The EPR location for the Northwood Station was located just north of the Gulliver's Retail Park Home Base outlet. Taking account of the metro now crossing over the M50 the Preferred Route proposal is to incorporate the station at a skew angle under the R108, south of the Gulliver's Retail Park. This provides good access to and from both sides of the road and provides a location appropriate for operational services. As such, this option is being incorporated into the on-going preliminary design for the route.

In addition, the revised station location will lie adjacent to the proposed tunnel launch site for the tunnelled route southwards to Charlemont (see Appendix B for details) and will form part of the overall construction works in this area. This area to the south and west of the station is currently open ground that is suitable for use as the TBM launch site. Whilst this area is subject to ongoing and future planning considerations for development, following tunnel construction it is anticipated that most of the area could be returned for future development.

The R108 will be affected during construction of the station and we will arrange diversions around the site to maintain movement. We will liaise closely with the local community to mitigate issues concerning access and construction.

Further details on the proposed change to Northwood Station can be found in Appendix H.

3.3.3 Ballymun Station

The EPR placed Ballymun Station in the middle of Ballymun Road and directed the twin bore tunnels northwards along the main road, with likely disruption to public utilities and possibly under the expected deep pile foundation of the Metro Hotel building.

The Preferred Route moves the single bore tunnel alignment to the west of Ballymun Road and under the site of the old shopping centre, where plans are in place for a new mixed-use quarter following demolition of the old centre. It is proposed that the station will be integrated with the redevelopment.

Further details on the proposed change to Ballymun Station can be found in Appendix I.

3.3.4 Griffith Park Station

The EPR was developed with a twin-bore tunnel from the city centre to just north of the airport. The construction methodology split the tunnelled section route into two almost equal halves and tunnel boring machine (TBM) launch site located at Griffith Park. Demand projections and the open ground at the location led to the selection of the CLG Na Fianna playing fields as the location of a new station.

The Public Consultation process resulted in a large number of submissions that raised concern about the risk to the future of the club and its supporting community. Taking account of these concerns and recognising the alternative proposed tunnelling strategy for the preferred Route, three alternatives have been considered for this location, namely:

- A - Station only on Na Fianna grounds;
- B - Station only on Home Farm FC grounds; and
- C - No station in locality.

With three schools and the sports facilities nearby, and in consultation with Home Farm using a more compact station design, we propose to construct the station under the Home Farm FC soccer pitch. This means the pitch will be unavailable during construction but will be fully restored afterwards.

The decision to move the tunnel launch site significantly reduces truck movements through the city. During station construction there will be strict traffic management and safe arrangements for pedestrians here.

Further details on the proposed changes to Griffith Park Station can be found in Appendix J.

3.3.5 Glasnevin Station

The EPR location of Glasnevin Station provided interchange capability with Irish Rail services on the Maynooth and Kildare lines that serve Connolly Station and Docklands Station. This important interchange station with Irish Rail is located to the west of Prospect Road (R135) on the northern side of the Royal Canal with the MetroLink rail level crossing below the existing railway lines.

The reduced platform length made possible by the move to Automatic Train Operation and high floor trains results in a shorter underground station box. This means that the residential block (Dalcassian Court) to the north of the station does not now need to be demolished (as required under the EPR proposals) and mining under the rail line to the south is reduced to a minimum.

The development of the track alignment preliminary design would indicate additional property impacts to the west of the station. We will work with the local community on issues around construction and with Irish Rail on the interconnection.

Further details on the proposals for Glasnevin Station can be found in Appendix K.

3.3.6 O'Connell St Station

The EPR location for the O'Connell Street Station was in the median of O'Connell Street Upper, in Dublin City Centre. The challenges presented in the planning of such major works on the main city thoroughfare were well recognised and the Public Consultation submissions made the public concerns apparent.

The location and construction of this station in the original proposal would have presented a significant challenge to maintain services on the Luas cross-city line and vehicular traffic on O'Connell Street. An opportunity has subsequently arisen to create an integrated station to the west of O'Connell Street under what was the old Carlton cinema site, which is proposed for redevelopment. NTA/TII are working with the owners of this site to create the opportunity to link the station into the proposed development.

The tunnel alignment as presented in the EPR would need to be locally modified to accommodate the relocation of the station under the development and discussions remain on-going with the Developer regarding the detail of the integration of the proposed station works with the planned development. Whilst the realignment of the route at this location is now proposed and shown as part of the Preferred Route it is subject to subsequent formal agreements between NTA/TII and the Developer.

Further details on the indicative proposals for O'Connell Street Station can be found in Appendix L.

3.3.7 Tara Street Station

Tara Street MetroLink Station will be a key interchange with Irish Rail main line and DART services. The current Tara Street DART Station and the station design must provide appropriate connectivity between these stations to facilitate interchange demand. The MetroLink station itself is forecast to be the busiest station on the MetroLink route, with close to 12,000 passengers boarding and alighting at this station in the morning peak hour by 2057.

The EPR located the proposed underground Tara Street Station adjacent to the DART Station on its west side, necessitating acquisition and demolition of the College Gate Apartment Building, the Sport and Fitness Markievicz Centre owned by Dublin City Council and Ashford House. While the site would be available afterwards for new development, the loss of the apartment block and a valued public amenity raised concerns during the public consultation process.

Eight route options were investigated using a multi-disciplinary assessment, including three options submitted by residents as well as a mined option and alternative realignments of the route to the east of the Tara Street DART Station. These comprise:

- Option 1 - Locating the station under the Hawkins House development;
- Option 2 - Moving the station north such that it is predominantly located beneath Ashford House, Tara Street and buildings immediately north west of Tara Street;
- Option 3 - Moving the station south so that it is predominantly beneath Townsend Street;
- Option 4 - An option incorporating mining beneath the College Gate Apartment block, between two shafts, so that the building need not be demolished;
- Options 5 & 6 - Two options looking to realign the metro to the east of Tara Street DART station with the station located east of the St. Georges Quay complex;
- Option 7 - An alignment running to the east of the Tara Street DART Station with the MetroLink station located south of Townsend Street; and
- Option 8 - A similar alignment to the east of the Tara Street DART Station but with the MetroLink station immediately adjacent to the DART station, under St George's Quay.

All options were assessed against the EPR proposed station location as a base case, adjusted to suit the single bore tunnel design.

While these eight options if implemented would avoid the College Gate Apartment building and Markievicz Centre, each would involve the demolition of other significant residential and/or commercial developments and in most cases remove the close interchange required between the DART and MetroLink stations. In addition, during construction, there would be closure of city streets to traffic and under some options the diversion of large sewers, critical to Dublin's drainage network. The assessment of the options indicated that those with least overall impact were the original EPR route, as modified slightly for the revised station size; and the mined tunnel option under College Gate Apartments.

The potential for mining under the College Gate Apartment building was considered in detail, as this option, Option 4, would provide a station arrangement in a comparable location to that proposed in the EPR and with the aim of avoiding demolition of the apartments. However, this would need to be undertaken in a very constrained working site for construction purposes and many construction activities would be undertaken very near to the apartment building. Particular activities associated with this option would require the sinking of two large shafts either side of and in close proximity to the building, before tunnel mining would be undertaken between the shafts. These construction activities are estimated to take up to two years. During this period there would be risk to the building from the mining activities including potential for structural damage, and significant construction disturbance, including noise and vibration, such that it is envisaged that this would require moving everyone out of the building during construction for a period of up to two years.

Although the mined option would appear to have merit, given the construction impacts and the long period of disturbance envisaged, the significant additional risk associated with this form of construction, including risk to cost, it is concluded that the original proposal remains the most feasible and safest option for construction of the MetroLink station at Tara Street and this option is retained as the Preferred Route.

Further details on the consideration of the alternative proposals for Tara Street Station can be found in Appendix M.

3.3.8 St. Stephen's Green Station

This station will be located as previously proposed at St Stephen's Green East. The EPR indicated that the station was situated directly under the road but with potential construction impacts on the adjacent Park boundary. Addressing these concerns, it is proposed to move the station partly under St Stephen's Green:

- This solution allows two lanes of traffic to remain open during construction which would reduce the impact on traffic and public transport in the Dublin City Centre area; and

- Avoids a major sewer that would otherwise require significant local disruption to divert due to its depth and location.

The potential environmental impacts of this option are being assessed and it is recognized that there would be potential for increased impacts on St Stephens Green having regard to the following:

- The archaeological and architectural value of the Green. St Stephens Green is a National Monument (DU018-020334);
- Potential impacts on the landscape & visual amenity of the park during the construction and operational phases; and
- Potential impacts on the important amenity value of the park during the construction phase.

The preliminary design is currently being developed to minimise the potential environmental impacts. The impacts will be mitigated as far as is possible and the required mitigation measures will be presented in the subsequent Environmental Impact Assessment Report for the scheme.

Furthermore, the outcomes of ongoing consultation with key stakeholders, including Dublin City Council and the Office of Public Works, will inform the development of the final option for this station.

An illustration of the current consideration of proposals for St. Stephen's Green Station can be found in Appendix M.

3.3.9 Charlemont Station

The EPR placed the proposed Charlemont Station underground to the south of the Grand Canal in an area subject to new development.

The public consultation on the EPR drew out several concerns regarding the location and impact on adjacent properties. Key among these were impacts on adjacent Dartmouth Terrace, impact on the office development proposals for the area and the impacts of the southern connection to the existing LUAS Green Line.

The Preferred Route proposals for Charlemont Station both amend the depth and adjust the station box size and layout compared to the EPR. The tunnel approach to the station from the north has been lowered to pass safely under the Grand Canal and the major combined sewer running under Grand Parade. The station box depth has been increased to suit this revised tunnel alignment.

The station box layout has also been developed to retain the ability to construct the full station box and internal fit-out in close proximity to a proposed office development overhead, including some advanced station box works to ensure the station can be safely constructed at a later date.

Design is on-going for this station, to accommodate the necessary station requirements, to minimize environmental impacts and to mitigate impacts on adjacent properties. Some additional construction impacts are currently envisaged on the gardens of Dartmouth Terrace properties due to potential station size requirements, but we will be seeking to ameliorate these impacts to property as much as possible as part of the design process.

The MetroLink Charlemont Station will continue to act as an interchange station with the adjacent LUAS Green Line Charlemont stop, with a pedestrian connection via Grand Parade between the two stations. Pending future extension of the Metro southwards, the station will now provide the temporary southern terminus for MetroLink, but with the tunnel extended southwards to facilitate the future Metro extension and temporary turn-back requirements for the Metro services.

Further details on the development of Charlemont Station can be found in Appendix O.

3.3.10 Green Line Tie-in

The change to the Emerging Preferred Route relating to the deferral of the LUAS Green Line upgrade to Metro standard affects the EPR proposals for the interface between the existing Green Line and Charlemont Station. In the original proposal, the tunnel emerged above ground just south of Charlemont and connected to the Green Line. This involved major works between Charlemont and Ranelagh and would have involved the temporary closure of a section of the Green Line to enable these works.

Under the revised proposals, MetroLink will terminate at Charlemont and the connection to the Green Line will be postponed to a future date when passenger demand necessitates its provision.

Charlemont station will still be constructed by the cut-and-cover method (see section 3.3.9 above) but there will be no tunnel portal here as proposed in the EPR. There will still be various temporary road closures required, and parts of some gardens will have to be temporarily acquired, but other property acquisitions proposed under the EPR south of Charlemont associated with a cut and cover tunnel and open cut section towards Ranelagh will not now go ahead.

To facilitate future connection to the Green Line, the Preferred Route now proposes that the TBM will continue boring for approximately 650 metres past Charlemont and will terminate underground south of the Ranelagh Luas stop. Extending the tunnel in this way will avoid very significant future disruption to properties and roads between Charlemont and Beechwood to gain access to tunnelling works otherwise necessary for a future connection and upgrade of the Green Line.

Part of the terminating tunnel section by Charlemont is proposed to be used to construct the turn-back facilities necessary for the initial Metro service between Charlemont and Estuary and to facilitate efficient operations commencement each day.

3.4 Other Station Locations

3.4.1 Dublin Airport Station

As part of the current Preferred route, Dublin Airport Station remains as indicated in the EPR, situated under the proposed ground transportation hub located at what is now the T2 surface level car park. The station is proposed to be similar to other underground stations being developed along the route. Development of this station is being undertaken in consultation with the Dublin Airport Authority and the Irish Aviation Authority to minimise impact on the airport operations whilst ensuring retention of benefits to passengers.

3.4.2 Collins Avenue

Concerns were raised from the EPR Public Consultation about the impact of construction of this station particularly on Our Lady of Victories church, and the nearby Our Lady of Victories National School. We’ve considered these concerns and examined the constraints carefully. Unfortunately, we have limited options for realignment in the area due to the surrounding buildings and difficulty of diverting traffic along the busy R108 Ballymun Road.

However, the proposed change in the metro design to automatic train operation and use of shorter trains is supporting the opportunity to develop more compact station layouts for the underground stations. This will provide opportunity to minimize the construction working area and associated construction disturbance in this location. This will include careful site management, protection measures for the stained-glass windows of the church, maintaining access to the church and school and strict construction traffic management.

3.4.3 Mater

The Mater Station location has not changed from the EPR proposals and will lie under the small park known as the Mater Plot or the Four Masters Park, which will provide convenient access to the Mater Hospital, St Joseph’s Church, Berkeley Street and this north inner-city location. However, as noted above, the development of a more compact station proposal will assist in reducing construction impacts in this location. For example, prior to construction the architectural structures and sculptures will be carefully removed, preserved and restored on completion of the works. Access to the church will be maintained during construction.

Notwithstanding the opportunity to reduce the working area, this will remain a challenging site to construct as temporary/partial road closures will be necessary and we will work closely with the local community to manage these.

3.5 Tunnel Intervention Shafts

The tunnelled lengths of the route require appropriate provision for tunnel ventilation, access for emergency services and egress for passengers in the event of an incident on the Metro. Generally, stations are located at appropriate intervals to provide the necessary access and ventilation requirements for the tunnel but where longer distances occur between stations then an intermediate ‘intervention/ventilation’ shaft or access is required. For the Preferred Route, intervention shafts are required on tunnel lengths either side of the airport station and between Collins Avenue and Griffith Park Stations. These comprise:

- Dublin airport north - this shaft at the north portal adjacent to the Naul Road will provide both intervention and ventilation for the tunnel length between Dublin Airport Station and the north portal of the tunnel. It will provide safe access outside of the airport perimeter and ventilation to the tunnel length under the airport.
- Dublin airport south - this shaft at the south portal adjacent to the old Airport Road will provide both intervention and ventilation for the tunnel length between Dublin Airport Station and the south portal of the tunnel. It will provide safe access outside of the airport perimeter and ventilation to the tunnel length under the airport
- Albert College Park - this shaft will provide both intervention and ventilation for the tunnel length between Collins Avenue and Griffith Park. The access shaft is proposed to be sited in the south-west corner of Albert College Park.

In all cases, the Intervention shaft will provide separate access for emergency services and a safe area at ground level or inside connection galleries to the tunnel for passenger evacuation.

4. Consultations and Next Steps

4.1 Public Consultation

The NTA commissioned Arup Consulting Engineers to undertake a Route Alignment Options Study for the MetroLink Scheme in 2016. The objective of the study was to carry out a comprehensive route option selection to identify an Emerging Preferred Route (EPR). The study was completed at the end of February 2018 and it included a Concept Design for the EPR.

Subsequently a programme of Public Consultation led by the NTA/TII was conducted between 22nd March and 11th May 2018, during which members of the public and other stakeholders were invited to submit their views and observations of the EPR. This has led to a re-examination of parts of the proposed route and construction methodology for the project. In addition, further route development has been progressing by Jacobs/Idom as part of the preparation of a Preliminary Design for the route.

The purpose of the public consultation being held in Spring 2019 is to present the updated Preferred Route that is being developed from the Emerging Preferred Route, which takes account of the comments and submissions received from the earlier EPR consultation and subsequent route development.

At MetroLink we recognise our obligations under the Aarhus Convention to facilitate public participation in decision making on major public infrastructure projects. This document is a comprehensive explanation of what we propose to do and why. It lays out in detail our response to the public consultation on the Emerging Preferred Route; how this has affected technical proposals for the project; where we've been able to respond to feedback; where we haven't and if so, why; and what the current Preferred Route comprises.

We are now seeking feedback on the Preferred Route.

4.2 Next Steps

4.2.1 Preliminary design

The preliminary scheme design is currently underway and to support this process feedback from this second public consultation process will be reviewed in detail. The concerns raised, and alternative options suggested will be balanced against the objectives and needs of the scheme and where practical, the scheme will be amended to address these concerns.

4.2.2 Environmental Impact Assessment

Development of the Environmental Impact Assessment Report will continue based on environmental surveys underway and continued compliance with the EU EIA Directive. This report is expected to be complete in early 2020.

4.2.3 Planning Approval

An application for planning approval for the MetroLink Scheme is expected to be made to An Bord Pleanála in 2020 and as part of that application process a statutory consultation process will be undertaken, at which point the public will once again have an opportunity to review proposals and make observations.

Our application to An Bord Pleanála for a Railway Order is broadly similar to the planning process with which most people are familiar. However, as MetroLink is categorised as Strategic Infrastructure Development (SID) the application is directly to An Bord Pleanála for permission. The Railway Order application process is set out in the Transport (Railway Infrastructure) Act 2001 as amended by the Strategic Infrastructure Act 2006.

We expect that An Bord Pleanála will conduct a full Oral Hearing. At an oral hearing all the authors of relevant reports and experts will give evidence and be available for questioning.

4.2.4 Detailed Design and Construction

After the planning stage, the detailed scheme design will be finalised and tender documents for infrastructure procurement, associated systems and vehicle fleet acquisition will be prepared. Subject to funding approval, the preferred scheme would then proceed to procurement and construction stages. It is currently intended that the MetroLink service would be operational in 2027.

Appendix A. Tunnel Configuration, Single Bore Tunnel

Contents

Executive Summary

The aim of this report is present the proposed change in the tunnel configuration from a twin bore tunnel as planned in the EPR Concept Design, to the Preferred Route single-bore tunnel configuration.

The Emerging Preferred Route (EPR) envisaged the construction of twin-bore tunnels along the route of the MetroLink project.

In the development of the Preferred Route Jacobs/IDOM have undertaken a multi-disciplinary analysis of the advantages and disadvantages of changing the tunnelling strategy to a single-bore design. This is an approach that is becoming increasingly implemented for new metro lines worldwide, particularly where Automatic Train Operation technology is being specified.

The benefits of this approach are explained in the following sections of this report. Annex A contains a list of metro examples from cities all around the world that are successfully using this single bore configuration.

The advantages and disadvantages of the single bore configuration are summarized in the points below.

ADVANTAGES

- Passenger evacuation onto tracks is safer and faster than lateral evacuation onto walkways.
- Increased space for emergency services access and working space adjacent to a train in the tunnel
- Using ventilation equipment, conditions can be created within a large bore diameter tunnel that facilitates smoke stratification at a high level in the bore for a longer period of time when compared to that in a twin bore configuration. Therefore, the single bore configuration facilitates enhanced evacuation safety conditions and provides better tunnel visibility during fire events when compared to the twin bore solution.
- Single-bore tunnel can be constructed at lower cost than twin bore due to the reduced construction works and quicker programme
- A single-bore tunnel can be constructed more quickly as:
    - No requirement for cross-passages, which are slow to construct and need to be mined as separate/later construction activities.
    - Not affected by extra mined/cut & cover sections required for track crossovers in twin-bore tunnels.
- Reduction in spoil quantities and associated handling and disposal costs compared to twin-bore tunnel.
- Building programme and construction activities within underground stations: affected only one time by drive through/pull through of TBM.

- Allows for a reduced environmental impact during the construction phase when compared to the twin bore configuration.

- The single bore configuration offers a more flexible system throughout the life cycle of the asset in terms of operational adjustments and future expansion.

DISADVANTAGES

- Higher number of intervention shafts.

- Portal lengths may be slightly longer but are narrower.

- Risk of collision following derailment of train however it is noted that such incidents are very rare.

1. Introduction

1.1 Tunnel Configuration for MetroLink

Tunnel configuration is one of the most important design decisions to make because it largely dictates many others such as rolling stock design, depth of tunnels and stations, safety and evacuation, ventilation and cost. The relative benefits of twin bore compared to single bore tunnels need to be compared having due regard to the Dublin geotechnical environment, the project requirements and environmental concerns.

Accordingly, the National Transport Authority commissioned a Tunnel Configuration Study in 2017 to address these considerations and to inform the later Route Alignment Options Study. The objective of the two studies was to carry out a comprehensive route option selection to identify an Emerging Preferred Route (EPR) for the Scheme. The study was completed at the end of February 2018 and it included a Concept Design for the Emerging Preferred Route (EPR) using a twin-bore tunnel as the basis of design.

Separately, in January 2018, the NTA/TII commissioned Jacobs and Idom JV (Jacobs/Idom) to provide engineering design services from Preliminary Design stage through to scheme completion.

1.2 MetroLink Development

Metro North was the project name of the original proposal for a metro railway system connecting Swords and Dublin Airport with Dublin City Centre at St Stephen’s Green. This scheme was developed by the Railway Procurement Agency through the Railway Order process to successful planning approval by An Bord Pleanála (ABP) in 2010. The global economic downturn intervened, and in 2011 the Government postponed the Metro North project.

The National Transport Authority’s (NTA) Transport Strategy for the Greater Dublin Area, 2016-2035 identified a Metro service as the preferred public transport mode to address the transport needs of the Swords-Airport-City Centre corridor. It also envisaged the upgrading of the existing Luas Green Line between Ranelagh and Sandyford to a Metro level of service.

Project Ireland 2040 included the National Development Plan (2018-2027), which combined those two projects to form MetroLink. In addition, the Scheme will ultimately connect to the existing Luas Green Line in the South City area, enabling through running metro services from Swords to Sandyford as shown in Figure 1.

The metro route length from Swords to City Centre is approximately 19km and the completed system will have 15 Stations, 3,000 Park & Ride spaces, and a journey time of approximately 25 minutes.

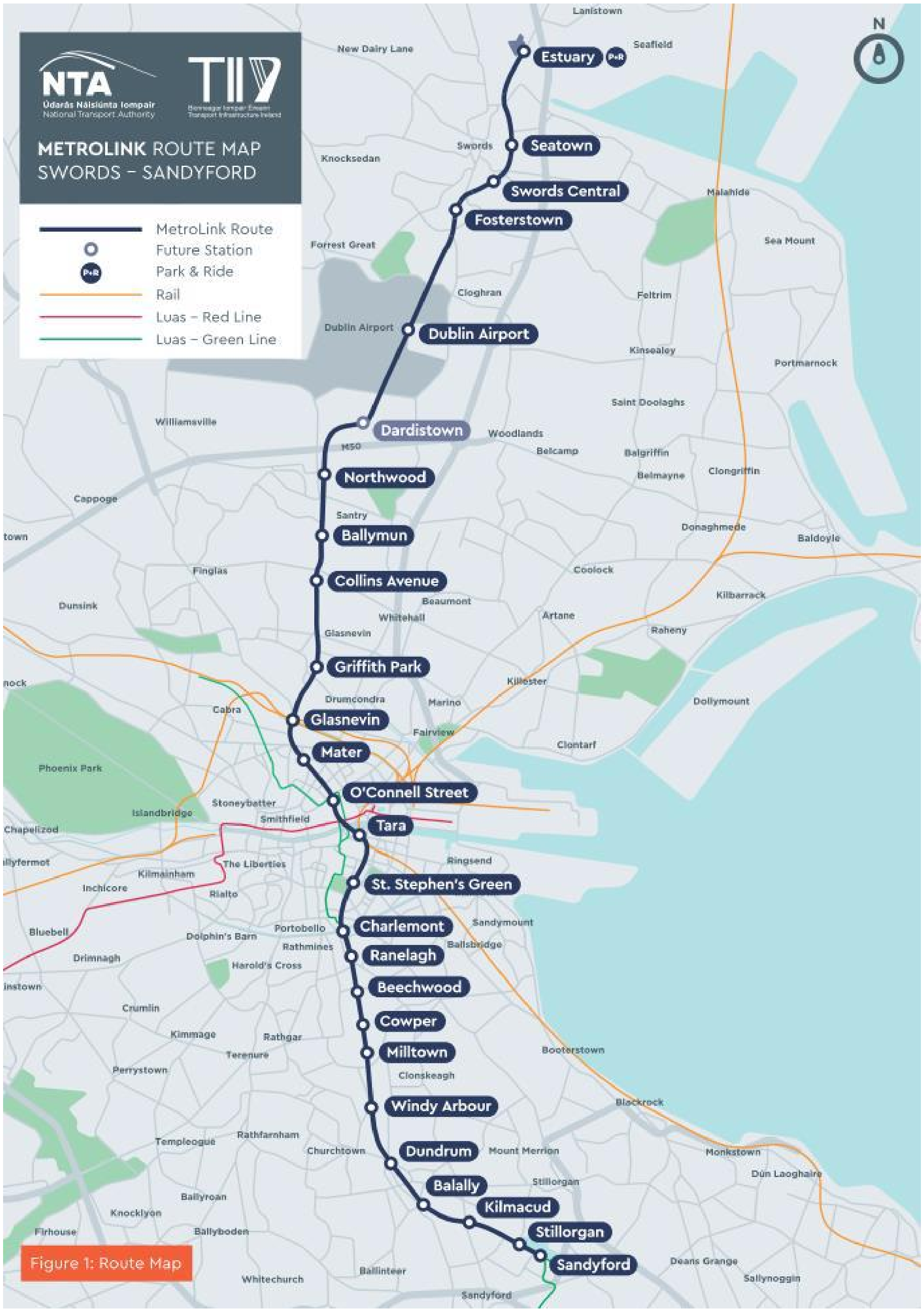


Figure 1 – Metrolink Emerging Preferred Route

1.3 Public Consultation

A programme of public consultation led by the NTA/TII was conducted in March and May 2018, during which members of the public and other stakeholders were invited to submit their views and observations of the EPR. The public consultation presented the MetroLink project in its entirety to ensure that the public is aware of the Emerging Preferred Route (EPR) for the metro from Swords to St. Stephen's Green as well as the tie-in details to the Luas Green Line. A large proportion of the route will be underground, including where it passes under the city centre area and Dublin Airport. The underground section will terminate close to the existing LUAS Charlemont Stop.

Many submissions were made during this process, particularly those relating to the proposals for Griffith Park Station Stop and the associated Tunnel Boring Machine (TBM) launch work site, which was made necessary by the EPR proposal to tunnel in twin bore all the way from the city to beyond Dublin Airport.

TII / NTA and its technical advisors have carefully considered the many statements and submissions made from the interested and affected parties. A multi-disciplinary analysis of these submissions, and of value engineering development has led to several proposed changes to the MetroLink scheme.

This report presents the design changes proposed for the MetroLink tunnel configuration and the resulting impacts on construction methodology and safety strategy.

2. Tunnel Configuration for the EPR

2.1 Tunnel Configuration Study by Arup, 2018

The tunnel configuration dictates many other issues including rolling stock design and escape strategy. The EPR Tunnel Configuration Study assessed four tunnel configurations as shown in Figure 2 below and made a recommendation for the type to be developed for the subsequent EPR alignment study.

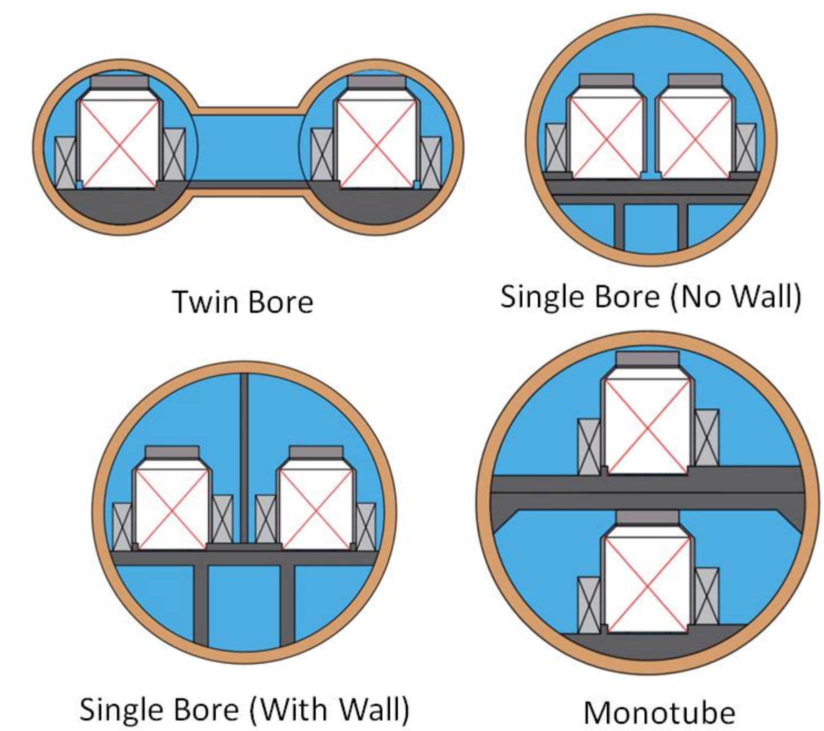


Figure 2 – Tunnel Configuration Options

Key features of each option are

- **Twin-bore tunnels** are of 5.9m internal diameter bores with cross passages at regular intervals. All stations have an island platform configuration.
- **Single-bore tunnel (no wall)** will typically have an internal bore diameter of 10.3m, with side platform configuration.
- **Single Bore tunnel (with wall)** may be required depending on the emergency escape strategy. The tunnel with a dividing wall is typically up to 12.6m internal diameter, with side platform configuration.
- **Monotube** tunnel configuration is typically of 13.9m external diameter with platforms provided within the bore in a stacked arrangement. This is only achievable for deep stations.

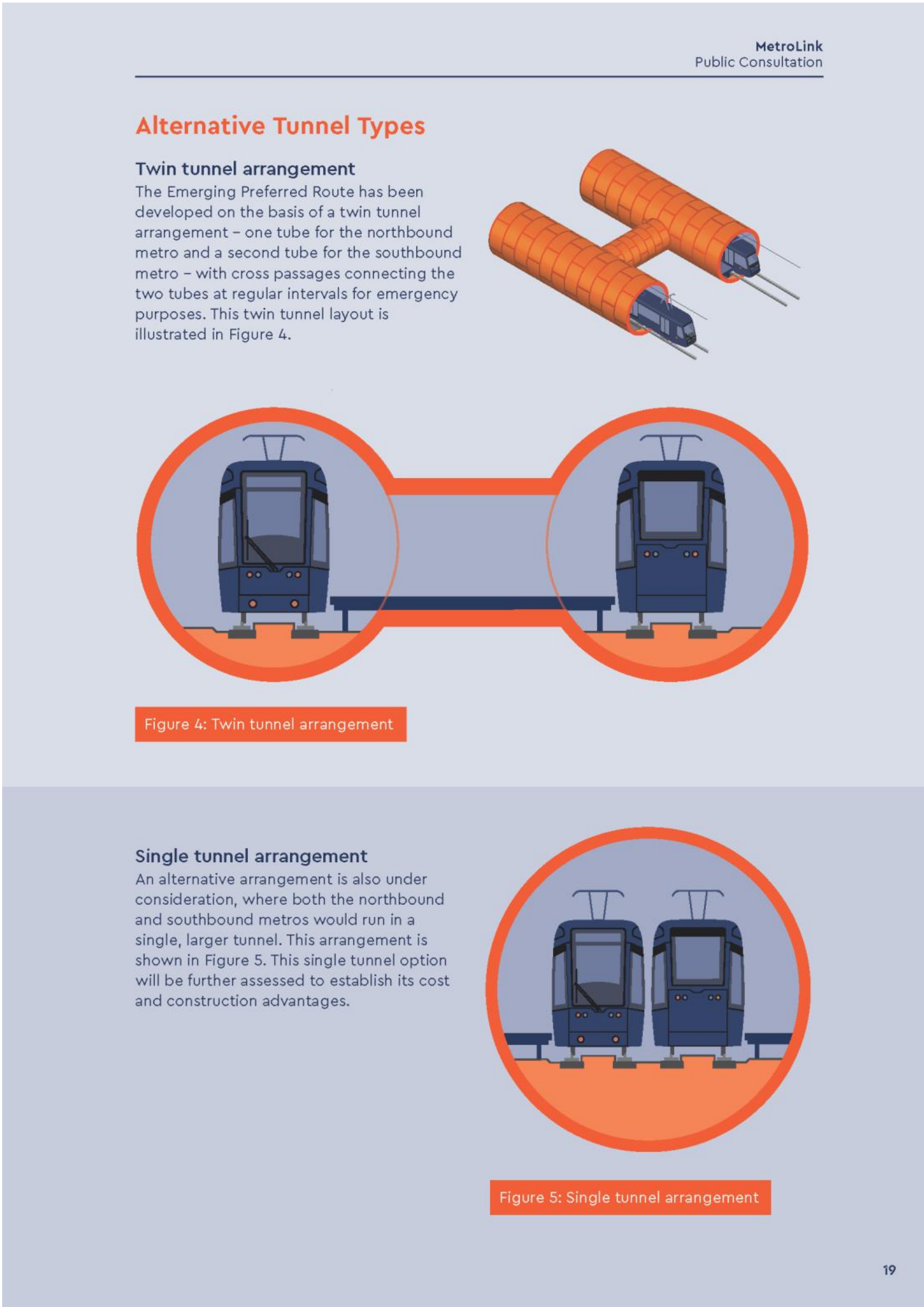
It was subsequently recommended that the single bore with dividing wall and the monotube were not taken forward for consideration because the cost and waste produced was significantly higher than the twin bore option. The single bore without a dividing wall was deemed comparable in cost to the twin-bore but fire life safety requirements and the associated potential number of escape shafts that would be required for a single bore was an additional cost consideration.

The twin-bore tunnel configuration was preferred for the Emerging Preferred Route (EPR).

2.2 Public Consultation Presentation

A brochure was published on the MetroLink website and it was also distributed at the Public Consultation meetings. The brochure presented the justification for MetroLink and provided information on passenger growth projections, the delivery programme, as well as a description on how the Emerging Preferred Route (EPR) was developed. The brochure confirmed that while the EPR had been developed using a twin-bore tunnel arrangement, the alternative of a single bore tunnel remained under consideration so that the respective cost and construction advantages could be further assessed.

The brochure page setting out this situation is shown in Figure 3 overleaf.



MetroLink
Public Consultation

Alternative Tunnel Types

Twin tunnel arrangement

The Emerging Preferred Route has been developed on the basis of a twin tunnel arrangement – one tube for the northbound metro and a second tube for the southbound metro – with cross passages connecting the two tubes at regular intervals for emergency purposes. This twin tunnel layout is illustrated in Figure 4.

Figure 4: Twin tunnel arrangement

Single tunnel arrangement

An alternative arrangement is also under consideration, where both the northbound and southbound metros would run in a single, larger tunnel. This arrangement is shown in Figure 5. This single tunnel option will be further assessed to establish its cost and construction advantages.

Figure 5: Single tunnel arrangement

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Figure 3 – Extract from Public Consultation Brochure 2018

The twin-bore tunnels for the EPR generally run parallel to each other with deviations to account for curvature or localized restriction.

3. Tunnel Configuration for the Preferred Route

3.1 Assessment of Route Wide Issues

3.1.1 Reassessment of EPR Proposals

On appointment in January 2018, Jacobs/Idom reviewed the tunnel and station design developed for the EPR and were also able to take account of the submissions received from the Public Consultation process. It is notable that the EPR proposals for a station and TBM Launch site at Griffith Park generated over two thirds of all consultation submissions.

The selection of a twin bore tunnel configuration for the underground EPR alignment from north of Dublin Airport to the city centre led to the decision to split the tunnel into two almost equal sections at Griffith Park. One twin-bore tunnel would have been bored from north of the Airport to Griffith Park where the two TBMs would have been removed and dismantled. A second pair of TBMs would at the same time have bored from Griffith Park southwards to Charlemont with the tunnel construction site and spoil removal at Griffith Park on the CLG Na Fianna pitches. At this location, an extensive construction site would have been required for the temporary storage of both excavated and construction materials. This decision at EPR stage was made mainly for construction programme reasons, recognizing that a twin bore tunnel cannot be fitted out with track, power and systems until all boring and lining work is completed and the TBM and associated equipment has been removed from the tunnel. To achieve the MetroLink programme, it was considered necessary to have at least two concurrent tunneling operations with four TBMs operating at the same time. The CLG Na Fianna pitch location was also proposed as the subsequent location for the Griffith Park Station.

Jacobs/Idom conducted a value engineering exercise where all the major design decisions adopted for the EPR were tested against worldwide best practice, recognising also that TBM technology continues to develop. This included consideration of engineering aspects; fire safety strategy; construction phase requirements; operational benefits; environmental and cost implications.

Single bore tunnel design has a number of advantages over twin bore tunnel design. During construction of a twin bore tunnel there is insufficient space in the tunnel bore to install track, overhead line and other equipment alongside operating conveyer and ventilation equipment. A larger diameter single bore can offer more working space behind the TBM and potentially facilitates a limited amount of fitting out work to proceed in the bore behind the TBM. A single bore tunnel has a quicker construction period because there is no requirement for mined cross passages and rail cross-overs between the tunnels which can be slow to construct safely and need to be undertaken after the tunnel boring is complete.

For the Preferred Route as a single bore tunnel, it is also proposed that the tunnels rise to the surface each side of the M50 to accommodate a depot better placed near the route centre and this results in two separate tunnel lengths as below:

- Dardistown (Old Airport Road) under the airport to north of Dublin Airport and the Naul Road.
- Northwood (south of M50) to Charlemont in the city centre.

This enables the TBM launch area to be relocated further to the north, away from the constraints of Griffith Park.

3.1.2 Safety Issues

A key consideration on tunnel choice was the Safety Evacuation Strategy and how it impacted on the selection of a single-bore tunnel configuration vs a twin-bore tunnel. Depending on the evacuation strategy followed (evacuation on side walkways in tunnels or evacuation onto the track slab), one tunnel configuration was preferred over the other. The process is presented in Figure 4 below with the Preferred Route decision for a single bore tunnel following the decision line shown in red.

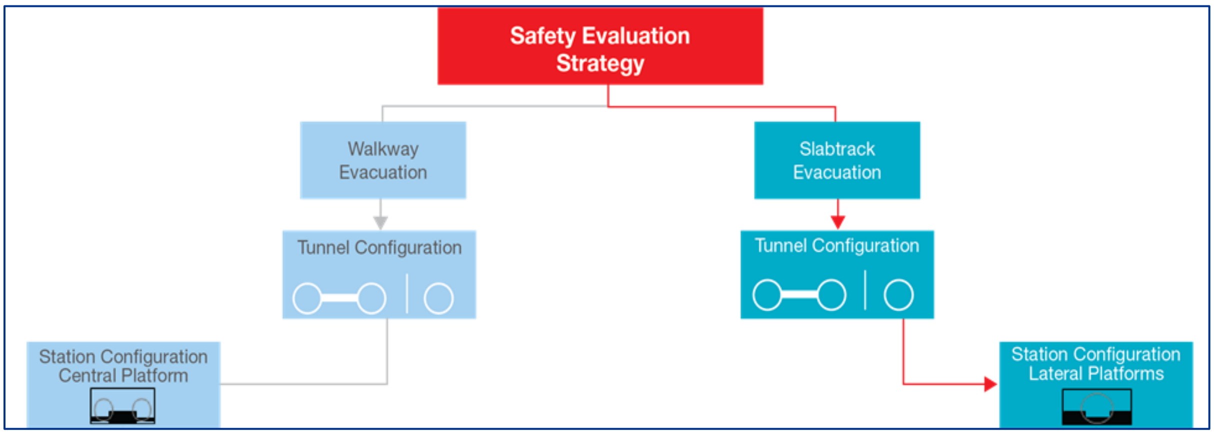


Figure 4 – Decision Process Flow

Single bore tunnel design has advantages over twin bore tunnel design in that it offers improved safety for evacuation and emergency service access at track level, due to the larger/wider tunnel bore. For a twin bore tunnel, emergency evacuation is typically via a more restrictive side walkway. Evacuation times from a train are also much quicker with a train in a wider single bore than in a narrower tunnel that would be used for a twin bore tunnel.

3.1.3 Rolling Stock

A further factor that has a direct influence on tunnel configuration is the type of rolling stock. High floor trains have more capacity than the low floor trains which were proposed as part of the EPR. This fact, combined with the 90 second peak headway (time between trains) which is made possible using (GoA4) driverless train technology, enables the target demand of 20,000 passengers per hour per day (pphpd) to be satisfied using shorter trains. Instead of the 90m long low-floor trains considered for the EPR, the high-floor trains are proposed to be shorter at 64m long and this results in more flexibility on the size and placement of the station boxes.

In addition, driverless technology with high-floor and constant floor level vehicle design can have passenger connectivity along the entire train length. The absence of the driver cab enables train-end escape in emergency situations, which allows passengers to disembark onto the track slab between the rails much more quickly than side evacuation onto a walkway typical in a twin bore arrangement. Lateral or side door escape with associated high-level walkways in the tunnel, which have their own risks, are not required and more space is made available in the tunnel for emergency response teams.

These factors are discussed in more detail in the next section of this report.

3.2 Twin Bore and Single Bore Tunnel Configuration Comparison

The Value Engineering work included the development of a Tunnel Safety Strategy and further considerations of tunnel and station design, construction methodology, operational planning, and comparative costs. These matters are addressed in the following sections.

3.2.1 Tunnel Safety Strategy

The Safety Strategy places safety at the heart of the tunnel configuration design. The key safety strategy aspects addressed as part of the overall metro design are shown in Figure 5 below (note 'Viaduct and at-grade sections' is not relevant to the tunnel design).

Figure 5 – Safety Strategy and Matters Considered

3.2.2 Twin-bore and Single-bore with/without Lateral Walkways.

Two different safety strategies are possible from trains stopped in tunnels:

- Evacuation by lateral walkways, or
- Evacuation onto track slab level.

For the twin-bore tunnel configuration with emergency walkways shown in Figure 6 below, the external tunnel diameter of 6.6m is defined by the kinematic envelope for the rolling stock, shown by the red and blue dotted lines representing the dynamic movement of the vehicle when moving along the tunnel. The inclusion of a lateral walkway has no effect on this diameter but the walkway width is narrow to fit within the tunnel.

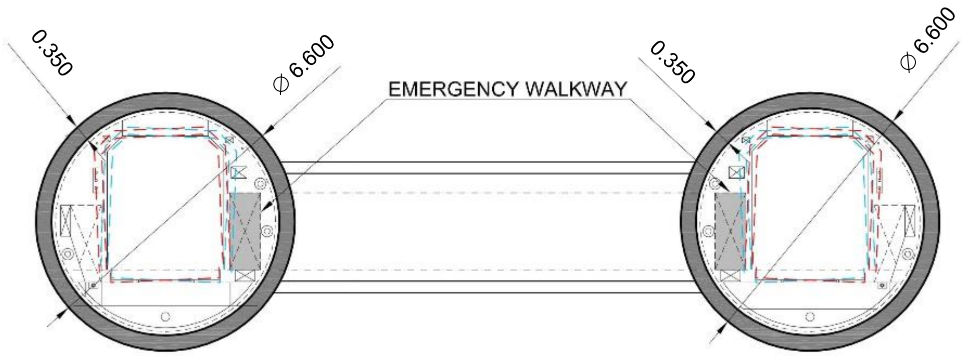


Figure 6 – Twin-bore with Lateral Emergency Walkways

The situation for train-end evacuation without lateral walkways is shown in Figure 7 below. Given that the kinematic envelope fixes the inner diameter, removing the walkways does not allow a reduction in the bore size.

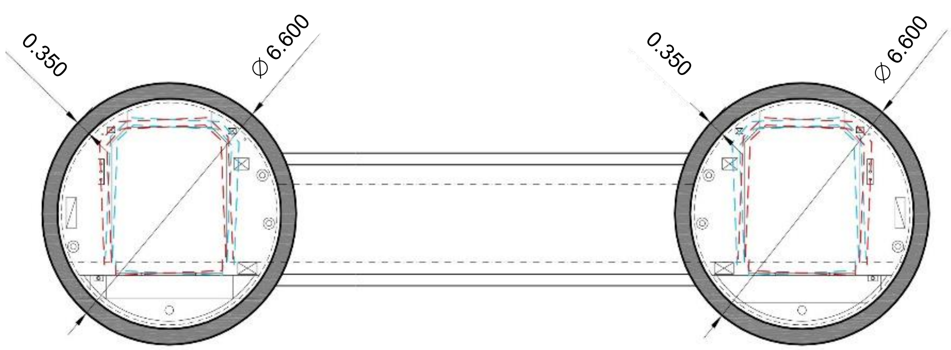


Figure 7 – Twin bore without Lateral Emergency Walkways

A single bore solution with side evacuation onto lateral walkways as presented in the Arup Tunnel Configuration study, and as shown in Figure 8 below. This would require a large diameter bore of approximately 10.3 metre external diameter. This option has large environmental and cost implications, as the larger bore diameter requires the excavation of a much larger amount of material when compared to the twin bore configuration. For this reason, this design has not progressed further.

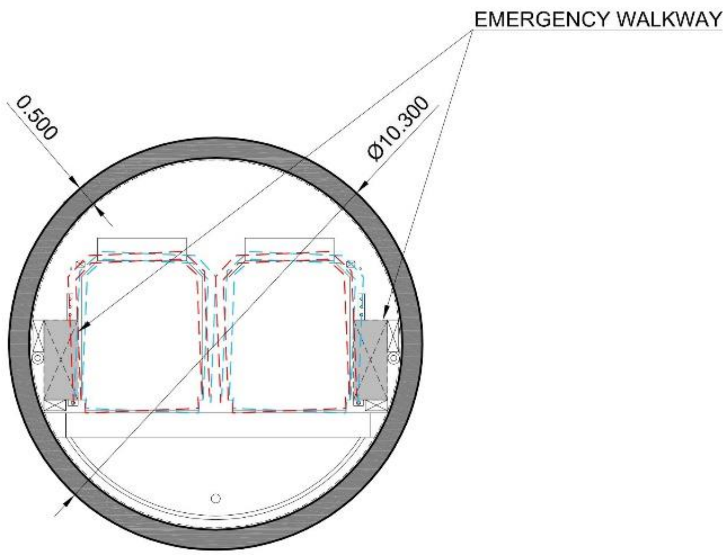


Figure 8 – Single-bore Tunnel with Lateral Emergency Walkways

The single-bore tunnel configuration without lateral walkways as shown in Figure 9 below requires a 9.2m external diameter tunnel and presents an evacuation route direct to the slab track, either from the ends of the train or from side doors onto the adjacent unoccupied track. The Value Engineering Study considered that this option delivered the greatest safety benefits whilst also delivering substantial direct cost savings derived from faster construction and with added benefits such as operational flexibility and future-proofing.

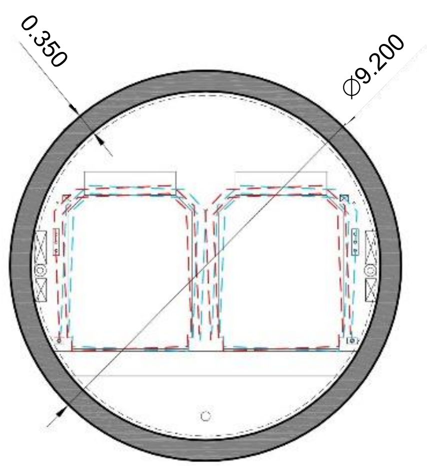


Figure 9 – Single-bore Tunnel without Lateral Walkways

With a safety strategy based on lateral walkways, as adopted for the EPR, the most competitive solution is the twin-bore configuration. However, with a safety strategy based on faster evacuation onto slab track, with greater access for emergency services by the train, the most competitive solution is the single-bore configuration.

The following sections of the report address tunnel configuration with or without lateral walkways.

3.3 Safety Analysis for Tunnel Configurations

3.3.1 Evacuation Routes

Train evacuation safety requires coordination of the vehicle design and the physical characteristics of the passenger evacuation zone. During an emergency where the train can advance to the next station, automatically controlled trains will ensure that passengers will be evacuated laterally onto station platforms. This is a requirement for compliance with European Standard EN 45545.

However, evacuation procedures for a train having to stop between stations must also be considered, particularly for railway tunnel systems. For the proposed MetroLink single-bore tunnel configuration, it is proposed that passenger evacuation is onto track slab level between the rails. To achieve this, trains must have open gangway connections between individual vehicles as well as opening front/rear end doors including ramps to track level.

For the twin-bore tunnel configuration, passenger evacuation would be achieved through vehicle side doors onto raised lateral walkways along the tunnel.

The images in Figure 10 below provide a visual representation of the benefits associated with slab track evacuation:

Slab Track Evacuation **Lateral Walkway Evacuation**

Figure 10 – Examples of Front & Rear-end Evacuation and of Lateral Walkway Evacuation

The overall speed of lateral walkway evacuation is dictated by the slowest person and this can inevitably lead to overtaking and pushing. Falls from height and localised overcrowding when leaving the train are risks associated with this evacuation method.

Front / rear-end evacuation to the track creates smoother evacuation patterns because once passengers are on the slab track they are less constrained, have more space to move and are not as prone to panic. Alternative lateral evacuation from high floor vehicles directly to track level is usually provided by using stairs as shown in Figure 11 below, however this is not proposed for MetroLink.

Figure 11 - Lateral Evacuation onto Slab Track

The front / rear end evacuation doors can be either operated from the Operations Control Centre (OCC) or by means of a button or a lever in the train near the door or on the door itself. This will require the train to be stopped and receive OCC confirmation for emergency deployment.

3.4 Emergency Service Access and Operation

3.4.1 Access to the tunnels

During an incident, emergency services will require access into the tunnel to assist passengers, coordinate evacuation and / or to tackle a fire. Tunnel access for emergency services will be via the portals, stations or through intermediate intervention shafts. The intermediate intervention or intervention/ventilation shafts will be located at a maximum separation of 1000 metres and located at stations, portals and specific intervention points. Figure 12 below indicates these locations, based on current preliminary design work. The actual distances will be dependent on finalisation of the design.

SECTION CHARLEMONT - ESTUARY

Alignment Element	Type of Station	Chainage Start	Chainage End	Length (m)	Intervention/ ventilation Strategy
At-Grade	At-grade	0+234	0+469	235	
Estuary (Park & Ride)	At-grade	0+469	0+534	65	
At-Grade - Elevated		0+534	0+920	386	
Open cut - Retained cut - Cut and Cover		0+920	2+005	1085	
Seatown	Retain-Cut	2+005	2+070	65	
Open cut - Retain cut - Cut and Cover	--	2+070,	2+973	903	
Swords Central	Retain-Cut	2+973	3+038	65	
Open cut - Retained cut - Cut and Cover	--	3+038	3+940	901	
Fosterstown	Retain-Cut	3+940	4+005	65	
Retained cut - Cut and Cover		4+005	4+545	540	
At-Grade		4+545	5+255	710	
Portal	--	5+255	5+279	24	Intervention/ ventilation building
Tunnel	--	5+279	6+188	909	
Dublin Airport	Underground	6+188	6+253	65	
Tunnel	--	6+253	7+558	1305	
Portal		7+558	7+628	70	Intervention/ ventilation building
Cut and Cover - Retained cut		7+628	8+092	465	
Dardistown	Retained-Cut	8+092	8+157	65	
Retained cut - Cut and Cover		8+157	8+740	582	
At-Grade - Elevated		8+740	9+160	420	
Retained cut - Cut and Cover		9+160	9+475	316	
Northwood (Portal)	Underground	9+475	9+540	65	
Tunnel	--	9+540	10+417	876	
Ballymun	Underground	10+417	10+482	65	
Tunnel	--	10+482	11+375	893	
Collins Avenue	Underground	11+375	11+440	65	
Tunnel	--	11+440	12+958	1518	Intermediate Ventilation & Evacuation Shaft provided
Griffith Park	Underground	12+958	13+023	65	
Tunnel	--	13+023	14+022	999	
Glasnevin	Underground	14+022	14+087	65	
Tunnel	--	14+087	14+791	704	
Mater	Underground	14+791	14+856	65	
Tunnel	--	14+856	15+800	944	
O'Connell Street	Underground	15+800	15+865	65	
Tunnel	--	15+865	16+550	684	
Tara Street	Underground	16+550	16+615	65	
Tunnel	--	16+615	17+652	1037	Ventilation requirements subject to final station location
St. Stephen's Green	Underground	17+652	17+717	65	
Tunnel	--	17+7170	18+496	779	
Charlemont	Underground	18+496	18+561	65	
		18+561	19+206	645	
Tunnel Termination		19+206	19+300	94	

Figure 12 – Platform stations and Tunnel Sections Length

The final design of the emergency shafts will ensure that separate routes will be provided for passengers' egress and emergency services access / egress.

3.4.2 Operation within the tunnels

The single bore tunnel configuration with no lateral walkways and with direct access to track level provides a wide space near and around an incident train for emergency services to deploy and execute their tasks. Furthermore, train emergency egress ramps and fire hose cabinets are all proposed to be located at track level. This eliminates risks associated with emergency service personnel having to climb up into trains from the track or up onto side walkways to reach the fire hose cabinets.

The images in Figure 13 below indicate the spatial benefits of the proposed tunnel configuration during a firefighting task and assisting a passenger requiring medical assistance. Note lateral evacuation is not proposed for MetroLink.

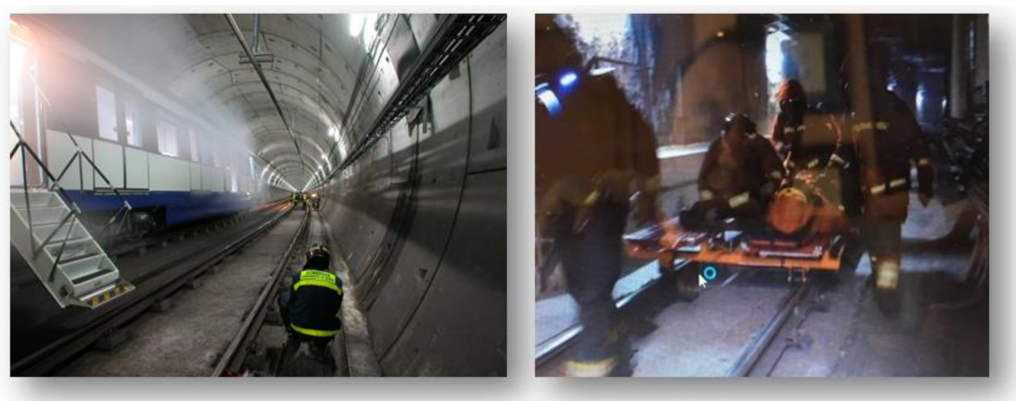


Figure 13 - Examples of Emergency Services Interventions

The space provided in a single bore tunnel is extremely beneficial for fire fighters who may be carrying large items of equipment. Depending on the circumstances, fire fighters could be significantly impeded in an incident in a twin bore tunnel configuration due to the lack of width between the train and the tunnel lining or the evacuation walkway.

In addition to fire incidents, more frequent emergencies in tunnels can consist of other scenarios such as:

- Traction power failures
- Derailments
- Obstacles or collisions that may require support from MetroLink staff and operatives in addition to the emergency services.

The single bore tunnel configuration with twin tracks provides the space required for operational personnel to undertake their duties, examples of which are shown on Figure 14 below.

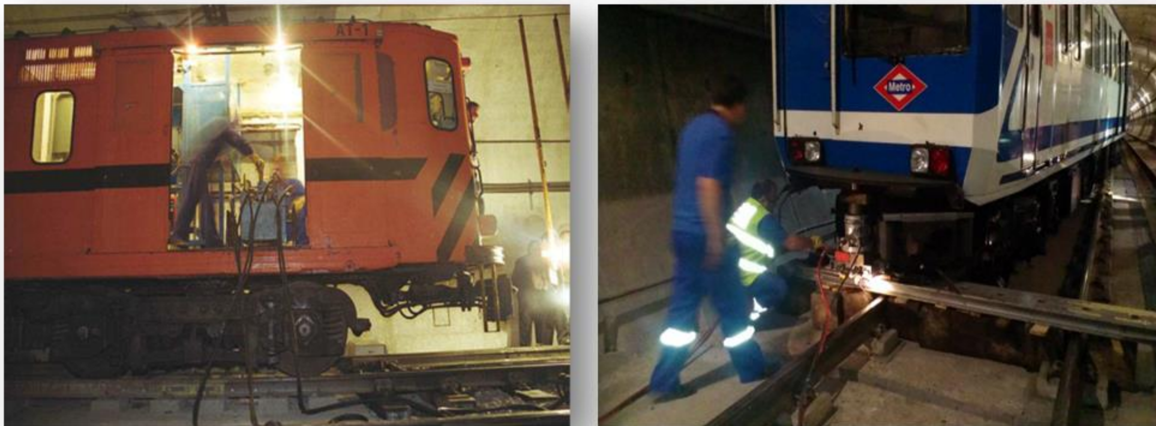


Figure 14 - Examples of Operational Emergency Interventions

3.4.3 Smoke Stratification

In the case of the single-bore tunnel (with twin tracks) configuration, there is extra volume in the tunnel crown compared to a twin bore configuration which allows initial accumulation of smoke above the train/passenger level. This results in increased time available for escape. This space can also be used for the installation of jet-fans which may be required as part of the ventilation strategy. In a twin-bore tunnel configuration, this extra space is not available therefore provision of additional intermediate ventilation shafts may need to be considered in the longer tunnel sections to ensure safe and timely evacuation.

Smoke stratification can be extremely beneficial during the early stages of a fire, before ventilation systems are activated. The conditions required for smoke stratification can be more easily created in a large diameter single bore tunnel as the larger cross-sectional area allows smoke to be confined at high level for a longer period as can be estimated from mathematical modelling output as shown in Figure 15.

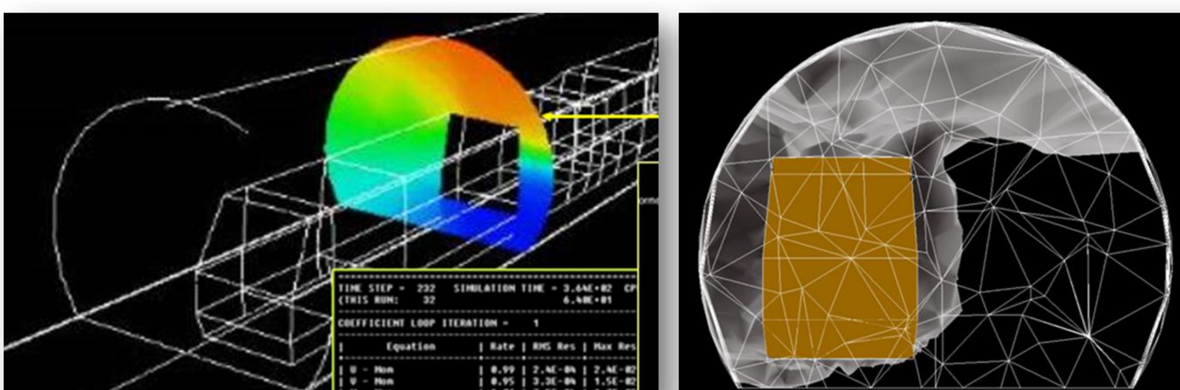


Figure 15 – Smoke and Heat Analysis for a Train Fire

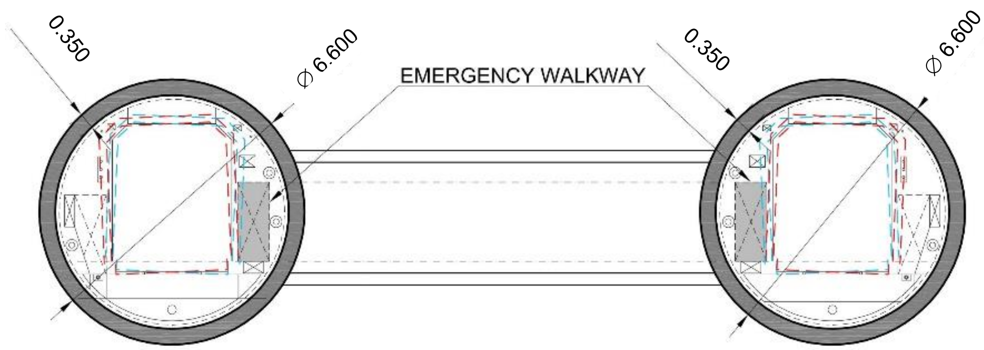
The larger the tunnel section, the lower the air velocities within the tunnel, which also leads to longer times for the smoke to fill the tunnel. This stratification of smoke greatly assists in the early and safe evacuation as visibility within the tunnel is maintained for a longer period of time.

Furthermore, as evacuation is proposed to be directly to track level (through the train's front or rear ends), people will be walking at the lowest level available in the tunnel, the furthest point from the smoke layer above.

3.5 Tunnel Design Considerations

3.5.1 Typical Cross Section – Twin Bore and Single Bore

The typical cross sections studied are shown in Figure 16 below:

Twin bore	

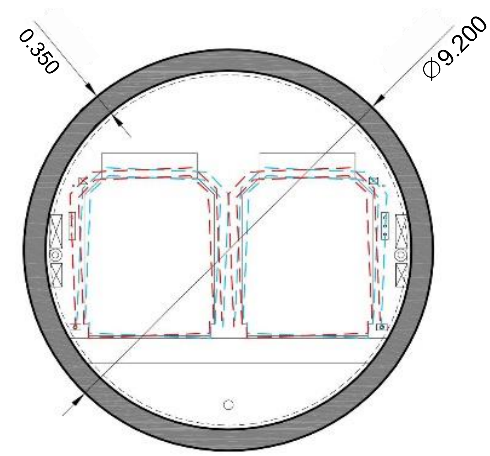
Single Bore (optimized)	

Figure 16 – Tunnel Configuration for Twin Bore and Single Bore Tunnels

The approach adopted for space proofing is similar to that used in the Concept Design Report for the EPR. Comparing both tunnel configurations, the volume of spoil to be excavated is similar in both cases (approx. 3% smaller in the single bore tunnel).

The difference in tunnel lining configuration between the two options results in the required concrete volume being approximately 29% less for the single bore solution.

3.5.2 Potential Ground Movement

The typical area in which there is likely to be a greater degree of settlement depending on the configuration of the tunnel is indicated on Figure 17, which indicates typical settlement above tunnels based on an assumed 1.5% volume loss.

The graph indicates that a larger diameter single-bore tunnel has greater potential for ground settlement compared to smaller twin bore tunnels along and close to the centre-line of the tunnel, but less settlement further away from the centre-line. This greater settlement is indicated below where the blue line passes under the green one. It should be noted that this fact does not mean that the settlement value obtained with single bore tunnel is outside permissible limits or likely to cause damage to properties.

The difference in settlement values between both configurations can be low and are very much dependent on the tunnel depths and tunnel diameters.

On the other hand, the single bore tunnel presents smaller settlements as the distance to the axis increases (between 7 and 20 m for the volume of settlement considered). That corresponds with the zone of where buildings are located when the tunnel alignment passes directly under roads and streets.

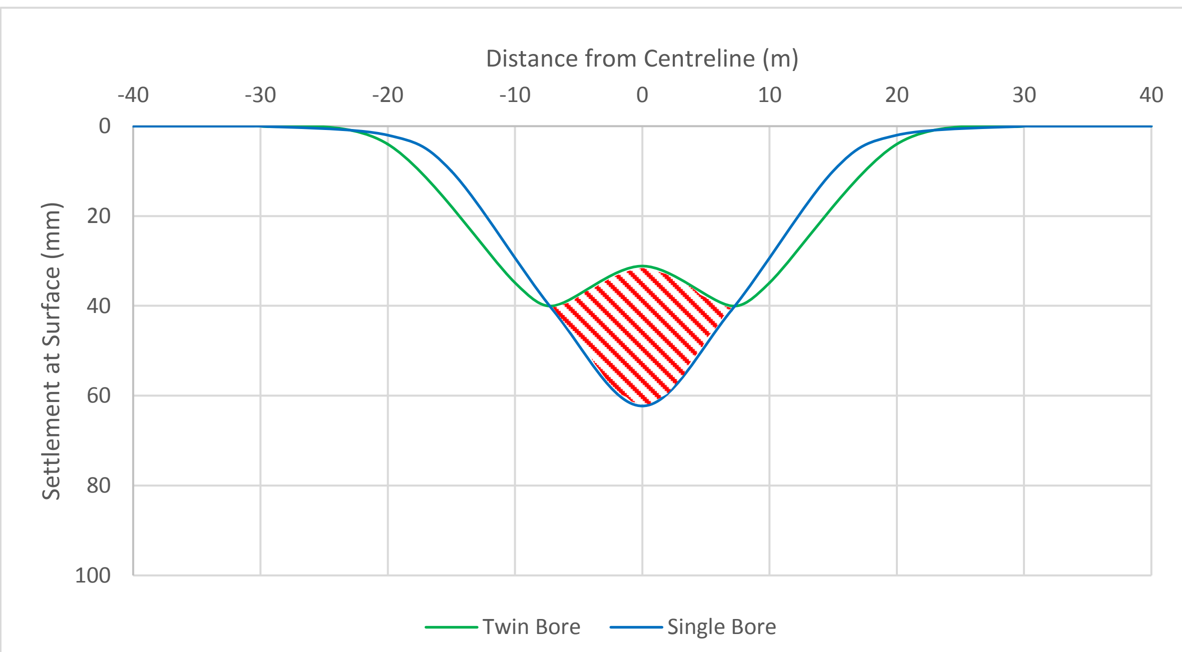


Figure 17 - Settlement profile at Surface Graph (indicative – based on nominal 1.5% Volume Loss)

The figure above considers cases where volume loss is high (1.5%). Expected values of Volume Loss for Dublin are anticipated to be much lower as follows:

1. Between 0.4 and 1% for boulder clay depending on the tunnel depth.
2. 1% for complete tunnel face in layer of transition between soil and rock (QTR).

3. For sandy soils (pre-glacial sands and gravels), values range between both values noted in points (1) and (2).

4. In case of limestone value is of the order of 0.4%.

In all the cases, MetroLink values are equal or lower to 1%, indicating lower settlements than implied by the example figure.

As it can be observed in Figure 17 at the same depth a single bore tunnel will cause larger settlements above the tunnel than a twin bore one. In practice, geology and hydrogeology play a much more important role when determining the tunnel depth and potential settlements than the bore diameter itself. As such, the geological properties will be the key driving factor for tunnel depth with specific settlement analysis required along the route and appropriate mitigation developed where necessary to address particular settlement concerns.

3.5.3 Tunnel Portals

The portal geometry is defined by the depth at break-in break-out, the gradient of the track, the gradient of the ground and spacing of the tracks. In terms of comparison between alternatives (twin bore and single bore), the only relevant criteria are the spacing of the tracks.

3.5.4 Cross Passages

NFPA 130 2017 section 6.3.1.6 states *"Where cross-passageways are utilised in lieu of emergency exit stairways, the following requirement shall apply: (1) Cross-passageways shall not be farther than 244 m (800 ft) apart; (2) Cross-passageways shall not be farther than 244 m (800 ft) from the station or portal of the enclosed trainway"*). As such, cross passages on twin-bore tunnels would need to be provided along tunneled sections where the length of clear tunnel is greater than 244 m. This means that in the case of **twin bore** configuration, the EPR requires approximately forty-two cross passages.

There is no need for cross passages in the case of a **single bore** configuration.

3.5.5 Crossovers

In the case of a **twin bore** configuration and because the two tracks are in two separate tunnels, track crossovers must be located in special sections built to join the tunnels and built specifically for this purpose. This means that when compared to the **single bore** configuration, additional cut-and-cover works or mined cavern sections will be required to install the crossovers.

This feature imposes a particular constraint on the flexibility of future operations.

An important benefit of the **single bore** configuration is that it has enough space available to install the crossovers without having to change the section of the tunnel, or to do any special work. This capability saves capital cost and enables track infrastructure changes to be easily made as train operations develop in the future.

3.5.6 Summary

The following table is a Red/Amber/Green (RAG) analysis to assess the twin bore vs. single bore options against these main tunnel design criteria:

Table 1 – RAG Analysis for Twin versus Single Tunnel Configuration

Parameter	Twin bore	Single Bore
Typical cross section – space proofing		
Longitudinal profile and ground movements		
Tunnel Portals		
Cross passages		
Crossovers		

3.6 Construction Activities

3.6.1 Spoil Management

The spoil from the excavation works will be generated from tunnels, underground stations, portals, shafts and cross passages. Estimated quantities are broadly similar for both the twin bore and single bore options. The single bore option produces a slightly smaller amount of spoil material as indicated in Table 2 below.

Table 2 – Excavation Volumes

Spoil Volume	Twin bore (m^3)	Single Bore (m^3)
Tunnel	801,449	778,635
UG Stations	940,000	880,000
Portals	185,000	185,000
Shafts	5,600	20,160
Crossovers	7,500	0
Cross passages	10,780	0
	1,950,329	**1,863,795**

3.7 Programme

3.7.1 TBM Launch and Retrieval Sites and number of TBMs

With respect to the programme of construction activities, there are several factors to be considered. The difference in the number of TBMs and the zones proposed for the launching and retrieval shafts in the twin bore and in the single bore are the following:

- **EPR and Twin-Bore**
    - Number of TBMs: 4
    - Launching/Retrieval shafts:

- EPR - Launching shafts: Naul Road and Griffith Park
- EPR - Retrieval shafts: Griffith Park and Charlemont

- **Preferred Route and Single Bore**
  - Number of TBMs: 1
  - Launching/Retrieval shafts
    - Launching shafts – Dardistown & Northwood.
    - Retrieval shafts – Naul Road (Note: Currently anticipated that the TBM will be buried south of Charlemont).

The single bore option with one TBM will provide construction programme savings. An alternative utilizing two separate TBMs and constructing the two single-bore tunnels concurrently is also feasible and would provide further programme savings.

3.7.2 Major Works on Programme

3.7.2.1 Construction of Intervention/Ventilation Shafts.

For a single bore configuration, it is necessary to build several intervention/ventilation shafts, to meet safety regulations. These intervention shafts will allow passengers exit the tunnel in the event of an emergency. The intervention shafts will also provide tunnel access and egress for emergency services during emergency events. It may be possible to optimize the number of shafts having regard to final station location adjustments and addressing the requirements of Dublin Fire Brigade.

In the case of a twin bore configuration and following the criteria adopted in the EPR, it would be necessary to build only one intervention shaft.

For a single-bore configuration the intervention shafts can be constructed offline from the main tunnel alignment and can be independent of TBM progress. There is an interface between the tunnel and the shafts. The construction of these intervention shafts is usually off the critical path and therefore this approach for the single bore option needs a shorter and less risky programme compared to the twin bore option with cross passages between tunnels.

3.7.2.2 Construction of Cross-passages.

These elements are necessary only for the **twin bore** configuration. Having reviewed the EPR alignment, calculations indicate the need for approximately 42 cross-passages along the route length. This activity would be on the critical path since they can only be constructed once the two TBMs have completed the tunnel drives and tunnel clearance is completed.

3.7.2.3 Construction of Crossovers

For a **single bore** configuration, track crossovers will be accommodated within the single-bore twin-track tunnel.

However, for a **twin bore** configuration, track crossover installation does have an impact on the programme because a cut-and-cover section or mined section is required to connect the two tunnels. The crossovers are typically located between stations, but they can also be situated next to them. For a cross-over between stations, a cavern must be built between the stations. Where a cross-over is required next to a station, the station must be lengthened to provide space to install the adjacent crossover cavern. In either situation, the works to construct a cavern will impact the tunnel construction programme.

It is noted that only two crossovers are shown in the EPR design, although more than two may be needed to operate the required train service. This requirement would significantly increase the twin bore tunnel costs. It should be noted that the options assessment has not allowed for more than two crossovers in the single bore option for the purposes of cost comparison.

3.7.2.4 Portals

According to the EPR proposal, the portals and required ramps are longer for a single bore configuration than the twin bore tunnel solution. This may or may not be the case depending on governing factors such as topography and vertical alignment, but the cost and physical impact is very low because they are located at the ends of the tunnel and any difference in length could be reduced as the design develops.

3.7.2.5 Station Depth

A single bore configuration does have a larger tunnel diameter. The depth of the stations included within the Preferred Route broadly follows the station depths designed as part of the EPR. Notwithstanding this, the overall station depths being developed for the Preferred Route are dictated by other factors such as ground conditions, geological strata and in some cases deep utilities.

3.8 Summary of Programme Impacts

Table 3 below provides a RAG analysis to assess the options against the main programme criteria, from which we note that the Single Bore option scores better on Construction activities, Programme (TBMs, Cross Passage impacts, Crossovers…) and Noise and Vibration.

Parameter	Twin bore	Single Bore
Construction activities (spoil management)		
Programme		
Launching/Retrieval shafts and number of TBMs		
Construction of intervention/ventilation shafts		
Construction of cross-passages		
Construction of crossovers		
Portals		
Stations depth		

Table 3 – RAG Analysis for Twin bore versus Single Bore

3.9 Operational Matters

3.9.1 User Experience

Normal user experience (non-emergency) of the tunnel configuration is exclusively related to the station platform layout and its ease of use. Two platform arrangements are considered.

- Island platform for twin bore
- Side platform for single bore

The impact on user experience is related to how many decisions are required to be taken by the user when accessing a platform from the surface and how easy it is to correct a wayfinding error (i.e. inadvertently reaching the wrong platform).

By default, the island platform provided for the twin bore solution is good because the same platform serves both directions meaning a passenger entering a station would not have to choose between lifts, escalators, stairs etc. The decision as to which side of the platform is correct will be made by the passenger once they arrive on the central platform

The other platform arrangements (side platform) are similar with respect to the number of decisions required and ease of access. The decision is taken before descending to the platform. Depending on the final station design and as the system will be ungated, apart from the lost time it should not be difficult for a user who inadvertently accessed the wrong platform to realize their mistake and return to a part of the station from where they can reach the correct platform. Good signage and way finding will be required to minimize these types of user mistakes.

3.9.2 Systems Operations

The most important impact on future operation is related to the crossover location, as the twin bore configuration implies a very high rigidity on the infrastructure and makes it quite difficult to build additional crossovers after the operation has started. The crossover locations identified and constructed at the start of the project will need to address all operational scenarios for the foreseeable future because the construction of future additional crossovers, whilst not impossible, will be very difficult and expensive to install. The construction of future cross overs in a twin bore system will also result in significant operational disruption.

The following table is a RAG analysis to assess the options against the main operational criteria:

Table 4 – RAG Analysis for User Experience

Parameter	Twin bore	Single Bore
User experience		
Systems operation		

3.10 Environmental Assessment

An environmental assessment was undertaken of the potential relative environmental impact of each configuration. Having regard to the environmental impacts of both configurations the following are the key issues that affected the choice of the most appropriate configuration:

3.10.1 Noise & Vibration

The levels of ground-borne noise and vibration generated during the construction phase occur for a limited period only during the advancement of the TBM once effective mitigation measures are introduced to mitigate other construction sources of vibration. The levels of noise and vibration will vary depending on details such as the TBM size, type of material that the TBM is advancing through and the depth of the tunnel beneath sensitive receptors. Another important factor is the number of TBM machines used at the same time in the same location. The twin bore solution proposed two TBMs for each tunnel, typically the second TBM would run 2-3 months behind the first so ground -borne noise and vibration could occur twice as each TBM passed by. With the single-bore option, the TBM would only pass receptors once, however the greater diameter of the single bore tunnel will require a larger

TBM which will generate slightly higher ground-borne noise & vibration levels than a smaller machine. In both cases, mitigation of noise and vibration from tunnel spoil being transported back along the tunnels may be required.

The twin bore tunnel configuration on this project would require the construction of 42 cross-passages along the length of the tunnel. These cross-passages would be generally constructed through rock by blasting which generates significant noise & vibration. The single bore solution does not require the construction of any cross passages and associated noise and vibration impacts.

3.10.2 Settlement and Potential Impacts on Property

As noted in Section 3.5.2, larger diameter single-bore tunnel has greater potential ground settlement compared to the smaller twin bore tunnel at the same depth (as shown in Figure 17 previously). Notwithstanding this, geology and hydrogeology play a much more important role when determining the tunnel depth than the bore diameter itself, so that the single-bore tunnel need not always be deeper than the twin bore. The geological properties will be the key driving factor for tunnel depth with settlement analysis identifying locations where specific intervention measures will be required to mitigate settlement.

3.10.3 Volumes of Materials and Spoil

Significant volumes of spoil material will be generated by the project regardless of the tunnel configuration. The material will be generated from the advancement of the TBM in addition to excavation works at station locations and other sites along the route. Having regard to the fact that re-use of spoil material within the project is limited there is a requirement to minimize the generation of spoil material where possible. It has been estimated that the where a single bore tunnel option is used it generates slightly less material at approx. 1.9million m^3 compared to the twin bore solution with generates approx. 2.0million m^3. (Refer to Table 2).

3.10.4 Construction Phase Impacts

The single bore tunnel configuration offers significant advantages in terms of the opportunity to reduce the potential environmental impacts of construction when compared to the twin bore option. In response to the public consultation on the EPR, many submissions were received relating to the proposals for Griffith Park Station and the associated TBM launch site and construction compound.

The selection of a twin bore tunnel configuration for the EPR alignment from north of Dublin Airport to the city centre resulted in the requirement to split the tunnel into two almost equal sections at Griffith Park, where a station and TBM receiving and TBM launch site was required, as well as station construction. At this location an extensive construction site was proposed for the temporary storage of excavated materials and construction materials over a prolonged construction period. This site is located in close proximity to a number of important community facilities including schools and sports clubs including the local CLG Na Fianna GAA club. A number of playing fields were proposed to be acquired from the CLG Na Fianna GAA club as part of the EPR.

This decision to locate the TBM launch site at Griffith Park was made primarily made to allow for the achievement of the proposed MetroLink programme. However, by adopting a single bore solution it will be possible to advance a single TBM machine from a less sensitive location (at Northwood) and advance it all the way to the end of the scheme south of Charlemont. This removed the requirement for an intermediate TBM launch site at Griffith Park, thereby reducing the potential for significant environmental impacts at that location. The adoption of the single bore TBM also means that the project programme can be achieved with the use of a single TBM machine rather than the deployment of 4 TBM machines as required for the Twin Bore configuration.

The following table is a RAG analysis to assess the options against the main environmental criteria:

Table 5 – RAG Analysis for Environmental Criteria

Parameter	Twin bore	Single Bore
Noise & Vibration		
Settlement & Potential impacts on Property		
Volumes of Material and Spoil		
Construction Phase Impacts		

3.11 Costs

Regarding the comparative costs of both configurations, the same criteria and ratios used in the EPR Concept Design report have been followed. The elements of both tunnel configurations which have been assessed are as follows:

- Tunnelling works (excavation, lining concrete, cross passages, TBM strategy)
- Underground crossovers
- Tunnel Portals
- Intervention shafts

A comparative evaluation of costs was undertaken based on the ratios and criteria used previously for the EPR with a reasonable estimation of the differentiating construction elements. This cost comparison indicated that the single bore configuration is approximately 20% cheaper when compared to the twin bore tunnel configuration.

The following summary table is a Red/Amber/Green RAG analysis to assess the options against the main construction cost criteria:

Table 6 – RAG Analysis for Tunnel Cost

Parameter	Twin bore	Single Bore
Tunnelling works		
Excavation		
Lining concrete (construction, transportation, storage)		
Cross-passages		
TBM Strategy (number of TBM and launching sites)		
Underground crossovers		
Tunnel portals		
Intervention shafts		

4. Conclusions

The comparison between both configurations (single bore versus twin bore) demonstrates that the single bore alternative has several advantages over the twin bore option. Therefore, it is recommended that the single bore configuration should be adopted for the preliminary design of the MetroLink project. This proposition is supported by examples of Metro Lines worldwide using this configuration, which is becoming more common globally, particularly for automated (driverless) trains as proposed for MetroLink.

The advantages and disadvantages of the single bore configuration are summarized in the points below.

ADVANTAGES

- Passenger evacuation onto tracks is safer and faster than lateral evacuation onto walkways.
- Increased space for emergency services access and working space adjacent to a train in the tunnel
- Using ventilation equipment, conditions can be created within a large bore diameter tunnel that facilitates smoke stratification at a high level in the bore for a longer period of time when compared to that in a twin bore configuration. Therefore, the single bore configuration facilitates enhanced evacuation safety conditions and provides better tunnel visibility during fire events when compared to the twin bore solution.
- Single-bore tunnel can be constructed at lower cost than twin bore due to the reduced construction works and quicker programme
- A single-bore tunnel can be constructed more quickly as:
  - No requirement for cross-passages, which are slow to construct and need to be mined as separate/later construction activities.
  - Not affected by extra mined/cut & cover sections required for track crossovers in twin-bore tunnels.
- Reduction in spoil quantities and associated handling and disposal costs compared to twin-bore tunnel.
- Building programme and construction activities within underground stations: affected only one time by drive through/pull through of TBM.
- Allows for a reduced environmental impact during the construction phase when compared to the twin bore configuration.
- The single bore configuration offers a more flexible system throughout the life cycle of the asset in terms of operational adjustments and future expansion.

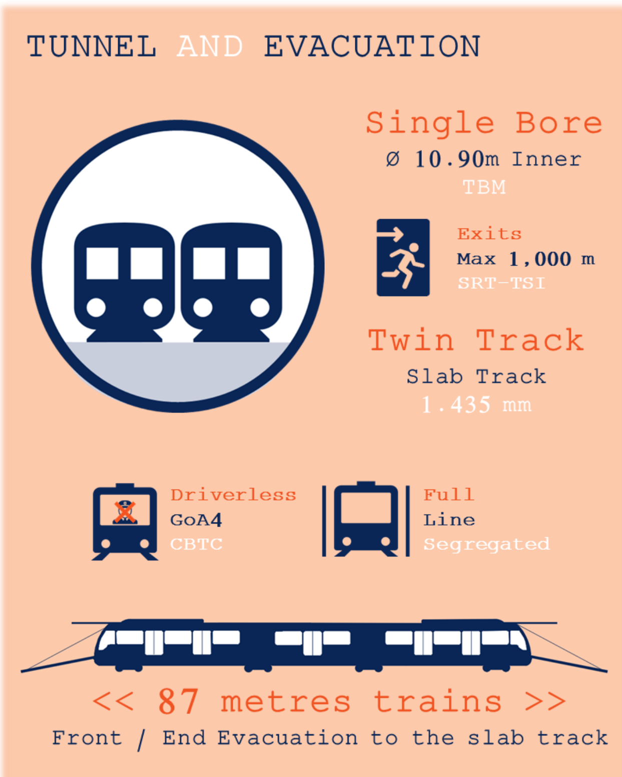
DISADVANTAGES

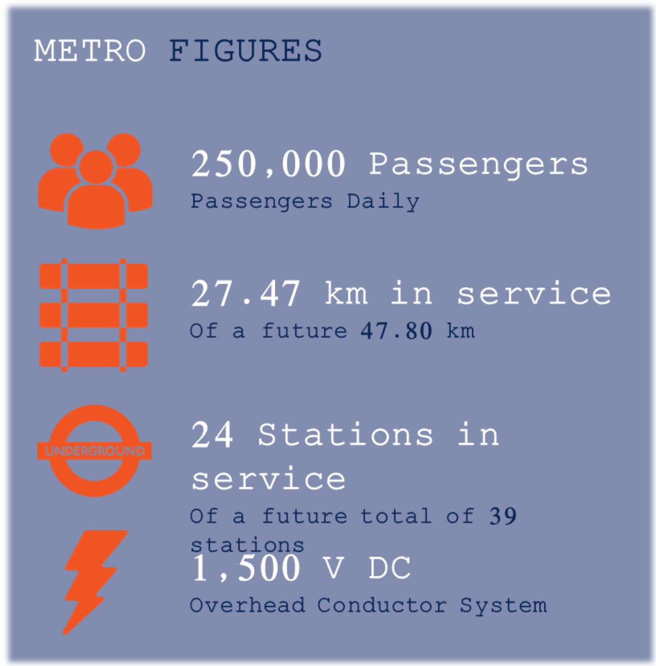
- Higher number of intervention shafts.
- Portal lengths may be slightly longer but are narrower.
- Risk of collision following derailment of train; however it is noted that such incidents are very rare.

A.1 Annex A - Single Bore Tunnel Examples

Some examples of single-bore Metro Lines configuration are shown in this Annex to support the recommendations of this report. From among them, Barcelona Metro Line 9 represents the most recent relevant example of single-bore and front and rear escape. Other important examples are also described below.

Metro Barcelona – Line 9





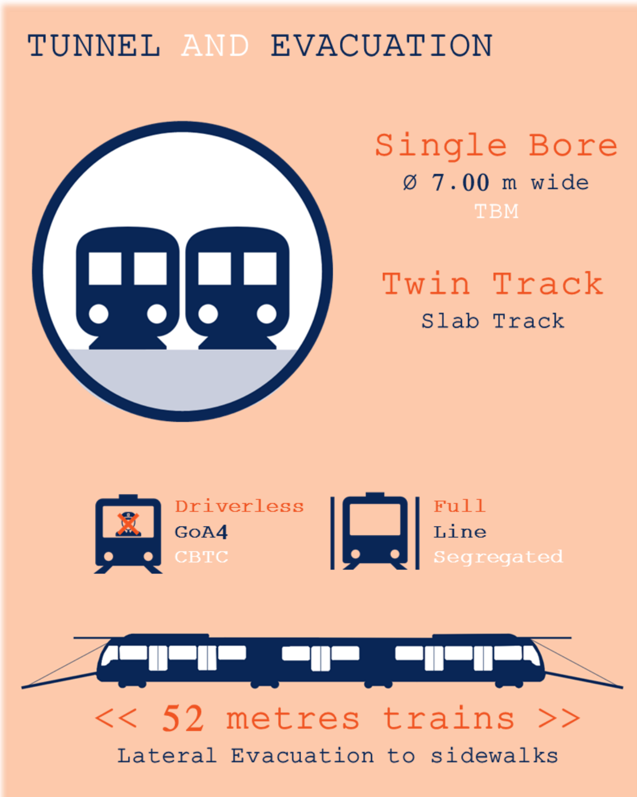
Line 9 is a line of the Barcelona Metro network that is currently under construction, with 24 stations open in Barcelona and the El Prat de Llobregat, L'Hospitalet de Llobregat, Badalona and Santa Coloma de Gramenet suburbs, since December 2009. Currently, the line is divided in two branches, waiting for the connection between them to be built.

The Aeroport T1 -Zona Universitària section is called L9 South (L9 Sud] and the La Sagrera - Can Zam section L9 North (L9 Nord). Upon completion, it will be the longest automatic train operation (i.e. driverless vehicle) metro line in Europe.

Rolling stock for Barcelona Metro line 9 consists of rail guided trains of the Alstom 9000 series, each with five coaches.

Trains are fully automated in GoA4, being merged with Trainguard MT CBTC driverless unattended train operation (UTO) control system.

Torino Metro Line 1

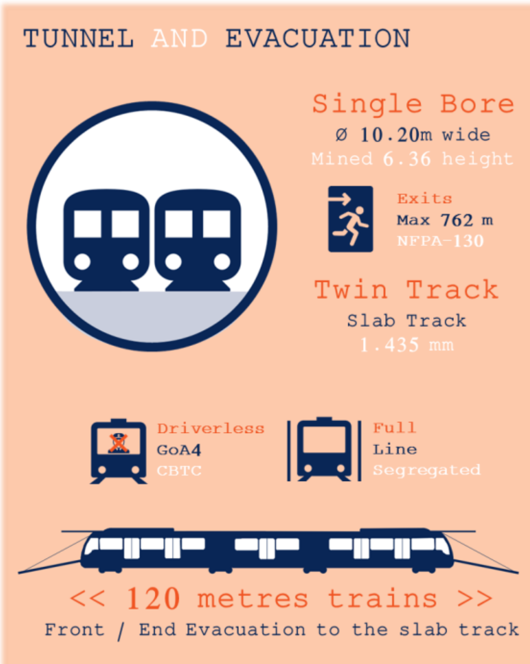


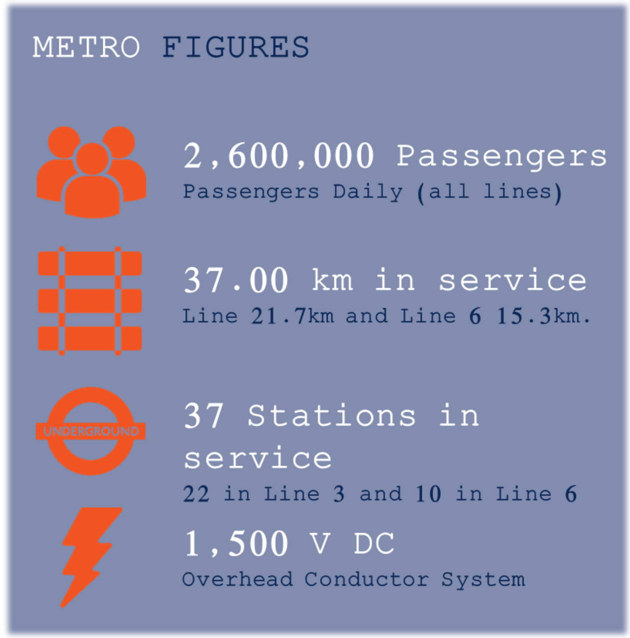
Torino Metro Line 1, known as Linea 1, is a 13.2km track long, automated and driverless metro line. It uses the Véhicule Automatique Léger (VAL) system (rubber tyre guided).

There are a total of 21 stations, which include platforms with automatic edge doors equipped with flashing visual and loud acoustic signals to facilitate the use of stations by passengers with impaired vision and hearing.

The Val 208 trains run at headway of two minutes during peak hours and they cover the entire 13.2km route in 22 minutes.

Metro Santiago L3 and L6:



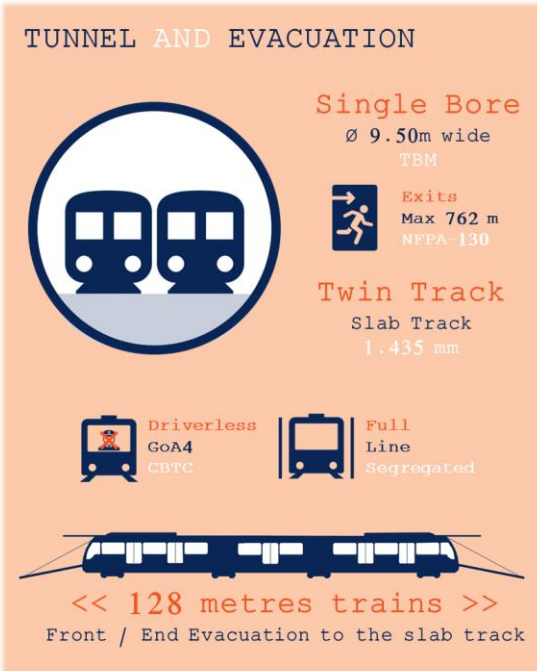


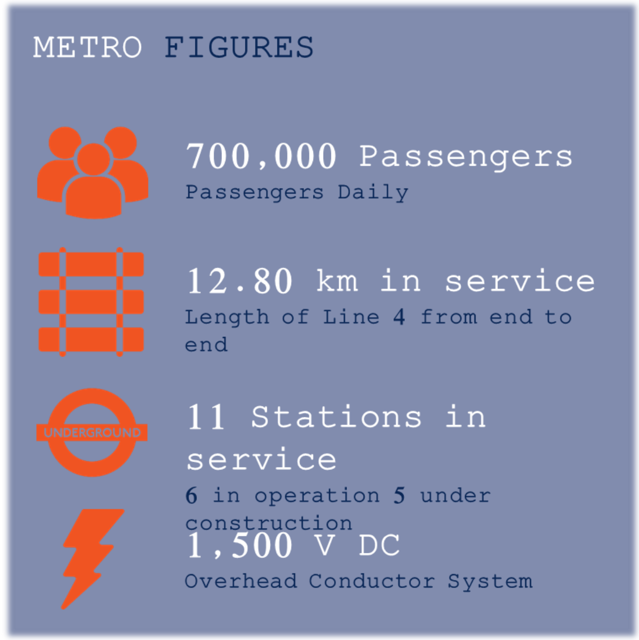
Santiago Metro Line 6 is a line on the Santiago Metro, Santiago, Chile. It connects the commune of Cerrillos, in the south west of the city, with Providencia in the east of the city, where most economic activity is concentrated. It has 10 new stations on 15.3 km of track.

Santiago Metro Line 3 is a new line due to open on the Santiago Metro, Santiago, Chile, in 2019. It will connect the commune of Huechuraba in the north of the city with the city centre, where most economic activity is concentrated, and the centre with the communes of Ñuñoa, La Reina and Peñalolén in the east side of Santiago. The first stage is scheduled to be completed by 2019, with the whole line by 2021. It will have 22 new stations on 21.7 km of track.

Both Line 3&6 comply with high security and passenger comfort standards. New security measures include cameras inside the trains, an OCS transmission line, GoA4 automatic operation, platform screen doors, air conditioning in the trains and connections with suburban trains.

Metro São Paulo L4:





Line 4 (Yellow) is a line of the São Paulo Metro, originally called Southeast-Southwest Line.

The line uses standard gauge with a width of 1.435 mm, and an overhead catenary power supply electrified at 1500 V DC (the only other line to use overhead catenary is line 5). This line is the first in São Paulo where all stations have platform screen doors, which would be later incorporated into all newly-opened stations and lines on the network.

The trains use communications-based train control (CBTC) automated (driverless) technology, allowing them to operate with reduced headways close to 90 seconds.

29 six-carriage trains manufactured by Hyundai Rotem are used on the line. The length of each trainset is 128 metres, and their capacity is 1,946 passengers (at AW3 6pax/m2), of which 307 are seated, a 25% increase from previous lines.

A list of other examples of metro lines with Single-Bore tunnel configuration in different countries worldwide are indicated below:

METRO NAME	LINE	CITY, COUNTRY	TYPE OF TUNNEL	TYPE OF OPERATION	TYPE OF EVACUATION	PHOTO
Metro Barcelona	**Line 9 (2009)**	Barcelona, Spain		GoA4	Front and Rear	
Metro Madrid	**All Lines**	Madrid, Spain		GoA2	Lateral	
Milan Metro	**Line 5 (2013)**	Milan, Italy		GoA4	Lateral	
Turin Metro	**Line M1 (2006)**	Turin, Italy		GoA4	Lateral	
Rennes Metro	**Line B (2002)**	Rennes, France		GoA4	Lateral	
Brescia Metro	**Single Line (2015)**	Brescia, Italy		GoA4	Lateral	
Metro Sao Paulo	**Line 4 (2010)**	Sao Paulo, Brazil		GoA4	Front and Rear	
Metro Santiago	**Line 3 & 6 (2017)**	Santiago de Chile, Chile		GoA4	Front and Rear	
Riyadh Metro	**Lines 4, 5 & 6 (2019)**	Riyadh, Saudi Arabia		GoA4	Lateral	
Metro de Lima	**Line 2 (under construction)**	Lima, Peru		GoA4	Front and Rear	

Appendix B. Tunnel Launch Sites

Contents

Executive Summary

This report has been prepared to describe the details of the two proposed tunnel launch sites which are required as part of the construction of the MetroLink project. The need for two launch sites arises from proposed changes to the tunnelling strategy with the proposed locations of the two tunnel launch sites now as follows:

1. Northwood
2. Dardistown

The Emerging Preferred Route (EPR) proposed a continuous twin bore tunnel from north of the Dublin Airport to Charlemont (south of Dublin city centre) which included the following:

- A tunnel portal in lands adjacent to the Naul Road, north of Dublin Airport. The Tunnel Boring Machines (TBMs) were proposed to be driven southwards from this location as far as Griffith Park; and
- A tunnel launch site located at Griffith Park, Dublin 9. The launch site was located off the R108 Ballymun Road within the lands of Cumin Lúthchleas Gael Na Fianna. The proposals included as part of the EPR required the acquisition of a number of playing pitches belonging to the club. The TBMs were proposed to be driven southwards from this location and it was also a reception site for the TBMs from the airport.

Following a review of the Route Alignment Options Study, changes have been proposed to the design of the project. These changes include relocating the MetroLink depot and revising the tunnelling strategy, in particular proposing a short tunnel under the airport and a second tunnel from Northwood southwards into the city, with a surface route past Dardistown linking the two tunnels. These changes to the tunnelling strategy have introduced the requirement for tunnel launch sites at both Northwood and Dardistown.

1. Introduction

Metro North was the project name of the original proposal for a metro railway system connecting Swords and Dublin Airport with Dublin City Centre at St Stephen's Green. This scheme was developed by the Railway Procurement Agency through the Railway Order process to successful planning approval by An Bord Pleanála (ABP) in 2010. The global economic downturn intervened, and in 2011 the Government postponed the Metro North project.

Figure 1 – MetroLink (2018)

The National Transport Authority's (NTA) Transport Strategy for the Greater Dublin Area, 2016-2035 identified a Metro service as the preferred public transport mode to address the transport needs of the Swords-Airport-City Centre corridor. It also envisaged the upgrading of the existing Luas Green Line between Ranelagh and Sandyford to a Metro level of service.

Project Ireland 2040 included the National Development Plan (2018-2027), which combined those two projects to form MetroLink. MetroLink will provide a fast, high capacity, high frequency, modern and efficient public transport service for people travelling along the Swords/Airport to City Centre corridor. In addition, the Scheme will ultimately connect to the existing Luas Green Line in the South City area, enabling through running metro services from Swords to Sandyford as shown in Figure 1.

The metro route length is approximately 19km and the completed system will have 15 new stations, 3,000 Park and Ride spaces, and a journey time of approximately 25 minutes from the City Centre to Swords.

The NTA/TII commissioned Arup Consulting Engineers to undertake a Route Alignment Options Study for the Scheme in 2016. The objective of the study was to carry out a comprehensive route option selection to identify an Emerging Preferred Route (EPR) for the Scheme. The study was completed at the end of February 2018 and it included a Concept Design for the EPR.

In January 2018, just prior to the initial public consultation Jacobs/Idom were appointed by NTA/TII to provide engineering design services, which included for the preliminary design, which in turn included for a review of the Route Alignment Options Study and the Tunnel Configuration Study.

2. Emerging Preferred Route and Initial Public Consultation

2.1 Emerging Preferred Route

Following the assessments of feasible route options, the EPR for Study Area B was identified. Study Area B extended from the Drumcondra area to north of Dublin Airport as described in the extract from the Route Alignment Study in Figure 2 below.

> It then runs from Whitworth northwards in a bored tunnel with a station provided at Griffith Park West before continuing to Ballymun Road where the station is located serving Dublin City University (DCU) and surrounding residential areas.
>
> The metro continues under Griffith Avenue/Collins Avenue junction with Ballymun Road to Ballymun Village where the next station is located. From here, the metro stays in tunnel to an underground station located on the western side of Northwood Business Park.
>
> From here the metro travels under the M50 through Dardistown where the next station is provided. It then travels in tunnel to the Airport perimeter road with the station provided in the Airport at the Ground Transportation Hub.
>
> The metro then runs in tunnel from the Dublin Airport station to a portal located in green belt lands north of the Naul Road. From here it runs at-grade in a segregated corridor before entering an underpass under the junction of the R132 with Nevinstown Lane/L2300.

Figure 2 - Extract from Route Alignment Options Study

Study Area B along with the horizontal alignment of the EPR is outlined in Figure 3 below. It should be noted that the EPR between Ballymun and Dublin Airport was proposed to be in an underground tunnel, including a tunnel under the M50.

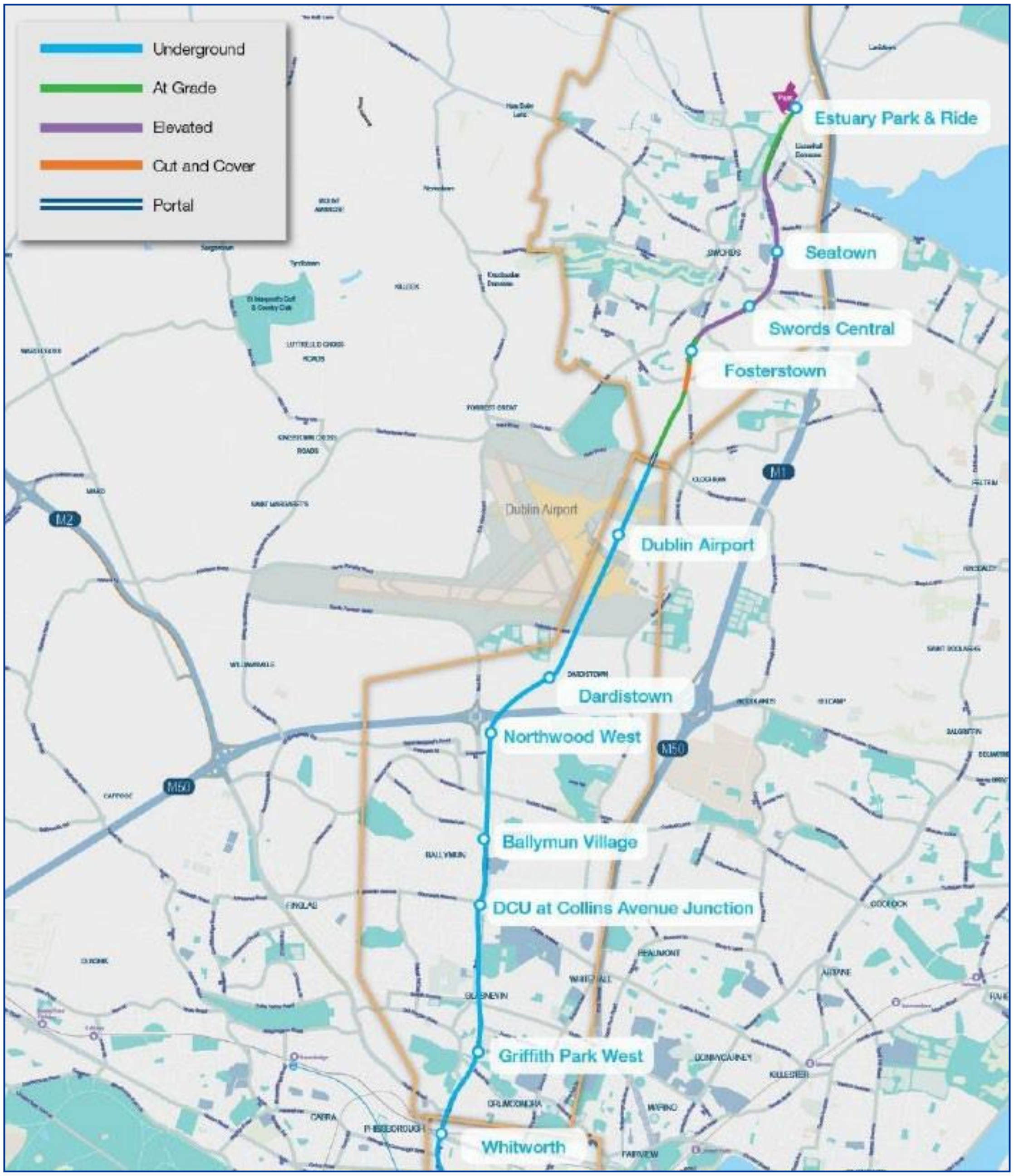


Figure 3 - EPR for Study Area B of the Route Alignment Options Study

2.2 Initial Public Consultation

A programme of public consultation led by the NTA/TII was conducted between 22nd March and 11th May 2018, during which members of the public and other stakeholders were invited to submit their views and observations of the EPR. A significant number of submissions and observations were received from the public and stakeholders regarding various sections of the project.

The NTA/TII and Jacobs/Idom have carefully considered the many statements and submissions made from the interested and affected parties along with other proposed route improvements and this has resulted in several proposed changes to the MetroLink scheme.

A high level environmental overview of the propose tunnel launch site locations has been undertaken. The environmental overview was assessed against the prescribed environmental factors required by Directive (2014/52/EU) and amending Directive 2011/92/EU (EIA Directive). After assessing potential impacts against the prescribed factors those with greater potential significance were identified. For the purpose of this report the more significant factors are detailed below under each option.

The prescribed environmental factors will be fully assessed in an Environmental Impact Assessment Report (EIAR). The EIAR will be prepared and will present the findings of the environmental assessments undertaken and accompany the Railway Order Application to An Bord Pleanála.

2.3 Initial Public Consultation – EPR at Dardistown

The alignment at Dardistown that was presented as part of the EPR is indicated on Figure 4 below.

The blue lines indicate the alignment of the underground twin bore tunnel. The yellow box indicates the location of the future station at Dardistown where the alignment is indicated as being underground in tunnel.

An alternative alignment entitled ‘Alternative Option B: Northwood and Airport’ was presented at the EPR public consultation. This alternative option is also included on Figure 4.

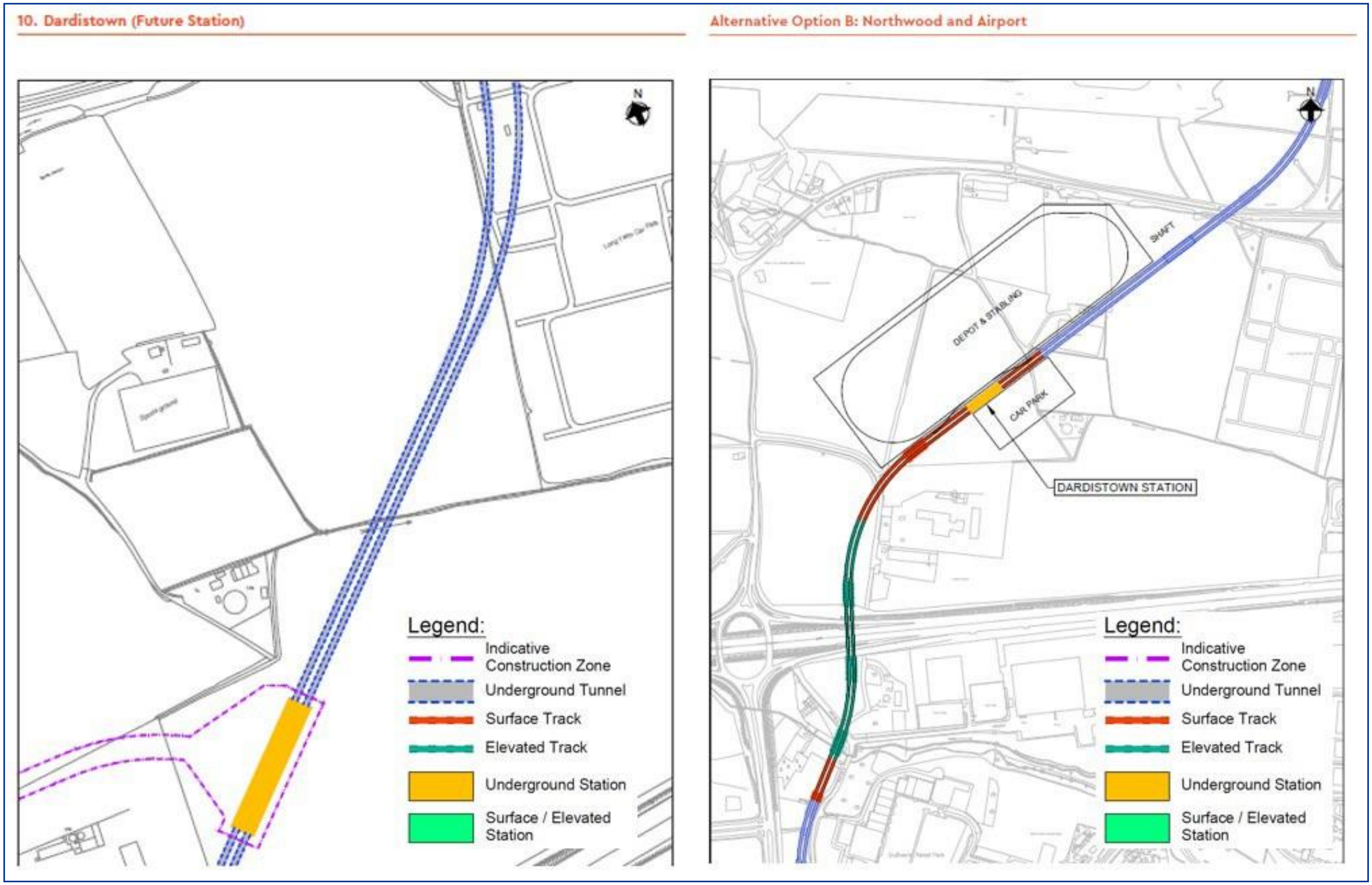


Figure 4 – EPR Options at Dardistown

2.4 Initial Public Consultation – EPR at Northwood

The alignment at Northwood that was presented as part of the EPR is indicated on Figure 5 below. The blue lines indicate the alignment of the underground twin bore tunnel.

The yellow box indicates the location of Northwood Station where the alignment is indicated as being underground in tunnel. It should be noted that the proposed alignment change for the current Preferred Route at the M50/Northwood/Ballymun area is discussed in Appendix D of the Preferred Route Design Development Report.

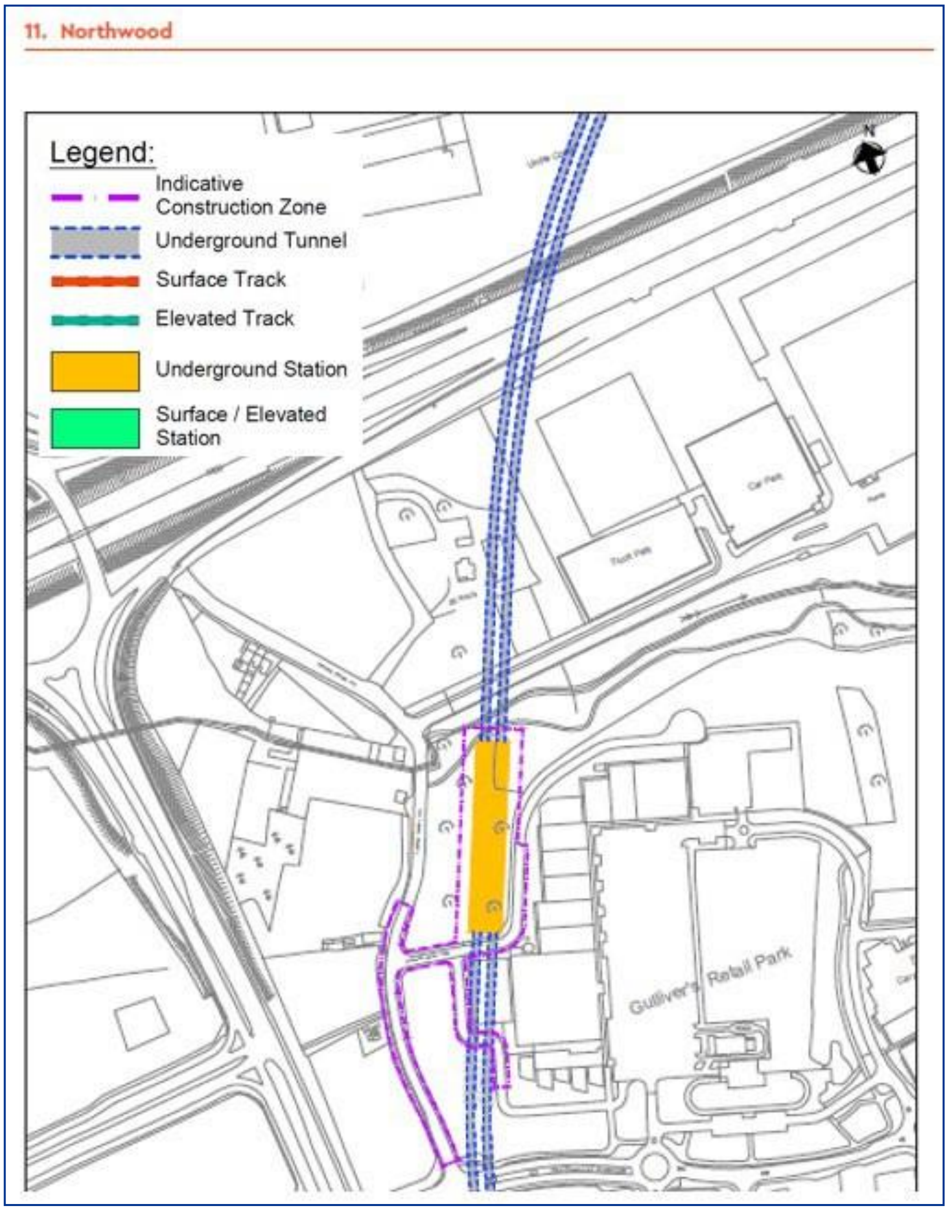


Figure 5 – EPR at Northwood

2.5 Initial Public Consultation – EPR at Griffith Park

The alignment and tunnel launch site at Griffith Park that was presented as part of the EPR is indicated on Figure 6. The blue lines indicate the alignment of the underground twin bore tunnel. The purple dashed lines indicate the 'indicative construction zone' and generally represents the lands required for the tunnel launch site / compound area at this location. It should be noted that there was a significant impact on the facilities of Cumann Lúthchleas Gael Na Fianna and Home Farm soccer club.

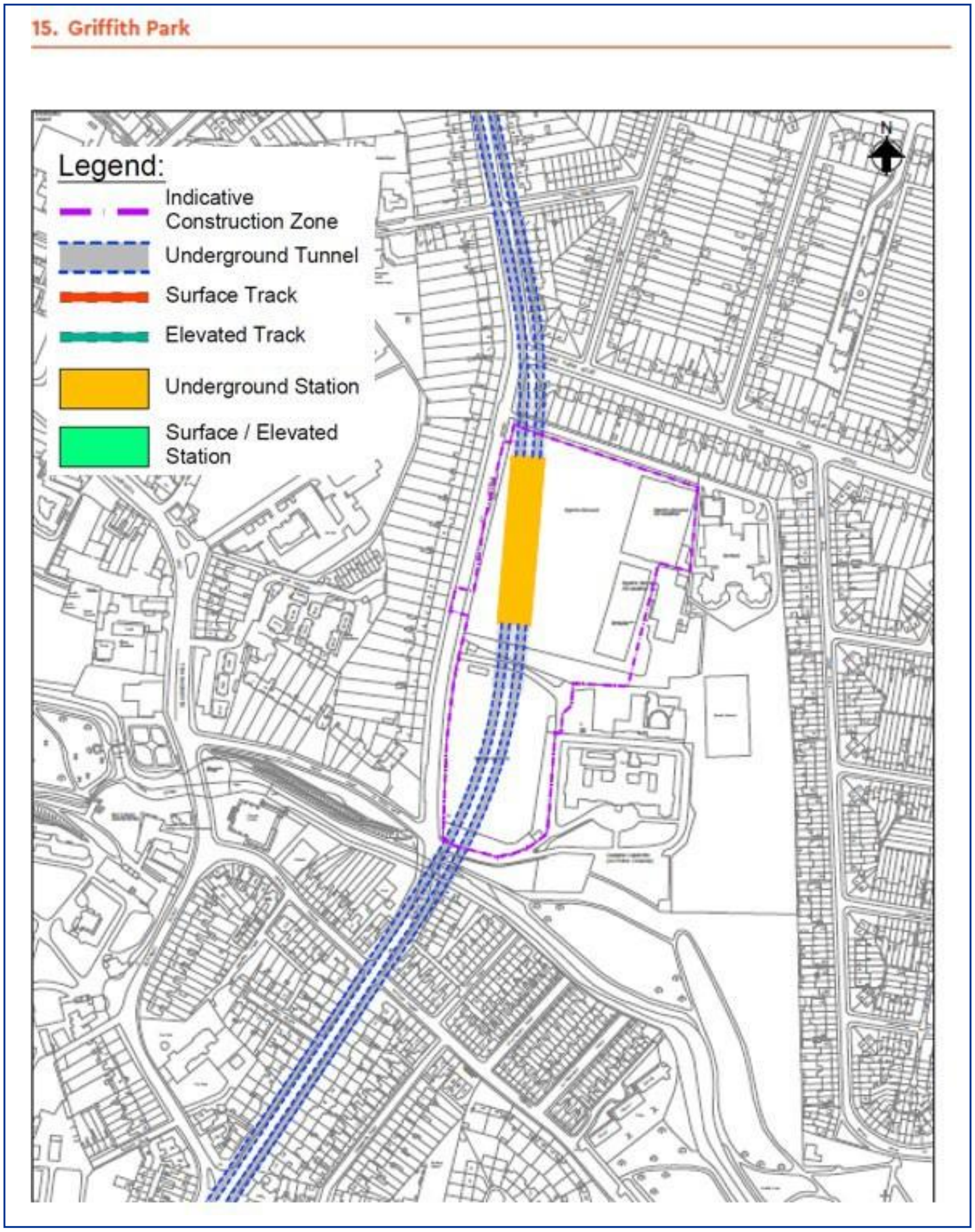


Figure 6 – EPR at Griffith Park

3. Review of Route Alignment Options Study

Shortly after appointment, Jacobs Idom undertook a review of the Route Alignment Options Study and other associated documentation including the Tunnel Configuration Study. Jacobs Idom recommended that a number of amendments be undertaken to the project to optimize the design. These recommendations were reviewed and subsequently accepted by the NTA/TII.

The main changes to the design which had an impact on tunnel launch sites are as follows.

- The MetroLink Depot would be moved from Estuary to Dardistown, with an associated change from tunnel in this area to a surface running section to facilitate connection to the depot. Please refer to Appendix C for more information regarding this change.

- From Northwood Station, the MetroLink alignment would be above ground passing over the M50 before returning to a tunnel in the lands just south of Dublin Airport. This change would effectively split the tunnelling works into two separate sections compared to the tunnel previously proposed in the EPR for this section of the alignment. Please refer to Appendix D for more information regarding this vertical alignment change.

- The EPR proposed that the tunnelled sections would be twin bore tunnels. Jacobs Idom undertook a value engineering assessment which concluded that a single bore tunnel with a twin track arrangement would be a more appropriate solution. The value engineering assessment was undertaken having full regard to tunnel safety requirements and best practice design. Please refer to Appendix A for more information regarding this change.

- Confirmation that the trains would be fully automated and would be able to operate at up to a 90 second interval (90 second headway).

4. Implications Arising from Changes to Tunnelling Strategy

The EPR for MetroLink proposed that the project would be a twin bore tunnel between the Naul Road (north of Dublin Airport) to Charlemont. The EPR included a tunnel launch site and construction compound on lands to the north of Dublin Airport and immediately north of the Naul Road. The outline of this site together with the proposed portal is indicated on Figure 7 below.

From this location it was proposed to drive the TBM southwards to the site at Griffith Park, creating a twin bore tunnel. The site at Griffith park as proposed in the EPR is indicated on Figure 6 of this report.

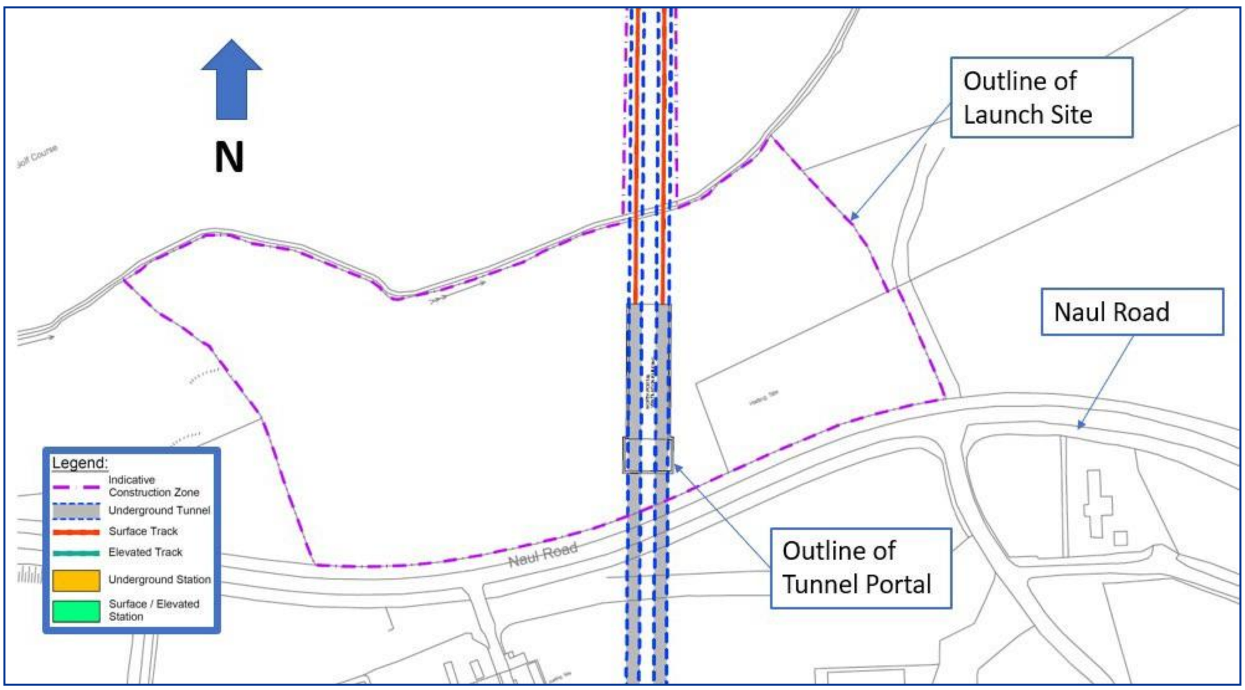


Figure 7 – EPR Tunnel Portal and Construction Compound Site (North of Dublin Airport)

The revised tunnelling strategy arising from the Jacobs Idom review of the options alignment study results in the project having the following two separate sections of tunnel:

1. A tunnel under Dublin Airport (Dardistown to north of Naul Road) – the TBM would enter the ground at Dardistown and be taken out of the ground at the site north of the Naul Road; and

2. A tunnel from Northwood to Charlemont – the TBM would enter the ground at Northwood and continue underground to south of Charlemont where it is currently envisaged to be abandoned. (The section of tunnel alignment south of Charlemont providing for turn back facilities for the metro and a future extension of metro services southwards).

This revised strategy results in the need for two tunnel launch sites, one at Dardistown, south of Dublin Airport and another at Northwood, south of the M50. These sites are discussed in more detail in Sections 5 and 6 of this report. In terms of the section of tunnel under Dublin Airport, the TBM is envisaged to be driven from Dardistown to the Naul Road, in a south to north direction. The description of the tunnel portal thus required at Dardistown is outlined in Section 5 of this report.

In terms of the tunnel through Dublin City, the TBM will be launched at Northwood and will be driven in a north to south direction to a point just south of Charlemont.

5. Dardistown TBM Launch Site - Description of Portal and Compound Area

This section of the report provides a description of the metro alignment, tunnel portal and the associated construction compound at Dardistown.

5.1 Preferred Route Alignment at Dardistown

The horizontal alignment for the preferred route at this location is indicated on Figure 8 below. The changes to the alignment between EPR and Preferred Route for the M50 crossing are included in Appendix D.

The horizontal alignment for the Preferred Route at Dardistown has been amended from the EPR route to accommodate the change to a surface route rather than a tunnelled route between the M50 and the southern portal to the airport. Approaching the airport from the south the EPR proposed tunnel passed under the Quickpark parking for Dublin airport. The revised proposed alignment in this location has been moved west to avoid the alignment and tunnel portal impacting on this existing car park and to keep the construction of the cut and cover approach to the tunnel and tunnel portal clear of airport safety zones as described in the following sections of this report.

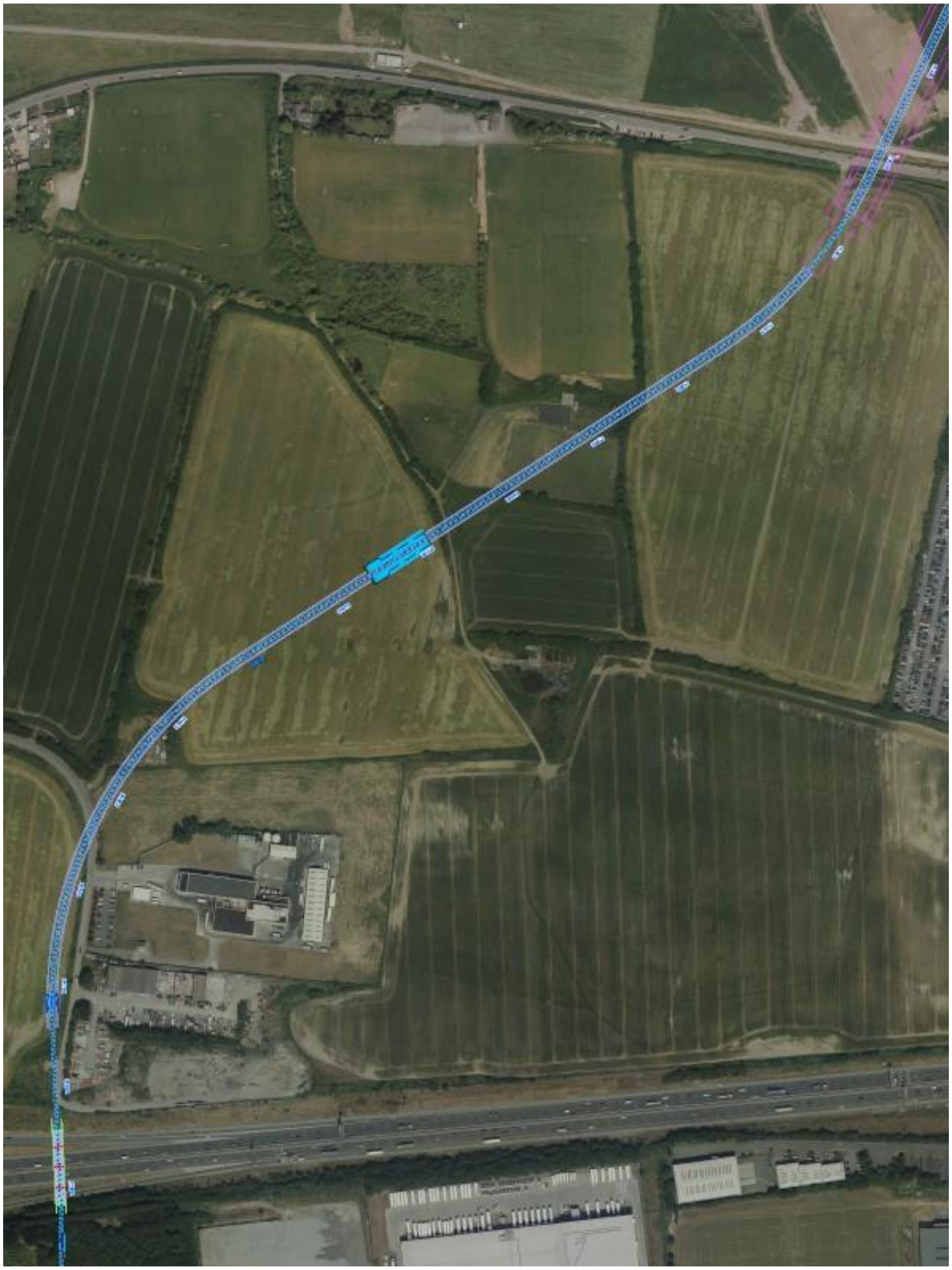


Figure 8 – M50 to Dublin Airport – Preferred Route Alignment

5.2 Portal Location

The portal is located in greenfield lands to the south of Dublin Airport. The location of the proposed portal is indicated on Figure 9 below.

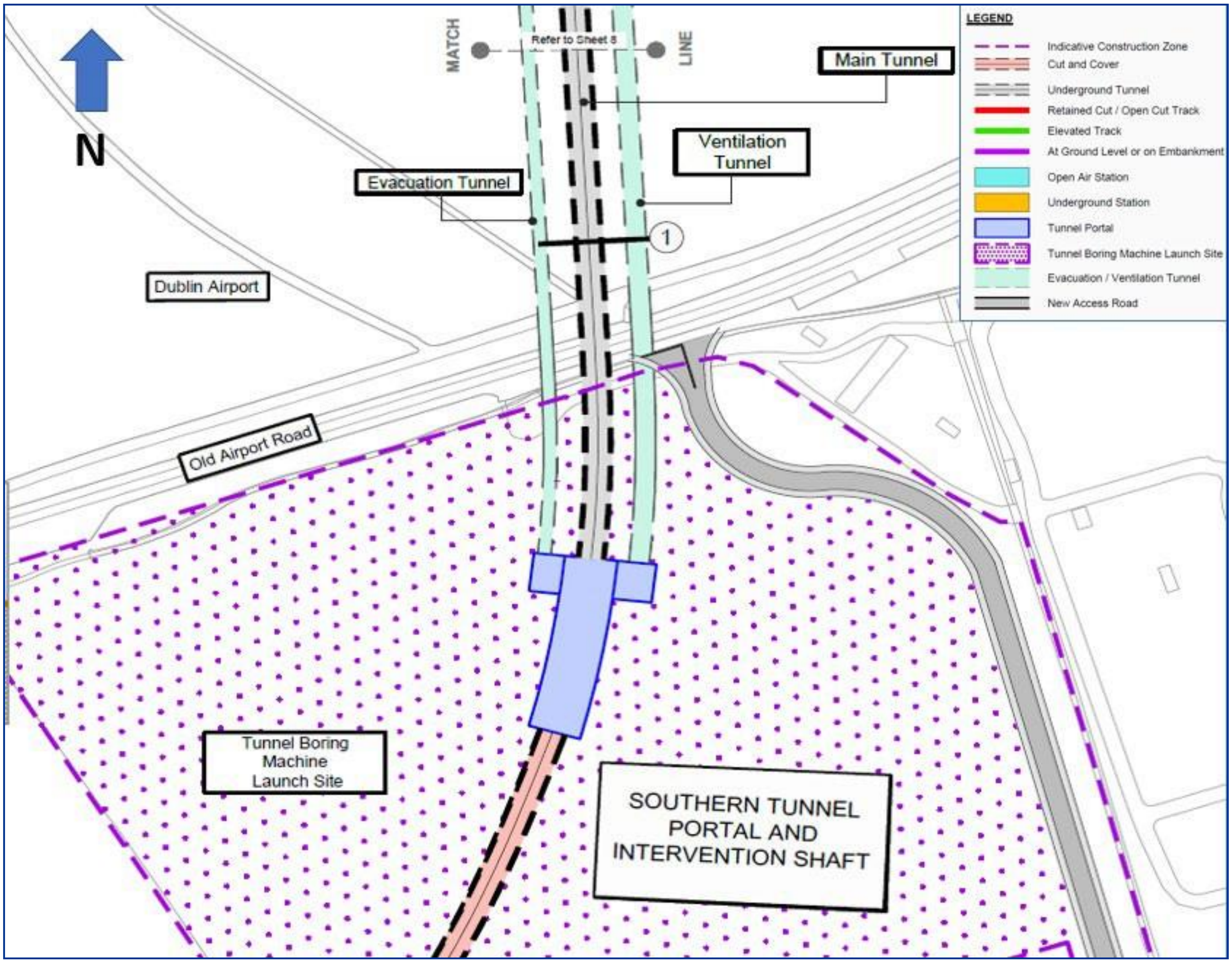


Figure 9 - Proposed Airport Tunnel Portal & Construction Compound

The location of the tunnel portal has been selected to avoid conflicting with the future Runway End Safety Area (RESA) for Runway 16/34 at Dublin Airport. Runway 16/34 is just over 2,000 metres long and is Dublin Airport's secondary runway (source: www.dublinairport.com).

Dublin Airport Authority (DAA) have informed TII that they have plans to extend the RESA at some stage in the future. Consequently, the location of the tunnel portal and intervention/ventilation shafts have been positioned to avoid the footprint of the future RESA. The future footprint of the RESA is indicated by the yellow hatched box on Figure 10 below.

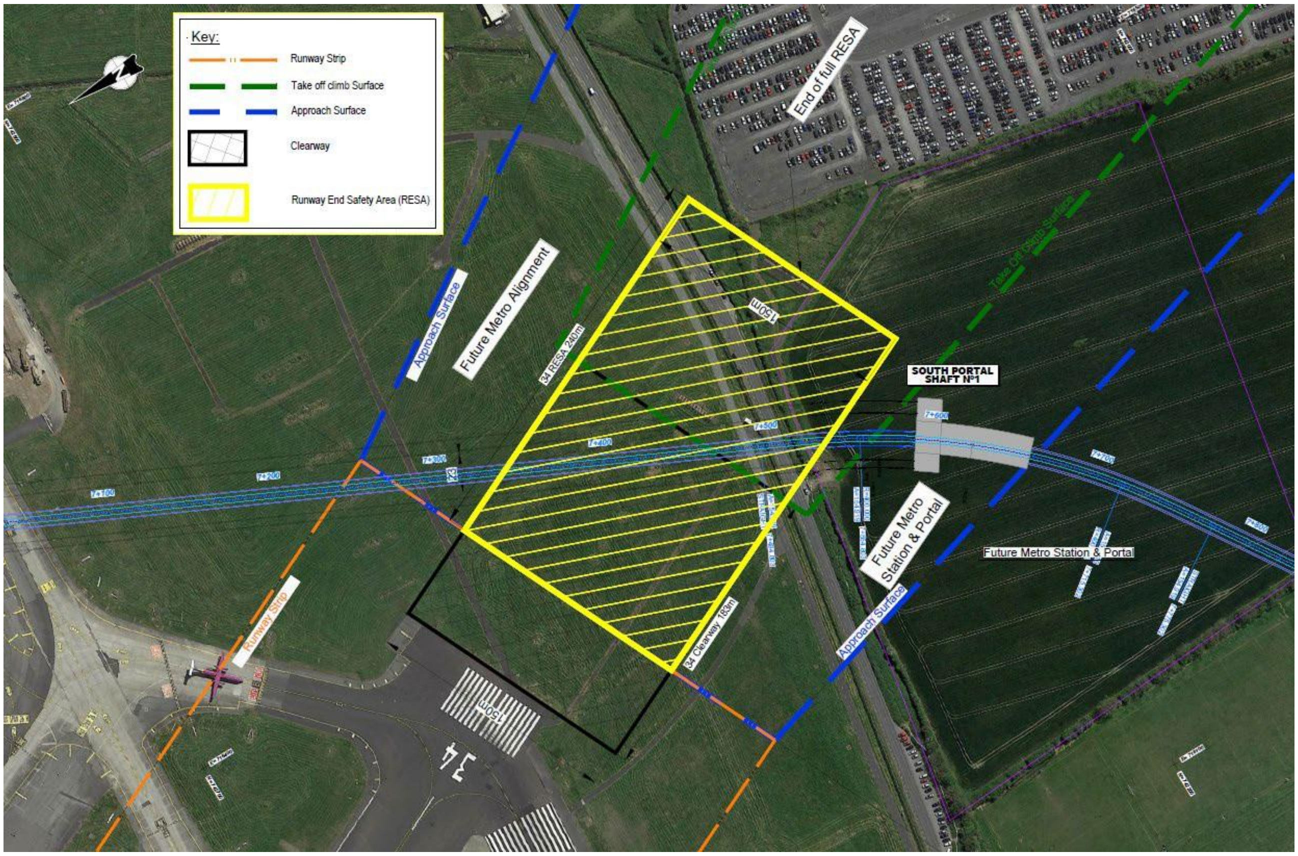


Figure 10 - Future footprint of RESA for Runway 16/34

A description / explanation of the terms noted on Figure 10 above are included in Table 1 below.

Table 1 - Explanation of Aviation Terms

Term	Description
Runway End Safety Area (RESA)	An area symmetrical about the extended runway centre line and adjacent to the end of the strip primarily intended to reduce the risk of damage to an aeroplane undershooting or overrunning the runway.
Clearway	A defined rectangular area on the ground or water under the control of the appropriate entity, selected or prepared as a suitable area over which an aeroplane may make a portion of its initial climb to a specified height.
Approach Surface	The purpose of the approach surface is to protect an aircraft during the final approach to the runway by defining the area that should be kept free from obstacles to protect an aeroplane in the final phase of the approach-to-land manoeuvre.
Take Off Climb Surface	The purpose of the take-off climb surface is to protect an aircraft on take-off and during climb-out.
Runway Strip	A defined area including the runway and stopway, if provided, intended: — to reduce the risk of damage to aircraft running off a runway; and — to protect aircraft flying over it during take-off or landing operations.

Further development of the preliminary portal design will take into account airport safety requirements, through liaison with both DAA and the Irish Aviation Authority (IAA). As such, the final location of the portal may be subject to minor changes pending the outcome of these discussions, especially having regard to the ‘approach surfaces’ and ‘take off climb surface’ for Runway 16/34.

5.3 Portal Construction

The portal will be constructed using cut and cover techniques and will be approximately 60m in length. The TBM will be assembled and launched from this portal as it moves from south to north under Dublin Airport.

5.4 Construction Compound Area

An area of approximately 30,000 – 35,000 m^2 will be required for the construction compound at this location. This is typically what is required for a large diameter tunnelling site in a largely unconstrained environment. This area of land is shown indicatively on Figure 11 below and will be refined as the preliminary design is progressed. The vast majority of this land will need to be temporarily acquired as part of the Railway Order application to A Bord Pleanála.

The required site area is defined by areas for:

- The construction of the portal, the open-cut to the south, and the tunnelling site set-up to take place simultaneously;
- The works requirements during tunnelling; and
- The rail yard needed in the fit-out phase which follows tunnelling.

Figure 11 – Indicative Construction Compound

5.5 Site Access and Egress

It is envisaged that the site will be accessed from the 'old airport road' with separate entrances for access and egress. The 'old airport road' is located along the southern boundary of Dublin Airport and provides a connection between the R132 and the R108.

5.6 Tunnelling Support Works

During tunnelling operations, the compound site must be configured to include for the following:

- Storage for excavated materials;
- Transfer of excavated material;
- Craneage to lift plant and material in and out of the portal structure (these are likely to be gantry cranes, but mobile and crawler cranes will also be required at times);
- A tunnel grout plant to store and mix the grout used to fil the annulus around the tunnel rings;
- Large storage areas for efficient deliveries and to minimise the risk of delay from material supply. These areas must always be secure. Some areas may need to be covered and / or bunded having regards to the safety requirements of Dublin Airport;
- Workshops and repair areas;
- A substantial HV power supply, switch, sub-station, transformers and electrical distribution;
- Tunnel ventilation;
- Large tanks in which the TBM cooling water cools down prior to going back into the TBM;
- Site run-off collection and water treatment tanks for this and water pumped from the tunnel;
- A wheel wash over which all HGVs leaving site must pass;
- A large office and welfare complex; and
- A large carpark for staff and workforce. It is likely that the use of public transport will be encouraged by the provision of a minibus pick-up from bus or rail stops, but it is considered likely that most of the team will arrive by private car, and car sharing should be encouraged.

The height of structures, material stockpiles and equipment to be used in the construction compound will be agreed with DAA and the IAA as part of on-going consultations with TII. It should be noted that the final layout of the construction compound will be determined by the Contractor at the construction stage of the project however the Contractor shall take account of all restrictions imposed by agreements between TII, DAA and the IAA.

5.7 Environmental and Planning Considerations

An environmental assessment has been undertaken on the proposal to construct a tunnel portal in this location in order to identify any potential significant environmental constraints and opportunities.

These findings were considered when identifying the preferred option. The following are the principle environmental considerations identified when assessing the preferred option:

- The location of the portal and alignment is situated over an identified site listed on the Record of Monuments and Places as an enclosure (DU014-121).

- The construction of the tunnel portal location will require management in line with the requirements of DAA given that the southern end of a runway is located 250m from the northern most aspect of the portal. Measures will be required to ensure that construction phase plant and machinery does not impact on the safety zones for approaching aircraft to the runway. In addition, it will be critical to ensure that the construction site does not attract bird activity in close proximity to the runway. The location of the portal has been chosen to ensure the runway RESA can be lengthened in future as outlined in this report.

- During the construction phase a significant volume of traffic will be generated from the site and this has potential to impact on the local road network. However, the proximity to the M50 motorway will ensure that Heavy Goods Vehicles (HGVs) potentially used for the transport of spoil material can quickly access the motorway and thereby minimising impacts on local roads. The anticipated access and egress arrangements are noted in Section 5.5 of this report.

- The proposed portal location is located on land currently utilised for agricultural purposes which will be impacted during construction. This is because the TBM will be launched from this location requiring a significant work area to be set aside. During operation the area will be segregated by the overland section of track reducing the area available for agricultural production. However, it should be noted that this area is zoned for future commercial development.

- The Dardistown area is notable for the presence of several sports and leisure facilities. Careful construction phase management will be required at the construction site to ensure that any impacts on these facilities are mitigated.

- The land is currently zoned for General Employment Uses in the Fingal County Development Plan 2017-2023 and is located within the Dublin Airport Outer Safety Zone. The lands are also subject to the Dardistown Local Area Plan 2017-2022.

It is considered that appropriate measures can be adopted into the design to mitigate the potential environmental impacts noted in this report. These proposed mitigation measures will be developed as part of the preparation of the Environmental Impact Assessment Report for the project.

6. Northwood TBM Launch Site - Description of Portal and Compound Area

This section of the report provides a description of the tunnel portal and the associated construction compound at Northwood.

6.1 Portal Location

The location of the proposed portal area, Northwood Station and the construction compound is indicated on Figure 12 below. The site is located to the east of the R108 Dual Carriageway and just south of the M50.

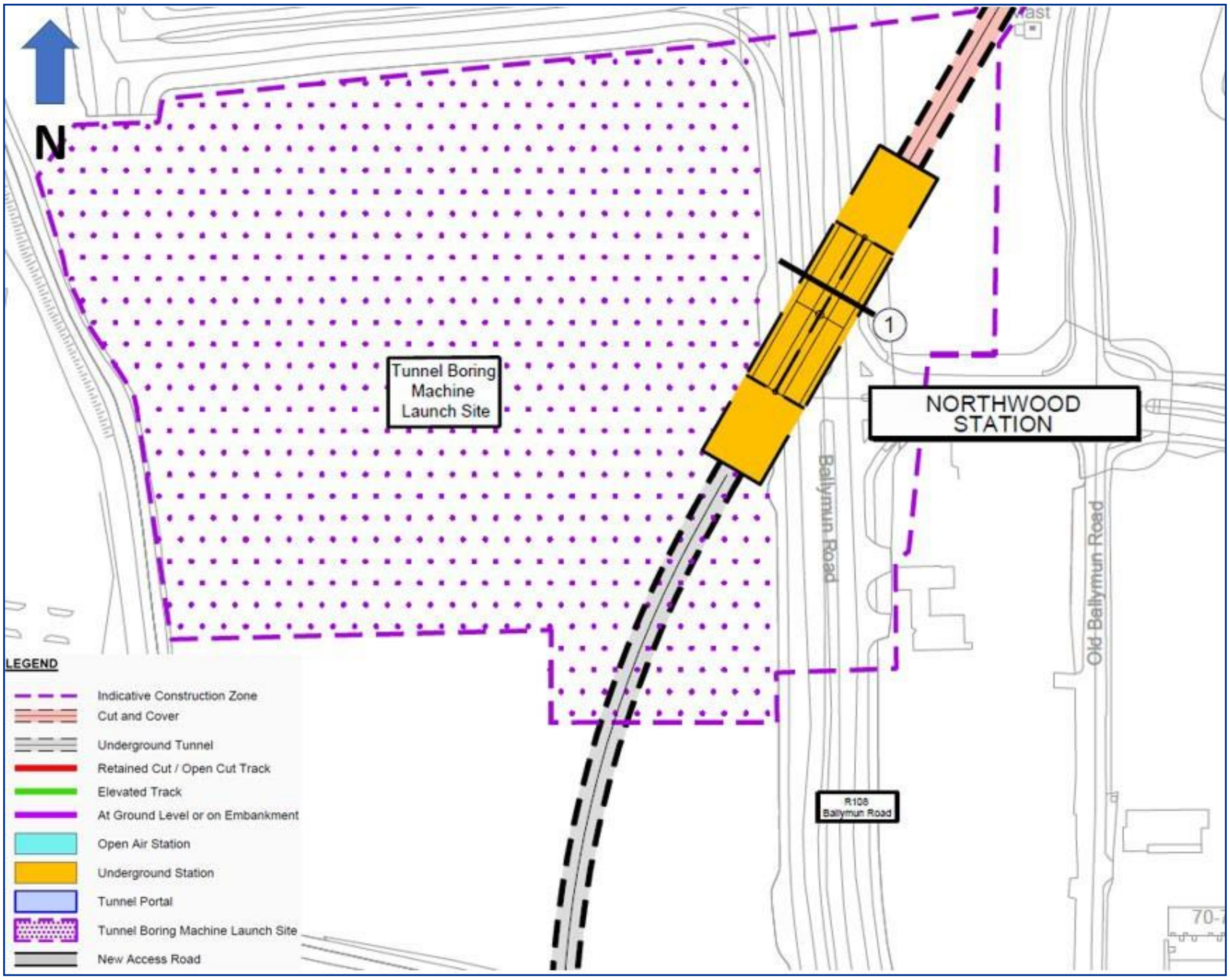


Figure 12 - Proposed Northwood Tunnel Portal & Construction Compound

6.2 Portal Construction

The Northwood Portal will be constructed using the cut and cover technique. A potential construction sequence could comprise:

- Divert the R108 to the east;
- Install diaphragm walls for the western half of Northwood Station and portal extension;
- Cast top slab over the station but no slab over the portal extension;
- Backfill over the station area and form a new road layout;
- Divert traffic to the west, over the new station slab;
- Install diaphragm walls for the eastern half of Northwood Station. At the same time, excavate for the western half of the station and portal extension, working from the portal extension;
- Cast the top slab over the remainder of the station then backfill over;
- Form new road layout and divert the road back to its original position; and
- Excavate for the eastern part of the station.

The anticipated geology in this area is made ground, boulder clay, alluvial sands and rock. The bottom 25% of the station excavation is anticipated to be in rock and this is expected to require hydraulic breaking or potentially blasting to excavate.

The TBM drive site would largely be set up using the plant and equipment previously used at the Dardistown tunnel launch site. The TBM would be transported in pieces of as large a size as is both permitted and practical for transport. Pieces would be re-assembled and the TBM re-tested and commissioned before starting tunnelling to the south.

It is unlikely that the whole Northwood station can be completed before the TBM starts to arrive, but the western section and portal extension can be sufficiently completed to erect the TBM. The TBM would therefore need to be launched in 'short mode' without a full set of gantries. The remaining gantries would then be installed as the TBM mines its way forward.

The site would then be used for a considerable time duration to support the tunnelling operation. This would largely be serviced through the portal extension, possibly using a vertical conveyor and vertical conveyor take-up loop, to minimise disruption to the station works, which will largely be serviced from a site on the east side of the R108.

6.3 Construction Compound Area

Under the Preferred Route, the second of the planned TBM drives (the first being under the Airport) will be southwards from the Northwood Portal. The site for station construction and TBM launch, muck out and construction material storage is proposed to be located immediately adjacent to the R108 dual carriageway and just south of the M50. Relocating the TBM launch site to the south of and close to the M50 means that all material excavated by the TBMs can more easily be taken by heavy goods vehicles (HGVs) onto the motorway network and on to designated disposal or re-use sites. Such a location close to the M50 will significantly reduce potential traffic impacts on urban roads closer to the city compared to the EPR.

An indicative construction site layout appropriately sized for the required plant and laydown area is shown on Figure 13 below. This area is part of a proposed future development zone and the final configuration of the construction site layout will look to support the approved phased development in this area whilst maintaining the capability to service the construction needs of the metro.

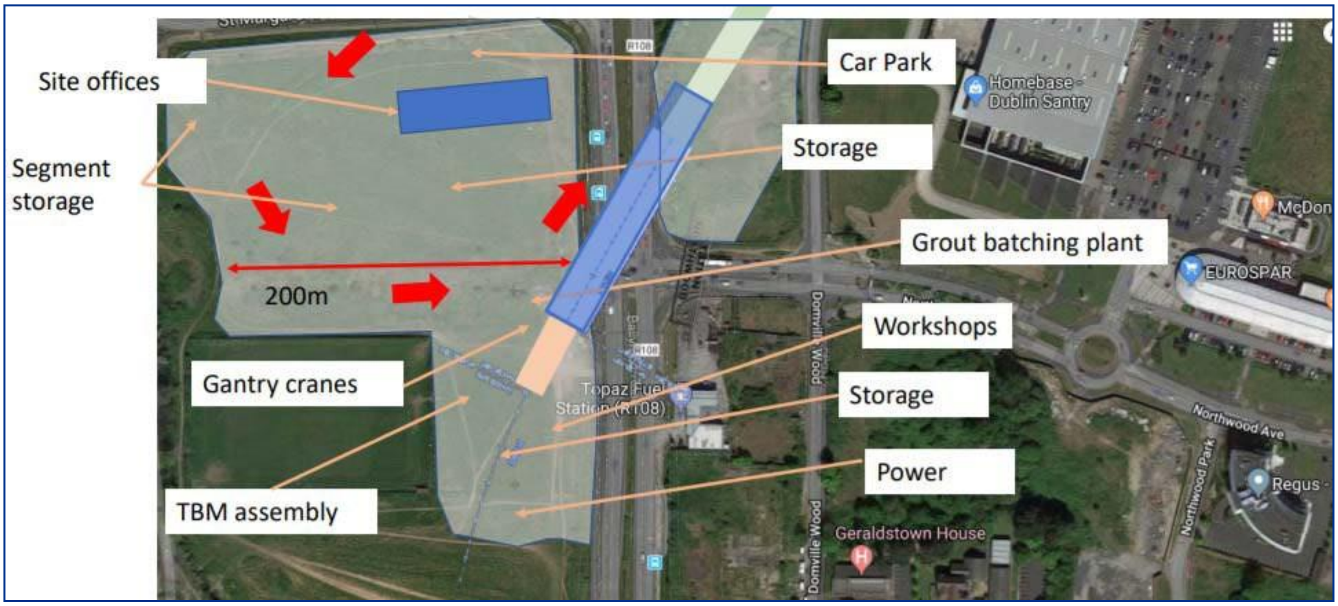


Figure 13 - Northwood Station, Tunnel Portal & Indicative Construction Compound Layout

Northwood Station is proposed to be constructed under the R108 and this will require several temporary and well-planned traffic diversions. This factor means that the completion of the station is likely to be later than the presumed TBM launch date. In order that the TBM can arrive from the Airport tunnel and be launched shortly after from the Northwood Portal, a short additional open box structure is proposed to the southwest of the station box as shown in the salmon colour area in Figure 13. This enables the TBM shield to be erected before the station box is complete and will allow the station to be fitted out whilst the TBM is still driving to the south.

The open box site is only around 200m from new residential properties to the east and around 500m from a school to the south west. It is therefore possible that acoustic insulated construction techniques could be required over the open-cut section to reduce the noise from the site, which is likely to be operational over 24-hour days. This will be determined during the environmental appraisal of the scheme.

The land for this launch site will need to be acquired as part of the Railway Order application to A Bord Pleanála. The majority of this land is likely to be acquired on a temporary basis.

6.4 Site Access and Egress

It is envisaged that the site will be accessed from the R108 and / or the access road into IKEA with separate entrances for access and egress.

6.5 Tunnelling Support Works

During tunnelling operations, the compound site must be configured to include for the following:

- Storage for excavated materials;
- Transfer of excavated material;
- Craneage to lift plant and material in and out of the portal structure (these are likely to be gantry cranes, but mobile and crawler cranes will also be required at times);
- A tunnel grout plant to store and mix the grout used to fill the annulus around the tunnel rings;
- Large storage areas for efficient deliveries and to minimise the risk of delay from material supply. These areas must always be secure.
- Workshops and repair areas;
- A substantial HV power supply, switch, sub-station, transformers and electrical distribution;
- Tunnel ventilation;
- Large tanks in which the TBM cooling water cools down prior to going back into the TBM;
- Site run-off collection and water treatment tanks for this and water pumped from the tunnel;
- A wheel wash over which all HGVs leaving site must pass;
- A large office and welfare complex; and
- A large carpark for staff and workforce. It is likely that the use of public transport will be encouraged by the provision of a minibus pick-up from bus or rail stops, but it is considered likely that most of the team will arrive by private car, and car sharing should be encouraged.

It should be noted that the final layout of the compound will be determined by the Contractor at the construction stage of the project.

6.6 Environmental and Planning Considerations

An environmental assessment has been undertaken on the proposed new location for the TBM launch site at Northwood to identify any potential significant environmental constraints and opportunities. These findings were considered when identifying the proposed site. The following are the principle environmental considerations identified when assessing the proposed site:

- There is sufficient space available to construct a TBM launch site adjacent to the proposed new station location. The final footprint of the construction compound will need to have regard for current zoning and land use requirements in this area;
- There is potential for construction related impacts arising from the TBM launch site on residential receptors. The TBM launch site is located across the R108 road from new residential properties to the east and around 200m from a school to the south west;

- Increased traffic disruption on the R108 during the operation of the TBM launch site;
- The tunnelling work will continue over several years and will generate a high volume of Heavy Goods Vehicles (HGVs) truck movements, which will involve careful traffic management to mitigate against congestion in the local area. However, the proximity to the M50 motorway will ensure that HGVs potentially used for the transport of spoil material can quickly access the motorway and thereby minimising impacts on the local road network. Traffic routing between the site and the M50 will likely be as indicated in Figure 14 below;

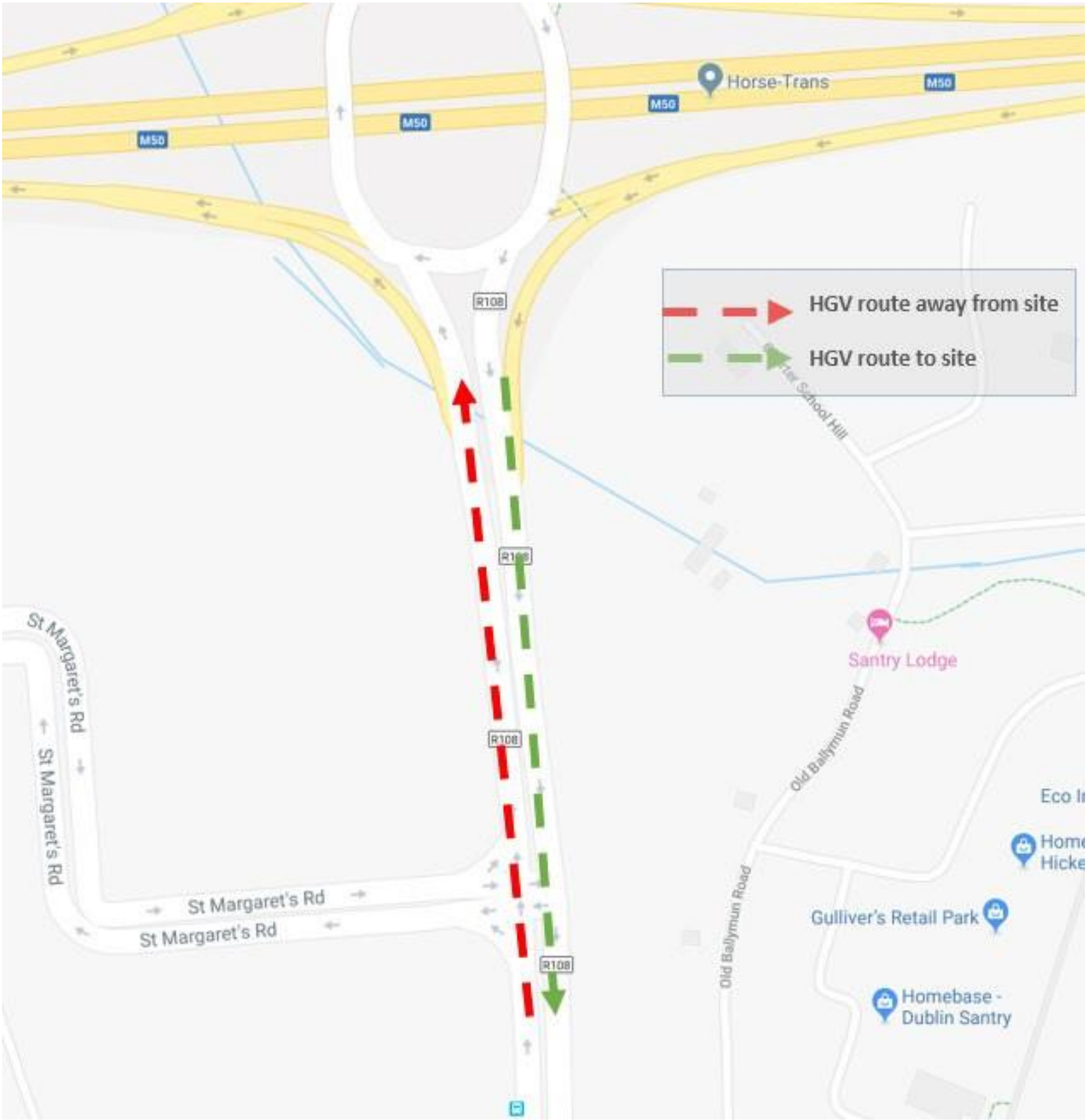


Figure 14 - Construction Traffic Management

- The traffic volumes generated by the station construction would vary through the construction phases. The heaviest traffic flow is expected to fall during the station excavation phase where the large volume of spoil must be removed to an off-site location. The following are the main sources of the construction traffic identified:
  1. Muck-away during the excavation;
  2. Delivery of materials;
  3. Waste removal;

4. Commuter trips; and
5. Machinery and equipment delivery and maintenance.

- Material delivery will peak during the site set-up and during the main structural works phases. The scale of large concrete pours would require detailed planning, including traffic diversions and marshals. The large volume of spoil to be removed during the tunnel excavation phase would require careful planning of the transport routes, including marshalling at the site access/egress points.

It is considered that appropriate measures can be adopted into the design to mitigate the potential environmental impacts noted in this report. These proposed mitigation measures will be developed as part of the preparation of the subsequent Environmental Impact Assessment Report for the project.

7. Summary and Conclusions

The proposed design of the project at EPR included one section of tunnel from North of Dublin Airport to Charlemont, south of Dublin City Centre. A tunnel portal was proposed to be constructed at a greenfield site immediately north of the Naul Road, adjacent to the Airport. Another TBM launch site was proposed to be constructed at the site of Cumann Lúthchleas Gael Na Fianna at Griffith Park, Dublin 9.

Following the EPR Public Consultation, a review of the Route Alignment Options Study, an assessment having regard to the potential positive and negative environmental impacts identified in the environmental assessment of the options, and assessment of other associated documentation including the Tunnel Configuration Study, Jacobs Idom recommended that a number of amendments be undertaken to the project to optimize the design.

The main changes to the design which had an impact on tunnel launch sites are as follows:

- The EPR proposed that the tunnelled sections would be twin bore tunnels. Jacobs Idom undertook a value engineering assessment which concluded that a single bore twin-track tunnel with trains travelling in opposite direction would be a more appropriate solution;

- The MetroLink Depot would be moved from Estuary to Dardistown, a more efficient location for the depot closer to the centre of the route;

- From Northwood Station, the MetroLink alignment would be above ground passing over the M50 before returning to a tunnel in the lands just south of Dublin Airport. This change would effectively split the tunnelling works into two separate sections but would provide a surface running section of the metro in this area to facilitate access to the depot. The EPR previously proposed that this section of the alignment would be in tunnel; and

- Confirmation that the trains would be fully automated and would operate at a 90 second interval (90 second headway).

These changes resulted in the need for two tunnel launch sites at the following locations:

1. Dardistown – A tunnel portal and construction compound are required in greenfield lands at Dardistown, south of Dublin Airport. The TBM is proposed to be launched from this point and driven northwards under Dublin Airport to a location just north of the Naul Road.

   The location of the portal has been selected having regard to the requirements of Dublin Airport. The portal also requires a large compound area and the land for this will need to be acquired as part of the Railway Order application to An Bord Pleanála. The majority of this land associated with the construction compound is likely to be acquired on a temporary basis.

   Consultations with both DAA and the IAA will continue throughout the preliminary design process to ensure that the final design of the portal meets the requirements of both stakeholders and MetroLink.

2. Northwood – A tunnel portal and construction compound are required in greenfield lands at Northwood. The location of this site is west of the R108 and south of the M50. The TBM is

proposed to be launched from this point and driven southwards under Dublin City to a point just south of Charlemont.

The location of the portal and construction compound have been selected having regard to the requirements of local development plans in this area. The land for this launch site will need to be acquired as part of the Railway Order application to An Bord Pleanála. The majority of this land associated with the construction compound is likely to be acquired on a temporary basis.

Appendix C. Depot Location

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Contents

Executive Summary

Under the EPR route the depot was proposed to be at Estuary at the extreme northern end of the route, given that the route through Dardistown was proposed to be tunneled and only emerging to the surface north of the airport.

Subsequent development of the MetroLink route has been undertaken having regard to a multi-disciplinary analysis of concerns raised at the public consultation and as part of ongoing design development. As part of the changes proposed, the EPR proposed tunneled length of the scheme, extending from the city to north of the airport, has been proposed now as two separate tunnels. This Preferred Route proposal will provide two separate tunnel sections, from Northwood southwards to Charlemont and a shorter tunnel section under the airport. This provides the opportunity to relocate the Depot to the Dardistown area where the Preferred Route would now be surface running and would enable an access to be created to a depot. Dardistown was the accepted location for the depot under the previous Metro North project and the current planning zoning for the Dardistown area still indicates the area for the earlier Metro North depot proposals, though current Preferred Route proposals consider an alternative location in the Dardistown area which is better suited to the current alignment.

Based on the findings of a multi-disciplinary analysis, the relocation of the depot location from Estuary to Dardistown is recommended. It will provide a better operational location, much more central to the overall MetroLink and thus providing easier and more efficient accessibility for addressing incidents on the line. From a maintenance perspective it provides more flexibility and longer maintenance periods overnight than the depot at Estuary.

From a Planning perspective, a Depot location is considered to be acceptable under the zoning objectives relevant to either Dardistown or Estuary. However, the location of the depot site on the General Employment zoned lands at Dardistown would be considered preferable from a planning perspective, if this was feasible with the current route.

Environmental considerations also favour the Dardistown location. Previously, An Bord Pleanála declined the development of a depot at Estuary, primarily as a result of flooding and planning issues. This area potentially lies closely near a flood zone along Broadmeadow River. Flood risk would require the depot ground levels to be raised. There is also risk of exacerbating flood risk to the surrounding lands which would require further investigation.

The Estuary Depot is also located at a considerable distance from Dublin Airport or Swords. This location would not represent the optimal location for long term efficient economic and environmentally sustainable operation of the rail service, in comparison with options closer to Dublin Airport at Dardistown.

This report concludes that the preferred location for the MetroLink depot is Dardistown. A potential site for the depot has been identified, lying adjacent to the M50.

1. Introduction

1.1 MetroLink Development and Consultation

Metro North was the project name of the original proposal for a metro railway system connecting Swords and Dublin Airport with Dublin City Centre at St Stephen's Green. This scheme was developed by the Railway Procurement Agency through the Railway Order process to successful planning approval by An Bord Pleanála (ABP) in 2010. The global economic downturn intervened, and in 2011 the Government postponed the Metro North project.

Figure 1: Route Map

Figure 1 – MetroLink (2018)

The National Transport Authority's (NTA) Transport Strategy for the Greater Dublin Area, 2016-2035 identified a Metro service as the preferred public transport mode to address the transport needs of the Swords-Airport-City Centre corridor. It also envisaged the upgrading of the existing Luas Green Line between Ranelagh and Sandyford to a Metro level of service.

Project Ireland 2040 included the National Development Plan (2018-2027), which combined those two projects to form MetroLink. MetroLink will provide a fast, high capacity, high frequency, modern and efficient public transport service for people travelling along the Swords/Airport to City Centre corridor. In addition, the Scheme will ultimately connect to the existing Luas Green Line in the South City area, enabling through running metro services from Swords to Sandyford as shown in Figure 1.

The metro route length from Swords to City Centre is approximately 19km and the completed system will have 15 Stations, 3,000 Park & Ride spaces, and a journey time of approximately 25 minutes.

The NTA commissioned Arup Consulting Engineers to undertake a Route Alignment Options Study for the Scheme in 2016. The objective of the study was to carry out a comprehensive route option selection to identify an Emerging Preferred Route (EPR) for the Scheme. The study was completed at the end of February 2018 and it included a Concept Design for the EPR.

1.2 EPR Public Consultation

A programme of public consultation led by the NTA was conducted between 22nd March and 11th May 2018, during which members of the public and other stakeholders were invited to submit their views and observations of the EPR.

The EPR location for the depot was proposed at Estuary, given the lack of any other appropriate location once the route emerged from tunnel north of the airport.

1.3 The Jacobs/Idom Preferred Route Design

Separately, in January 2018, the NTA/TII commissioned Jacobs and Idom JV (Jacobs/Idom) to provide ongoing engineering design services to support and develop the EPR through to scheme completion. This includes further developing the EPR scheme to Preliminary Design, preparation of an Environmental Impact Assessment Report and progression of the scheme to obtain a Railway Order, allowing construction to begin.

The MetroLink design and planning team has reviewed the EPR proposals and taken account of the consultation submissions. Several important changes have been proposed to the EPR leading to the current proposed Preferred Route.

The Preferred Route now proposes two separate tunnel lengths, with an overground/surface route section between Northwood and the airport. This supports the relocation of the proposed EPR depot at Estuary to a more central location along the route at Dardistown. It should be noted that the earlier Metro North project included a depot in the general Dardistown area.

The following sections of this report present a summary of the assessments undertaken to-date to identify the optimal location for the depot. The assessment is currently at high level and considers the main relative merits of a depot in the general locations noted – it does not consider a detailed depot layout at each location. Further, detailed assessment of the proposed specific depot layout will be subsequently undertaken.

The analysis to identify the preferred option was undertaken having regard to the following:

- Operational & maintenance issues;
- Environmental constraints; and
- Planning constraints.

2. Depot Location Overview

2.1 Location Overview

The EPR proposed the depot location at Estuary, as shown (in orange) on Figure 2 below. Given that the tunneled section of route ran from the city to the north side of the airport and the depot needs to be adjacent to a surface section of route, the options for location of the depot were limited and a location at Estuary was identified as the preferred location. This is at the extreme northern end of the route.

As part of the development of the EPR to the current Preferred Route proposal, investigation of an alternative depot site at Dardistown has been undertaken as part of other considerations for a revised tunnel configuration. A site at Dardistown would locate the depot much more central for the overall route, lying approximately 8 kilometres south from Estuary and approximately 11km from Charlemont and the proposed metro turnback; or some 18 kilometres from Sandyford for a future extended metro. Figure 3 below shows a potential Dardistown depot location (in orange).

The following sections describe the benefits and impacts of the two alternative locations in more detail and considers potential depot locations considered in Dardistown.

Figure 2. EPR Proposed Location for Maintenance Depot at Estuary.

Figure 3. Proposed Location for Maintenance Depot at Dardistown.

2.2 Operation & Maintenance Issues

2.2.1 Operational issues

MetroLink's demand forecast for 2057 indicates that the main expected demand will be concentrated in the central - southern part of the line south of the Airport. This can be represented by two assessed operating train circuits:

- One circuit will call at all stations from Estuary to Charlemont (and subsequently Sandyford when the metro is extended)
- The other circuit will run between the Airport and Charlemont (or subsequently Sandyford)

Based on these circuits, a preliminary operations assessment was undertaken to compare the impacts of a depot at Estuary and at Dardistown. This focusses on the empty running of trains to either establish initial morning services, or close down of services at the end of the day and return of trains to the depot or other stabling location. The assessment was based on anticipated services for a weekday, plus Saturday and Sunday (when services would be fewer). This indicated a modest but beneficial saving for the depot location at Dardistown compared to Estuary.

In addition, if the urgent removal of one of the operating trains is necessary due to an incident, the central location of a depot at Dardistown will facilitate a quicker removal when compared to the case of the depot being located at the extreme end of the route.

The entrance and exit of the trains would be simpler if the depot is located in Estuary, due to the straight run that is possible into a depot location at the end of the line after Estuary Station. However, the distance travelled by services that start or end at the airport is shorter if the depot is located in Dardistown.

2.2.2 Maintenance Issues

MetroLink maintenance vehicles will remain parked in the depot during service hours. At night these teams will go out to the main line to start their activities. This needs to be undertaken following removal of the final scheduled service trains to the depot or other stabling point and the commencement of the morning scheduled services the following day. This restricts the available working time for maintenance activities. The shorter the distance a maintenance train has to travel to its point of work, the longer time there is available for effective maintenance. With the depot located more centrally along the route at Dardistown this provides a significant improvement in available working time over a depot located at Estuary due to the shorter travel distances required.

In contrast, by placing the depot at Estuary, this would increase the risk compared to a depot at Dardistown of an incident on the line affecting access to or from the depot to maintenance activities.

3. Depot Options - Planning Overview

A planning overview was carried out on each alternative depot location, i.e. either Estuary or Dardistown, in order to identify any significant planning constraints to the development of a depot at Estuary or Dardistown. This comparison reflects the overarching zoning objectives and development plan objectives. Mapped environmental constraints in the Fingal Development Plan 2017-2023 are considered in the Environmental assessment summarized in Section 5 of this report.

3.1 Estuary

The Estuary Depot site is proposed on lands with the zoning objective 'ME - Metro Economic Corridor' in the Fingal Development Plan 2017-2023. The Metro Economic Corridor lands are adjacent to lands with the zoning objective 'OS – Open Space, and 'HA - High Amenity' lands to the south following the Broadmeadow River. The lands are subject to the requirement to prepare a Local Area Plan for the development of the lands.

There is a roads proposal crossing the proposed depot location at Estuary. This is the Swords Western Distributor Road, part of which will require construction to deliver access to the proposed Estuary MetroLink station.

A Metro Depot is not identified as 'Permitted in Principle' or as 'Not Permitted' under the zoning objective. Uses which are neither 'Permitted in Principle' nor 'Not Permitted' will be assessed in terms of their contribution towards the achievement of the Zoning Objective and Vision and their compliance and consistency with the policies and objectives of the Development Plan. In this regard, it is considered that a Depot is permissible at this location, noting however that it would not directly deliver on the objectives for the site, "*to facilitate opportunities for high density mixed use employment generating activity and commercial development, and support the provision of an appropriate quantum of residential development within the Metro Economic Corridor"*.

The previous planning decision in respect of Metro North identified that Bellinstown, just north of here, was not the preferred location for the proposed depot for flooding and planning policy reasons and this will continue to be a relevant consideration in respect of this project.

3.2 Dardistown

The landholdings at Dardistown are within the functional area of Fingal County Council and have zoning objectives of 'GE – General Employment' and 'HT – High Technology' in the Fingal Development Plan 2017-2023. The lands are also subject to the existing Dardistown Local Area Plan 2017-2022.

The lands are affected by the Public Safety Zones for Dublin Airport with the lands to the north of the site (zoned as General Employment) subject to significant limitations on the intensity of use and concentration of people who would be permitted to be located there.

The Local Area Plan (LAP) for the lands identifies a vision for Character Areas; various sets of development opportunities and constraints to achieve sustainable development principles between land use, high quality urban design, transport infrastructure provision, access and drainage proposals. The LAP identifies the location for the Metro North Depot based on the location permitted by An Bord Pleanála in 2011 (ABP Ref. PL06F.NA0007). Deviation from the depot layout as shown in the LAP would clash with the attributes, land use and urban design of the remaining Character Areas.

Under the Fingal Development Plan 2017-2023, a Metro Depot is not identified as 'Permitted in Principle' or as 'Not Permitted' under either of the zoning objectives. Uses which are neither 'Permitted in Principle' nor 'Not Permitted' will be assessed in terms of their contribution towards the achievement of the Zoning Objective and Vision and their compliance and consistency with the policies and objectives of the Development Plan. In this regard, it is considered that a Depot is permissible at this location, particularly given the recognition of the depot within the Dardistown LAP. However, within the site the preferred location on land use zoning grounds will be:

- Preferred Location Consistent with LAP (on General Employment zoned lands)
- Next Preferred General Employment zoned lands
- Least Preferred High Technology zoned lands (current Preferred Route location)

4. Depot Options - Environmental Overview

4.1 Introduction

An environmental assessment has been undertaken on the two proposed alternative depot locations for the future depot in order to identify any potential significant environmental constraints to the development of a depot at the Estuary or Dardistown sites.

4.2 Estuary

The following are the principle environmental considerations identified when assessing the Estuary location for the proposed depot:

- The proposed Estuary Depot site is located to the west of the R132 road and north of the Broadmeadow River with potential for impacts on water quality if not mitigated. The Broadmeadow River flows into several designated European sites downstream (namely Broadmeadow/Swords Estuary SPA and Malahide Estuary SAC).

- The Emmaus Retreat and Conference Centre is regarded as a sensitive receptor in this area. In addition, there are residential properties, and nearby agricultural enterprises in the vicinity of the proposed depot location. The provision of a depot at this location would result in potential impacts in terms of noise, vibration and dust during construction phase and the operational phase.

- The development of a depot at this location would also result in potential landscape and visual impacts in this predominantly open agricultural area, with an area just east of the R132 defined in the Fingal County Development Plan 2017 – 2023 as a Highly Sensitive Landscape.

- The provision of a Depot location at Estuary would result in increased traffic during both the construction and operational phases of the project. The proposed depot location lies in close proximity to an area prone to flooding along Broadmeadow River. Flood risk may require the depot ground levels to be raised resulting in further landscape & visual impacts. There is also risk of exacerbating flood risk to the lands surrounding the site.

The proposed Estuary depot site is located at a considerable distance from Dublin Airport or Swords. This location would not represent the optimal location for long term efficient economic and environmentally sustainable operation of the rail service, in comparison with options closer to Dublin Airport at Dardistown.

4.3 Dardistown

The following are the principle environmental considerations identified when assessing the Dardistown location for the proposed depot:

- The proposed depot location at Dardistown is located within a mainly agricultural plot of land bounded by the Old Airport Road south of Dublin Airport, the R108 and industrial/commercial buildings to the west; a long-term airport car park to the east; and the M50 motorway to the south.

- Local sensitivities include sports clubs located further north and north-west of the site near the future Dardistown Station location.

- The development of a depot location at Dardistown has potential for noise and air quality impacts during both the construction and operational phase. However, the proposed site is not in close proximity to sensitive receptors. Furthermore, the area would not be considered sensitive with already elevated ambient noise levels due to the location in close proximity to Dublin Airport and the M50 motorway.

- The proposed depot site is located in proximity to the Mayne River with potential for impacts on water quality if not mitigated. It is likely that a drainage ditch that flows to the Mayne River will require a diversion.

- The area in the immediate vicinity of the Mayne River is prone to flooding.

- The proposed Dardistown depot location is well connected to the M50 allowing good access for staff and deliveries of machinery and parts required for the operation of the depot. However, there will be potential impacts on a local road (the Old Airport road linking the R132 and the R108) due to the location of depot and increased traffic.

- The proposed Dardistown area for the depot is ideally positioned to maximise the long term efficient economic and environmentally sustainable operation of the rail service.

4.4 Overall Environmental Conclusions

A summary of a detailed environmental assessment of the two options for the required depot is presented above. Based on this assessment, it is considered that the Dardistown location is the better option as it reduces potential impact on sensitive environmental receptors and it is a better location to allow for a more sustainable operation of the Metro fleet.

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5. Depot Options at Dardistown

5.1 Dardistown Options

Potential locations within the Dardistown area have been assessed for their ability to accommodate an appropriate depot layout. This needs to support the implementation of the new metro system, including provision of a short test track, provide a level, suitably sized and accessible depot and provide appropriate sidings and facilities for rolling stock and trackway maintenance operations. The options presented in the following sections would be compatible with the necessary operating requirements for managing operations at the depot.

The options are described in detail in this section of the report, with key construction issues and associated planning and environmental issues identified. Each of the options developed for the Dardistown lands principally affect the High Technology lands. These options are considered below for their particular effects on the implementation of the Local Area Plan objectives and vision.

5.2 Option 1

This Option is shown in Figure 4 below.

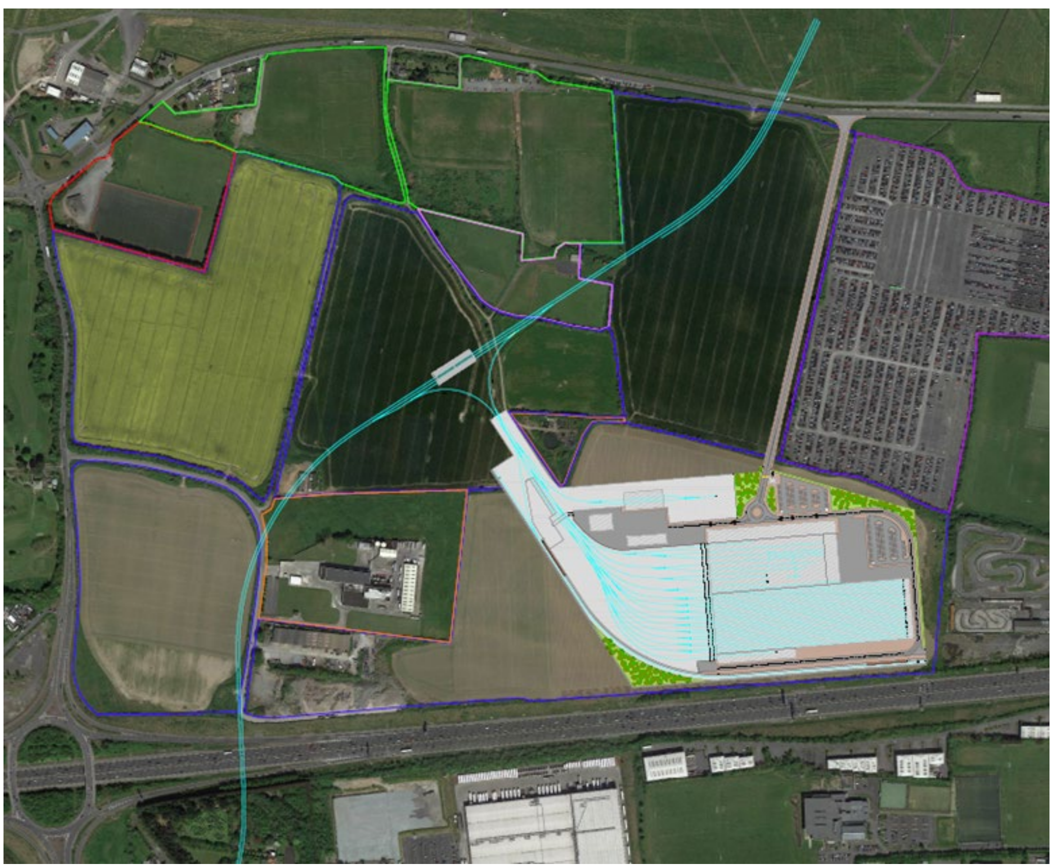

Figure 4. Potential Maintenance Depot at Dardistown – Option 1

5.2.1 Construction & Operation

This potential site for a depot at Dardistown would require approximately 17ha of land. From an operational perspective this would provide the best-balanced solution, subject to further detailed development. Compared to the other options it would provide better manoeuvrability, better accessibility to the buildings (particularly direct connection between the workshop and test track) and have less internal clashes between rail track and the road network. The site would require some levelling to provide an appropriate flat area for the depot, with low cut slopes and could be placed above local flood levels from adjacent waterways. It would be able to accommodate future construction of part of the Greater Dublin Drainage (GDD) pipeline in this area.

Access to the depot would require cross-overs on the mainline or potentially a grade separated access.

5.2.2 Planning Considerations

This location principally takes up land identified as ‘Hub’ Character Area (new business district, corresponding to High Technology zoned lands) as well as the ‘Eastern Corridor’ Character Area (employment/commercial uses corresponding to the General Employment zoning). Eastern Corridor land uses could potentially include logistics, warehousing, commercial car parks and transport depot uses. The potential Central Spine road, which would be the main distributor of traffic to, from, and through the LAP lands, would provide a critical link between the Naul Road (R108) and the Swords Road (R132). This proposed dual carriageway and the proposed Airport Avenue would have to go over the metro track in this area. Pedestrians and cyclists will still be able to permeate north and south from the Metro station to reach the employment lands on either side. It is noted that the route of the Greater Dublin Drainage Project runs along the southern part of the land holding.

This option reduces the impact on the LAP access strategy, although it will have a significant effect on the ability to develop the overall land holding.

5.2.3 Environmental Considerations

An environmental assessment of options identified constraints and opportunities for each option and these were considered when identifying the preferred option. The most significant environmental considerations relevant to this option are detailed here:

- This option has potential for noise and air quality impacts during both the construction and operational phase. However, it is not in close proximity to sensitive receptors.

- The site is located in proximity to the Mayne River with potential for impacts on water quality if not mitigated. It is likely a small tributary that flows to the Mayne River will require a diversion. There is potential for impacts arising from the access road which will require a crossing of a tributary of the Mayne River. These impacts have the potential to occur in the absence of suitable mitigation.

- Of the options assessed this option has the smallest footprint reducing the number of land owners affected.

5.3 Option 2

This Option is shown in Figure 5 below.

Figure 5. Potential Maintenance Depot at Dardistown – Option 2

5.3.1 Construction & Operation

This potential site for a depot at Dardistown would also require approximately 17ha of land for the depot but would also sterilize an area between the depot access and the main line. It would provide a similar ‘cul-de-sac’ facility as Option 1.

As shown, this layout would significantly affect access to the existing industrial facility that would lie adjacent to the eastern edge of the depot, with a new access required from the Old Airport Road to the north.

A further significant constraint is achieving an appropriate level site in this area to minimize cut and fill requirements. In particular the western boundary alongside the R108 would require high retaining walls due to the level difference required between the road and the adjacent depot.

There would be potential to relocate the depot further to the north, to assist in retaining access to the industrial facility but this would affect existing sports pitches and would increase the area of land sterilised between the access to the depot and the main line.

5.3.2 Planning Considerations

This option largely affects the ‘Gateway’ Character Area, which is principally located on High Technology zoned lands. The option impedes the proposed access road into the LAP lands, from the R108, planned to be the principal entrance to the lands and is of strategic importance. It is also where the improved bus facilities are identified. The principal entrance and central spine road would need to be realigned around the depot so that it is serve the centre of the LAP lands. Thus, the option potentially affects the overall key objectives of the movement strategy in the LAP. It also splits the Hub area away from the public roads and reduces its connectivity to surrounding lands and the wider catchment. This option has poor connectivity to the future station from outside the overall Dardistown site.

5.3.3 Environmental Considerations

An environmental assessment of options identified constraints and opportunities for each option and these were considered when identifying the preferred option. The most significant environmental considerations relevant to this option are detailed here:

- There are a number of sports facilities situated to the north west of the depot near the future Dardistown Station location. This creates potential for noise and air quality impacts on these facilities during both the construction and operational phases. If the depot location was relocated further north then these facilities would be directly impacted.

- The proposed option would block access to the existing industrial facility from the R108, requiring a significant diversion route to be incorporated. Relocation of the depot northwards would ameliorate this issue.

- With this proposed layout and location, the depot would potentially impact on an identified archeological site. (a burnt mound (Ref: AH583)).

5.4 Option 3

5.4.1 Construction & Operation

This option is shown in Figure 6 below.

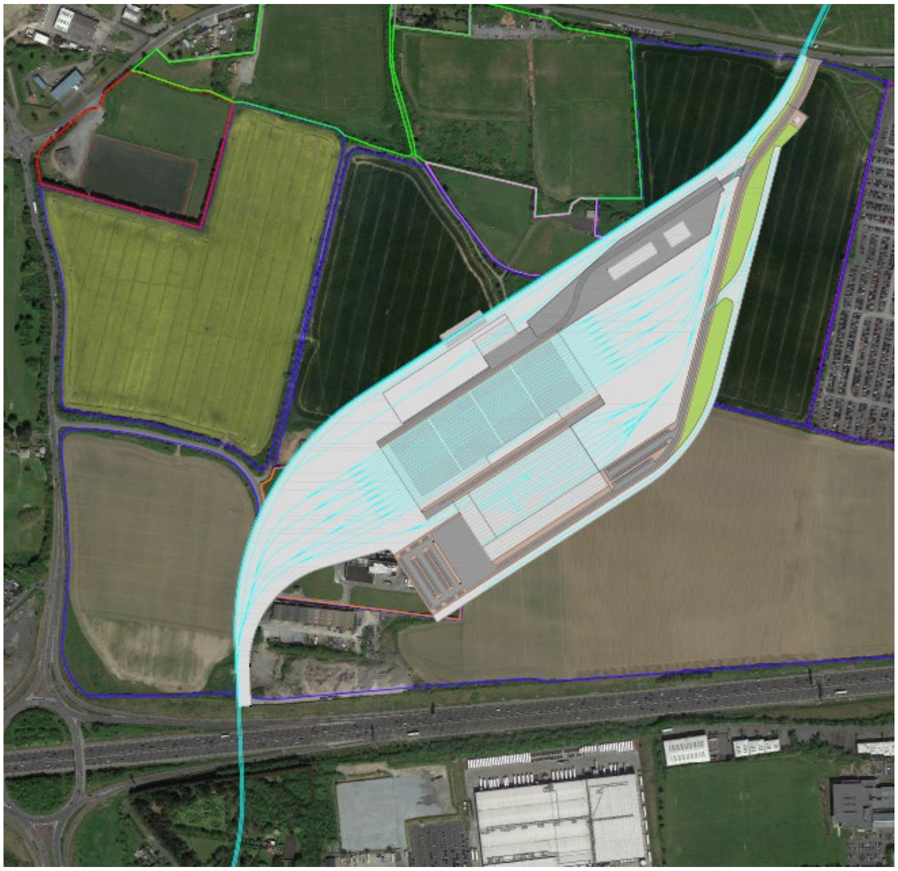

Figure 6. Potential Maintenance Depot at Dardistown – Option 3

This option is located on the southern side of the main line, taking 24ha of land. It was developed to indicate an option aligned with the main line, i.e. a through depot type rather than the cul-de-sac type of Options 1 and 2. However, the main constraint with this option is related to the connections with the main line because the required distance between the access and egress links to the depot would exceed the available distance between the Airport tunnel portal and the abutment of the viaduct over the M50. Changes to the rail alignment to accommodate the depot accesses would thus require significant structural changes to both the Airport tunnel portal and adjacent tunnel and the M50 bridge.

5.4.2 Planning Considerations

This depot location/layout will comprise lands largely with a High Technology zoning but also some General Employment zoned lands. The option would impair potential connectivity across the site, both east-west and north-south. In particular, the high intensity / high density development areas (the 'Hub' Character Areas) on the southern half of the LAP lands will be isolated and significantly impact on the ability to develop the lands as a coherent development area. The lands will be in isolated pockets separated by an impermeable depot.

Option 3 impacts on the proposed function of the Central Spine Road as well as the proposed Airport Avenue which runs in a north south direction from Collinstown Lane (also known as Old Airport Road). The overall key objectives of the movement strategy in the LAP would be significantly affected. However, connection to the public roads to the north and west will be preferable to Option 2.

5.4.3 Environmental Considerations

An environmental assessment of options identified constraints and opportunities for each option and these were considered when identifying the preferred option. The most significant environmental considerations relevant to this option are detailed here:

- This option has potential for noise and air quality impacts during both the construction and operational phase. However, it is not in close proximity to sensitive receptors.
- The depot footprint/layout is larger than options 1 and 2 at 24 ha, which has an increased potential impact on biodiversity values at a local level.
- The footprint of this option has direct property impacts on four land owners and requires the acquisition and demolition of an industrial facility in its south western corner.
- The footprint of the depot creates the potential for direct impacts on a tributary of the Mayne River located on the depot's eastern boundary if not suitably mitigated.
- This option requires increased earthworks to create an access road which has the potential to create more run off within the catchment of the Mayne River.
- With this proposed layout and location, the depot will potentially impact two archeological sites in the north eastern end of its footprint. These are an enclosure (Ref: AH585) and a cremation pit (Ref: AH584).

6. Conclusions

6.1 Routewide Depot Location

Under the EPR route the depot was proposed to be at Estuary at the extreme northern end of the route, given that the route through Dardistown was proposed to be tunneled and only emerging to the surface north of the airport.

With the Preferred Route proposal to provide two separate tunnel sections, from Northwood southwards to Charlemont and a shorter tunnel section under the airport, this provides the opportunity to relocate the depot to the Dardistown area where the Preferred Route would be surface running and would enable an access to be created to a depot. Dardistown was the accepted location for the depot under the previous Metro North project.

Depot sizes would be similar for either location, although specific layout arrangements would need to suit the specific constraints of each location, hence infrastructure costs and running costs would be similar.

The location of the planned Swords Western Distributor Road (SWDR) would restrict opportunities for the depot at Estuary. If the depot was to be located to the north of the SWDR, then this road would need to pass over the rail link thereby potentially creating more difficult road access into the Estuary station and associated Park and Ride. Alternatively, MetroLink would need to pass under the SWDR. If the depot was to remain south of the SWDR then the location of the depot would need to extend further west and would directly impact the Emmaus Centre.

A depot location at Dardistown (which would be more central to the overall metro route), would provide associated benefits to the operation and maintenance of the metro as identified in this report and summarized below.

Dardistown benefits:

- The depot will be used for overnight stabling of the majority of the metro fleet (with limited train sets stabled at the northern and southern ends of the route to establish initial morning services). The Depot's location at Dardistown reduces travel distance to establish the remaining train start locations for daily operations;

- The more central location of a depot at Dardistown reduces the empty kilometers for removing trains from service during inter-peak periods or for re-inserting trains into the scheduled service as required (noting that a reduced service frequency is envisaged between the Airport and Estuary stations);

- With a depot at Dardistown, there is quicker ability to address operational issues that may occur during service (e.g. breakdown, power loss or other incidents);

- The location of the Depot at Dardistown removes the risk of an incident on the track between Estuary and Dardistown blocking access to the maintenance depot for other trains;

- The more central location of Dardistown offers faster access to most areas of the route for overnight maintenance activities, maximizing available working time on the route before scheduled services restart;

- A depot at Dardistown will reduce the total distance run by empty trains to establish start of daily services and conclude services in the evening with trains being stabled overnight, compared to a depot at Estuary. Although the difference in distance is not large, it does marginally benefit from a depot at Dardistown. The saving in distance travelled will also represent a small operational cost saving for the Operator.

- The Depot's location at Dardistown has less environmental impacts than the location at Estuary, with reduced potential for impacts on biodiversity and other sensitive receptors having regard to noise, air quality and water. Furthermore, there would be less impact on properties and a reduced potential for impact on traffic.

- From a planning perspective, both the Estuary and Dardistown locations fall within lands zoned for development.

Estuary benefits:

- A depot at Estuary would be accessed via a direct continuation of the rail lines northwards from Estuary station. This arrangement would avoid the need for crossovers along the line to facilitate trains going into and out of the Depot. Crossovers would be required at Dardistown.
- From a planning perspective, both the Estuary and Dardistown locations fall within lands zoned for development. However, from a purely zoning perspective alone Dardistown is a less preferable location than Estuary due to it's impact on High Technology lands but overriding operational requirements mean it is the better location for a depot.

6.2 Depot Options at Dardistown

As discussed in this report, three options have been considered for a depot located at Dardistown. Of these, the through depot option (Option 3) is not considered to be technically feasible due to the fact that there is not sufficient space between the Portal to the north of this depot and the M50 bridge crossing to the south to allow for the required connections from the Depot to the line.

Of the two other options assessed, Option 1 offers the least overall land take requirements to provide a depot site capable of providing the operational requirements of the metro. In addition, this option also reduces the impact on the LAP access strategy when compared to other options, although it will impact on the ability to develop the overall land holding.

Option 2 is capable of providing the required facilities and operational capacity. However, this option performs less well on some of the internal depot train movements required and would sterilize additional areas of land when compared to Option 1. This option also has results in poor connectivity to the proposed future station at Dardistown from outside the area and would require major earthworks/retaining structures to develop the site.

This report thus concludes that the preferred location for the MetroLink depot is Dardistown, with the Depot location Option 1 adopted as part of the proposed Preferred Route.

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Appendix D. Crossing of M50

Contents

Executive Summary

An Emerging Preferred Route (EPR) for the proposed MetroLink scheme serving the Swords-Dublin Airport-City Centre transport corridor was developed with a twin-bore tunnel from the city centre to just north of the airport. The construction methodology split the tunnelled section route into two almost equal halves with a station and one tunnel launch and reception site located at Griffith Park.

The Public Consultation process in Spring 2018 resulted in many submissions that raised concerns about the environmental and community impact of a tunnel construction site at Griffith Park as well as other submissions on the proposals at Northwood Station. Operational considerations suggested that the depot would be better located towards the central section of the route.

NTA/TII instructed its consulting engineers, Jacobs/Idom Joint Venture, to examine alternative options to allay concerns and identify a preferred site for the train maintenance depot.

This review identified that the proposal for a single-bore tunnel design with two separate tunnels and surface running each side of the M50 would provide better opportunities to mitigate construction impacts of the EPR route and would also provide improved operational benefits through relocation of the MetroLink depot to a more central site at Dardistown compared to Estuary as proposed in the EPR. The TBM launch site is relocated to the portal now proposed at Northwood, just south of the M50, which enables the route to pass over the M50 and continue past Dardistown on a surface running section before it goes underground again to pass under Dublin Airport.

This report sets out the resulting proposed alignment for the surface running section of MetroLink across the M50 corridor.

1. Introduction

1.1 MetroLink Development and Consultation

Metro North was the project name of the original proposal for a metro railway system connecting Swords and Dublin Airport with Dublin City Centre at St Stephens Green. This scheme was developed by the Railway Procurement Agency through the Railway Order process to successful planning approval by An Bord Pleanála (ABP) in 2010. The global economic downturn intervened, and in 2011 the Government postponed the Metro North project.

Figure 1 – EPR MetroLink (2018)

The National Transport Authority's (NTA) Transport Strategy for the Greater Dublin Area, 2016-2035 identified a Metro service as the preferred public transport mode to address the transport needs of the Swords-Airport-City Centre corridor. It also envisaged the upgrading of the existing Luas Green Line between Ranelagh and Sandyford to a Metro level of service.

Project Ireland 2040 included the National Development Plan (2018-2027), which combined those two projects to form MetroLink. MetroLink will provide a fast, high capacity, high frequency, modern and efficient public transport service for people travelling along the Swords/Airport to City Centre corridor. In addition, the Scheme will ultimately connect to the existing Luas Green Line in the South City area, enabling through running metro services from Swords to Sandyford as shown in Figure 1.

The metro route length from Swords to City Centre is approximately 19km and the completed system will have 15 Stations, 3,000 Park & Ride spaces, and a journey time of approximately 25 minutes.

The NTA commissioned Arup Consulting Engineers to undertake a Route Alignment Options Study for the Scheme in 2016. The objective of the study was to carry out a comprehensive route option selection to identify an Emerging Preferred Route (EPR). The study was completed at the end of February 2018 and it included a Concept Design for the EPR.

1.2 Public Consultation.

A programme of public consultation led by the NTA/TII was conducted between 22nd March and 11th May 2018, during which members of the public and other stakeholders were invited to submit their views and observations on the EPR.

Under the EPR, the route passed in tunnel under the M50. As such, submissions were received in relation to the adjacent Northwood Station, rather than the M50 location itself, but which have a bearing on the alignment of the M50 crossing. Other principle submissions concerned the proposed location of the Tunnel Boring Machine (TBM) launch site at Griffith Park, Glasnevin.

Following a review of the Route Alignment Options Study, changes have been proposed to the design of the project. These changes include relocating the MetroLink depot and revising the tunneling strategy, in particular proposing a short tunnel under the airport and a second tunnel from Northwood southwards into the city, with a surface route past Dardistown linking the two tunnels. The key advantage is that the train maintenance depot can be relocated from its EPR location at Estuary to a more central and surface location at Dardistown, which brings operational benefits.

These changes to the tunneling strategy have introduced the requirement for an elevated crossing over the M50, which is described in the following sections.

2. Emerging Preferred Route and Crossing of M50

2.1 EPR Route Alignment

The Emerging Preferred Route (EPR) that was developed before Public Consultation in 2018 had a route alignment entirely underground from the city centre to north of Dublin Airport, from where it continues on the surface or elevated structures to the proposed Estuary Station. As shown in Figure 2 the EPR passes under the M50 and Dublin Airport.

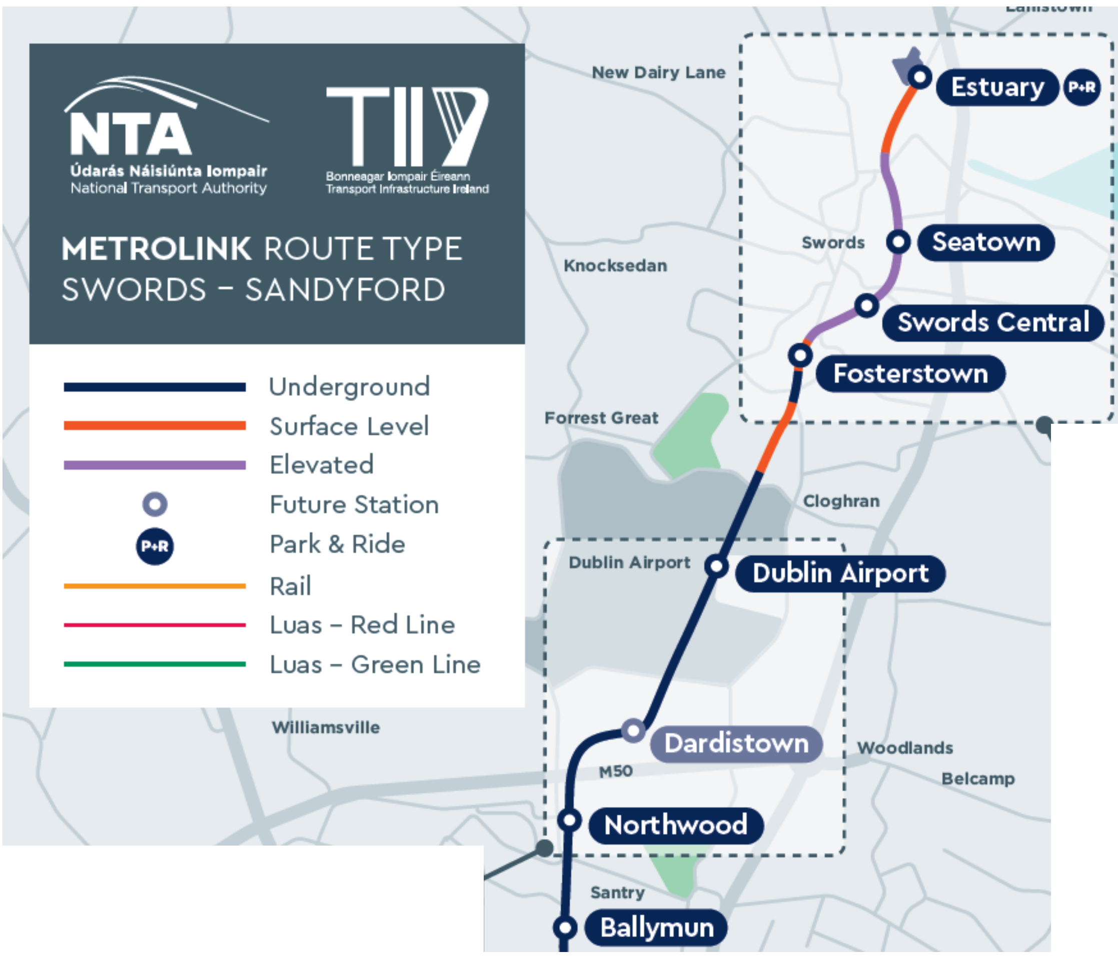


Figure 2 – The EPR Alignment Proposal

The EPR was developed based on a twin bore tunnel configuration although it was recommended that a single bore tunnel arrangement should be investigated.

2.2 M50 Crossing and Northwood Station

For the EPR, the location of Northwood Station was in the green space adjacent to the existing Gulliver's Retail Park and south of the junction between the M50 and the Ballymun Road (R108). The arrangement is shown in Figure 3 below which indicates the twin-bore tunnel alignment passing under the M50 to the north.

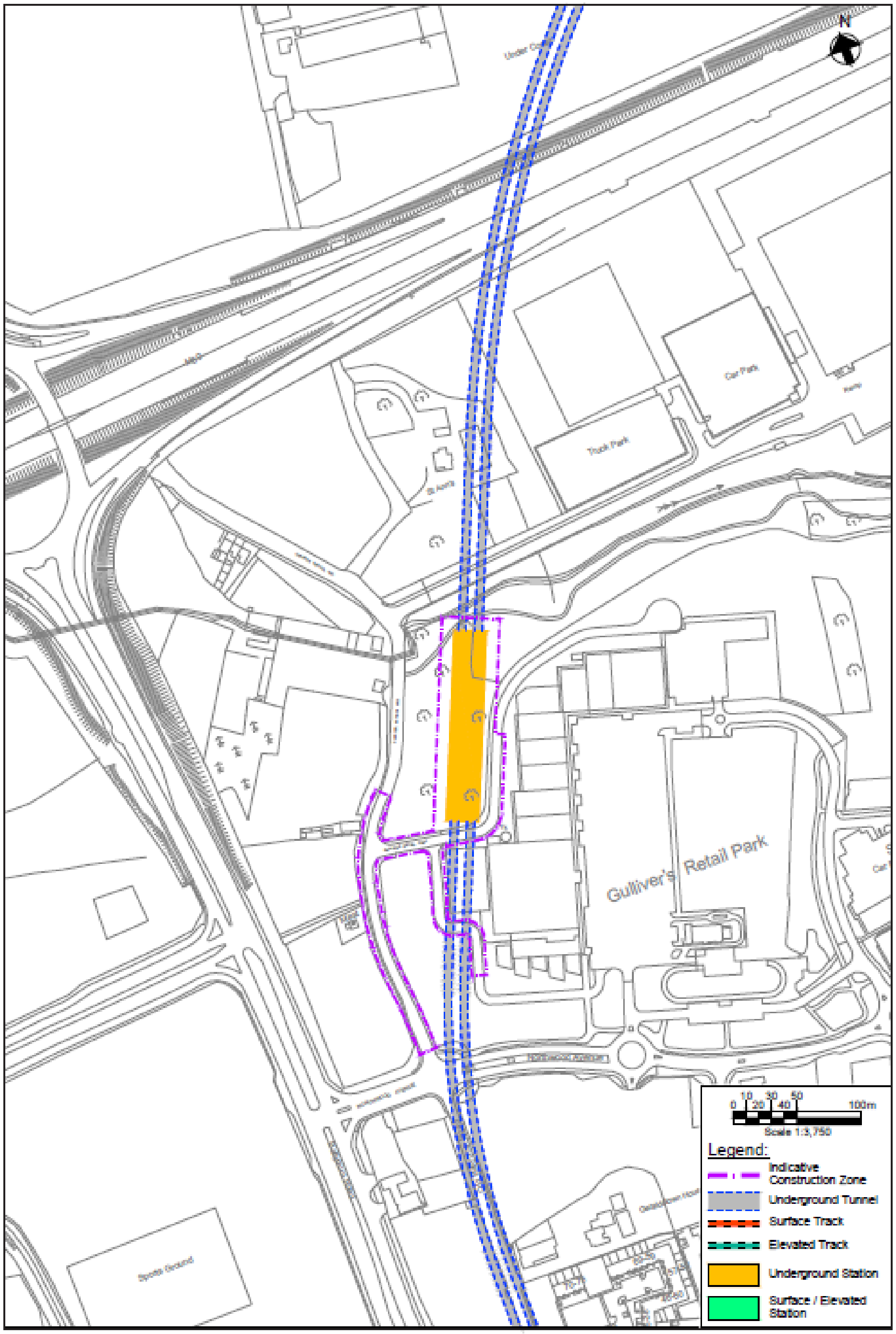


Figure 3 – EPR Northwood Station and Crossing the M50

3. Preferred Route Alignment at the M50

3.1 Tunnels for the Preferred Route

Under the Jacobs/Idom Preferred Route, with a single bore tunnel, it is proposed that the tunnels rise to the surface each side of the M50, which results in two separate tunnel lengths as described:

- Northwood (south of M50) - a tunnel to Charlemont in the city centre
- Dardistown (north of M50) - a tunnel under the airport from south of the Old Airport Road to the north of the Naul Road, following the EPR alignment.

The Preferred Route at the M50 crossing between the two tunnel sections is shown on Figure 4 below. The image shows Ballymun Station to the west of the R108, Northwood Station is shown under the R108 and the M50 crossing is elevated on a bridge structure.

Figure 4 – Image of Preferred Route at M50

For the Preferred Route the TBM launch site at Griffith Park under the EPR scheme would be relocated to Northwood and single bore tunnelling would progress continuously from there southwards to Charlemont, thereby dealing with many of the concerns raised during consultation.

3.2 Crossing the M50

The proposed plan arrangement for the M50 crossing leading from Northwood Station and tunnel portal is shown in Figure 5 below.

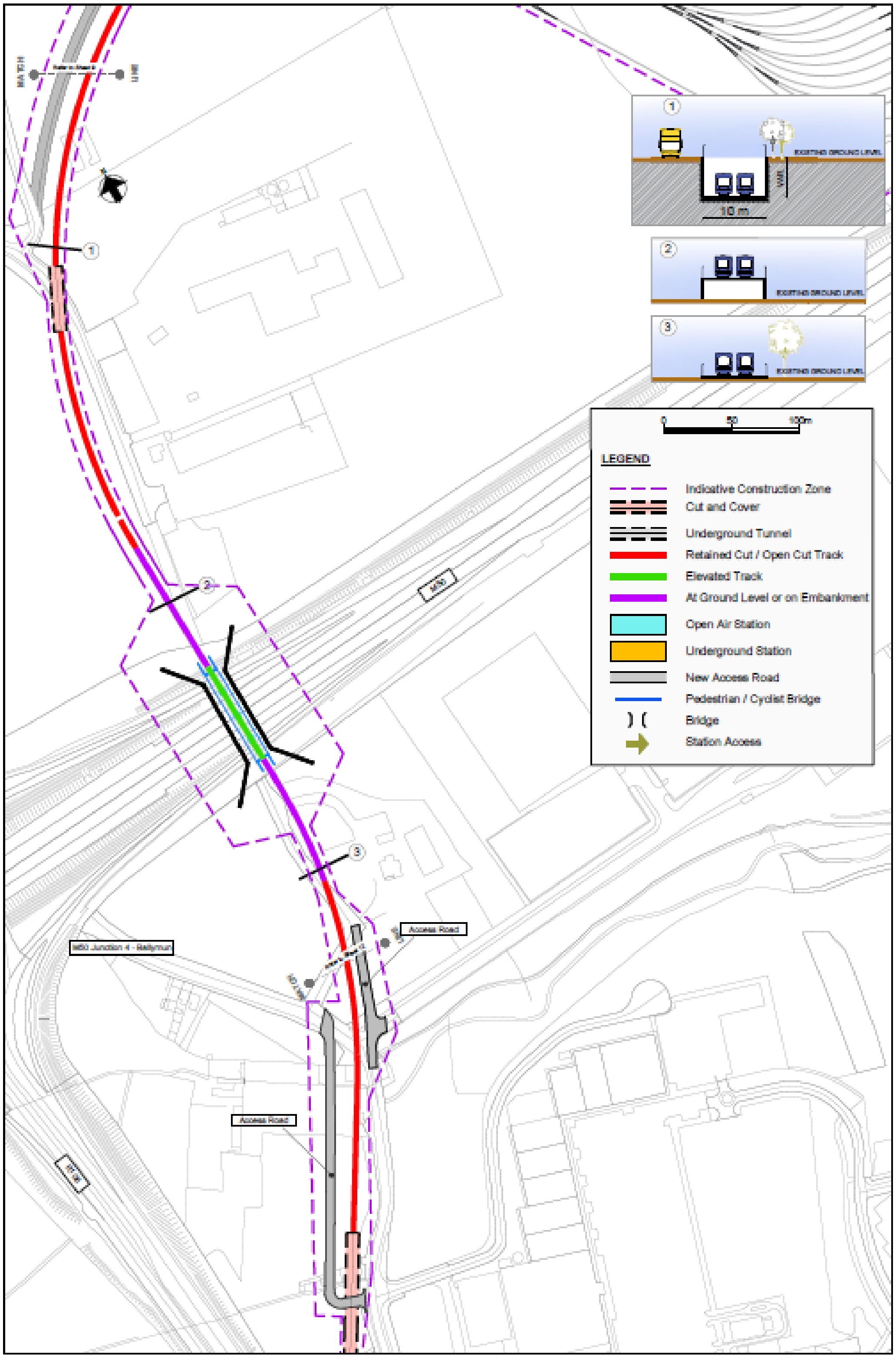


Figure 5 – Preferred Route Alignment at M50

The Preferred Route alignment is also influenced by the revised station location at Ballymun to the south as presented in the relevant report contained in Appendix I of the Preferred Route Design Development Report.

A longitudinal section and plan image of the M50 crossing is provided in Figure 6 below, where the track profile is shown in blue.

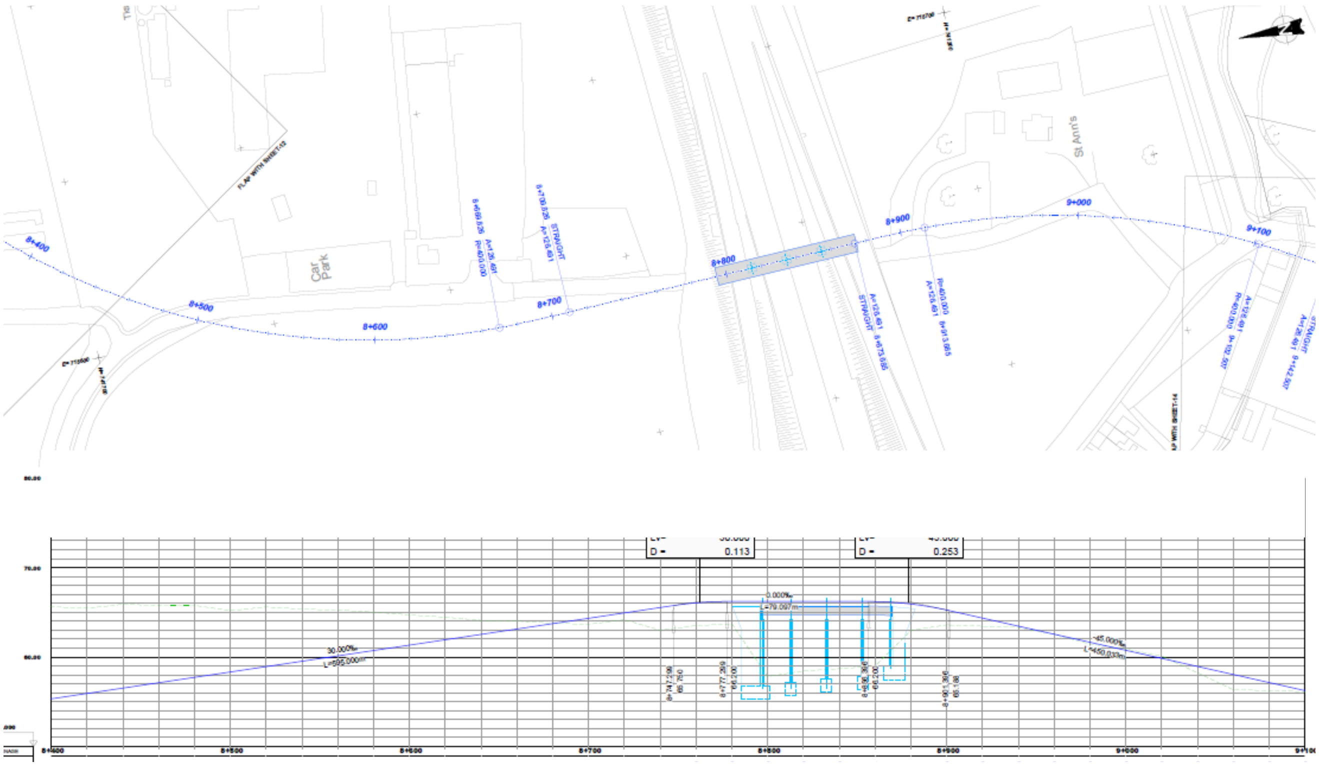


Figure 6 – M50 Crossing Plan and Longitudinal Section

Figure 7 below illustrates the Preferred Route on a map background as it crosses the M50.

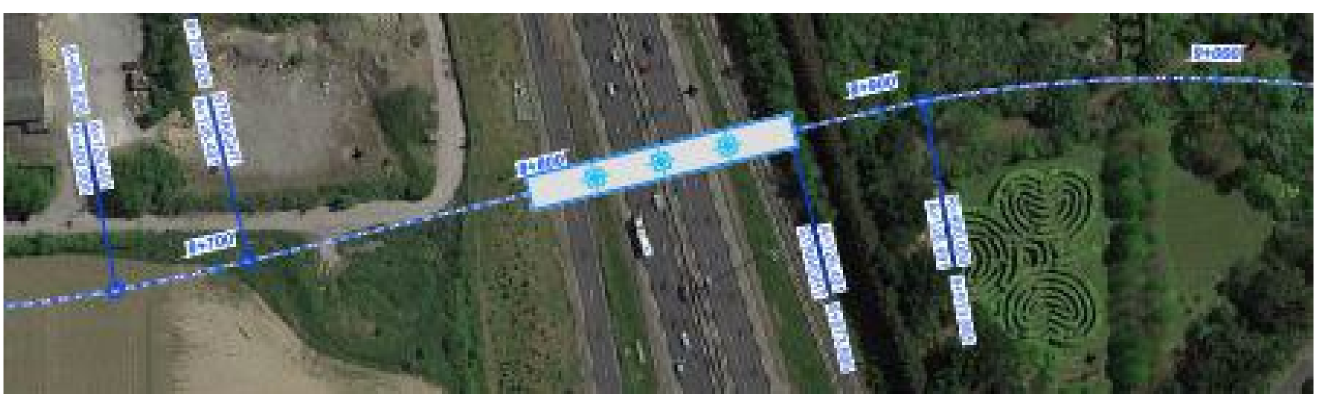


Figure 7 – Plan Image of M50 Crossing

3.2.1 Environmental Considerations to the proposed M50 crossing

An environmental assessment has been undertaken on the proposal to go over the M50 in order to identify any potential significant environmental constraints and opportunities. These findings were considered when identifying the preferred option.

The following are the principle environmental considerations identified:

- Potential visual impact to residences and businesses either side of the M50 at that location, both during construction and operational phases;
- Potential for increased traffic disruption to the M50, the Ballymun Road (R108), and the Old Ballymun Road / Charter School Hill during the construction phase. These roads provide access to residential units and a large Tesco and Keeling's distribution depot;
- Potential impact on Santry Lodge;
- Potential for increase in noise and vibration at residential properties near the new alignment;
- Potential for air quality impacts during the construction phase due to above ground works in proximity to residential developments; and
- Potential for direct property impacts, including development potential.

The Environmental Impact Assessment Report (EIAR) will present a detailed analysis of the environmental impacts and determine the required mitigation measures to minimise impacts.

3.2.2 Planning Considerations to the proposed M50 crossing

The alignment of both the EPR and the preferred M50 crossing as it passes through the Dardistown lands is within the functional area of Fingal County Council, and is located in the zoning objective 'HT (High Technology) – to provide for office, research and development and high technology and high technology manufacturing type employment in a high quality built and landscaped environment'. The lands are also subject to the existing Dardistown Local Area Plan (LAP) 2017-2022 where the MetroLink project is recognised as having been approved by two earlier Railway Orders, traversing the LAP. The development principles for the relevant LAP lands and its character are identified as Opportunity Sites 1 and 2; prominent sites with frontages onto the M50. This represents strategic development sites immediately available to deliver any significant employment benefits or investment opportunities for Fingal.

The LAP recognises the need to accommodate a network of permeable, safe, secure and high-quality pedestrian/cyclist routes, as well as additional connections to existing/proposed routes in the wider area. It is noted that the LAP does not specify whether a proposed Metro route would be underground, at grade or elevated across the site.

An elevated route will have a greater potential impact on the flexibility of development layouts on the site, but is consistent with the zoning objectives and local area plan policies.

Under Objective MT15 of the Fingal Development Plan 2017-2023, it is an objective to 'Investigate and avail of the opportunities provided by new Metro North and any other public transport infrastructure to provide new cycle and pedestrian links including crossings of the M50 which currently represents a major barrier to active transport modes.'

This objective will apply to either the EPR or preferred option. This objective will be examined as part of preliminary design for how or whether, such links could be achieved.

The southern side of the M50 crossing is zoned 'ME - Metro Economic Corridor' in the Fingal Development Plan 2017-2023. This zone facilitates opportunities for high density mixed use employment generating activity and commercial development, and support the provision of an appropriate quantum of residential development within the Metro Economic Corridor. The lands are subject to the requirement to prepare a masterplan. To date this masterplan has not been prepared.

There is no extant planning permission on the land holding as the MetroLink crosses south from the M50.

4. Recommendation

The Preferred Route design is for a single bore tunnel, split into two unequal sections each side of the M50.

It has been found possible to relocate the TBM launch site northwards from the Griffith Park Station site proposed under the earlier EPR proposals, with the tunnel drive southwards to the city commencing from Northwood just south of the M50. There are operational benefits in relocating the train maintenance depot to the Dardistown area on the surface which means that the Preferred Route alignment now needs to pass over the M50 motorway.

The Preferred Route alignment will thus now rise from the tunnel portal and ramp at Northwood onto a bridge structure over the M50 and then onto a surface running section at Dardistown before entering the Airport tunnel at the Old Airport Road. This surface section will facilitate the re-location of the MetroLink depot from the EPR location proposed at Estuary to a more operationally efficient location nearer the middle of the MetroLink route.

Appendix E. Alignment along R132

Contents

Executive Summary

The EPR route north of Swords was designed to run along the R132 median on an elevated viaduct to pass over the roundabouts at Estuary, Seatown, Malahide and Pinnock Hill. An alternative solution identified as 'Alternative Option A: Fosterstown and Estuary Station' was also presented. This option was to run the majority of the route along the central median of the R132 at surface level but with grade separation at the roundabouts.

The Public Consultation process raised concerns about aspects of the EPR proposals and some of these were related to the route section north of Dublin Airport and within the R132 road corridor, including visual intrusion and station accessibility.

Further consideration has been given to the route in this area and the route north of Swords was further assessed. This considered a number of options, including design variations on the elevated viaduct; an alignment in cutting in the road median; and an alternative alignment in a mix of open-cut and cut-and-cover and bridge structures along the eastern side of the R132. The latter option would mean MetroLink would run below the road level along the R132, thus alleviating concerns raised about the visual impact of an elevated structure.

A multi-discipline assessment has been undertaken on these options. From this work the recommendation is that the Preferred Route north of Swords should include an alignment along the eastern side of the R132 with consequent changes to the station proposals at Seatown, Swords Central and Fosterstown. This option is now being progressed in more detail through the on-going preliminary design development.

The changes to the stations are summarised as;

- Seatown Station is moved from the central median to the east of the R132 and placed in a cutting. It is now in an improved location beside the junction of Seatown Road and the R132.

- Swords Station in the EPR was located in the median of the R132, south of the Malahide Road roundabout and across the road from the Pavilions Shopping Centre. For the Preferred Route it moves to the east of the road and a footbridge is provided for a efficient connection to the shopping centre, bus stops and Swords town centre.

- Fosterstown Station in the EPR was located just north of Airside Retail Park on the R132. The Preferred Route relocates it to the south and closer to the retail park. A bridge will be constructed for pedestrians and cyclists so that people in the Boroimhe development will have easy access to the station.

1. Introduction

1.1 MetroLink Route Development

Metro North was the project name of the original proposal for a metro railway system connecting Swords and Dublin Airport with Dublin City Centre at St Stephens Green. This scheme was developed by the Railway Procurement Agency through the Railway Order process to successful planning approval by An Bord Pleanála (ABP) in 2010. The global economic downturn intervened, and in 2011 the Government postponed the Metro North project.

The National Transport Authority's (NTA) Transport Strategy for the Greater Dublin Area, 2016-2035 identified a Metro service as the preferred public transport mode to address the transport needs of the Swords-Airport-City Centre corridor. It also envisaged the upgrading of the existing Luas Green Line between Ranelagh and Sandyford to a Metro level of service.

Figure 1 – MetroLink Route Map with R132 corridor highlighted

Project Ireland 2040 included the National Development Plan (2018-2027), which combined those two projects to form MetroLink. MetroLink will provide a fast, high capacity, high frequency, modern and efficient public transport service for people travelling along the Swords/Airport to City Centre corridor. In addition, the Scheme will ultimately connect to the existing Luas Green Line in the South City area, enabling through running metro services from Swords to Sandyford as shown in Figure 1.

The metro route length from Swords to City Centre is approximately 19km and the completed system will have 15 Stations, 3,000 Park & Ride spaces, and a journey time of approximately 25 minutes.

The NTA/TII commissioned Arup Consulting Engineers to undertake a Route Alignment Options Study for the Scheme in 2016. The objective of the study was to carry out a comprehensive route option selection to identify an Emerging Preferred Route (EPR) and Concept Design. The study was completed at the end of February 2018.

Separately, in January 2018, the NTA/TII commissioned Jacobs and Idom JV (Jacobs/Idom) to provide ongoing engineering design services through to scheme completion.

1.2 Public Consultation

A programme of public consultation led by the NTA/TII was conducted between 22nd March and 11th May 2018, during which members of the public and other stakeholders were invited to submit their views and observations of the EPR. A keen interest was evident in the R132 corridor.

There were 9 No. submissions in relation to Seatown Station, which as shown in Figure 2 was located on an elevated viaduct in the median of the R132 to the eastern side of Swords Village.

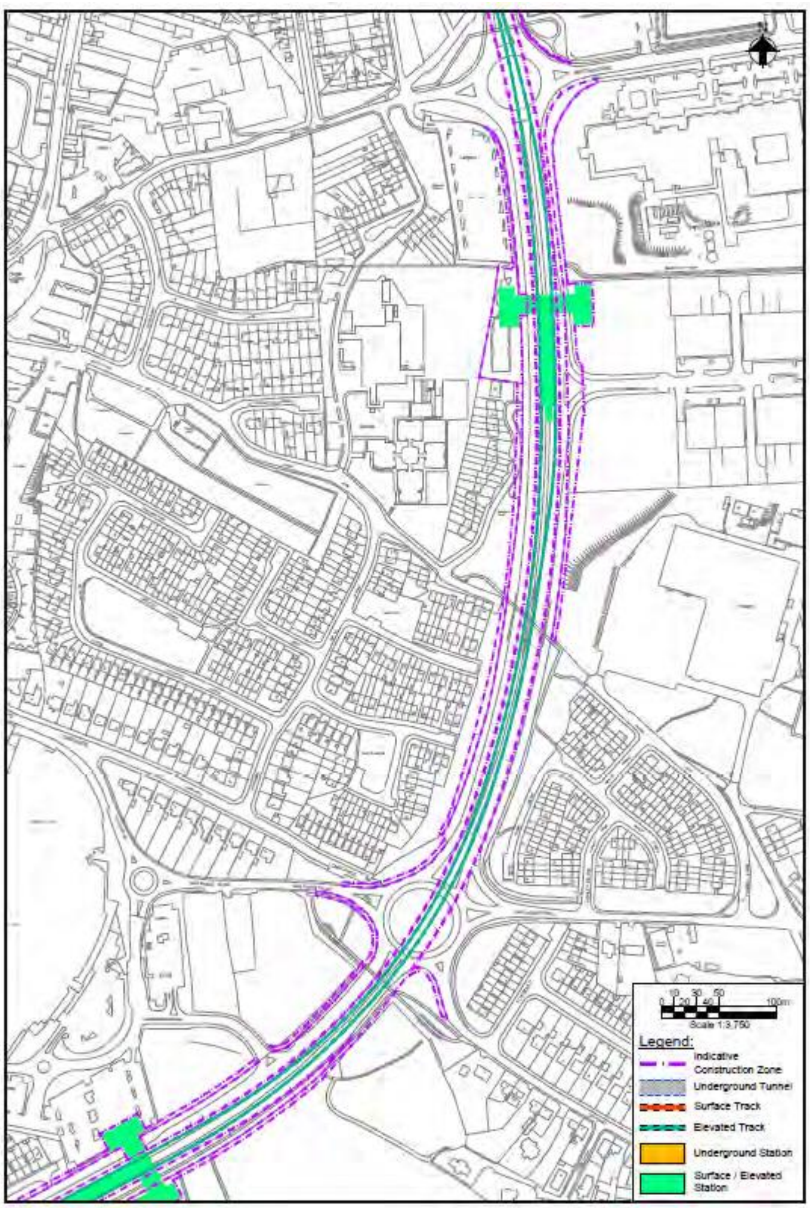


Figure 2 - Seatown Station for EPR

The main concerns expressed in the consultation submissions in relation to the Seatown Station were:

- Visual intrusion of the elevated viaduct on residential areas either side of the R132 such as Ashley Avenue, Castle Grove, Longlands, Castle Park, Chapel Lane and Seatown Walk;
- Access to the station for pedestrians, cyclists and mobility impaired users;
- Anti-social activity at the stations and underground passages and
- Integration with the bus network to facilitate accessing the station from surrounding areas, particularly residential areas to the west of Swords.

There were 6 No. submissions in relation to Fosterstown Station, which as shown in Figure 3 below was located on the eastern side of the R132 to the north of Airside Retail Park.

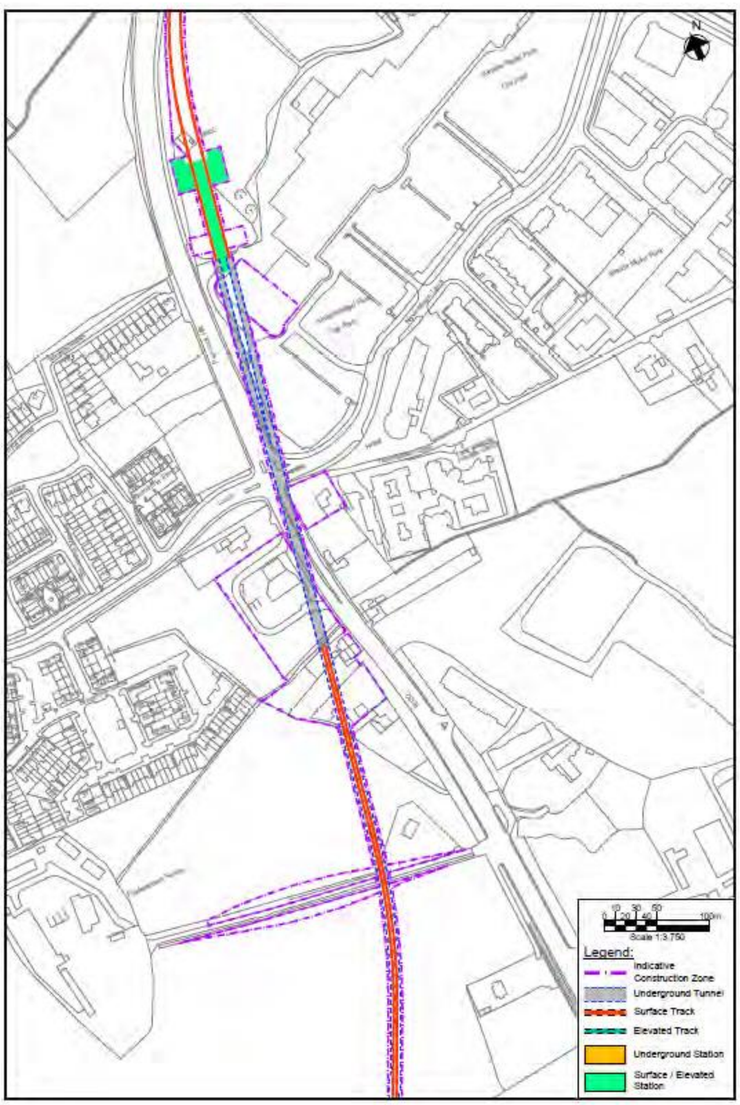


Figure 3 – Fosterstown Station for EPR

The main concerns expressed in the consultation submissions for Fosterstown Station were:

- Access to the station from residential areas to the west, such as Boroimhe and Ridgewood, including a request to consider a proposal to move the alignment and station to the western side of the R132 to facilitate this;
- Property acquisition south of the station where the route crosses the R132 at the junction with Nevinstown Lane, and
- Reduction in the amenity value of the green space to the south of Boroimhe residential area, north of the Naul Road/Dublin Airport, due to the alignment being at-grade in this location which results in restrictions to access and increased noise during operation.

The Public Consultations also raised Scheme-wide issues and some of them related to the route north of Dublin Airport and long the R132. These included concerns on;

- Concerns from several stakeholders in relation to how the EPR would impact on their proposed developments or planning application;
- Ensuring integration with the cycling, walking and bus networks;
- Additional park & ride locations should be considered;
- Impacts on surrounding properties during construction due to vibration and ground movement;
- Disruption due to increased traffic movements from construction traffic accessing the site;
- Health and safety concerns due to construction generated dust and noise;
- The route should be serving Swords main street;
- A station should be provided within the Metro Economic Corridor zoned land in Lissenhall;
- Depot should be moved further beyond the Estuary station to lands west of the M1 and adjacent to the proposed Swords Western Ring Road;
- Relocate the Estuary Station south of Lissenhall Bridge;
- Visual impact of the elevated section in Swords on residential areas located along the R132; and
- Visual intrusion from pedestrian overbridges on adjacent residential areas

Other alternative options were suggested during the consultation phase and the main points raised are summarised below:

- Move the route underground via Swords Main Street rather than along the R132; and
- Move the Fosterstown station and approach route to the western side of the R132;

The NTA/TII and Jacobs/Idom have carefully considered the many statements and submissions made from the stakeholders together with other proposed route design improvements. This has resulted in several proposed changes to the MetroLink scheme.

This report presents the proposed changes to the planning of MetroLink since the Public Consultation that have led to the Preferred Route and specifically the route section north of Dublin Airport and along the R132 corridor.

2. EPR Route and Stations adjacent to R132.

2.1 EPR Route Description

The Emerging Preferred Route (EPR) for MetroLink going south begins at Estuary Station as shown in Figure 4 below. This is also the location for the proposed park and ride car park which will provide up to 3,000 spaces.

From Estuary the route proceeds southwards on lands adjacent to the western boundary of the R132, rising onto an elevated structure to pass over the roundabouts at Estuary, Seatown, Malahide and Pinnock Hill. Stations are also located at Seatown, Swords Central and Fosterstown.

Figure 4 – R132 Area of EPR Alignment

The EPR route returns to ground level immediately south of the Pinnock Hill roundabout and runs along the central median of the R132 towards Fosterstown Station. From Fosterstown Station the alignment enters a short tunnel beneath the R132, rising to surface level on lands adjacent to the western boundary of Swords Road until it goes underground north of Dublin Airport.

2.2 Review of EPR

To address some of the concerns raised at the Public Consultation, a review was undertaken to evaluate whether it was possible to have at-grade sections while also providing grade separation at the roundabouts on the R132 road, which is important for Metro service reliability and reduced traffic congestion.

It can be seen from the longitudinal section in Figure 5 that there is not enough distance between the elevated structures at roundabouts to provide at-grade sections between them with acceptable gradients. The impact of the level changes along the road would not be visually pleasing and could be a distraction to drivers on the R132.

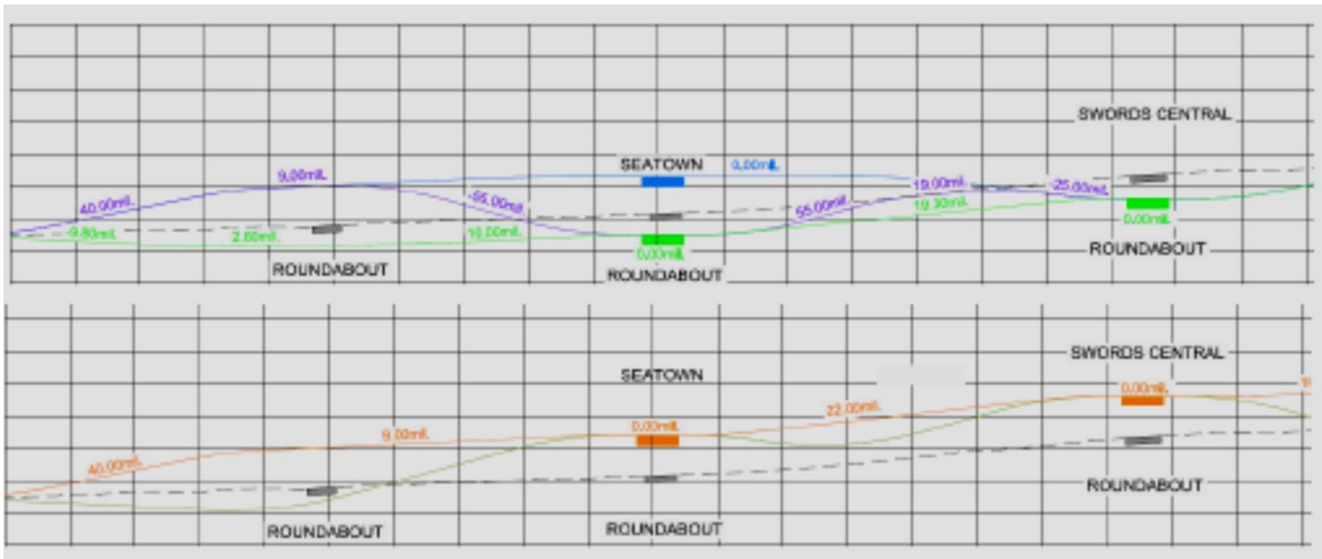


Figure 5 – Grade Separation at Roundabouts

For these reasons, only the options for either an elevated or open-cut alignment were considered further. These design solutions will have only limited differences in level between rail track and existing ground.

The review of the EPR identified two clashes with existing infrastructure as highlighted in Figure 6 below. They are located at:

- Airside Retail Park Building Unit and Car Park
- Texaco Petrol Station

Figure 6 – EPR Identified Alignment Clashes

The EPR Option was aligned to the east of the R132 and clashed with the west side of the Airside Retail Park building.

The clash with the Service Station is indicated in Figure 7 below and this shows the highly skewed crossing of the R132 at its junction with Boroimhe Road.

Figure 7 – EPR South of Fosterstown Station and the highly skewed Road Crossing

2.2.1 Environmental and Planning Considerations

A planning and environmental assessment was undertaken and the principal constraints identified for the EPR are:

- **Landscape and visual**. The elevated section of track will result in landscape and visual impacts on the surrounding landscape and sensitive receptors mainly because of its appearance in relation to the nearby pattern of development, which is relatively low level and low density.

- **Property impacts**. Utilising the publicly owned R132 median strip has the benefit of reducing the need for private property acquisition. However, there would still be land required for ancillary developments such as overbridges, attenuation basins and flood risk management measures.

- **Traffic disruption.** There will be potential impacts on traffic during construction of the track, whether within the median or on the roadway. This impact is increased for the EPR route in the central median and at crossings of the busy road junctions.
- **Utilities**. There could be disruption at the construction phase during relocation of utilities such as stormwater drains, gas, electricity and telecommunications infrastructure.

- **Noise and vibration impacts**. There are sensitive locations including residential properties near the alignment along the length of the R132.

3. Preferred Route Development

3.1 Key Design Changes for Preferred Route

From the review of the Route Alignment Study by Arup and other associated documentation including the Tunnel Configuration Study, significant changes were proposed by Jacobs/Idom, which were subsequently accepted by the NTA/TII. These changes have been carried forward into the preliminary design and include:

- The alignment would run above ground from the Northwood Station, pass over the M50 motorway before returning to tunnel under Dublin Airport. This effectively split the tunneling works into two separate sections;
- A change from twin bore tunnels to a single bore tunnel with trains running in both directions;
- Confirmation that the trains would be of high-floor design and be fully automated, capable of operating at a 90 second interval/headway (time between trains).

There were several implications arising from the changes noted above but the key change for the route north of Dublin Airport is:

Reduction in length of stations. High floor trains have more capacity than low floor trains and this, when combined with the 90 second peak headway made possible by the planned use of (GoA4) driverless train technology, enables the scheme to satisfy the target demand of 20,000 passengers per hour per direction (pphpd) with shorter trains. This means that instead of the 90m long low-floor trains required for the previously developed EPR, the high-floor trains are proposed to be shorter at 64 metres. This reduction in train length gives more flexibility on the size and location of the station so that surface impact can be minimised.

3.2 Addressing the Public Consultation Concerns

NTA/TII instructed Jacobs/Idom to study the EPR alignment and to consider alternative designs with at-grade and cut & cover sections. Where the car park is noted it refers to the Airside Retail car park.

Accordingly, the Route Options identified and studied were:

- **Option 1: Route Elevated on the median, with two variants:**
  - 1A: Elevated in the median (full alignment) - Fosterstown Station elevated in median
  - 1B: Open-cut and elevated (along the alignment) Fosterstown Station elevated in median
- **Option 2**: **Route in Open-cut in the median, with two variants:**
  - 2A: Elevated in the median (full alignment) Fosterstown Station open-cut in Airside Car Park
  - 2B: Open-cut and elevated (along the alignment) Fosterstown Station open-cut in Airside Car Park
- **Option 3: Route in Open-cut on East side of R132**

3.3 Route Option Assessment

3.3.1 Option 1A: Elevated in the median (full alignment) - Fosterstown Station

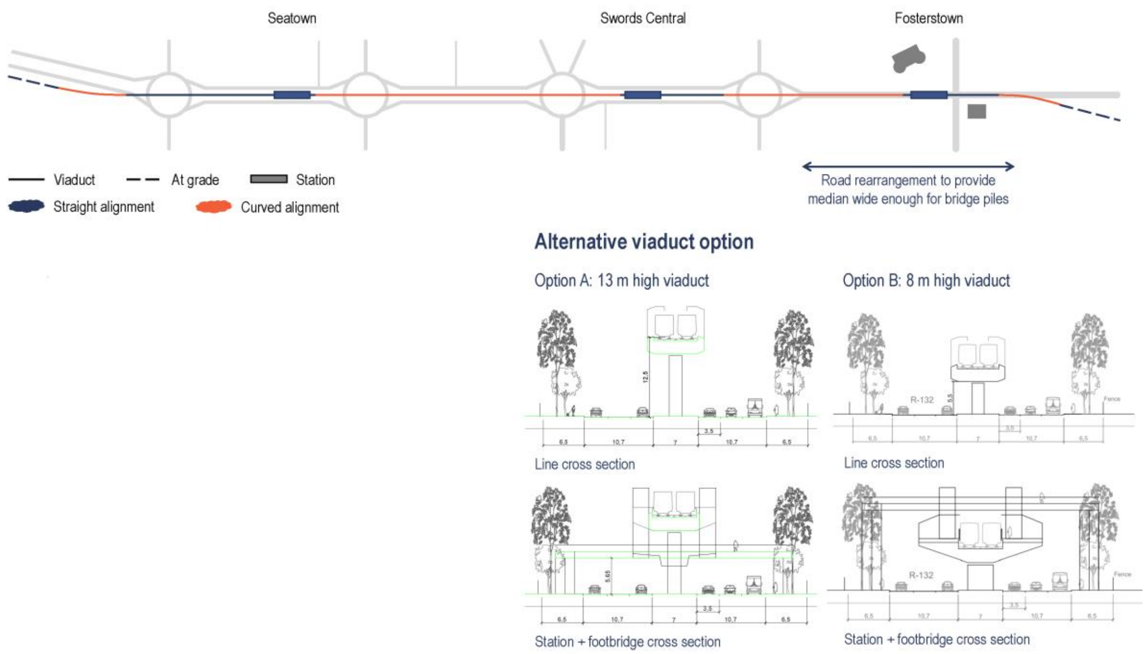


Figure 8 – Fosterstown Section Elevated in the Median

This option is like the EPR proposal in that Fosterstown Station is located in the median on an elevated structure to resolve clashes with the retail area and petrol service station. Seatown Station is moved northwards to be on a straight alignment of track, which is highly desirable for safety reasons.

Environmental and Planning Considerations

A planning and environmental assessment was undertaken of the different options and the findings of this assessment were considered when identifying the preferred option. The following are the principal environmental and planning constraints and opportunities identified for this option:

- Landscape and visual. The elevated section of track will create visual impacts on the surrounding landscape. This is due to its proposed appearance in relation to the nearby pattern of development which is relatively low level and low density.

- Property impacts – Utilising the publicly owned R132 median strip has the benefit of reducing the need for private property acquisition. This option also provides for a reduced impact due to the avoidance of the Retail park and petrol station. There is a lower impact on property when compared to the EPR.

- Traffic disruption: Potential impacts on traffic during construction of the track structures either within the median or roadway. This is due to the route crossing roundabouts and to allow for site access to construction traffic during the construction of the elevated railway structures.

- Potential disruption during relocation of utilities during the construction phase. These include stormwater drains, gas, electricity and telecommunications infrastructure.

- Potential for construction phase impacts including noise and vibration at residential properties near the new alignment. There are sensitive locations in close proximity to the proposed alignment, along the length of the R132.

- The revised station locations allow for improved access to the stations when compared to the EPR.

3.3.2 Option 1B: Open-cut and elevated (along the alignment) Fosterstown Station elevated in median

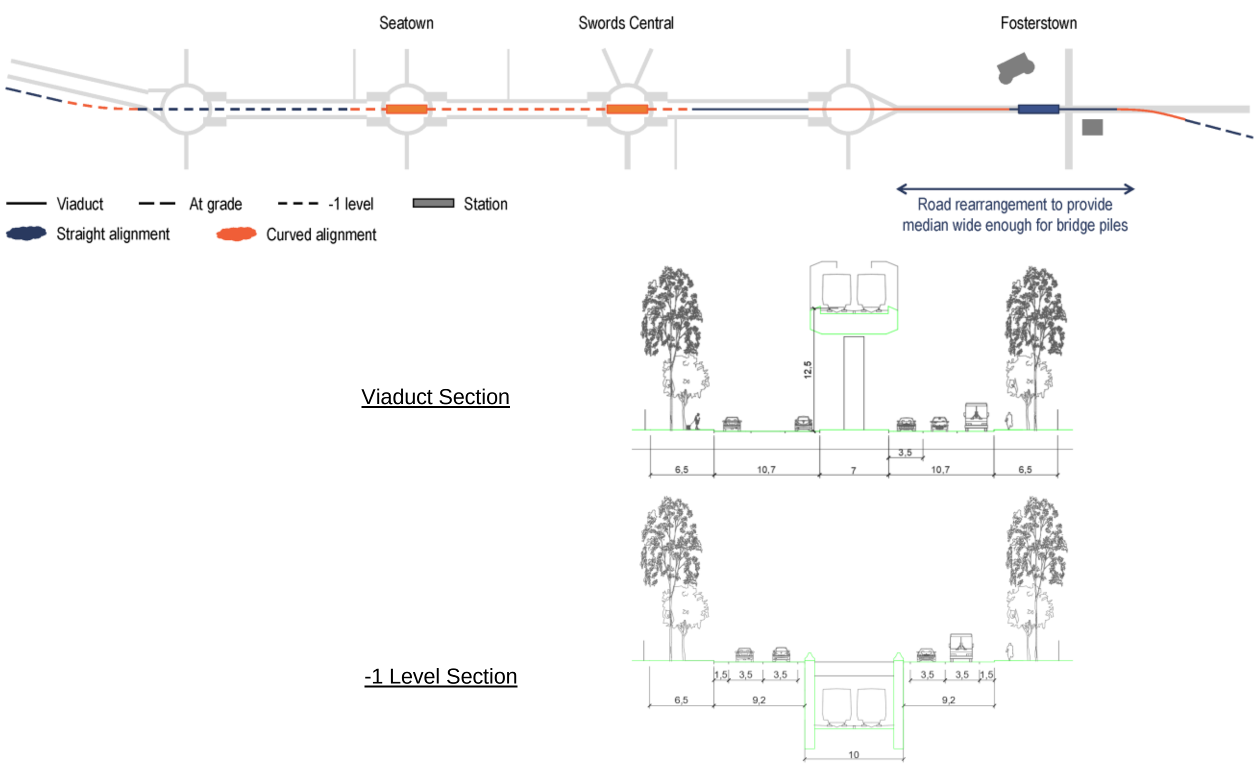


Figure 9 – Fosterstown Section Elevated and Open-cut in Median

It is not considered feasible to have an open-cut section within the median without affecting the adjacent road carriageways and at Fosterstown the alignment must be elevated. This would mean major disruption of the road for widening of the median, which is currently 7 m wide compared to the necessary 10 m width.

It is not feasible to incorporate open-cut stations within the median and stations so they would have to be located within the roundabouts. This would be undesirable because of their curved alignments amongst other access constraints.

Environmental and Planning Considerations

A planning and environmental assessment was undertaken of the different options and the findings of this assessment were considered when identifying the preferred option. The following are the principal environmental and planning constraints and opportunities identified for this option:

- Landscape and visual. The elevated section of track will create visual impacts on the surrounding landscape. This is due to its proposed appearance in relation to the nearby pattern of development which is relatively low level and low density. However, the impact on the visual amenity for this option is much lower than that for the EPR due to the limited section of elevated line included in this option.

- Traffic disruptions. Potential impacts on traffic during construction of the track either within the median or roadway. This option has potential for significant traffic impacts as it will primarily be constructed in the median and crossing roundabouts.

- The requirement for a significant proportion of the route here to be in cut will result in the generation of a significant volume of spoil material. However, the volume of material will be less than other options with larger sections in cut.

- Potential disruption during relocation of utilities during the construction phase. These include stormwater drains, gas, electricity and telecommunications infrastructure.

- Potential for construction phase impacts including noise and vibration at residential properties near the new alignment. There are sensitive locations in close proximity to the proposed alignment, along the length of the R132.
- The revised station locations allow for enhanced access to the stations when compared to the EPR.

3.3.3 Option 2A: Elevated in the median (full alignment) Fosterstown Station open-cut in Airside Car Park

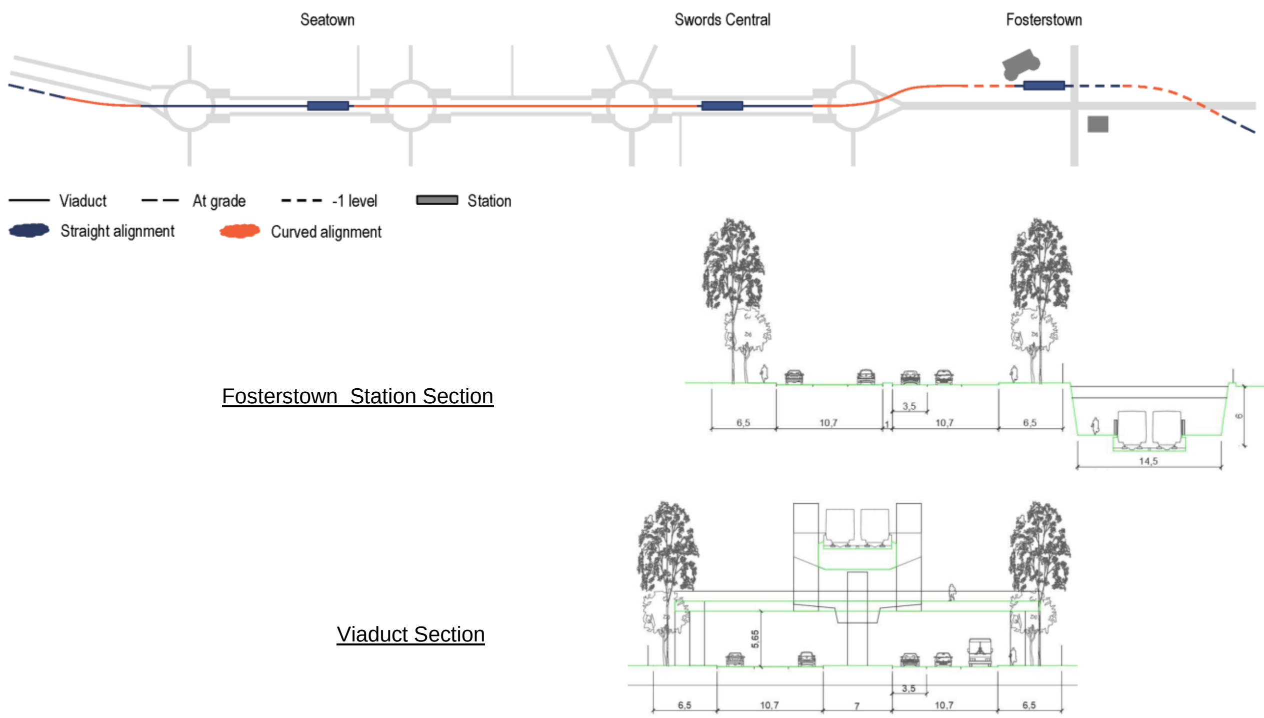


Figure 10 - Fosterstown Section Elevated in Median and Open-cut in Carpark

This option is for an elevated viaduct in the median over most of the length. To avoid road traffic disruption at the Fosterstown area the alignment and station is moved eastwards to the Airside Retail Park area carpark, where, taking advantage of the terrain slope, this section is in open or retained cut to ease the crossing below the roads before rising onto viaduct heading north along the median.

Environmental and Planning Considerations

A planning and environmental assessment was undertaken of the different options and the findings of this assessment were considered when identifying the preferred option. The following are the principal environmental and planning constraints and opportunities identified for this option:

- Landscape and visual. The elevated section of track will create visual impacts on the surrounding landscape. This is due to its proposed appearance in relation to the nearby pattern of development which is relatively low level and low density.

- Property impacts – utilising the publicly owned median strip has the benefit of reducing the need for private property acquisition. The southern extent of this part of the scheme does require the acquisition of the Airside Retail Park building unit and the Texaco Petrol Station. These are well utilised commercial properties and their loss will be disruptive for the community and business owners.

- Traffic disruptions: Potential impacts on traffic during construction of the track either within the median or roadway. This is due to this option primarily progressing along the centre of the R132.
- The requirement for a small proportion of the route here to be in cut will result in the generation of volumes of spoil material. However, the volume of material will be less than other options with larger sections in cut.
- Potential disruption during relocation of utilities during the construction phase. These include stormwater drains, gas, electricity and telecommunications infrastructure.
- Potential for construction phase impacts including noise and vibration at residential properties near the new alignment. There are sensitive locations in close proximity to the proposed alignment, along the length of the R132.
- The revised station locations allow for enhanced access to the stations at Swords Central and Fosterstown.

3.3.4 Option 2B: Open-cut and elevated (along the alignment) Fosterstown Station open-cut in Airside Car Park

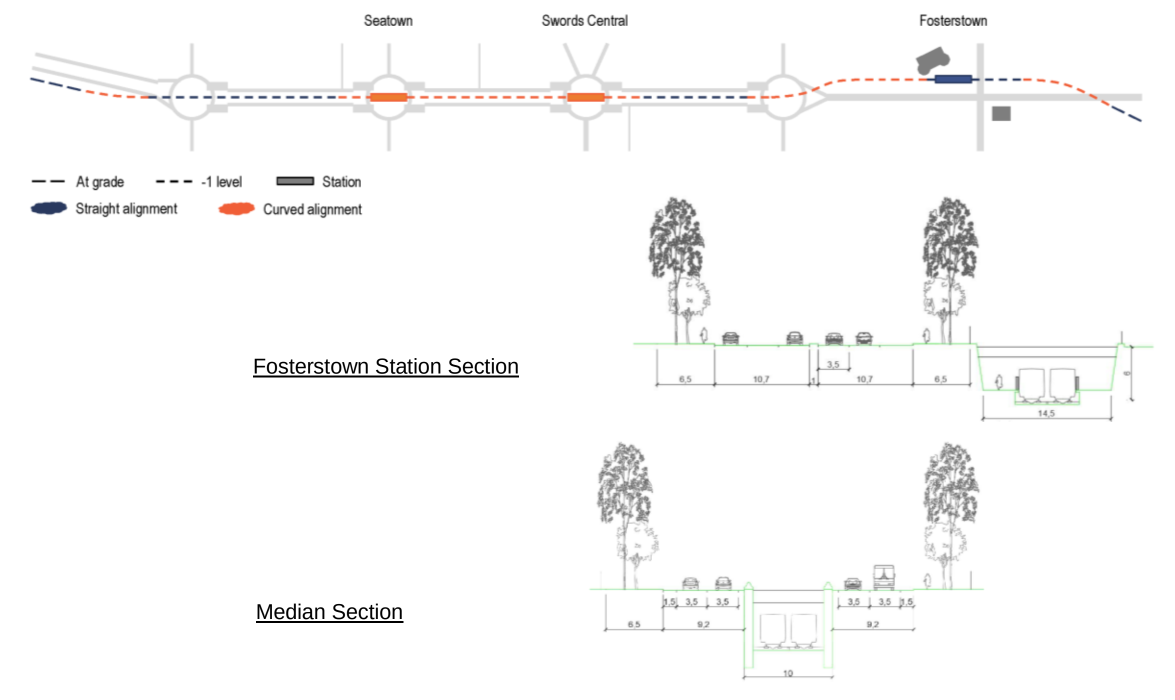


Figure 11 - Fosterstown Section Open-cut in Median and Car Park

To avoid road traffic disruption at the Fosterstown area in this option the alignment and station is moved eastwards to the Airside Retail Park area carpark. However, it is not considered feasible to have an open cut section in the median and the alignment must be elevated. This would mean major disruption of the road for widening of the median, which is currently 7 m wide while 10 m is needed.

Environmental and Planning Considerations

A planning and environmental assessment was undertaken of the different options and the findings of this assessment were considered when identifying the preferred option. The following are the principal environmental and planning constraints and opportunities identified for this option:

- Traffic disruptions: Potential impacts on traffic during construction of the track either within the median or roadway. This is due to this route progressing primarily down the centre of the R132.
- Property impacts – utilising the publicly owned median strip has the benefit of reducing the need for private property acquisition. However, the southern extent of this part of the scheme does require the acquisition of the Airside Retail Park building unit and the Texaco Petrol Station. These are well utilised commercial properties and their loss will be disruptive for the community and business owners.
- The requirement for a significant proportion of the route here to be in cut will result in the generation of a significant volume of spoil material.
- Potential disruption during relocation of utilities during the construction phase. These include stormwater drains, gas, electricity and telecommunications infrastructure.
- Potential for construction phase impacts including noise and vibration at residential properties near the new alignment. There are sensitive locations in close proximity to the proposed alignment, along the length of the R132.
- The revised station locations allow for improved access to the stations when compared to the EPR.

3.3.5 Option 3: Fosterstown Section Open-cut on East side of R132

This option avoids the road disruption that would result from the widening of the median for open-cut or elevated station structures by moving the alignment to the east side of the R132. The track would be constructed in a cutting with slopes sides or between retaining walls.

This solution avoids an alignment moving from ground level to elevated structures over the roundabouts while simplifying road crossings and improving visual impacts. It would require the removal of the existing tree line along the east side of the route, which would be replaced with landscape planting. Local road disruption will occur during construction of road crossing boxes to take the railway under the roads so temporary traffic diversions will be necessary to keep crossing roads open.

It is acknowledged that a wider land take will be necessary when compared to the other options running along the R132 median.

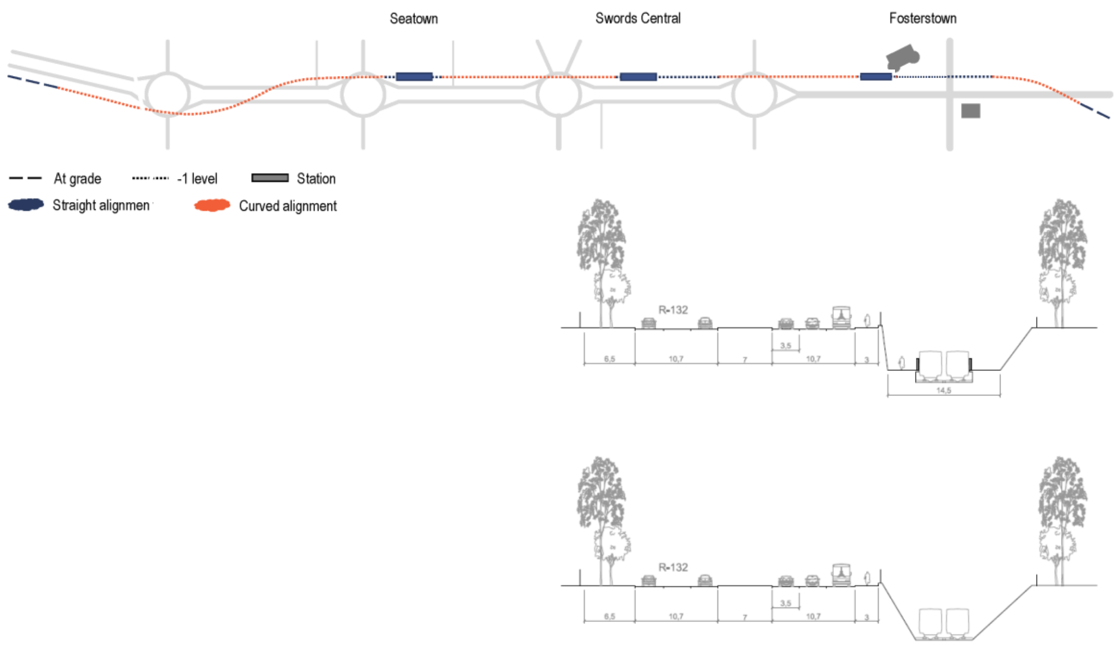


Figure 12 – Fosterstown Section to East of R132 in Open-cut in Median and Car Park

3.3.6 Environmental and Planning Considerations

A planning and environmental assessment was undertaken of the different options and the findings of this assessment were considered when identifying the preferred option. The following principal environmental constraints and opportunities have been identified for this option.

- Local roads off the R132 may experience impacts from traffic diversions needed for the construction of track underneath intersections. However, traffic impacts will be less than for other options that would be constructed in the median of the R132;
- The station locations have better access compared to the EPR;
- There is a much-reduced visual impact as the route is mostly in cutting. Planting of screen vegetation will partially mitigate loss of existing tree screening
- An increased property impact and land take requirement results from situating the alignment on private land as opposed to the median strip proposed for the EPR and other options. This includes the required acquisition of the Airside Retail Park building. This is a well utilised commercial property and the loss will be disruptive for the community and business owners. However, impact on the Texaco petrol station has been avoided;
- Potential increased disruption during relocation of utilities to make way for the cut section of the route. Utilities are primarily situated on the edge of the road or berm where the track is to be situated. These include stormwater drains, gas, electricity and telecommunications infrastructure;

- Potential for increased construction phase impacts including noise and vibration at residential properties near the new alignment. There are sensitive locations near to the proposed alignment, particularly at Foxwood and Seatown Villas;

- The proposed Seatown and Swords Central stations locations are on land zoned for Metro Economic Corridor, which has the objective to facilitate opportunities for high-density mixed-use employment generating activity and commercial development and supports the provision of an appropriate quantum of residential development. The proposed Fosterstown station is located on lands zoned for High Technology and for Retail Warehousing;

- The route will need to consider the interface with a permitted development at Crowcastle for a proposed 110kV ESB substation (Ref. 15A/0067), which will require local mitigation; and

- With a significant proportion of the route to be in cut, this will result in the generation of additional volumes of spoil material when compared with other options.

4. Conclusions and Recommendation

The Public Consultation process produces many submissions and raised some concerns about the EPR proposals north of Dublin Airport along the R132 Corridor near to Fosterstown Station. The NTA/TII instructed Jacobs/Idom to examine alternatives for the route at this location. Three alternative options, including sub-options were identified as listed below:

- **Option 1: Route Elevated on the median, with two variants:**
    - 1A: Elevated in the median (full alignment) - Fosterstown Station elevated in median
    - 1B: Open-cut and elevated (along the alignment) Fosterstown Station elevated in median
- **Option 2: Route in Open-cut in the median, with two variants:**
    - 2A: Elevated in the median (full alignment) Fosterstown Station open-cut in Airside Car Park
    - 2B: Open-cut and elevated (along the alignment) Fosterstown Station open-cut in Airside Car Park
- **Option 3: Route in Open-cut on East side of R132**

Having regard to the comparative positive and negative impacts of each option **Option 3: Route in Open-cut on East side of R132** was selected as the Preferred Route.

The principle reasons for the choice of the Preferred Route are as follows:

- Lower overall construction costs;
- Lower impacts on the landscape and visual amenity;
- Lower potential impacts on traffic along the R132 during the construction phase;
- Improved access to stations.

Potential negative impacts arising from the preferred option will be minimised during the development of the preliminary design and on the basis of the detailed environmental assessment to be presented in the subsequent Environmental Impact Assessment Report (EIAR).

For other information on the Preferred Route reference should be made to **Annex A**, which includes indicative details of the revised station concepts under development, while **Annex B** includes details of the Preferred Route from Estuary, Seatown, Swords, to Fosterstown.

Annex A: Indicative Stations Layouts at Seatown, Swords Central and Fosterstown

A.1 Seatown Station

The EPR located Seatown Station on an elevated viaduct at the median of R132, the alignment of which made it impossible to locate the station in a straight track section. To locate the station in the widest radius possible, the station was located 150 m from Seatown roundabout.

By moving the station to the east side of the R132, in an open cut configuration, the track alignment can be adjusted to metro standards while not absolutely following the existing road alignment. This enables a straight track section to be engineered for safety next to Seatown roundabout where the station is placed for the Preferred Route. A station placed next to the roundabout is closer to the area of demand for users accessing on foot, bicycle or bus.

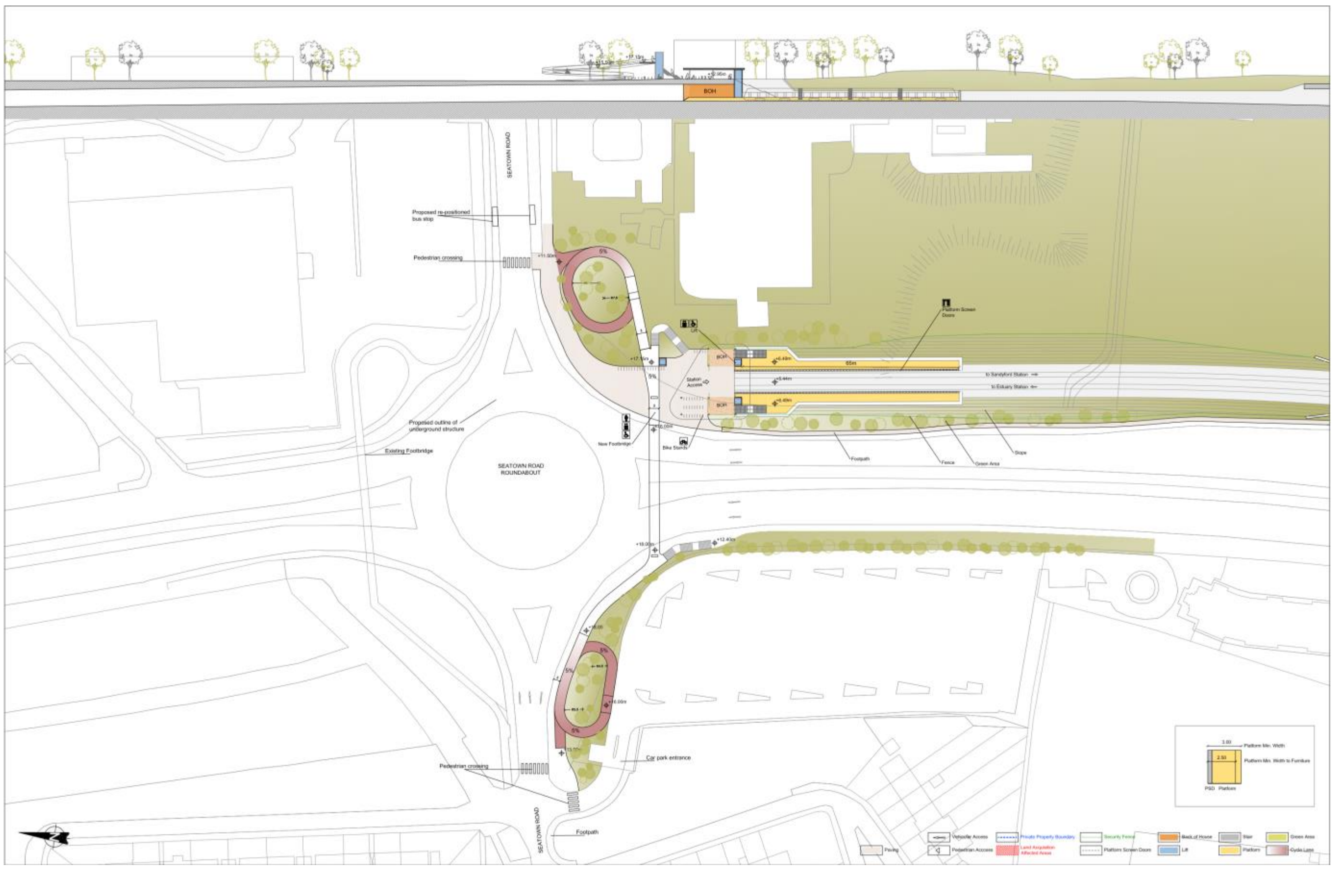


Figure 14. Longitudinal and plan view of Seatown Station

A.2 Swords Central Station

The EPR located Swords Central Station on an elevated viaduct at the median of R132 so that the existing road alignment determined the rail track alignment. To place the station in a straight track section it had to be located 280 m from the Malahide roundabout.

By moving the station to the side of R132, in an open cut configuration the track alignment can be adjusted to metro design requirements without absolutely following the existing road alignment. This enables a straight track section to be designed closer to the Malahide roundabout on which the station is placed for the Preferred Route.

The Preferred Route station is located 150 m from the roundabout and next to the existing bus stops on the R132. This position is closer to the demand that is concentrated in the roundabout area and improves the exchange with local bus services.

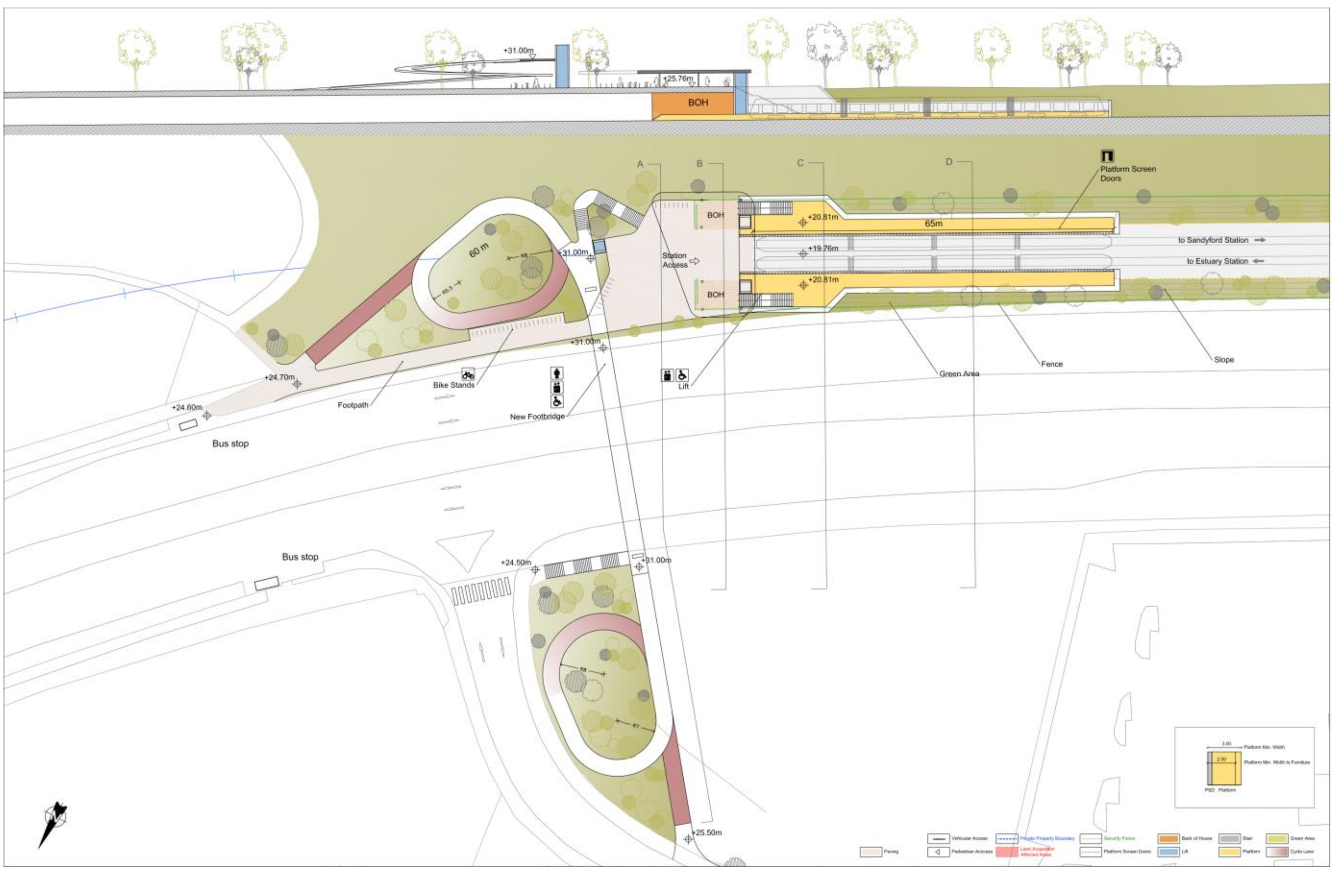


Figure 15. Longitudinal and plan view of Swords Central Station

A.3 Fosterstown Station

The ERP planned the Fosterstown Station as an at-grade station on the transition from the then proposed viaduct over the R132 median to the cut and cover section crossing under the junction of R132, L2300 and the L2305.

The location of this station has been maintained for the Preferred Route but the design is changed from at-grade to open cut because the route on each side is to be below ground level.

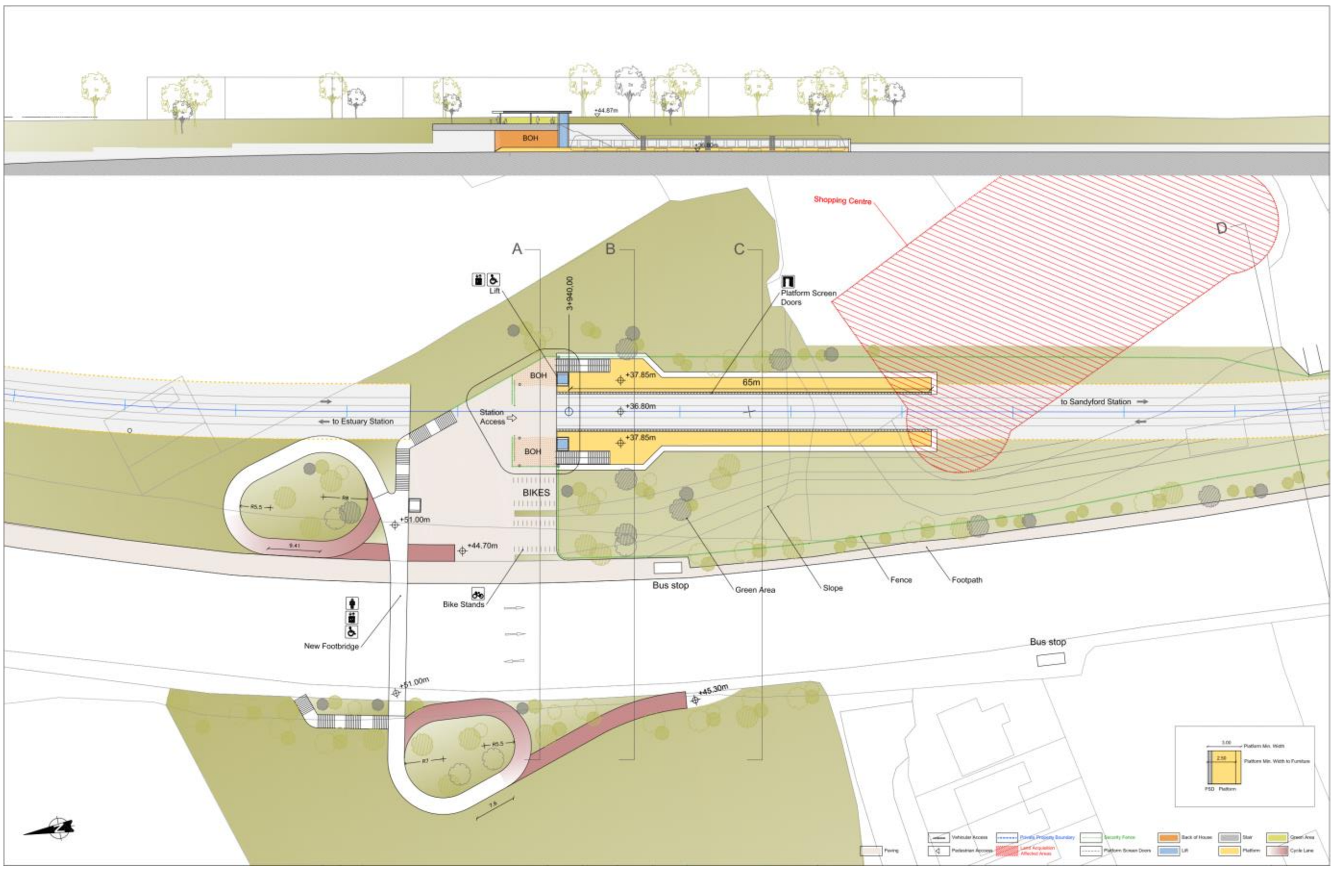


Figure 16. Longitudinal and plan section of Fosterstown Station

Annex B – Preferred Route and Stations

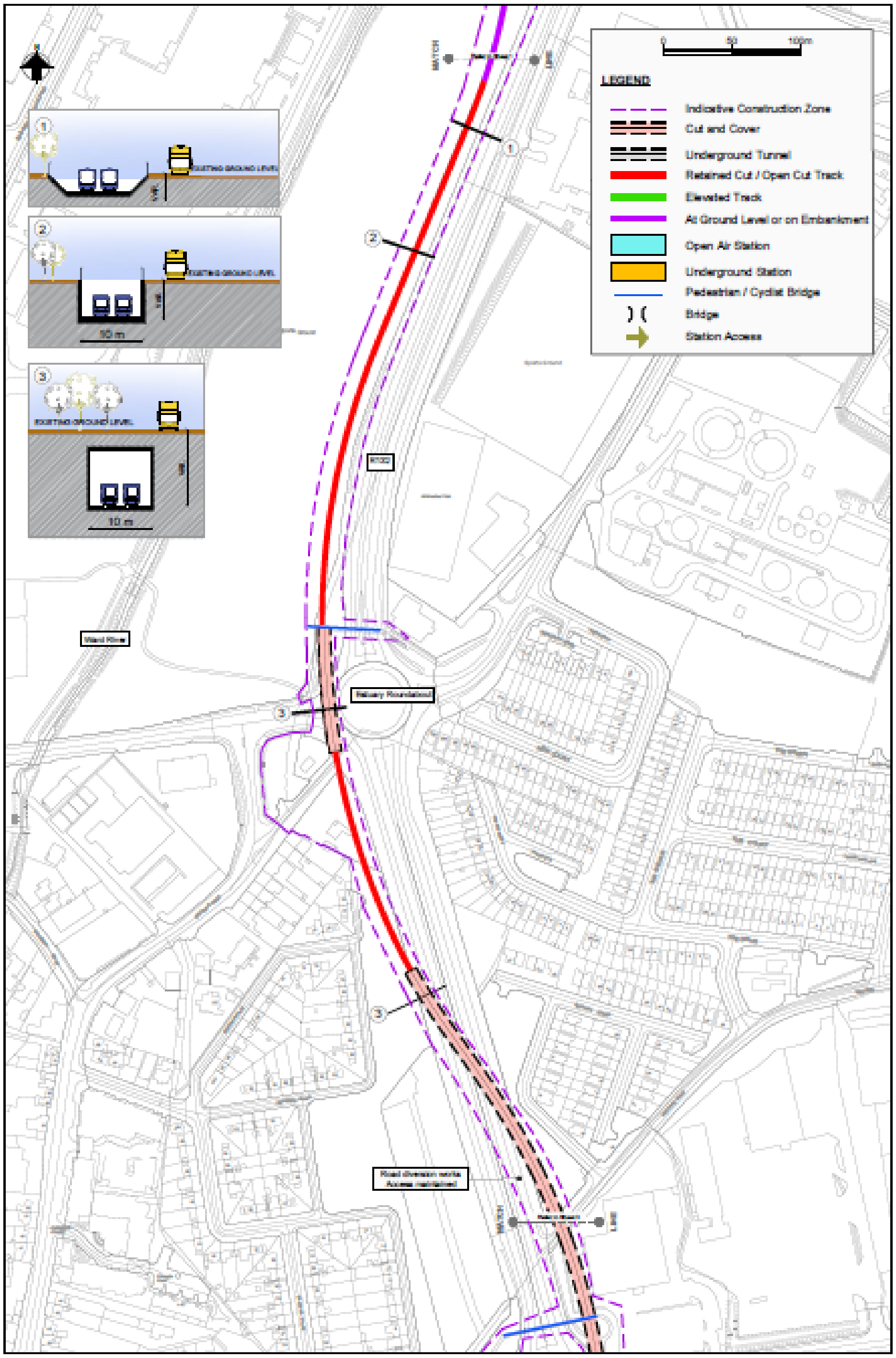


Figure 17 – Preferred Route at Estuary Roundabout

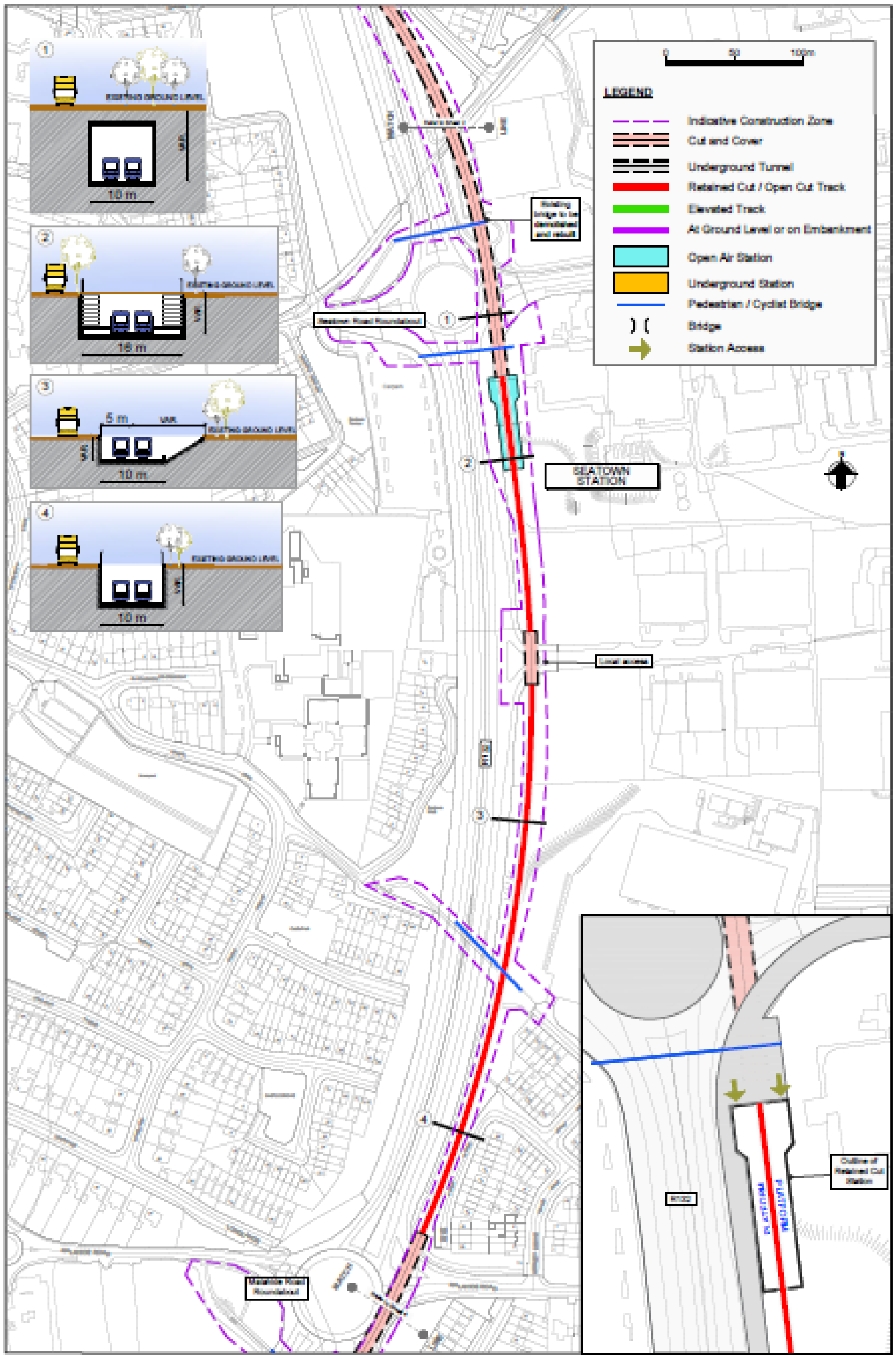


Figure 18 – Preferred Route at Seatown

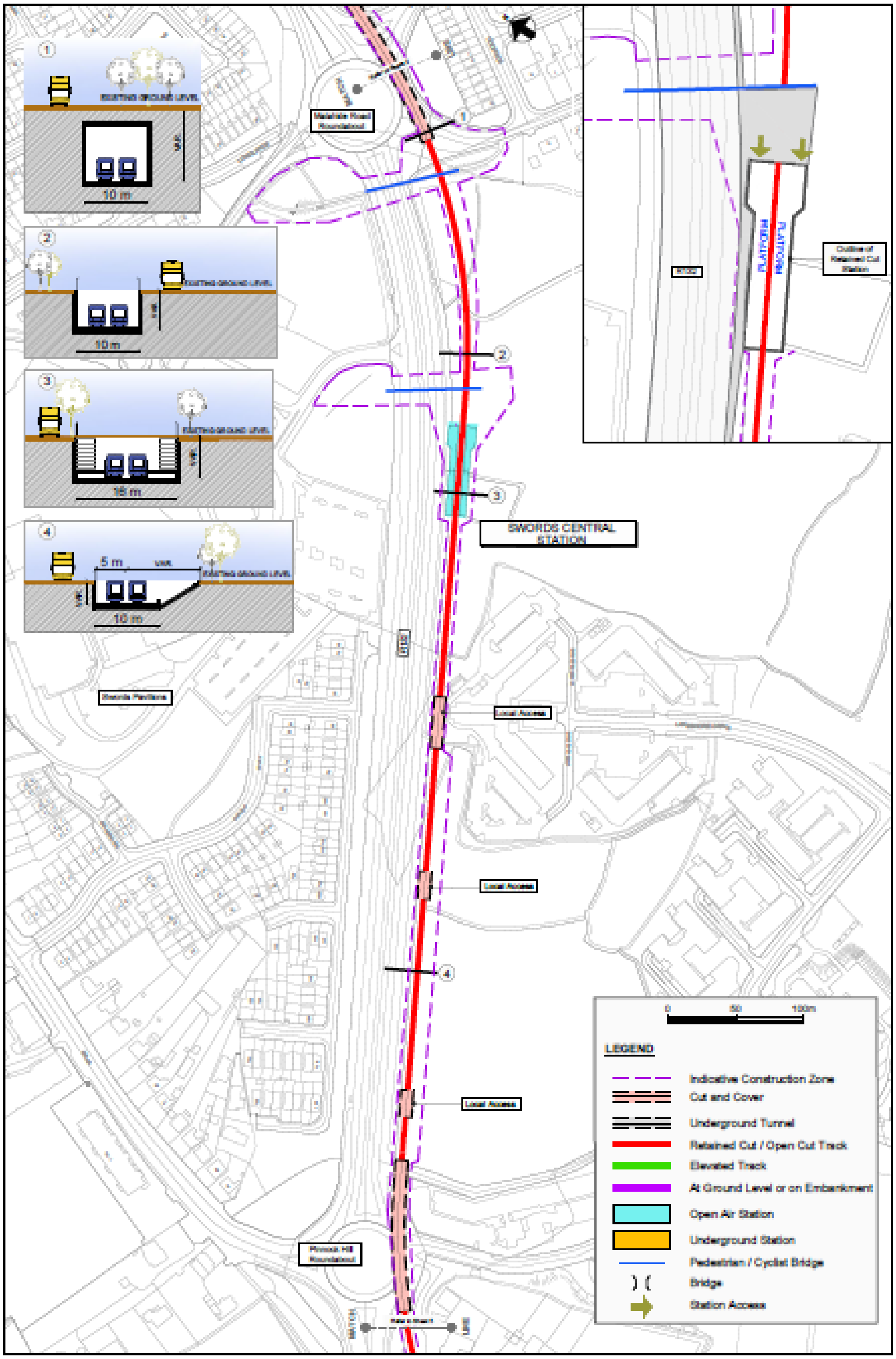


Figure 19 – Preferred Route at Swords and Pinnock Hill Roundabout

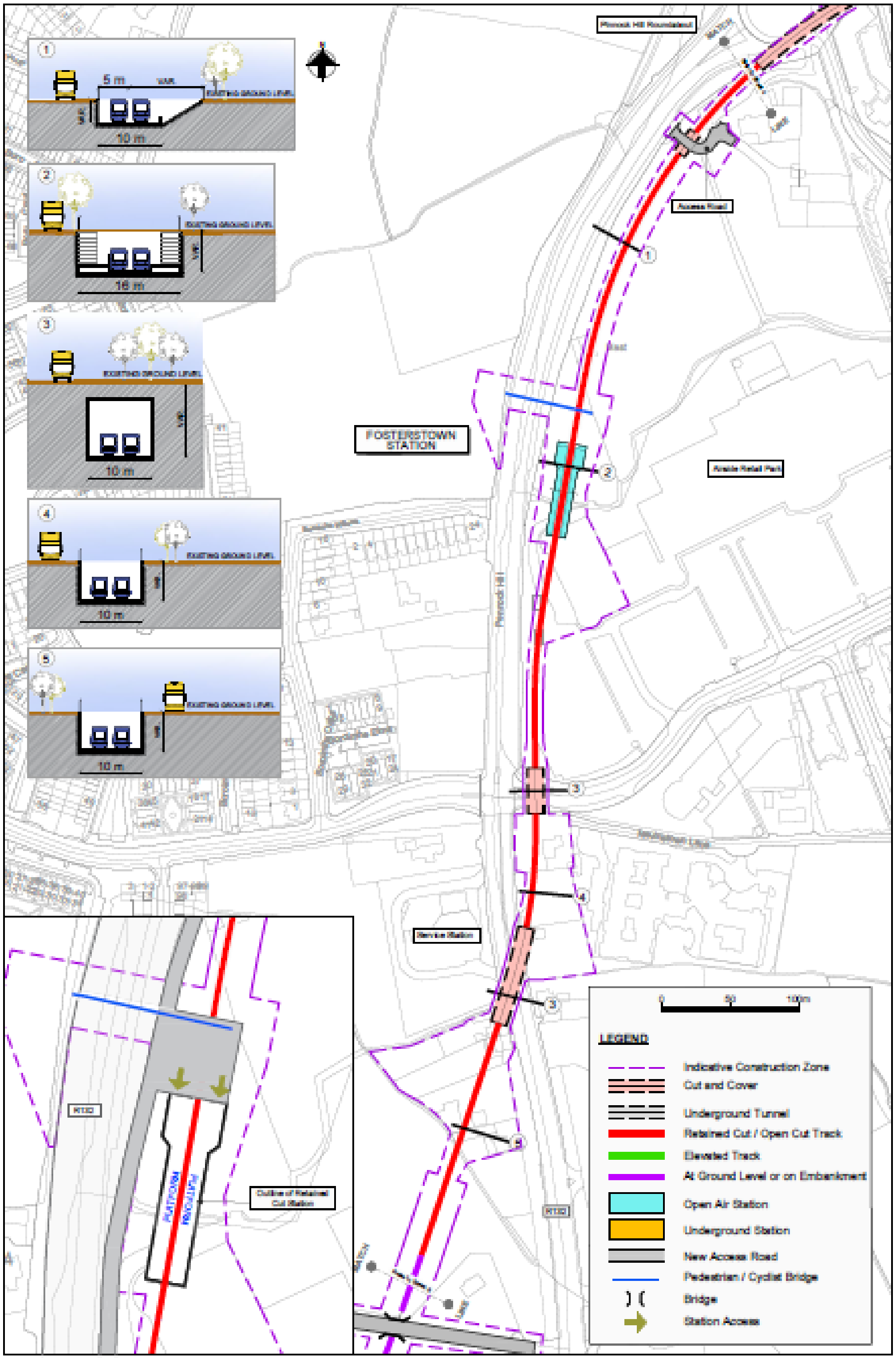


Figure 20 – Preferred Route at Fosterstown

Appendix F. Train Capacity

1. Rolling stock proposed specification

1.1 Proposed Capacity

For MetroLink the Rolling Stock will comprise high floor trains able to provide the required demand of up to **20,000** passengers per hour and per direction (pphpd) in 2057. The 20,000 pphpd is achieved with a capacity of **500 passengers/train** at **40 TPH** (trains per hour), equivalent to **90 seconds** headway.

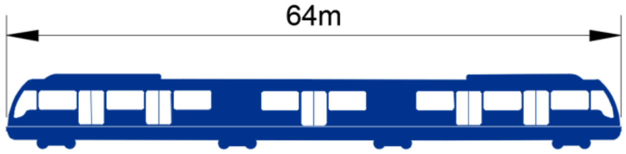
It should be noted that the capacity of 20,000 pphpd includes an allowance of around 10% on forecast demand figures and is only required to meet forecast demand on the route in 2057 between Glasnevin and the city centre during the morning peak period, which will be the busiest section of the line; all other sections of the line are forecast to have lower demand figures throughout the day, typically 15,000 pphpd or less in 2057. Demand figures are significantly lower at opening year, with consequently additional available headroom in capacity or less frequent services possible.

1.2 Proposed rolling stock

The adoption of high floor vehicle solutions and automatic trains achieves a better seated to standing ratio for passengers and permits shorter headways in the train service. Therefore, vehicles of more limited length can achieve capacity in excess of 500 passengers. This in turn enables a reduced length required for the platform faces with associated reduction in size of the station boxes with obvious cost savings.

Automatic systems offer better capacity improvements by increasing the train frequency, which is the most appropriate mechanism to add capacity to a system. The alternative would be to build larger stations initially to accommodate longer trains for which the need might never materialise.

Based on a benchmarking exercise with the main rolling stock manufacturers in the market, and considering a maximum width of 2,65m and an AW2* at 4 passengers/m2, the required length of a generic high floor rolling stock will be approximately 64 metres long.



This configuration can provide up to **500 passengers/train**, which delivers **20,000pphpd** at 90 seconds headway**.** Only cities with extensive metro networks and much higher development density than Dublin plan metros with over 20,000 pphpd.

**Note: manufacturers indicate these are standard capacities, which can be increased through adjustment of the comfort level factor AW2 as noted below.*

2. Options to increase train capacity

Options to increase train capacity as passenger demand increases include the following:

- **Increase the train frequency –** MetroLink plans to expand capacity by increasing the frequencies up to 40 trains per hour or a train every 90 seconds. Whilst the proposed headway of MetroLink trains has been established at 40 TPH (90 second headway), the headway could be further reduced due to the automatic nature of the trains.
- **Reduce the comfort level -** MetroLink will have a comfort index of **AW_2** (4 passengers/m^2 standing and with seats ≥ 20%). This will maintain a good level of comfort including at peak times. If comfort levels were accepted to be reduced to **AW_3** standard (6 passengers/m^2 i.e. trains carry additional passengers, (affecting comfort levels), this will increase overall train capacity.

The table below shows the range of potential increase in capacity that could be achieved on MetroLink if these types of measures were introduced.

High Floor Train (64m long)		Passengers/m^2				
		AW2				AW3
		4.0	4.5	5.0	5.5	6.0
Capacity (passengers/train)		500	550	600	650	700
Headway (secs)	90	20,000	22,000	24,000	26,000	28,000
	85	21,176	23,294	25,412	27,529	29,647
	80	22,500	24,750	27,000	29,250	31,500
	75	24,000	26,400	28,800	31,200	33,600

3. Conclusions

The proposed MetroLink train capacity based on good comfort levels for passengers will provide for up to 20,000pphpd; based on forecast demand figures this will still provide headroom of around 10% in 2057 over the short busiest section of line in the morning peak and substantial headroom over demands on other sections of the line throughout the rest of the day. Should a capacity increase be required, this can be readily achieved through a combination of reduction in comfort levels (applicable only to the short section in the peak period) or small reductions in train headway or both. For example, maintaining the proposed headway at 90 seconds but decreasing comfort levels to AW_3 standard would provide a typical capacity of 28,000 pphpd, significantly above current forecast demand for 2057.

Appendix G. Estuary to Lissenhall

Contents

Executive Summary

The Emerging Preferred Route (EPR) placed the alignment of MetroLink across the existing Lissenhall bridge on the approach to Estuary Station. The location of Estuary Station and the proposed Park and Ride (P&R) facility would have required the demolition of a farm house and buildings and also conflicted with the proposed horizontal alignment of the Swords Western Distributor Road (SWDR).

The Jacobs Idom design team has undertaken a multi-disciplinary analysis of options having regard to identified constraints and this analysis led to the development of the current Preferred Route proposal, accommodating Estuary Station, a multi-storey P&R building and associated infrastructure. In particular the desire to accommodate and avoid conflict with the SWDR has been considered and the design has taken account of information received from consultations with Fingal County Council and the Department of Culture, Heritage and the Gaeltacht.

In addition, an alternative alignment design layout for the approach to the Estuary northern terminus has been developed which seeks to minimize environmental impact, including impacts to Lissenhall Bridge, and avoid any major conflict with the SWDR. This revised arrangement now forms the proposed Preferred Route in this location.

1. Introduction

1.1 MetroLink Development and Consultation

Metro North was the project name of the original proposal for a metro railway system connecting Swords and Dublin Airport with Dublin City Centre at St Stephen's Green. This scheme was developed by the Railway Procurement Agency through the Railway Order process to successful planning approval by An Bord Pleanála (ABP) in October 2010. The global economic downturn intervened, and in 2011 the Government postponed the Metro North project.

Figure 1 – MetroLink (2018)

The National Transport Authority's (NTA) Transport Strategy for the Greater Dublin Area, 2016-2035 identified a Metro service as the preferred public transport mode to address the transport needs of the Swords-Airport-City Centre corridor. It also envisaged the upgrading of the existing Luas Green Line between Ranelagh and Sandyford to a Metro level of service.

Project Ireland 2040 included the National Development Plan (2018-2027), which combined those two projects to form MetroLink. MetroLink will provide a fast, high capacity, high frequency, modern and efficient public transport service for people travelling along the Swords/Airport to City Centre corridor. In addition, the Scheme will ultimately connect to the existing Luas Green Line in the South City area, enabling through running metro services from Swords to Sandyford as shown in Figure 1. The metro route length is approximately 19km and the completed system will have 15 new stations, 3,000 Park and Ride spaces, and a journey time of approximately 25 minutes from the City Centre to Swords.

The NTA commissioned Arup Consulting Engineers to undertake a Route Alignment Options Study for the Scheme in 2016. The objective of the study was to carry out a comprehensive route option selection to identify an Emerging Preferred Route (EPR) for the Scheme. The study was completed at the end of February 2018 and it included a Concept Design for the EPR.

Separately, in January 2018, the NTA/TII commissioned Jacobs and Idom JV (Jacobs/Idom) to provide engineering design services through to scheme completion.

1.2 Public Consultation

A programme of public consultation led by the TII was conducted between 22nd March and 11th May 2018, during which members of the public and other stakeholders were invited to submit their views and observations of the EPR.

1.3 The Preferred Route Design

TII and Jacobs/Idom have carefully considered the many statements and submissions received from the interested and affected parties. The submissions received during the public consultation were reviewed and analysed and fed into the preliminary design development where relevant. This process has resulted in a number of proposed changes to the MetroLink project.

This report considers the relative merits of the proposed Estuary Station to Lissenhall alignment as presented in the Emerging Preferred Route, including the proposed Park & Ride location, versus the option being currently developed as part of the Preferred Route. The outcomes of a multi-disciplinary analysis of the options having regard to the identified constraints are presented with particular consideration of the following:

- Conflicts with the proposed Swords Western Distributor Road;
- Property impacts; and
- Environmental and planning constraints.

2. Estuary to Lissenhall - EPR

2.1 Description of EPR

Estuary Station was located in lands west of the R132, just south of M1 Junction 5 (Lissenhall Junction) as part of the design of the Emerging Preferred Route (EPR). The location of the station is indicated on Figure 2. The station was proposed to be constructed at-grade (i.e. at existing ground level), located adjacent to a new multi-storey Park and Ride facility.

It is noted that the route location as per the EPR would conflict with the proposed Swords Western Distributor Road (SWDR) and would have required the demolition of an existing farm house and buildings on the approach to Estuary Station. The alignment of MetroLink also passed directly over Lissenhall bridge, which would have resulted in an impact to this National Monument.

At EPR stage of the design process, Estuary Station was the last station on the MetroLink route with the alignment continuing north to a proposed depot. The depot was proposed to be in agricultural lands adjacent to Lissenhall Junction. The relocation of the MetroLink depot is addressed in Appendix C – Depot Location. The location of the depot as presented as part of the EPR is indicated on Figure 3.

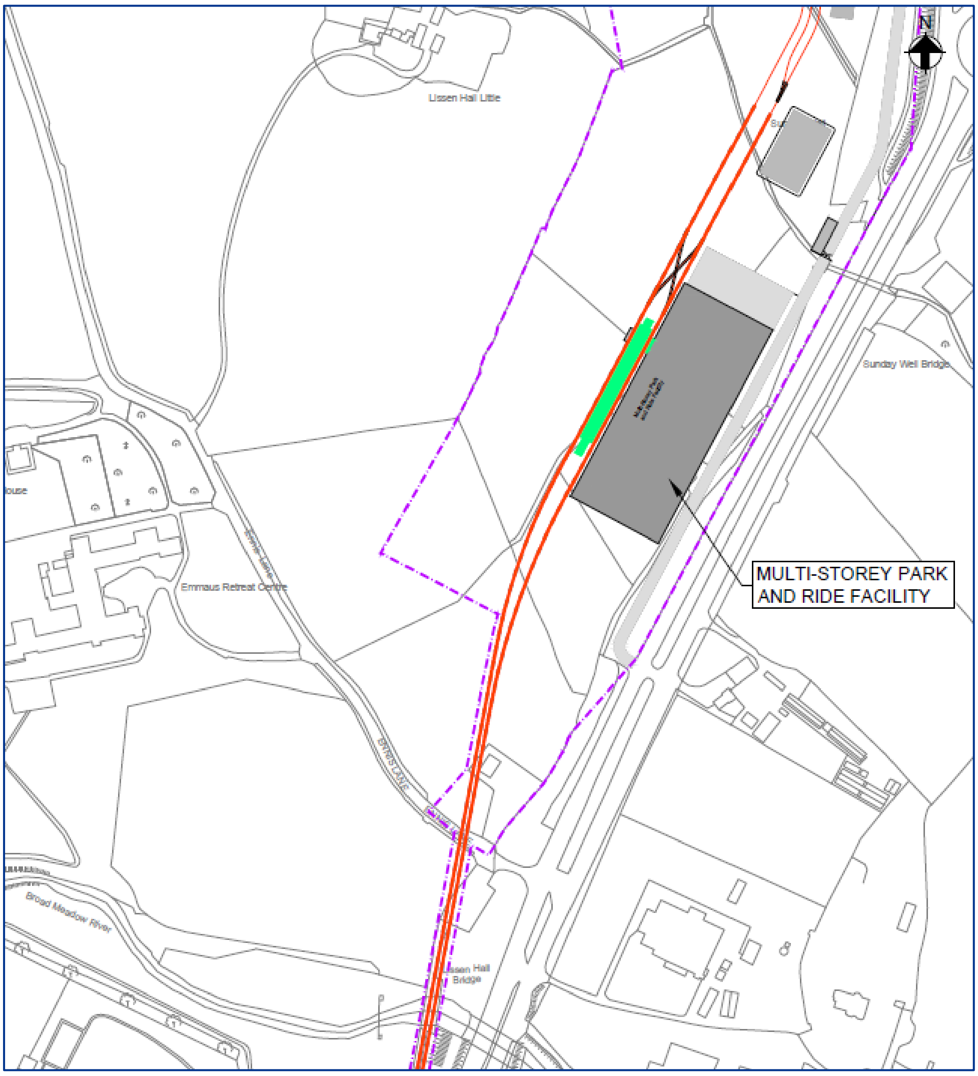


Figure 2 - Estuary Station as proposed as part of EPR

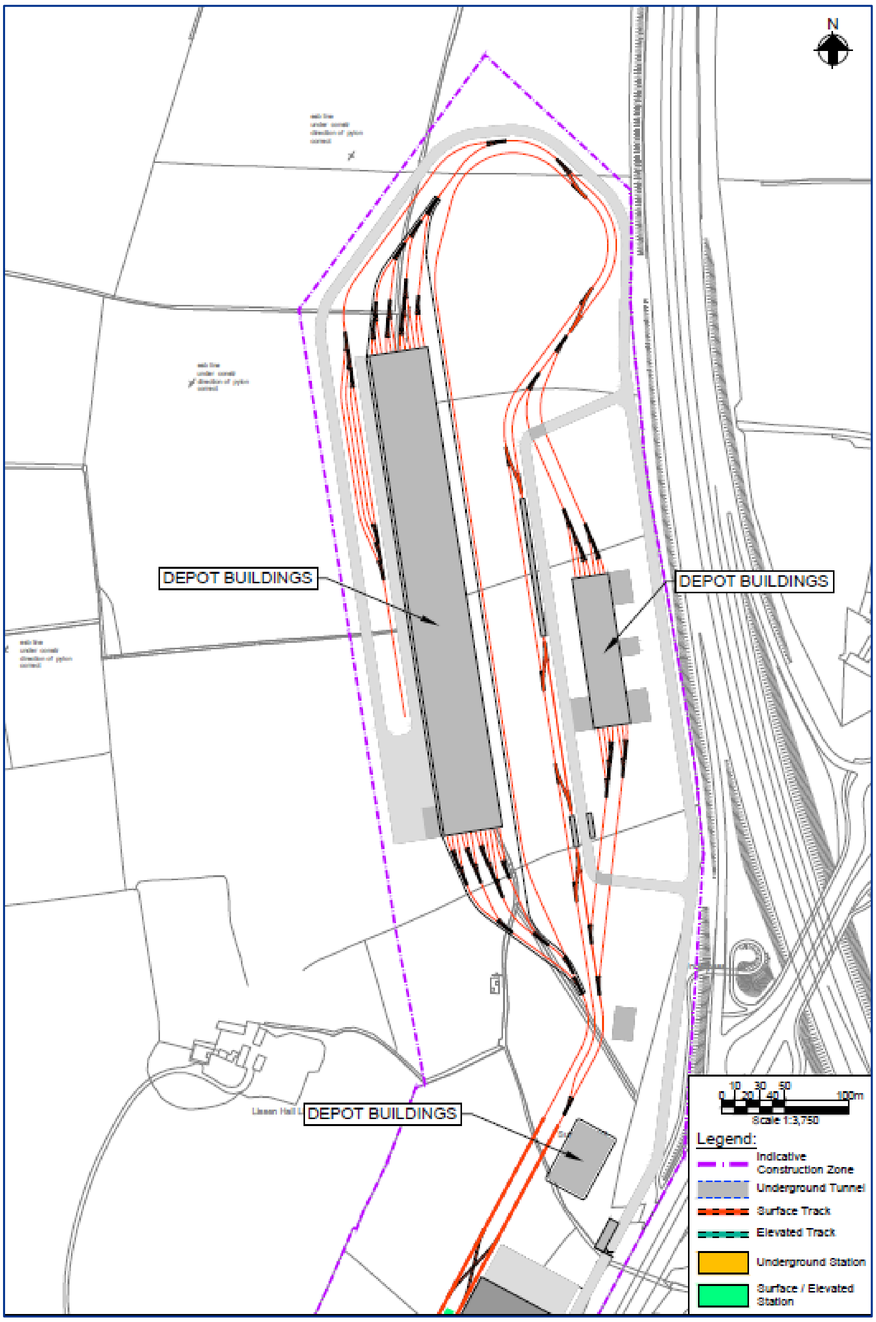


Figure 3 – Depot Location as proposed as part of EPR

2.2 Constraints to the EPR

The following are the principal constraints to the proposed Station and P&R locations as presented in the EPR:

Swords Western Distributor Road - Fingal County Council informed TII that there is a future plan to build a new distributor road named the Swords Western Distributor Road (SWDR). The road is proposed to pass around Swords and to the north of Estuary Station before connecting to the R132. The location of Estuary Station and the Park and Ride needs to be compatible with this future road development. The corridor for the SWDR is indicated on Figure 4.

Figure 4 – Proposed SWDR

Lissenhall Bridge – The alignment of the EPR passed over the existing Lissenhall Bridge. During the consultation period, information was received from The Department of Culture, Heritage and the Gaeltacht which confirmed that this bridge is a National Monument. Correspondence between TII and the Department of Culture, Heritage and the Gaeltacht notes the following:

'it is clear that significant medieval fabric (potentially pre-1600 in date) has survived within Lissenhall Bridge. Given that this survival is a rare example of extant medieval bridge fabric in north Dublin, Lissenhall Bridge should be considered to be a national monument within the meaning of section 2 of the National Monuments Act 1930'.

An image of Lissenhall Bridge is provided on Figure 5.

Figure 5 – Existing Lissenhall Bridge *(Source: www.buildingsofireland.ie)*

Property Impacts – The location of the multi-storey car park as part of the EPR required the demolition of a house and a number of farm buildings. These building are indicated on Figure 6.

The EPR also required the demolition of a house just north of Ennis Lane. This house is indicated on Figure 2. The EPR passed close to an existing halting site which is located between this house and the R132.

Figure 6 – Existing House & Farm Buildings *(Source: www.bing.com/maps)*

2.3 Environmental Considerations of the EPR

In addition to the principal constraints mentioned in Section 2.2, an environmental assessment was undertaken of the proposed location as presented in the EPR. These findings were considered when identifying the preferred option. The following principal environmental constraints and opportunities have been identified when assessing the EPR option:

- The proposed Station and P&R site is located to the west of the R132 road and north of the Broadmeadow River with potential for impacts on water quality if not mitigated. The Broadmeadow River flows into several designated European sites downstream (namely Broadmeadow/Swords Estuary SPA and Malahide Estuary SAC);

- There are potential ecological impacts at a local level due to the scale of the station and P&R facility and supporting infrastructure proposed. Local level impacts include habitat loss and increased levels of disturbance (i.e. lighting, noise) to bats and birds species that use the area;

- The Emmaus Retreat and Conference Centre is regarded as a sensitive receptor in this area. In addition, there are residential properties, and nearby agricultural enterprises in the vicinity of the proposed location. The provision of a station and P&R facility at this location could result in potential impacts in terms of noise, vibration and dust during both the construction phase and operational phases;

- The proposed P&R facility is a multi-story structure that will be visually prominent once constructed in an area that is primarily agricultural with a low level of development. The potential station and P&R buildings impacts are exacerbated due to their contrast to the existing open agricultural landscape and the proximity to an area to the east of the R132 defined in the Fingal County Development Plan 2017 – 2023 as a “Highly Sensitive Landscape”;

- There will be potential traffic impacts to the R132 during construction. Vehicle movements associated with earthworks and transport of material for the construction of buildings and tracks will be via the R132;

- There will be potential archaeological impacts during construction and from the footprint of the proposed station. Evidence exists of potential archeology including possible banks, walls and stone features. To the south and outside the footprint of the station there is evidence of an enclosure including a ditch including pits which is archeological in nature and not associated with modern agriculture; and

- There are several overhead and underground utility services in this area. These services include the following:
  - Overhead medium voltage ESB lines.
  - Underground Eir services.
  - Underground Irish Water watermains (ranging between 80mm diameter to 762mm diameter).
  - Medium pressure gas mains (Gas Networks Ireland).

2.4 Planning Considerations of the EPR

A planning assessment has been undertaken of the EPR option which considers development plan context and relevant planning history. The following are the principal planning considerations:

- The lands at Estuary are within the functional area of Fingal County Council. The majority of the lands have the zoning objective ‘ME - Metro Economic Corridor’ in the Fingal Development Plan 2017-2023. The objective of Metro Economic Corridor’ land is to facilitate opportunities for high-density mixed-use employment generating activity and commercial development and support the provision of an appropriate quantum of residential development within the Metro Economic Corridor. All of the EPR station location is within this land use zoning.

- As described in Section 2.2, there is a Road Proposal identified in the Fingal Development Plan 2017-2023. The development of the station at the EPR location would not be compatible with this plan.

- The EPR station location sits entirely within the Metro Economic Corridor zoning and is better aligned with the zoning principles. However, in terms of facilitating station access in the longer term to a residential community and any related employment, relocation of the EPR station would be beneficial.

- The EPR proposes to locate a depot at Estuary Station. This is not considered to be the preferred location for a depot.

- Under the EPR option, careful design would be needed to ensure that high quality connections with public transport, cycling and walking modes are facilitated, as well as ensuring efficient connection to the P&R.

3. Estuary to Lissenhall – Preferred Route Proposals

3.1 Location

As noted earlier in this report, the depot for MetroLink is proposed to be relocated south to Dardistown. The emergence of the SWDR and the recognition of the status of Lissenhall Bridge has resulted in proposed changes to the EPR alignment in this area, with the Estuary Station and P&R facility being moved a short distance to the south of the position identified during the design of the EPR.

To avoid potential impacts on Lissenhall Bridge, the proposed alignment of the MetroLink route has been moved west of the existing National Monument. The location of the new alignment conflicts with an existing 762mm watermain therefore a localized diversion of this main will be required. Other utility diversions and utility protection measures will be included in the Preliminary Design Report.

The Preferred Route alignment, station and P&R location are situated to minimize impact on the proposed SWDR, keeping MetroLink assets to the south of this proposed road alignment. Access to the station and P&R is envisaged to be principally from a junction to be incorporated on the SWDR. The MetroLink project will undertake the following roads works:

1. The necessary junction works on the R132

2. Construction of the initial section of the SWDR to facilitate access to the station and lands which have had their existing access impacted by MetroLink.

Item no.2 would only be required if the SWDR is not already constructed by time the construction phase of MetroLink commences.

These proposed alignment changes, together with the preference to avoid an existing house and farm, has resulted in the station location moving approximately 330m south west of the location proposed in the EPR. The existing house north of Lissenhall Bridge, which was required to be demolished as part of the EPR, will still need to be demolished as part of the Preferred Route together with the need to relocate the existing halting site.

The proposed locations of the station, the associated P&R and the SWDR are indicated on Figure 7. It should be noted that the details on Figure 7 are indicative and will be further progressed during the preliminary design process.

3.2 Proposed Park and Ride

The P&R facility is currently being designed for 3,000 car parking spaces. Transport modelling is currently ongoing to validate this number. The final design of the facility shall take account of the requirements of the following publications:

- Rail Park & Ride Strategy for the Greater Dublin Area published by the DTO in 2005.
- Transport Strategy for the Greater Dublin Area 2016 – 2035.

The P&R will be a multi-storey building located between Estuary Station and the R132. This is indicated on Figure 7.

The ticketing arrangements currently envisaged are as follows:

- Users will not require a ticket to gain access to the facility (i.e. No barrier will be required at the entrance)
- Passengers will be able to purchase tickets for parking and metro at the facility, i.e. the Automatic Fare Collection System should be linked to the P&R facility to accommodate this. This is a similar arrangement to the Luas P&R system.

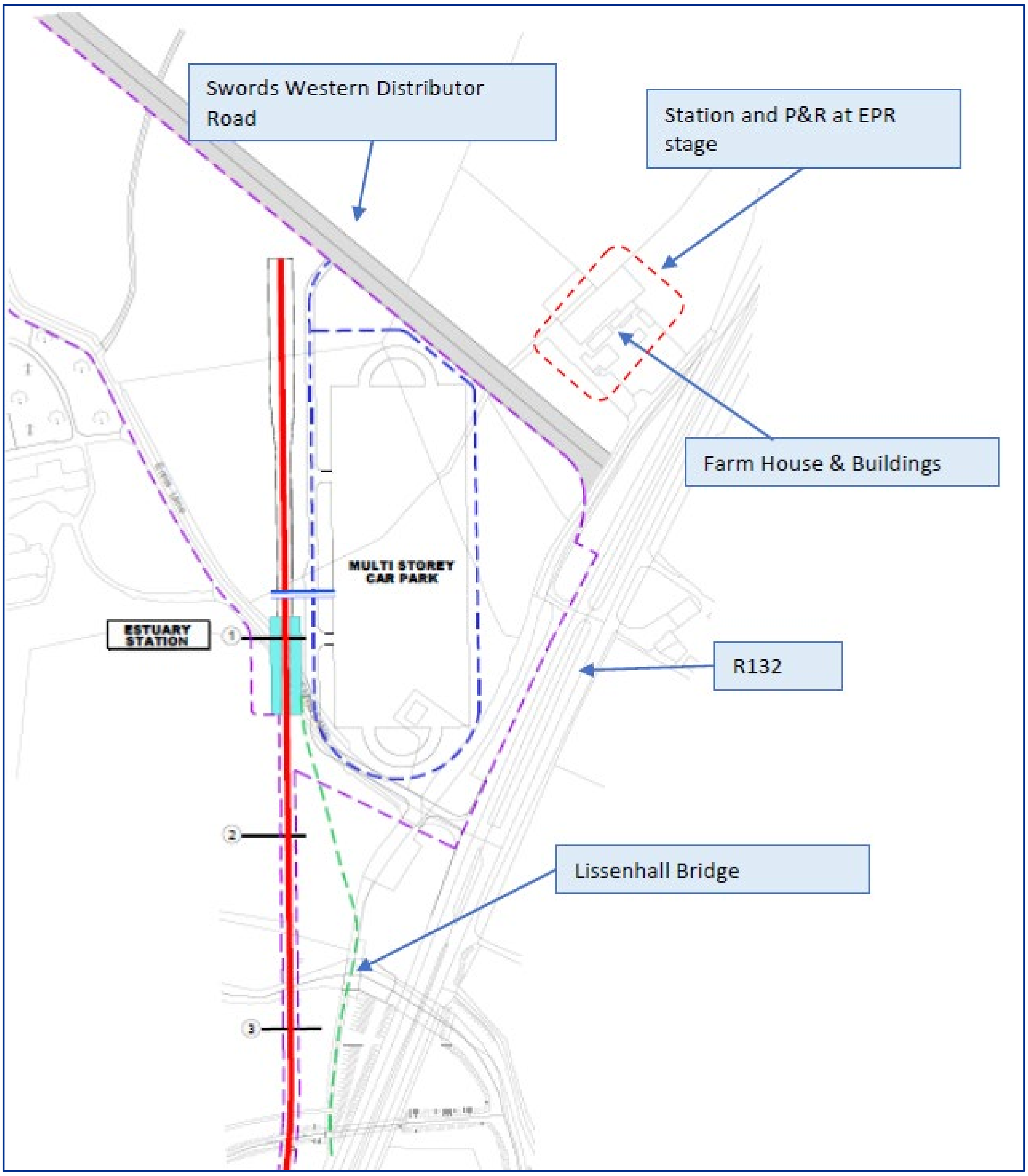


Figure 7 – Preferred Route Proposals for Estuary Station

3.3 Environmental Considerations of the Preferred Route Option

An environmental assessment has been undertaken on the proposed new location for the station and P&R facility and the findings of this assessment were considered when identifying the preferred option. The following principal environmental constraints and opportunities have been identified for the preferred option:

- Potential for increased noise, dust and other construction related impacts on the Emmaus Retreat and Conference Centre as the proposed site is slightly closer than that proposed in the EPR;
- The potential impacts listed for the EPR on surface water bodies and on the downstream SAC and SPA are slightly elevated for the preferred option as the station and P&R location are in closer proximity to the Broadmeadow River;
- The P&R building will have potential landscape and visual impacts similar to that detailed in Section 2.3 for the EPR; and
- There will be potential archaeological impacts during construction and from the footprint of the proposed station. Within the proposed footprint of the Park & Ride building there is evidence of an enclosure including a ditch and pits which is archeological in nature and not associated with modern agriculture. Evidence exists of potential archeology including possible banks, walls and stone features to the south and outside the preferred route red line boundary.

3.4 Planning Considerations of the Preferred Route Option

A planning assessment has been undertaken of the preferred route option which considers development plan context and relevant planning history. The following are the principal planning considerations:

- Similar to the EPR option, the majority of the lands at Estuary have the zoning objective 'ME - Metro Economic Corridor' in the Fingal Development Plan 2017-2023. South of the station location of the preferred route option is on lands with the zoning objective 'OS – Open Space', to preserve and provide for open space and recreational amenities, and close to 'HA – High Amenity', to protect and enhance high amenity areas.

- As discussed earlier in this report, there is a road proposal, identified in the Fingal Development Plan 2017-2023, located north of the proposed station and turnback, which forms part of the Swords Western Distributor Road. Part of this road, connecting the station to the R132 will form part of the MetroLink project in the event that the road is not constructed by the time MetroLink is constructed.

- A Metro station is not identified as 'Permitted in Principle' nor as 'Not Permitted' under these zoning objectives. Its use will need to be assessed in terms of role in helping to achieve the zoning objectives of the Fingal Development Plan.

- No extent planning applications were noted on the site of proposed metro station or P&R. A previous planning application for a house on land to the north of this site was refused planning permission (under Ref. F07A/0839).

- The proposed station location is partially zoned as Metro Economic Corridor and Open Space under the Fingal County Council Development Plan 2017-2023. In line with the zoning objective, the station and access design will facilitate connections to future development and ensure positive urban design outcomes.

- For the Preferred Route station option, careful project design will ensure high quality connections to public roads for public transport, bike and walking modes, as well as ensuring efficient vehicular connection to the P&R.

- The preferred station location requires the closure of Ennis Lane. Alternative public access arrangements will be included in the Preliminary Design for the project.

4. Conclusion

The design of the Preferred Route at this location was developed having regard to the potential positive and negative environmental impacts that were identified in the environmental assessment of the options. The main reasons for the choice of the preferred option are as follows:

- The preferred option will avoid direct impact to Lissenhall Bridge (National Monument);
- The design is compatible with the SWDR whilst maintaining MetroLink requirements for an integrated station at this location;
- it retains an associated multi-storey P&R building, similar to the EPR proposal, adjacent to the station;
- The intention to locate the depot at Dardistown removes the need for additional railway connection works and land-take in this area; and
- The revised proposals at this location also mitigate the impact on an existing house and farm and overall property impacts associated with the preferred route are less when compared to the EPR.

Potential impacts arising from the preferred option will be minimised during the development of the Preliminary Design and having regard to a detailed environmental assessment which will be presented in the subsequent Environmental Impact Assessment Report.

Appendix H. Northwood Station

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Contents

Executive Summary

The development of a revised tunnel strategy for the Preferred Route incorporates an elevated section of route over the M50 to accommodate a depot location at Dardistown. Associated with this change is a revised rail alignment as the route runs southwards from the M50 towards Northwood, Ballymun and on southwards to the city. This changed alignment requires a new location for the Northwood Station as the station location under the EPR was for a tunnelled section of route at this location.

Northwood Station under the EPR was located just north of the Gulliver's Retail Park Home Base outlet. Two options have been considered for the revised station location:

- Relocation of the station to the west of the R108, closer to Ballymun; and
- Relocation of the station under and across the R108.

A third option, to place the station to the east of the R108, closer to the original EPR location, was discounted as it would require a gradient too steep for the metro to cross over the M50.

The option to place the station west of the R108 was discounted as it would provide poor accessibility from the station to the Gulliver's Retail Park east of the R108; and it would be too close to the Ballymun Station to provide efficient operational metro services.

The optimum location for the revised station location was to incorporate the station at a skew angle under the R108, south of the Retail Park. This provides good access to and from both sides of the road, provides a location appropriate for operational services as well as better addressing some concerns raised during the EPR consultation. As such, this option is being incorporated into the on-going preliminary design for the route.

The Preferred Route proposal is to pull it south of the Retail Park so that it will now sit directly under and at an angle to the junction of the R108 and Northwood Avenue - the Park entrance. This will allow passengers to access the station from either side of the R108 and pedestrians to cross the R108 through the station without having to cross a busy road.

In addition, the revised station location will lie adjacent to the proposed tunnel launch site for the tunnelled route southwards to Charlemont (see Appendix B of the Preferred Route Design Development Report for details) and will form part of the overall construction works in this area. This area to the south and west of the station is currently open ground that is suitable for use as the TBM launch site. Whilst this area is subject to ongoing and future planning considerations for development, following tunnel construction it is anticipated that most of the area could be returned for future development.

The R108 will be affected during construction of the station and we will agree and arrange appropriate traffic management or diversions around the site to maintain safe movement of road users and pedestrians. We will liaise closely with the local community to mitigate issues concerning access and construction.

1. Introduction

1.1 MetroLink Development and Consultation

Metro North was the project name of the original proposal for a metro railway system connecting Swords and Dublin Airport with Dublin City Centre at St Stephen's Green. This scheme was developed by the Railway Procurement Agency through the Railway Order process to successful planning approval by An Bord Pleanála (ABP) in 2010. The global economic downturn intervened, and in 2011 the Government postponed the Metro North project.

Figure 1 – MetroLink for EPR (2018)

The National Transport Authority's (NTA) Transport Strategy for the Greater Dublin Area, 2016-2035 identified a Metro service as the preferred public transport mode to address the transport needs of the Swords-Airport-City Centre corridor. It also envisaged the upgrading of the existing Luas Green Line between Ranelagh and Sandyford to a Metro level of service.

Project Ireland 2040 included the National Development Plan (2018-2027), which combined those two projects to form MetroLink. MetroLink will provide a fast, high capacity, high frequency, modern and efficient public transport service for people travelling along the Swords/Airport to City Centre corridor. In addition, the Scheme will ultimately connect to the existing Luas Green Line in the South City area, enabling through running metro services from Swords to Sandyford as shown in Figure 1.

The metro route length from Swords to City Centre is approximately 19km and the completed system will have 15 Stations, 3,000 Park & Ride spaces, and a journey time of approximately 25 minutes.

The NTA/TII commissioned Arup Consulting Engineers to undertake a Route Alignment Options Study for the Scheme in 2016. The objective of the study was to carry out a comprehensive route option selection to identify an Emerging Preferred Route (EPR). The study was completed at the end of February 2018 and it included a Concept Design for the EPR.

2. Emerging Preferred Route and Northwood Station

2.1 EPR Route Alignment

The Emerging Preferred Route (EPR) that was developed before the Public Consultation in 2018 had a route alignment entirely underground from the city centre to north of Dublin Airport, from where it continued on the surface or elevated structures to the proposed Estuary Station. As shown in Figure 2 below the EPR passes under the M50 and Dublin Airport.

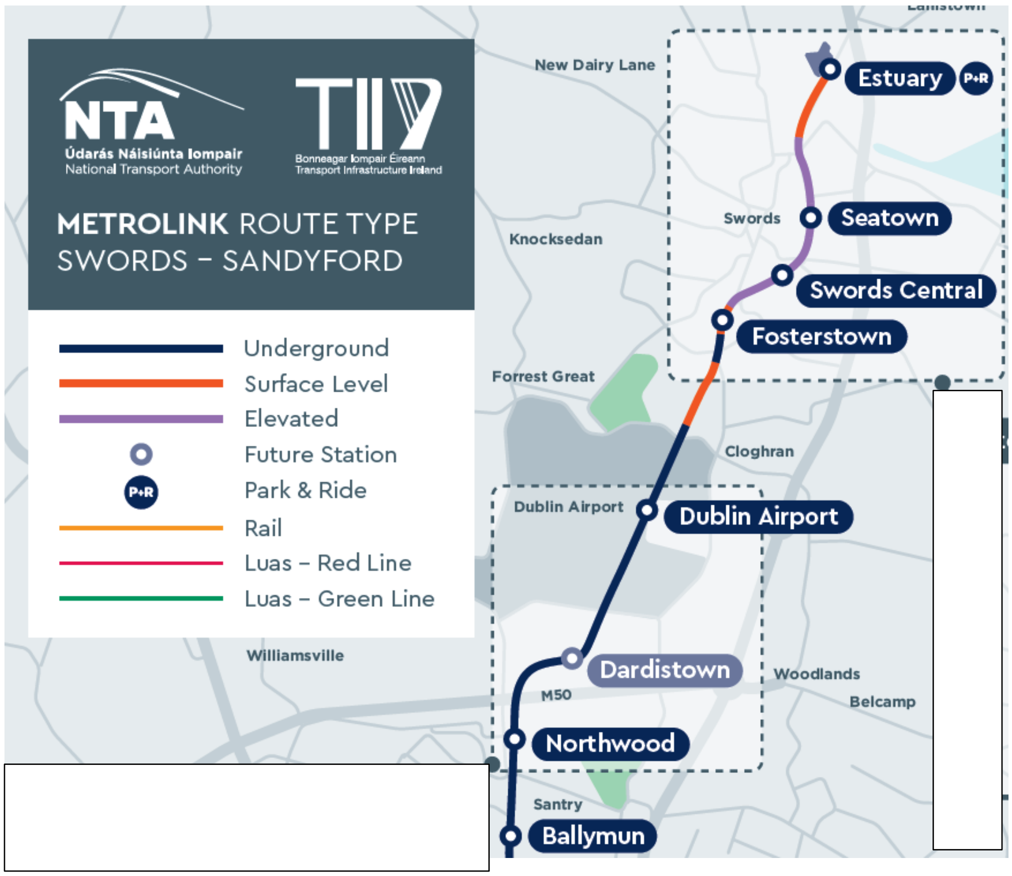

Figure 2 – The EPR Alignment Proposal

The EPR was developed based on a twin bore tunnel configuration although it was recommended that a single bore tunnel arrangement should be investigated.

2.2 Northwood Station

For the EPR, the location of Northwood Station was in the green space adjacent to the existing Gulliver's Retail Park and south of the junction between the M50 and the Ballymun Road (R108). The arrangement is shown in Figure 3 below which indicates the twin-bore tunnel alignment passing under the M50 to the north. There was also an alternative station location to the south of Northwood Avenue but this was not progressed in the EPR beyond Consultation.

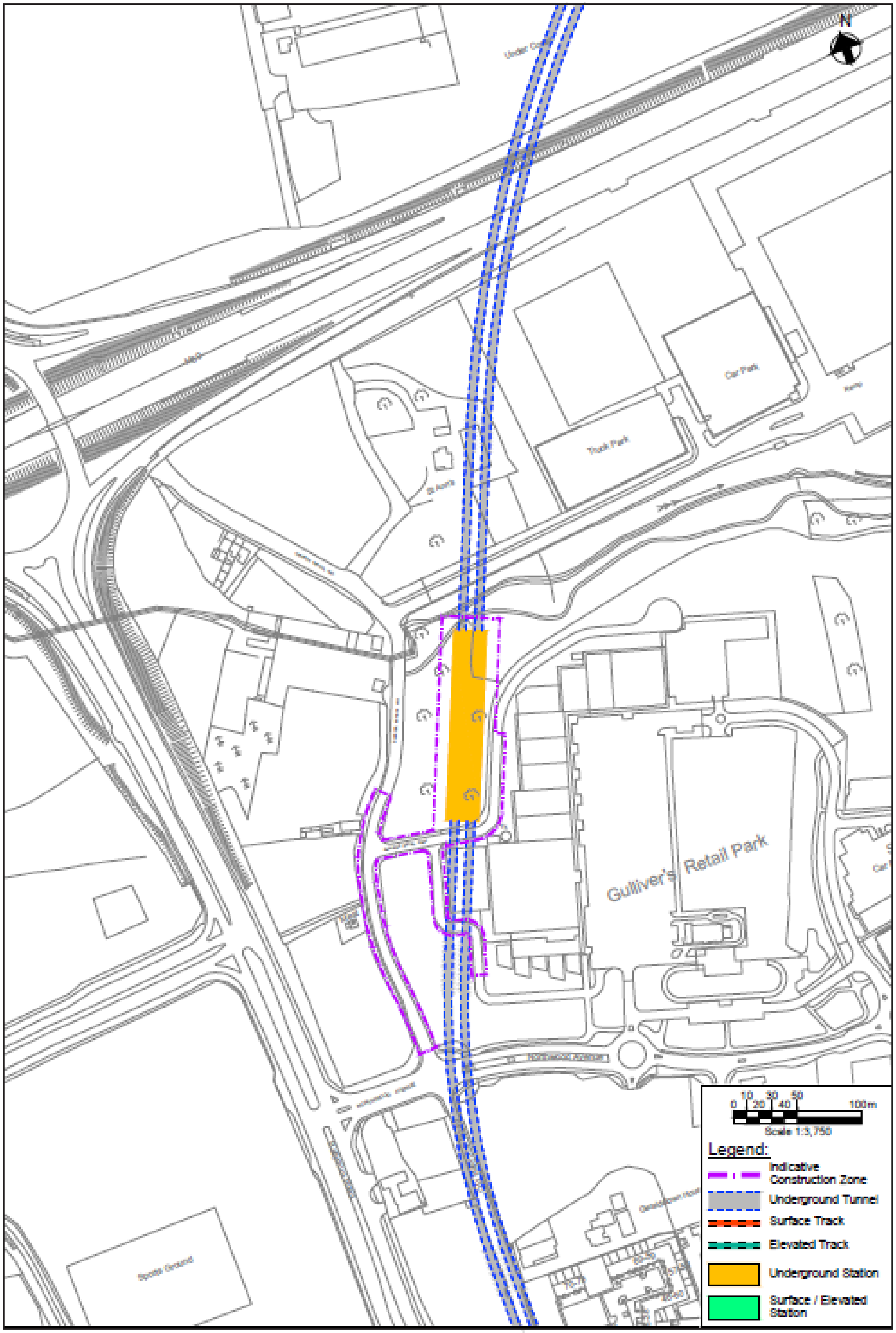

Figure 3 – EPR Northwood Station and Crossing under the M50

2.3 Public Consultation Submissions

A number of submissions from the EPR Public Consultation were received on the EPR Northwood Station including the following:

- Difficulty accessing the station from residential areas to the west of the R108 roadway;
- Potential for impacts on surrounding properties during construction due to vibration and ground movement;
- Potential impact on residential lands to the south of the proposed station;
- Potential disruption during construction due to increased traffic movements from construction traffic accessing the site; and
- Potential health and safety concerns due to construction generated dust and noise.

The alternative station location to the south of Northwood Avenue, which was not progressed in the EPR, prompted concerns on the potential impact on residential lands to the south of the proposed station.

In addition to these specific submissions relating to Northwood, a revised tunnel strategy for the Preferred Route has been proposed incorporating an elevated section of route over the M50, rather than tunnel under, accommodating a depot location at Dardistown. Associated with this change is a revised rail alignment as the route runs southwards from the M50 towards Northwood, Ballymun and on southwards to the city.

This changed alignment requires a new location for the Northwood Station to be identified as the station location under the EPR was for a tunnelled section of route at this location. In addition, the tunnel is proposed as a single bore twin-track tunnel rather than the EPR proposed twin bore tunnel. This revised tunnel proposal requires side platforms at Northwood rather than the central platform proposed in the EPR.

3. Preferred Route Alignment and Northwood Station

3.1 Preferred Route Alignment by Northwood

Under the Preferred Route, with a single bore tunnel, it is proposed that the tunnels rise to the surface each side of the M50, which results in two separate tunnel lengths as follows:

- Northwood (south of M50) - a tunnel to Charlemont in the city centre
- Dardistown (north of M50) - a tunnel under the airport from south of the Old Airport Road to the north of the Naul Road.

The Preferred Route at the M50 crossing between the two tunnel sections is shown on Figure 4 below. The image shows Ballymun Station to the west of the R108, Northwood Station is shown under the R108 and the M50 crossing is elevated on a bridge structure.

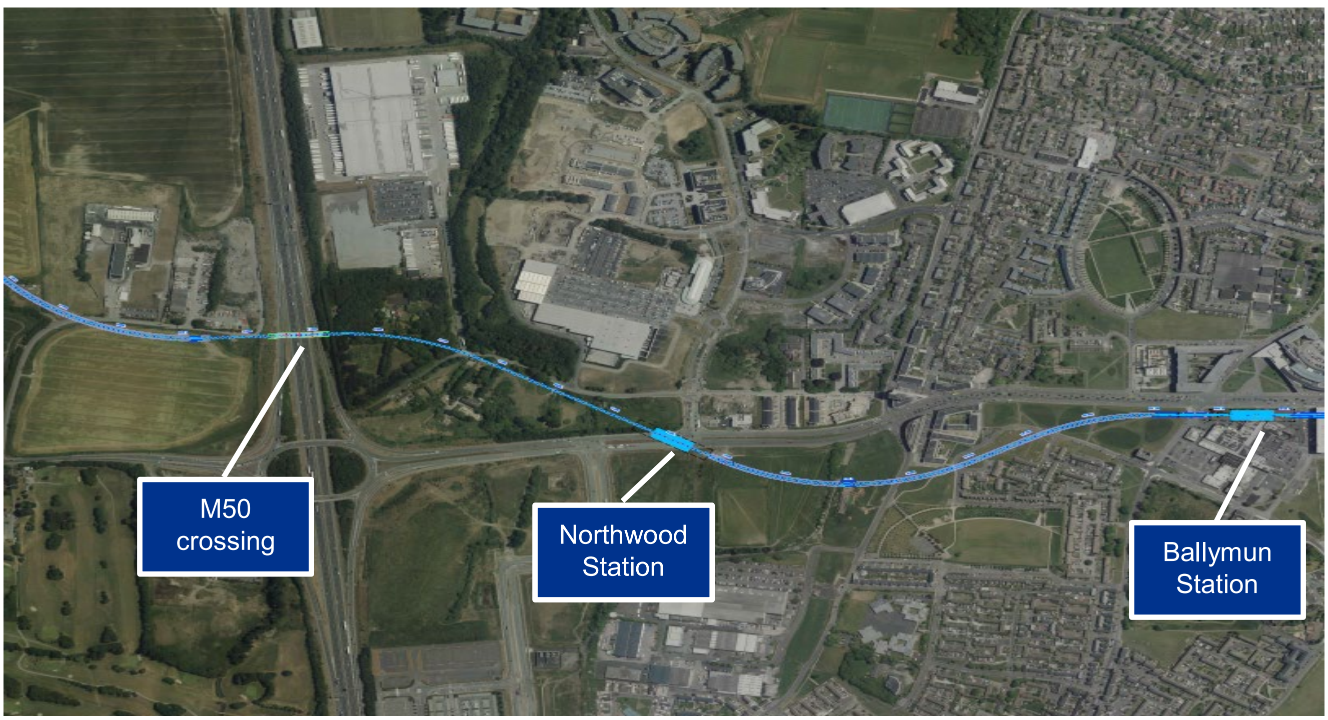

Figure 4 – Image of Preferred Route at M50

For the Preferred Route, the TBM launch site at Griffith Park as part of the EPR scheme would be relocated to Northwood and single bore tunnelling would progress continuously from there southwards to Charlemont, thereby also dealing with many of the concerns raised for Griffith Park during the EPR consultation.

3.2 Northwood Station

The Preferred Route moves the tunnel alignment at Ballymun to the west and this is discussed in the Ballymun Station report contained in Appendix I of this report.

The decision to move the Ballymun Station and to pass over the M50 also means that the R108 must be crossed and this opened the possibility of relocating Northwood Station further south compared to the EPR position. Two options were considered for the revised station location:

- Relocation of the station to the west of the R108, closer to Ballymun; and
- Relocation of the station under and across the R108.

The potential relocation of the station to the west of the R108 is illustrated in Annex A. However, this option was not considered appropriate for operational and accessibility reasons.

A third option, to place the station to the east of the R108, closer to the original EPR location, is not feasible. This is because the rail level should be flat, or near flat, as it passes through a station and if the Northwood Station was aligned to the east of the R108 it would not be possible to gain enough height to cross over the M50.

The option thus proposed for inclusion in the Preferred Route and ongoing preliminary design aligns the station under the R108.

The station box for the Preferred Option is shown in Figure 5 below, which is at an angle to the R108 and of a length that extends beyond both sides of the road so that passengers can access MetroLink from each side of the R108. The plan also gives an indication of the single bore tunnel depth as it approaches the station box from the south, the cross section of the station box itself, and the ramp beyond the portal as the railway rises to ground level before it crosses the M50.

The plan also shows a possible construction compound area to the west of the station and the R108 Ballymun Road. As discussed in the Tunnel Launch Sites report contained in Appendix B of the Preferred Route Design Development Report, this site will also be used as the TBM launch site.

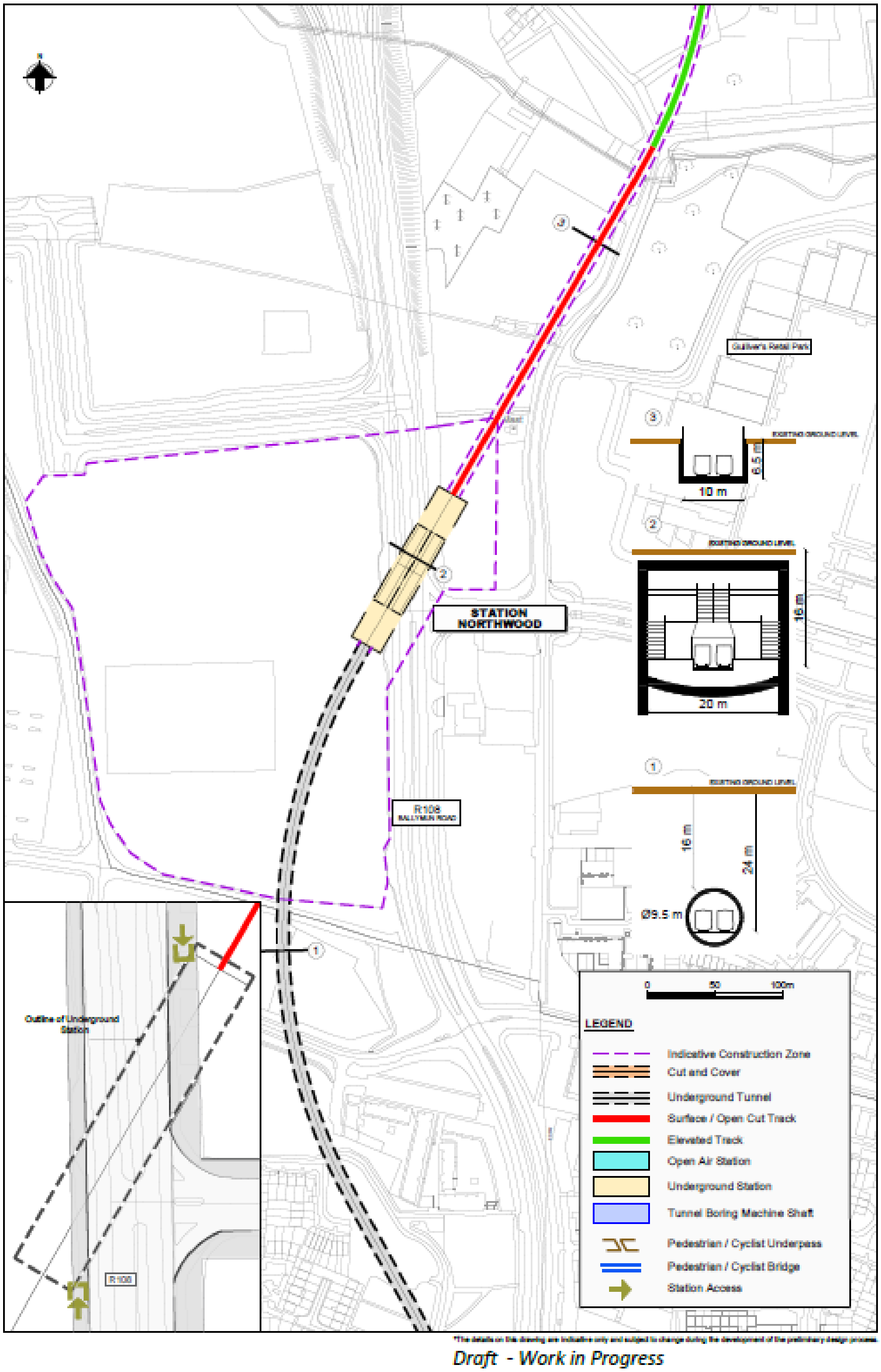

Figure 5 – Northwood Station Location for Preferred Route

An indicative station plan is shown in Figure 6 below, which also shows the station access points provided on each side of the R108. An indicative construction zone for the station box is also indicated on the east side of the R108 although this remains subject to further planning and design work.

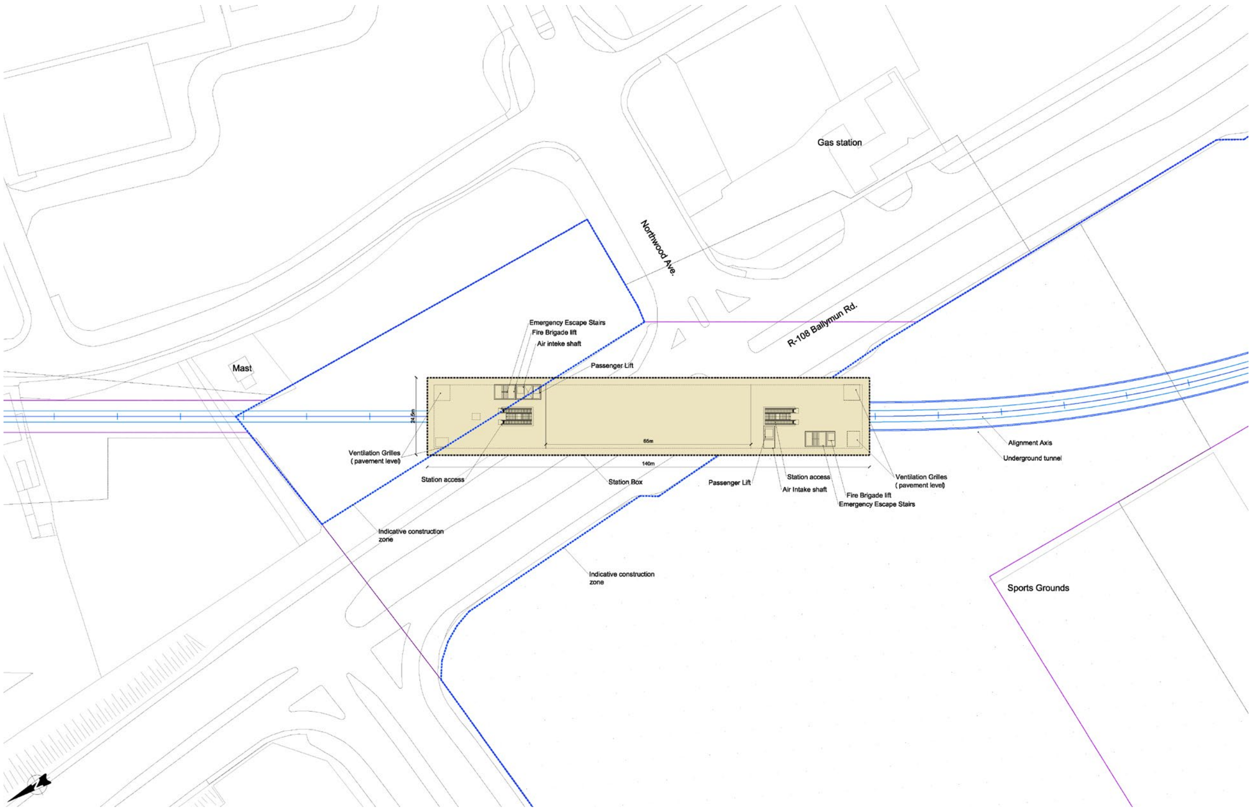

Figure 6 – Northwood Station Box Layout

Northwood Station is now the shallowest station (18m depth) on the proposed MetroLink alignment. Its design is well suited to a location where the exit to street must be from the ends of the station. The precise layout, including ventilation grilles, natural lighting and emergency exits will be further developed as the design progresses to suit the existing site constraints.

Indicative cross sections through the station box at passenger access points and where the station is under the road are shown in Figure 7 and Figure 8 below.

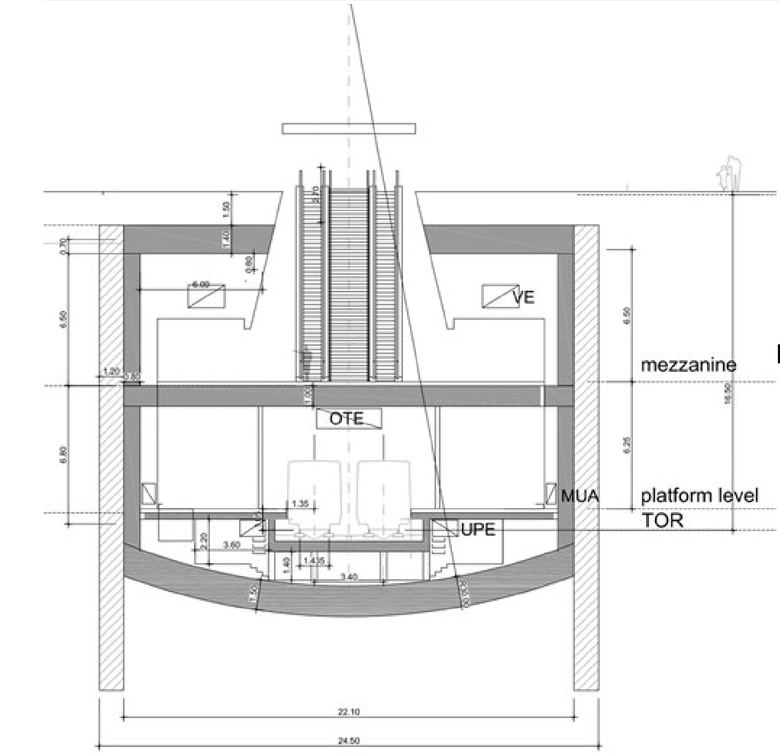

Figure 7 – Cross section below R108, Ballymun Road

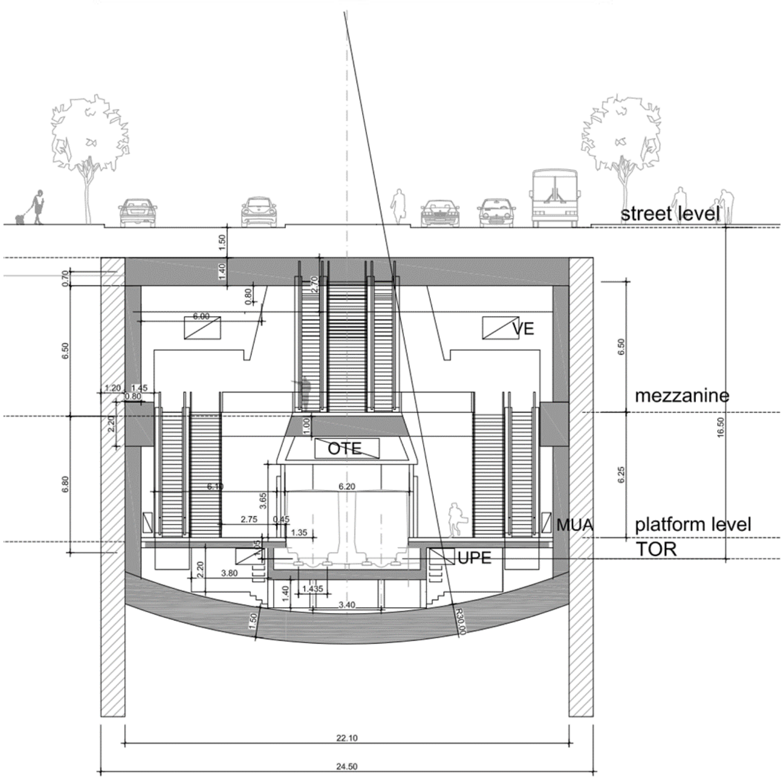

Figure 8 – Cross section at Station Access

The longitudinal section shown in Figure 9 below indicates the length of the station box relative to the R108. The extended length enables access points and ventilation systems to be provided at each end of the station, outside the road boundary.

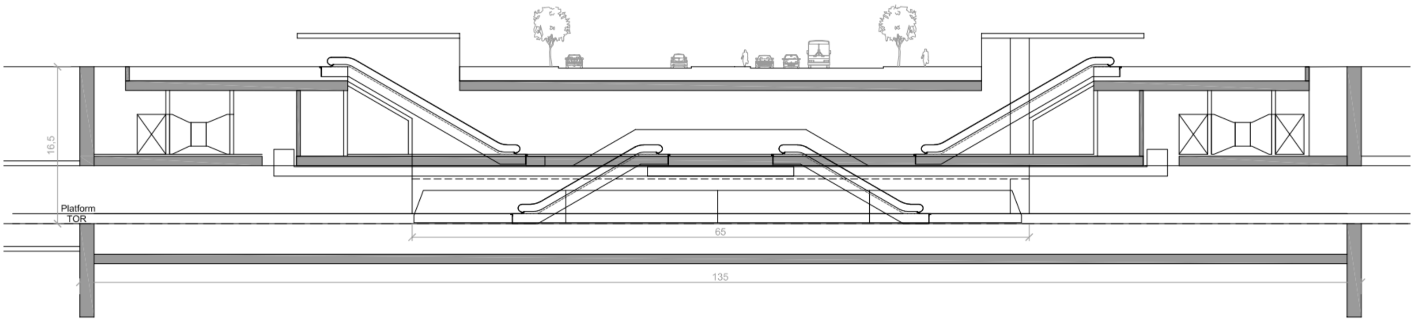

Figure 9 – Longitudinal section through Northwood Station

Much of the site would subsequently be returned to its existing condition and use after construction and a representation of what might be achieved is shown in Figure 10 below.

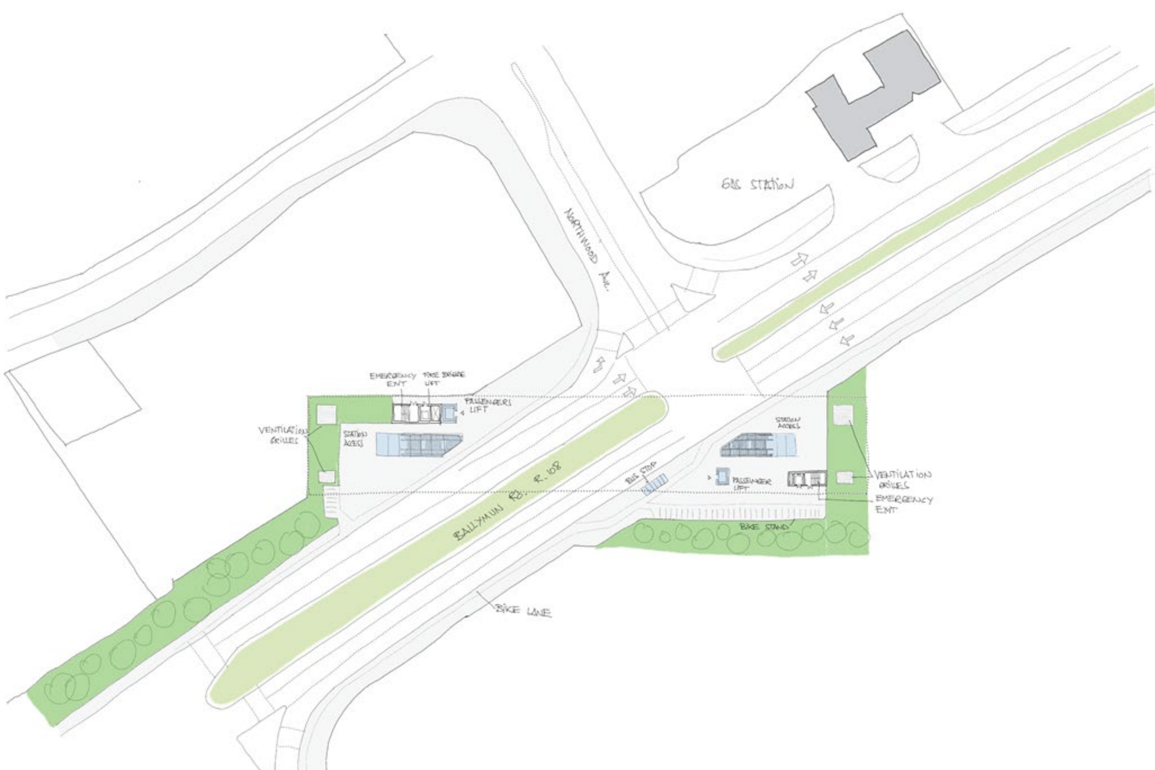

Figure 10 – Possible Return of Construction Site to Use

3.3 Environmental Considerations

An environmental assessment has been undertaken on the proposed new location of the Northwood Station under the R108 to identify any potential significant environmental constraints and opportunities when compared to the EPR. These findings were considered when identifying the preferred option. The following are the principle environmental considerations identified:

- Positive socio-economic impacts to local businesses through increased footfall arising from Northwood Station;
- Reduced potential for an impact on the deep piled foundations of the Metro Hotel; and
- Increased noise and vibration and other construction phase impacts from the station construction on residential receptors. The open box site is approximately 200m from new residential properties to the east and approximately 500m from a school to the south west.

3.4 Planning Considerations

A planning assessment has been undertaken of the Preferred Route option which considers development plan context and relevant planning history. The following are the principle planning considerations:

- Greater impact on the potential development area under zoning objective 'ME - Metro Economic Corridor' in the Fingal Development Plan 2017-2023 where the route descends from the M50; however
- This option has greater connectivity across the overall zoning objective due to the proposed station location at the R108.

3.5 Construction Traffic Impacts

The station and associated tunnel construction site will continue over several years and will generate a high volume of HGV truck movements, which will involve careful traffic management to mitigate against congestion in the local area. Traffic routing will likely be as indicated in Figure 11 below.

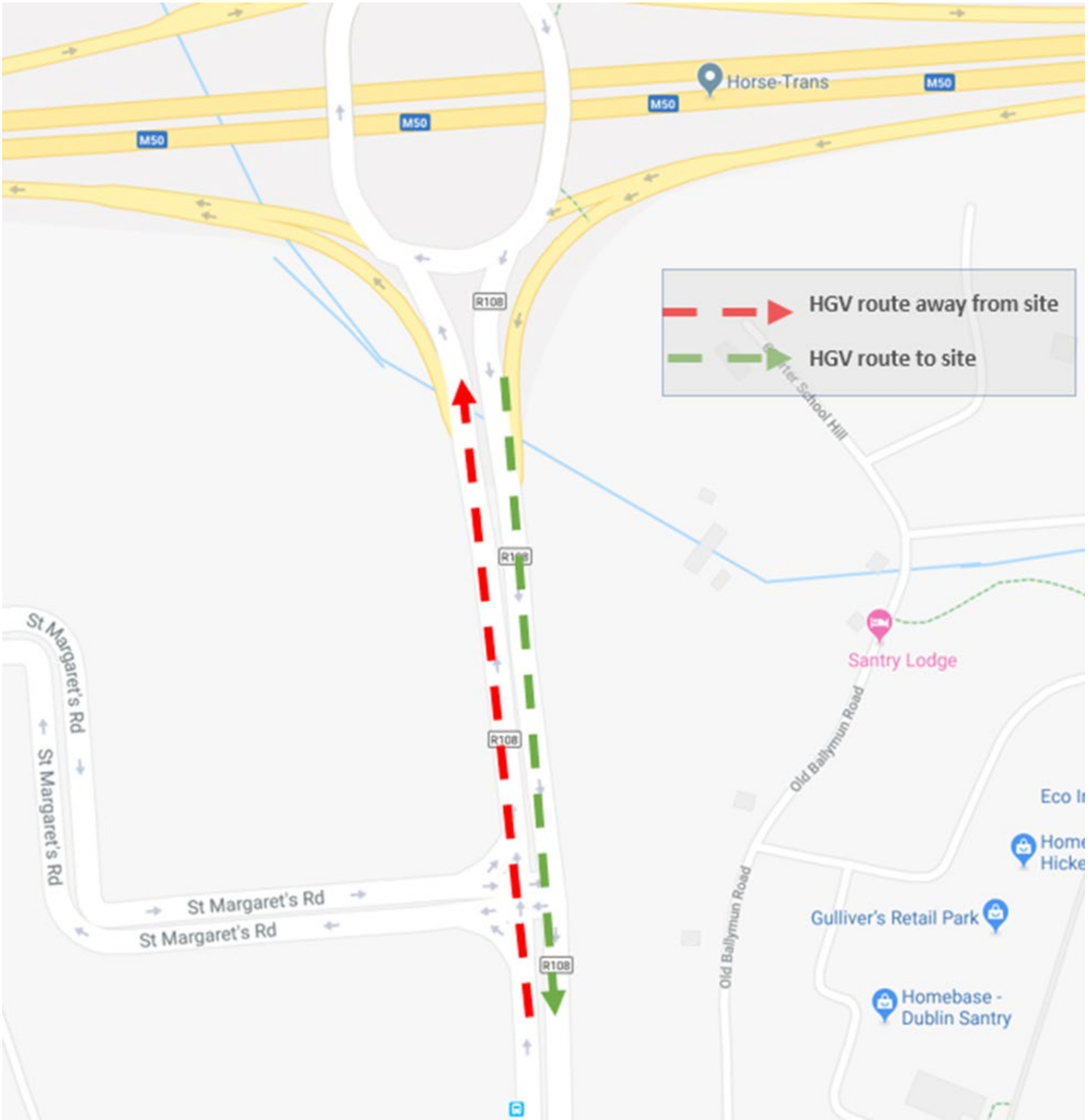

Figure 11 – Potential Construction Traffic Management

The traffic volumes generated specifically by the station construction would vary through the construction phases. The heaviest traffic flow is expected to occur during the station excavation phase where the large volume of spoil must be removed to an off-site location.

The following are the main sources of the construction traffic identified:

- Removal of excavated material from the station box;
- Delivery of materials;

- Waste removal;
- Workers commuter trips; and
- Machinery and equipment delivery and maintenance.

4. Recommendation

The development of a revised tunnel strategy for the Preferred Route incorporates an elevated section of route over the M50 facilitating a depot location at Dardistown. Associated with this change is a revised rail alignment as the route runs southwards from the M50 towards Northwood, Ballymun and on southwards to the city. This changed alignment requires a new location for the Northwood Station as the station location under the EPR was for a tunnelled section of route at this location.

Two options were considered for the revised station location:

- Relocation of the station to the west of the R108, closer to Ballymun; and
- Relocation of the station under and across the R108.

A third option, to place the station to the east of the R108, closer to the original EPR location, is not feasible as it would require a gradient too steep for the Metro to cross over the M50.

The option to place the station west of the R108 was discounted as it would provide poor accessibility from the station to the Gulliver's Retail Park east of the R108; and it would be too close to the Ballymun Station to provide efficient operational metro services.

The optimum location for the revised station location was to incorporate the station at a skew angle under the R108, south of the Retail Park. This provides good access to and from both sides of the road, provides a location appropriate for operational services as well as better addressing some concerns raised during the EPR consultation. As such, this option is being incorporated into the on-going preliminary design for the route.

The Preferred Route proposal is to pull it south of the Retail Park so that it will now sit directly under and at an angle to the junction of the R108 and Northwood Avenue - the Park entrance. This will allow passengers to access the station from either side of the R108 and pedestrians to cross the R108 through the station without having to cross a busy road.

In addition, the revised station location will lie adjacent to the proposed tunnel launch site for the tunnelled route southwards to Charlemont (see Appendix B of the Preferred Route Design Development Report for details) and will form part of the overall construction works in this area. This area to the south and west of the station is currently open ground that is suitable for use as the TBM launch site. Whilst this area is subject to ongoing and future planning considerations for development, following tunnel construction it is anticipated that most of the area could be returned for future development.

It is recommended that the development of the Northwood Station should be progressed under the R108 Ballymun Road as presented in this report, complete with the associated TBM launch site to the west of the road, as part of the Preferred Route in this area.

Potential impacts arising from the Preferred Route will be minimised during the development of the preliminary design and based on the detailed environmental assessment to be presented in the Environmental Impact Assessment Report. The R108 will be affected during construction of the station and we will agree and arrange appropriate traffic management or diversions around the site to maintain safe movement of road users and pedestrians. We will liaise closely with the local community to mitigate issues concerning access and construction.

Annex A – Northwood Station Rejected Option

An alternative alignment option for the route by Northwood was considered that kept the tunnel nearer to the west side of the R108 as it passed northwards from Ballymun Station and which located the Northwood Station adjacent and parallel to the road.

This arrangement is shown in the image in Figure 12 below.

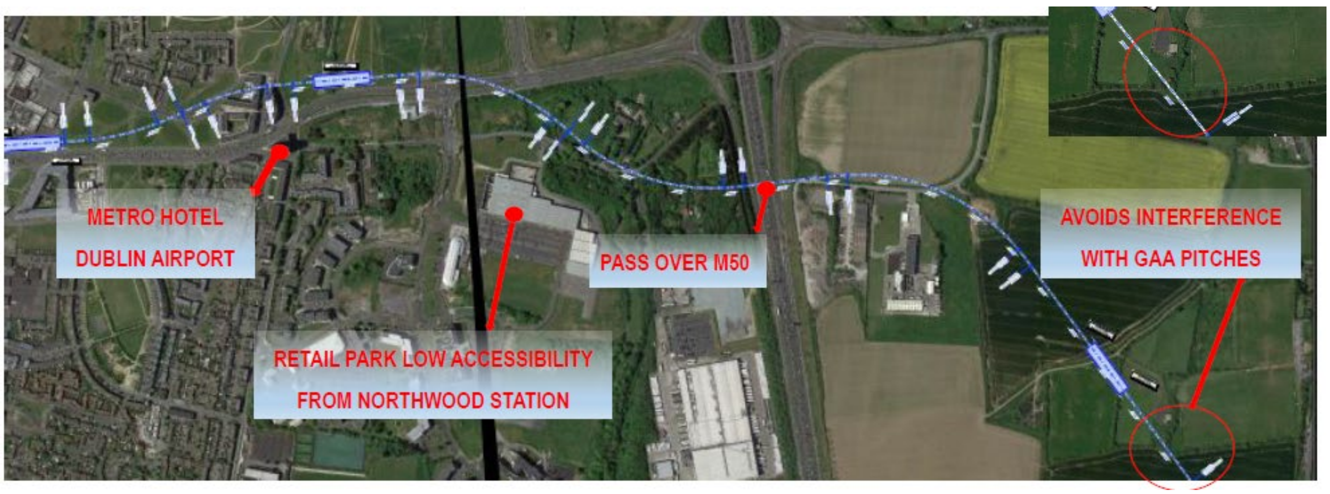

Figure 12 - Alternative Alignment and Northwood Station Location

However, this option was not progressed due to:

- The lack of accessibility to the Northwood Station from the east side of the R108;
- Poor accessibility to Gulliver's Retail Park from the Northwood Station, due to the need to cross the R108 and the distance of the station from the retail park; and
- The proximity of the Ballymun Station to the south, which would reduce the efficiency of metro operations due to the closeness of the two stations.

Appendix I. Ballymun Station

Contents

Executive Summary

The Emerging Preferred Route (EPR) placed the proposed Ballymun Station in the middle of Ballymun Road and directed the twin bore tunnels northwards along the main road and under the expected deep pile foundation of the Metro Hotel building.

The Preferred Route developed by Jacobs/Idom has changed the tunneling strategy to a single bore design and has moved the TBM launch site to the Northwood area just south of the M50. The resulting realignment of the route has enabled consideration to be given to the relocation of the Ballymun underground station box to the west of the R108 Ballymun Road. The possibility of integrating the station with the proposed redevelopment of the shopping centre adds to the attractiveness of this solution.

We have examined the benefits and constraints of this single option and we have concluded that relocating the proposed Ballymun Station to the west side of Ballymun Road should be progressed. This should be done if possible in conjunction with the Shopping Centre redevelopment to achieve an integrated solution.

1. Introduction

1.1 MetroLink Development and Consultation

Metro North was the project name of the original proposal for a metro railway system connecting Swords and Dublin Airport with Dublin City Centre at St Stephen's Green. This scheme was developed by the Railway Procurement Agency through the Railway Order process to successful planning approval by An Bord Pleanála (ABP) in 2010. The global economic downturn intervened, and in 2011 the Government postponed the Metro North project.

Figure 1 – EPR MetroLink (2018)

The National Transport Authority's (NTA) Transport Strategy for the Greater Dublin Area, 2016-2035 identified a Metro service as the preferred public transport mode to address the transport needs of the Swords-Airport-City Centre corridor. It also envisaged the upgrading of the existing Luas Green Line between Ranelagh and Sandyford to a Metro level of service.

Project Ireland 2040 included the National Development Plan (2018-2027), which combined those two projects to form MetroLink. MetroLink will provide a fast, high capacity, high frequency, modern and efficient public transport service for people travelling along the Swords/Airport to City Centre corridor. In addition, the Scheme will ultimately connect to the existing Luas Green Line in the South City area, enabling through running metro services from Swords to Sandyford as shown in

The metro route length from Swords to City Centre is approximately 19km and the completed system will have 15 Stations, 3,000 Park & Ride spaces, and a journey time of approximately 25 minutes.

The NTA/TII commissioned Arup Consulting Engineers to undertake a Route Alignment Options Study for the Scheme in 2016. The objective of the study was to carry out a comprehensive route option selection to identify an Emerging Preferred Route (EPR) for the Scheme. The study was completed at the end of February 2018 and it included a Concept Design for the EPR.

Separately, in January 2018, the NTA/TII commissioned Jacobs and Idom JV (Jacobs/Idom) to provide engineering design services through to scheme completion.

1.2 Public Consultation

A programme of public consultation led by the NTA/TII was conducted between 22nd March and 11th May 2018, during which members of the public and other stakeholders were invited to submit their views and observations of the EPR. Many submissions were made during this process including those relating to Ballymun Station.

1.3 The Preferred Route

The NTA/TII and its advisors have carefully analysed the many statements and submissions made from the stakeholders. Other potential changes to improve the proposed route that were identified through the preliminary design process were also considered. A multidiscipline analysis of the potential options has resulted in several proposed changes to the MetroLink scheme.

This report considers the relative merits of the proposed Ballymun Station location as presented in the Emerging Preferred Route versus the option for its relocation that is being developed for the Preferred Route. The outcome of the multi-discipline analysis is presented with consideration of the following:

- Potential traffic impacts during construction;
- Potential Impacts with Property Foundations;
- Constructability & Access;
- Environmental and Planning Constraints.

2. EPR Ballymun Station

2.1 Location

The underground Ballymun Station proposed in the EPR was located under the Ballymun Road as shown in Figure 2 below for the twin track and tunnel arrangement. The station design has two sub-surface levels, including the track level which was set at approximately 18m below ground.

The EPR station construction plan was to use cut-and-cover methods using secant pile walls to retain the ground while excavation was carried out through the expected overburden and possible rock at lower levels. The Tunnel Boring Machines (TBMs) would then break through the specially prepared end walls of the station box as they tunneled northwards from the proposed launch site at Griffith Park.

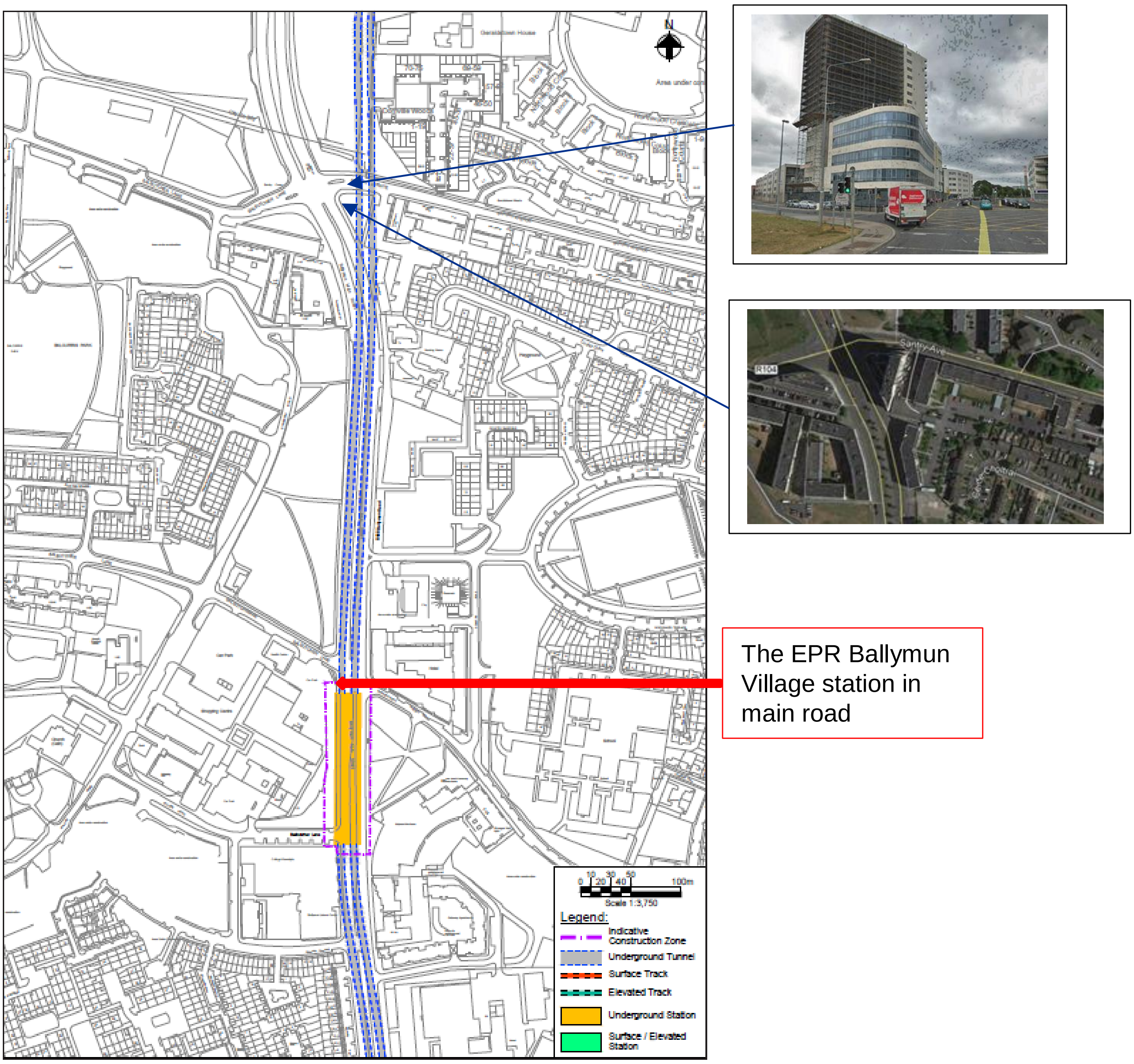

Figure 2 – Ballymun Station EPR Location

The EPR design placed the station box and associated tunnels in and along Ballymun Road. This decision was taken because it is usually easier to progress the planning and construction processes when tunnel schemes are placed under public roads. This is mainly because it simplifies land acquisition and reduces the construction interface with existing buildings.

However, for Ballymun Station this option would create the following issues:

a) **Traffic congestion during construction**. The construction of an underground station box of large plan dimensions and over 20m deep in the middle of the main road through Ballymun would inevitably lead to major disruption to traffic flows during construction. This would lead to traffic congestion in the wider area and would have a negative impact on the business and the community.

b) **Potential clash with existing building foundations.** Placing the station box in the Ballymun Road means that the EPR tunnel alignment to the north of Ballymun must pass under a more-than 20-storey hotel building (Metro Airport Hotel), which we understand is supported on piles and likely founded at rock head level or deeper (ref: Figure 2 above).

c) **Public Utilities.** It is highly likely that there are existing services in and along Ballymun road and this would require major service diversions if the station box is kept in the original EPR location.

2.2 Alternative Option to EPR Ballymun Station Location

To address the concerns raised on Ballymun Station during public consultation, taken together with other proposed route developments, Jacobs/Idom were instructed to carry out a review of feasible alternatives. This review had to take account of the revised tunnel boring strategy, which has moved away from the original EPR strategy of tunneling twin bores all the way from the city centre to beyond Dublin Airport. The Preferred Route now proposes a surface running section each side of the M50 and a single bore tunnel solution running southwards from Northwood.

These changes mean that the TBM can be launched at the proposed Northwood Portal on a revised route just west of Ballymun Road and providing an opportunity to place the station box to the west of Ballymun Road and perhaps become part of the proposed Shopping Centre redevelopment.

The multi-disciplinary review team studied the EPR Ballymun Station proposal with respect to the changes before arriving at a single feasible Option, namely:

Single Option: Move the tunnel alignment and Ballymun Station to the west of Ballymun Road.

The advantages and disadvantages of the option are discussed in the following section before a recommendation is made on how to proceed.

3. Preferred Route and Ballymun Station

3.1 Jacobs/Idom Preferred Route Design

Jacobs/Idom Joint Venture was appointed as the Preliminary Design Lead in January 2018, shortly before the public consultation phase, and has since developed a Preferred Route and design for the scheme. To address the concerns raised during the public consultation period and to assess other route alignment developments, TII/NTA requested that Jacobs/Idom review feasible alternatives for Ballymun Station.

3.2 Preferred Route Re-alignment

Taking account of the revised tunnel strategy the Preferred Route alignment and the station at Ballymun has been moved westwards off Ballymun Road as shown in Figure 3 below.

Figure 3 - Tunnel Realignment to West of Ballymun Road

The Preferred Route now passes well to the west of the Metro Hotel and avoids any interference with its foundations.

3.3 Ballymun Station for Preferred Route

This Preferred Route alignment means that a station box for the Ballymun Station stop can be situated immediately to the west of the Ballymun Road as part of the existing Ballymun shopping centre area, which is scheduled for redevelopment. It is envisaged that a station at this proposed location would enhance the redevelopment plans for this area because it could be designed as a fully integrated facility providing benefits to both developments in terms of footfall for retail opportunities and passenger experience.

The reduced plan dimension of the underground station box made possible by the shorter train and platform lengths, means that it can fit between the adjacent roads of Shangan Road to the north and Balbutcher Lane to the South. This in turn means that disruption to local traffic routes during construction can be managed more easily and, of course, disruption to traffic on Ballymun Road during construction will be much reduced when compared to the EPR centre of road location. A reduced impact on existing utilities in Ballymun is a further benefit.

An indicative plan of the station and its relationship to the surrounding roads is shown in Figure 4 below, with more detail provided in Figure 5 to show the tunnels and the outline of the existing shopping centre buildings.

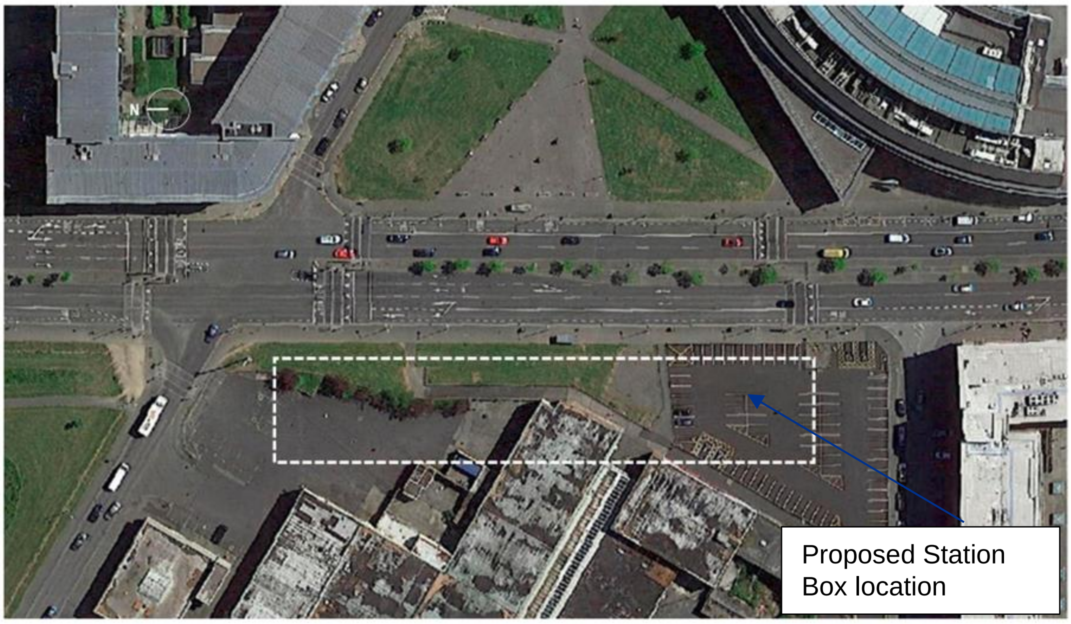

Figure 4 – Proposed Ballymun Station Location

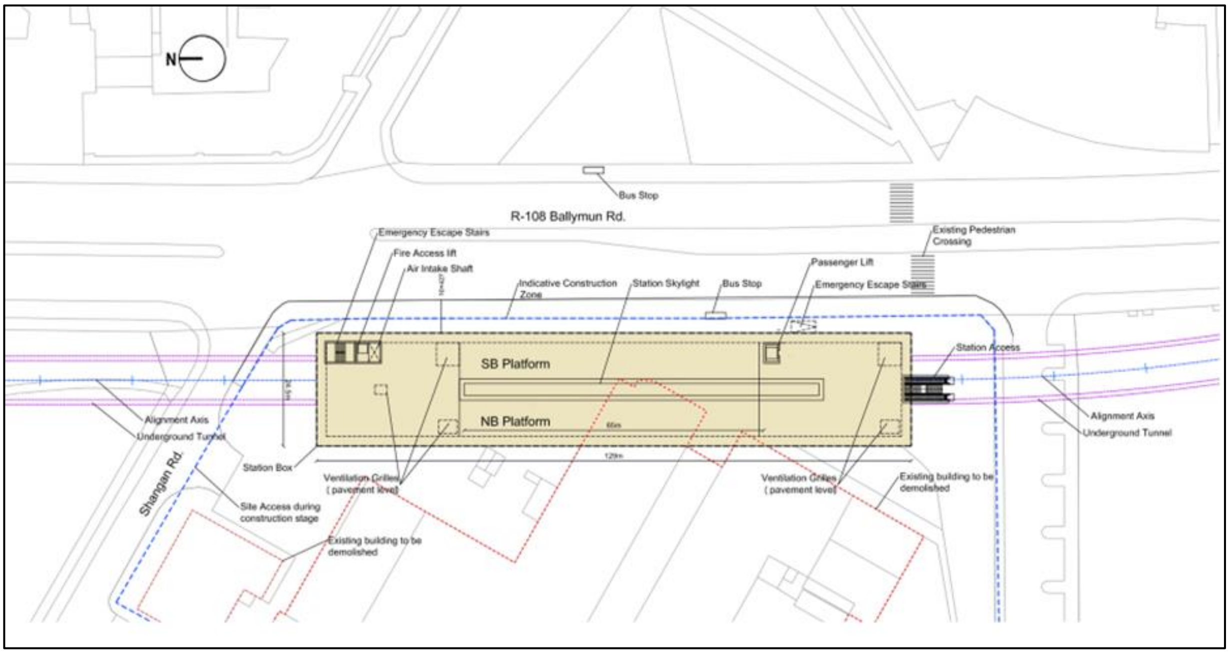

Figure 5 – Indicative Station Layout

The cross sectional details are being developed but the depth from ground level to Top of Rail at the station is to be approximately 24m as shown in Figure 6 below.

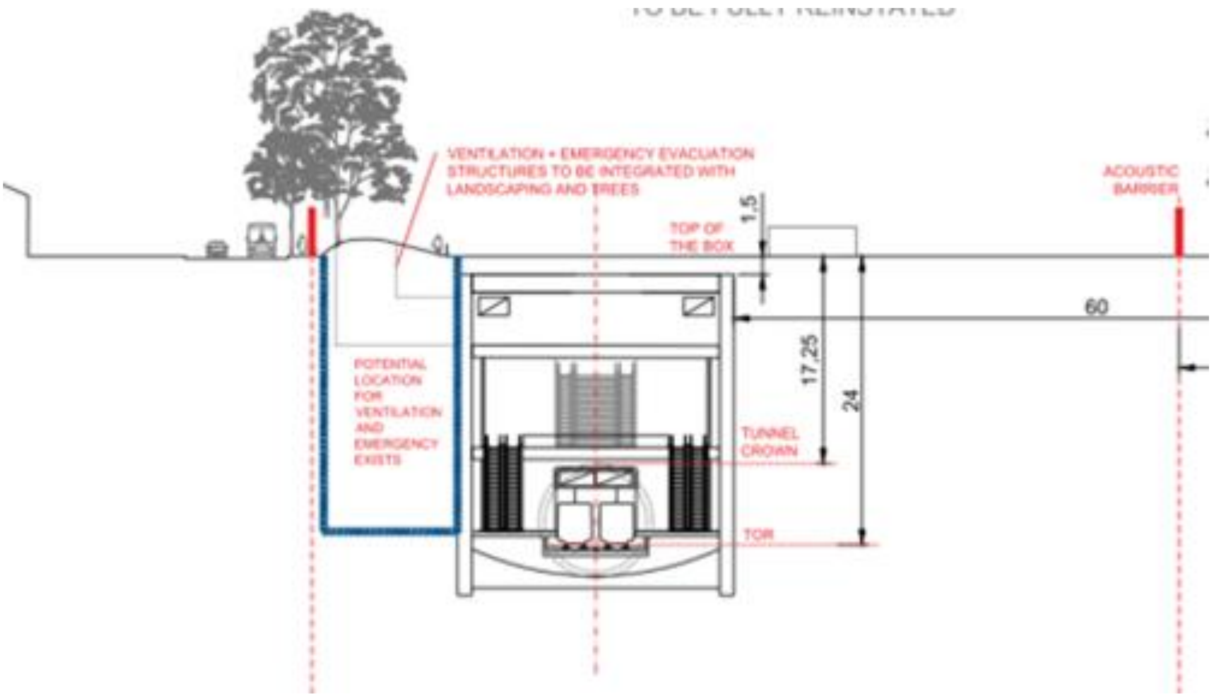

Figure 6 – Typical Cross Section

Access and ventilation shafts are indicated on the road side of the main station box and the station entrance would then be located between the box and the footpath. In the urban context the completed station would be designed to enhance the Ballymun Village area in its architectural aesthetics as well as enabling improved access along the transport corridor afforded by MetroLink. The situation at completion might be as shown in Figure 7 below, excluding consideration of integration implications with the proposed new shopping centre development.

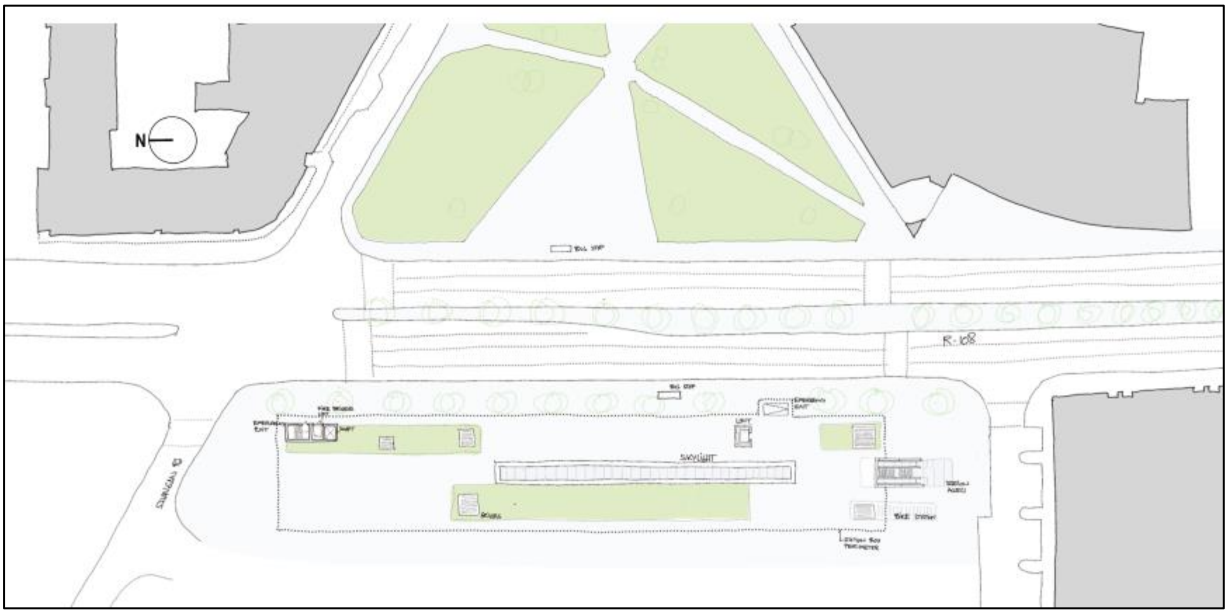

Figure 7 – Ballymun Station in Urban Context

3.4 Constructability and Access

Currently, we assume that the existing car park area to the south and west of the station box would be available as a temporary construction site as well as working space to the west of the station box. We further assume that the use of the car park does not require a replacement facility to be provided and that any demolition is carried out by others before the Station is established.

The construction site entrances and exits will be directly onto the Ballymun Road (R108). Traffic would leave site heading north and meet the M50 after only 1.5km. Traffic coming to site would probably need to travel past the site by 700m and perform a U-turn at the R103 junction. Discussions will be progressed with the road authority and Gardai to ascertain whether this manoeuvre is permitted. Some junction works or traffic light phasing works may be necessary.

An alternative route to site could be travelling south from the M50 on the R104, travelling west on the R103, and then north on the R108 into site.

The site is constrained, and a lorry holding area is likely to be required whenever large numbers of HGVs are required (for example during excavation or concrete pours). The site would benefit from a centralised Logistics Centre for the project, where loads can be consolidated before delivery to site.

3.5 Environmental Considerations

An environmental assessment was undertaken of the two options and the findings of this assessment were considered when identifying the preferred option at Ballymun. The following principal environmental constraints and opportunities have been identified for this option:

- The primary environmental benefit of the preferred station location is a reduction in traffic disruption to the R108 as the station box will be constructed outside of the road corridor. This option potentially allows the area west of the station box to be used as a works area providing more construction space than the EPR option. The relocation would also avoid utilities in the road corridor.

- The Ballymun Shopping Centre redevelopment may provide a potential opportunity to connect with MetroLink in future. The potential for the shopping centre development to integrate the station may improve urban integration and reduce potential visual impacts.

- During construction, there is potential for noise, vibration and dust impacts on sensitive receptors including The Ballymun Civic Centre, Ballymun Community Swimming Pool and Ballymun Healthcare Facility and Trinity Comprehensive School (less than 200m away).

- The revised alignment to facilitate the proposed station location will be tunnelled in closer proximity to a number of sensitive receptors such as residential developments, schools and community facilities. This could result in increased impacts from ground borne noise and vibration and settlement during the construction and operational phase if not appropriately mitigated;

- Moving the station off the main road will reduce potential traffic impacts during construction and will avoid disturbing the utilities that will be running in the road.

Potential impacts arising from the preferred option will be minimised during the development of the preliminary design and on the basis of the detailed environmental assessment presented in the Environmental Impact Assessment Report.

3.6 Planning Considerations

A planning assessment has been undertaken of the options which considers development plan context and relevant planning history. The following are the principal planning considerations.

3.6.1 Development Plan Context

The station location options at Ballymun, both in the EPR and in the preferred route design, are within the functional area of Dublin City Council and has the zoning objective of 'Z4 – To provide for and improve mixed-services facilities', (District Centres) in the Dublin City Development Plan 2016-2022. The lands are also a Key District Centre with an objective to provide a comprehensive range of commercial and community services to the surrounding population.

The lands form part of the area of the Ballymun Local Area Plan 2017. The key development principles for these lands are 'Proposed Mixed Use' (residential, retail & commercial).

A Metro station is not identified as 'Permissible Uses' nor as 'Open for Consideration Uses' under the zoning objective. Its use will need to be assessed in terms of role in helping to achieve the zoning objectives and their compliance with the policies and objectives of the Dublin City Development Plan. It is considered that a Metro Station will help to deliver on the objectives of the zoning in supporting commercial and community facilities for its catchment community.

3.6.2 Relevant Planning History

Planning Permission is extant for the redevelopment of the Ballymun Shopping Centre site (under Planning Ref. 4828/08). Locating a metro station here will need to coordinate with the site's development which currently includes two basement levels.

The lands to the north of the proposed station location are subject to two planning permissions (Planning Ref. 3960/17 and 4537/18).

3.6.3 Commentary

- The EPR reduces potential conflict between future development and the alignment by following the R108 or public land.
- Under the EPR option, careful design would be needed to ensure high quality urban integration with the redeveloped Ballymun Shopping Centre, Civic Centre Buildings and associated public space.
- Both the EPR and proposed station locations sit in a central location in Ballymun and provide good connectivity to other modes of transportation including Dublin Bus, car and bike.
- The proposed station location is zoned for mixed-services facilities in the Dublin City Council Development Plan 2016-2022. A station design at this location that facilitates overhead development appropriate to the zoning can contribute to integrating the MetroLink to the surrounding catchment.
- The alignment of the tunnel in its approaches to the proposed station passes through further lands zoned for mixed-use facilities. Design of the tunnel route will need to facilitate

future overhead development to ensure that these lands can be developed appropriately, in line with their zoning objective.

4. Conclusion

The decision to relocate Ballymun Station just off and west of the main road was taken to align with the Preferred Route, which runs to the west of the R108, and to take the opportunity presented by redevelopment plans for the existing Ballymun shopping centre to design an integrated station. Discussions are continuing with Dublin City Council about the integration of the station with the future development.

The preferred option was chosen having regard to the potential positive and negative environmental impacts that were identified in the environmental assessment of the options. The preferred option to move the station off the main road will reduce traffic congestion during construction and will avoid disturbing the utilities that will be running in the road. The realignment of the route also avoids any interface with the expected deep pile foundations for the Metro Hotel.

Despite potential for temporary impacts during the construction phase, the outcomes of the multidisciplinary analysis undertaken has identified that Ballymun Station should be progressed on the west of Ballymun Road, if possible in conjunction with the proposed redevelopment of the Shopping Centre.

Appendix J. Griffith Park Station

Contents

Executive Summary

An Emerging Preferred Route (EPR) for the proposed MetroLink scheme serving the Swords-Dublin Airport-City Centre transport corridor was developed with a twin-bore tunnel from the city centre to just north of the airport. The construction methodology split the tunnelled section route into two almost equal halves with a station at Griffith Park incorporating a single tunnel launch and reception facility.

The Public Consultation process resulted in a large number of submissions that raised concern about the risk to the future of the club and its supporting community. Taking account of these concerns the NTA/TII instructed its consulting engineers, Jacobs/Idom to examine alternative options.

Three options were considered that also take into consideration the Preferred Route proposal for tunnelling in two sections with surface running each side of the M50 and a relocated maintenance depot at Dardistown. These changes led to the TBM launch and reception site proposed under the EPR at the CLG Na Fianna playing fields being moved to the revised portal proposed at Northwood, south of the M50.

Jacobs/Idom identified and assessed the three Options appropriate to the revised tunnelling strategy, namely:

Option A - Station only on Na Fianna grounds;

Option B - Station only on Home Farm FC grounds; and

Option C - No station in this locality.

After consideration of relevant factors as discussed in this Report we recommend that **Option B** - Station only on Home Farm FC grounds is incorporated into the Preferred Route.

1. Introduction

1.1 MetroLink Development and Consultation

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Figure 1 – EPR MetroLink (2018) and Griffith Park

The National Transport Authority's (NTA) Transport Strategy for the Greater Dublin Area, 2016-2035 identified a Metro service as the preferred public transport mode to address the transport needs of the Swords-Airport-City Centre corridor. It also envisaged the upgrading of the existing Luas Green Line between Ranelagh and Sandyford to a Metro level of service.

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1.2 Public Consultation

A programme of public consultation led by the NTA/TII was conducted between 22nd March and 11th May 2018, during which members of the public and other stakeholders were invited to submit their views and observations of the EPR.

Many submissions were made during this process, particularly those relating to the proposals for Griffith Park Station and the associated Tunnel Boring Machine (TBM) launch and reception work site.

Some of the key concerns raised were the;

- Length of time for construction;
- Impact on surrounding roads from construction traffic;
- Impact on access into local schools and the GAA clubhouse and facilities; snd
- Impacts from noise, vibration and dust generated during construction.

In addition, the comprehensive written submission from CLG Na Fianna raised several concerns regarding the use of the sports facilities during construction, the proximity of educational establishments, and the risk of long-term damage to the future of the club and local community.

1.3 The Preferred Route Design

The NTA/TII and Jacobs/Idom have carefully considered the many statements and submissions made from the stakeholders along with other proposed route improvements and a multidiscipline analysis of these has fed into the preliminary design where appropriate.

This process has resulted in several proposed changes to the MetroLink scheme and this report presents the changes leading to the Preferred Route and to the planning of the proposed Griffith Park Station.

2. EPR Griffith Park Station and TBM Launch Site

2.1 Station Location

Griffith Park Station under the EPR proposals was located on the CLG Na Fianna grounds, as shown in Figure 2 below. The key factors that support an underground metro station at this location are the passenger demand figures for the surrounding area and the relatively long distance to the next proposed stations north and south of Griffith Park. The presence of the schools and the college in the locality contribute to the demand assessment which was undertaken in Arup's Concept Engineering Design, Appendix 8.1. Transport Modelling & Economic Assessment Report and this contributed to the selection of the route and station location.

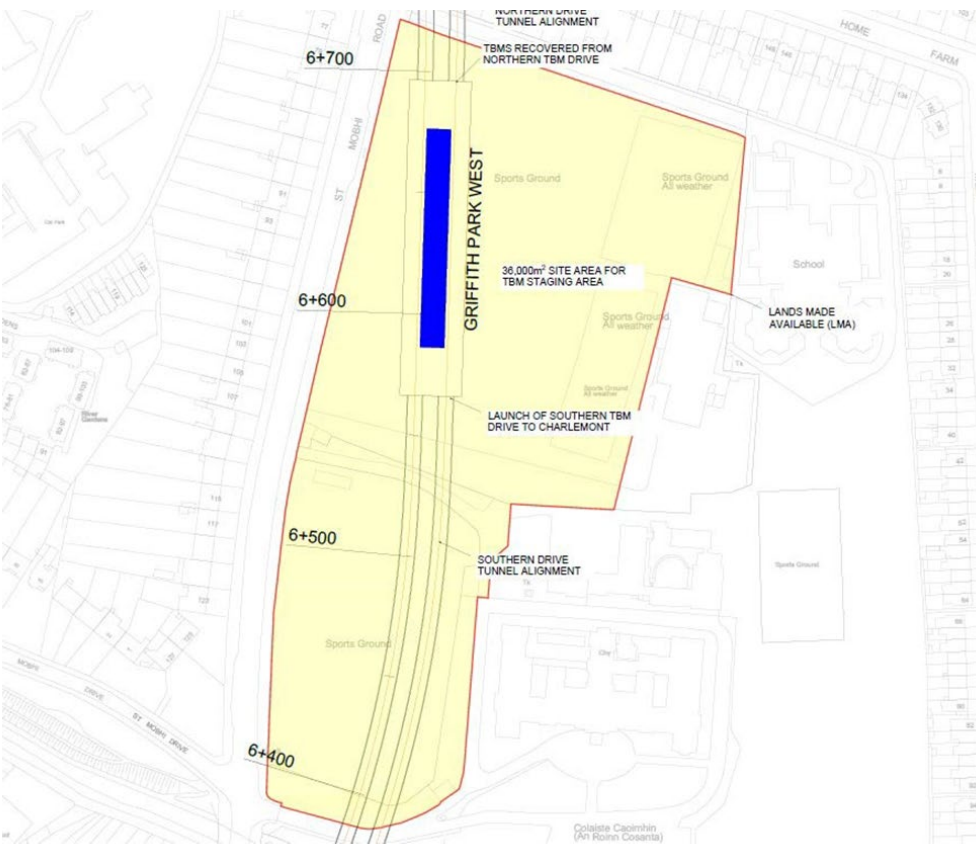

Figure 2- Griffith Park Station and Construction Site for the EPR

The Griffith Park Station site is approximately mid-way between the proposed Collins Avenue and Glasnevin Stations, which are approximately 2.6km apart. If a station was not to be constructed at Griffith Park then another intervention/ventilation shaft in the locality would have to be provided instead for tunnel safety reasons.

2.2 Tunnel Boring Machine (TBM) Launch Site for the EPR

It is common practice to locate a TBM launch site and associated work site at a station location to limit the environmental impacts and to reduce costs. The construction methodology for the EPR twin bore tunnels took account of the decision for the route to run entirely underground from the city centre to beyond Dublin Airport. This influenced the decision to locate a launch & reception site for the TBM approximately midway along the route in the grounds adjacent to the proposed station.

The launch site was located at the Griffith Park Station location for the following main reasons:

a) There is open space around the station to accommodate the launch site without demolishing a significant number of properties;

b) This station location is close to mid-point of the tunnel length, which facilitates the completion of the construction within the scheduled construction programme.

The EPR design for the Griffith Park site assumed that two TBMs would be launched southwards from the previously constructed station box toward the proposed portal at Charlemont. The two TBMs launched separately from the tunnel portal north of Dublin Airport for the drive towards the south would be extracted at the Griffith Park site.

Mucking out of the tunnel drives to the south would take place from the station box and the material would be taken off site by road vehicles. Construction materials such as concrete segments would also be delivered to the site by road. Other facilities typically required for tunnel boring operations would include diesel generators; electricity substation for construction power supplies; water treatment facilities; gantry cranes; and mortar pumps and mixing tanks.

The EPR was developed for a twin-bore tunnel solution and this means that cross connections between the tunnels would have been needed at regular centres. This work can only be done once the TBM has completed its drive and this constraint to the construction programme was an incentive to split the tunnel length into two almost equal halves, with both receiving and launching TBMs at Griffith Park.

3. Preferred Route Development

3.1 Design Changes for the Preferred Route

Jacobs/Idom Joint Venture was appointed as the Engineering Designer (ED) in January 2018, shortly before the EPR public consultation phase, and have since been developing a Preferred Route and design for the scheme. This work takes account of decisions made following analysis of submissions received from the Public Consultation process as well as further consideration of other design developments. Particular changes proposed to the design include:

a) Tunnel Configuration

Single bore tunnel design has advantages over twin bore tunnel design in that it offers improved safety for evacuation and emergency service access at track level, as well as a quicker construction programme. A single bore does not require the mined cross passages needed to connect the two bores at regular spacings for safety reasons. This potentially allows for some fitting out work to proceed in the greater space available in the single bore behind the TBM as it continues to excavate the tunnel ahead. This could shorten the construction programme because fitting out works can proceed in parallel with excavation work.

In the case of a twin bore tunnel, emergency evacuation is via a more restrictive side walkway. During construction there is insufficient space in the tunnel bore to install track, overhead line and other equipment alongside the still operating conveyer and ventilation equipment.

Considering these factors, it is possible to maintain the construction programme using only one TBM for the proposed single bore tunnel drive in two unequal lengths. This means that the TBM launch site can be relocated further to the north away from Griffith Park at Northwood, just south of the M50, where the route is now proposed to rise to the surface to accommodate a revised depot location at dardistown.

b) Station Length

The EPR concept design had to make provision for both high and low-floor vehicles, and this meant that compromises had to be made in platform lengths and station design. High-floor trains have more capacity than low-floor trains and this fact, combined with the up to 90 second peak headway (time between trains) made possible by the planned use of (GoA4) automatic train operation technology, enables the Preferred Route scheme to satisfy the target demand of 20,000 passengers per hour per direction (pphpd) with shorter trains. This allows train lengths to be reduced from the 90m long low-floor trains required for the EPR, to 64m long high-floor trains.This reduction in train length gives more flexibility on the size and placement of the station box so that surface impact can be minimised.

These benefits can be applied to the alternative Options A and B, which include stations at Griffith Park as discussed below.

4. Preferred Route Options for Griffith Park Station

4.1 Options for Consideration

To address the concerns raised during the EPR public consultation period, NTA/TII requested that Jacobs/Idom carry out a review of feasible alternatives to the proposals identified in the EPR.

This review has resulted in a revised tunnel strategy, which changed the EPR strategy of tunnelling twin bores from the city centre to beyond Dublin Airport, in favour of a single bore tunnel from the city centre to just south of M50, a short surface running section introduced on each side of the M50, and a shorter tunnel under Dublin Airport, completed by a surface section to Estuary.

The Preferred Route is designed for a single bore tunnel solution, which would require alternative tunnel boring locations/portals.

Based on the revised tunnel strategy, the review team studied the situation at Griffith Park and arrived at three new possible alternatives, namely:

A. Griffith Park Station located on CLG Na Fianna grounds but with no TBM launch facilities.

B. Griffith Park Station located on Home Farm FC grounds with no TBM launch facilities.

C. No station or TBM launch facilities in this locality.

These options are presented below. The advantages and disadvantages of each option are discussed before a recommendation for one option is made.

4.2 Option A – Station only on CLG Na Fianna Grounds

4.2.1 Description

This option would consist of a station box of reduced size to suit shorter trains situated beneath the playing pitch in CLG Na Fianna grounds with no provision for a TBM launch site at this location.

As shown in Figure 4 below, the station would be located at a slight angle to Mobhi Road and the main station box is fully within the playing pitch. The station box proposed is of the “ -3 levels ” type with base slab depth of approximately 26.0m below ground level. The access and ventilation shafts are indicated on the road side of the main station box, offset to provide the clear surface area for playing pitch reinstatement on completion. The station entrance would then be located between the pitch edge and the footpath.

The works required to construct the station box structure would require a significant engineering effort and would require mobilisation of a substantial amount of machinery, materials and other auxiliary equipment. The construction works can be split into broad phases including:

- Site set-up;
- Enabling works and utility diversion;
- Station box construction;

- Progressive excavation and temporary works installation;
- Structural slabs construction and temporary works removal;
- TBM pass-through;
- Finishing and Fit-out; and
- Reinstatement works.

4.2.2 Potential Environmental Considerations

An environmental assessment has been undertaken of the different options to identify any potential significant environmental constraints and opportunities to the development of the site. These findings were considered when identifying the preferred option. The following are the principal environmental considerations and opportunities identified for this Option A:

- A TBM launch site will not be located at this site and therefore the scale and duration of construction impacts are significantly less than that for the EPR. Further details on the identification of the tunnel launch site is assessed in detail in Appendix B of the Preferred Route Design Development Report.

- The proposed station box location at CLG Na Fianna would be located adjacent to Mobhi Road beneath a playing pitch beside the CLG Na Fianna GAA clubhouse. Construction works at this location will result in a direct property impact and the closure of a key local amenity to the club members of Na Fianna GAA club. Figure 3 below shows the schools and the CLG Na Fianna/Home Farm FC facilities in this area.

- There are several sensitive receptors in this area including churches, hospitals, schools, Montessori and local clubs. Scoil Chaitríona, Scoil Mobhi, Whitehall College of Further Education and Tír na nÓg (Montessori) are regarded as sensitive receptors in this area and lie in proximity to the station location. In addition, there are several residential properties on Mobhi Road and Home Farm Road that could be affected. The provision of a station at this location would result in potential impacts in terms of noise, vibration and dust during construction phase in the absence of appropriate mitigation.

- The proposed station location lies approximately 190m north of the Tolka River with potential risk of contaminated run-off during construction to the Tolka catchment, in an absence of appropriate mitigation. There are also several historic rivers in this area and feedback from the EPR public consultation included information that an underground culverted river runs through Na Fianna grounds. There is evidence of a piped watercourse running in a north/south direction through the station location towards the River Tolka.

- The development of a station at this location would also result in potential biodiversity impacts at a local scale due to vegetation clearance and lighting during construction. There may also be potential for impacts on winter birds (House Sparrow, Herring Gull and Swift) identified within 30m of this area. Invasive species (Three Cornered Leek) were also identified at the north west corner of the playing field during recent surveys.

- The River Tolka has conservation value in terms of having connectivity with coastal designated sites (North Dublin Bay pNHA, South Dublin Bay and River Tolka Estuary SPA).

Therefore, the River Tolka is found to be an important ecological corridor and will require the implementation of mitigation measures to avoid run off from construction works.

- Construction works at this location may result in additional traffic flow and congestion on Mobhi Road and surrounds. Any potential impacts on the access road to Scoil Mobhi will require mitigation measures. However, it should be noted that impacts on traffic flow during construction would be much less than for the EPR due to the absence of a TBM launch site. In addition, once the project is complete and in operation the area will have significantly improved public transport.

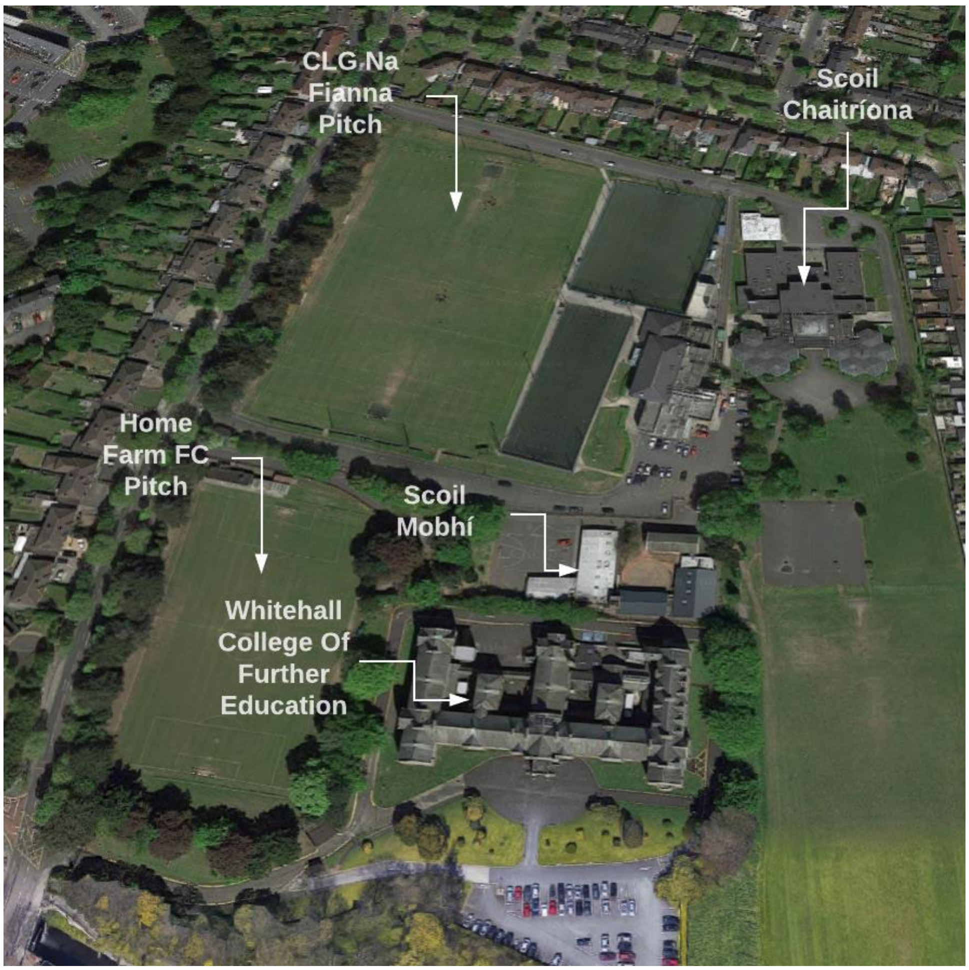

Figure 3 Proximity of schools and college to sports fields

4.2.3 Planning Considerations

A planning assessment was carried out on Option A to identify any significant planning constraints to the proposed development of a station at CLG Na Fianna grounds. The assessment reflects the overarching zoning objectives and development plan objectives. The station at Na Fianna pitch is proposed on lands with the zoning objective 'Z15: Community and Institutional Resource Lands (Education, Recreation, Community, Green Infrastructure and Health)' in the Dublin City Development Plan 2016-2022.

A Metro station is not identified as a 'Permissible' use nor as a 'Open for Consideration' use under this zoning objective. The provision of a Metro station below ground level, accessible from the public road and with reinstatement of the existing sports use, will help to enable the continuation of the institutional and community facilities.

No extant planning permissions are noted on either the site identified for the station in the EPR or on the station proposed for Option A. It is noted that planning permission for development to the immediate north of the CLG Na Fianna grounds (Planning Ref. 4437/18), which was above the EPR route alignment, will not be affected by the proposed route alignment.

Both the EPR and the Option route have an alignment that passes through open space lands rather than passing along the public road at this location. Careful design is needed to ensure high quality integration of the station to the public road and reinstatement of the sporting use at surface level. It is noted that the proposed station minimises encroachment onto the landholding because the station is located closer to the public road.

4.2.4 Construction Traffic Management

Pedestrian/cyclist safety would be the greatest priority in designing the construction stage traffic management.

For Option A the footpath on the east side of the Mobhi Road would need to be closed between Scoil Chaithríona and the CLG Na Fianna gates. A temporary pedestrian crossing should therefore be installed near the CLG Na Fianna / Home Farm FC gates to reduce the risk of pedestrians crossing in an uncontrolled manner. At the same time, the existing crossing near the Scoil Chaithríona entrance should remain operational.

The traffic volume generated by the site would vary through the construction phases. The heaviest traffic flow is expected to fall during the station excavation phase where the large volume of spoil must be removed to an off-site location.

4.2.5 Site & Compound Layout

The site compound would need to accommodate a range of back-up facilities, machinery and materials required for the construction. The compound including the station box and additional working space, will form the overall construction area required. This area would need to be sized to allow adequate space for the following items:

- Site offices and welfare;
- Hardstanding areas for piling machinery and its maintenance;
- Fabrication and storage area for steel cages used to construct diaphragm walls / piles;
- Access and internal service roads for concrete deliveries;
- Granular material / excavated material stockpiles;
- A bentonite batching and recycling plant; and
- A water treatment facility.

Independent access and egress to the site is proposed as separate from the existing Scoil Chaitríona, CLG Na Fianna and Scoil Mobhi access roads, which would remain fully accessible.

The final design of the site layout would be influenced by the contractor responsible for the site, but an indicative concept layout is shown on Figure 4 below.

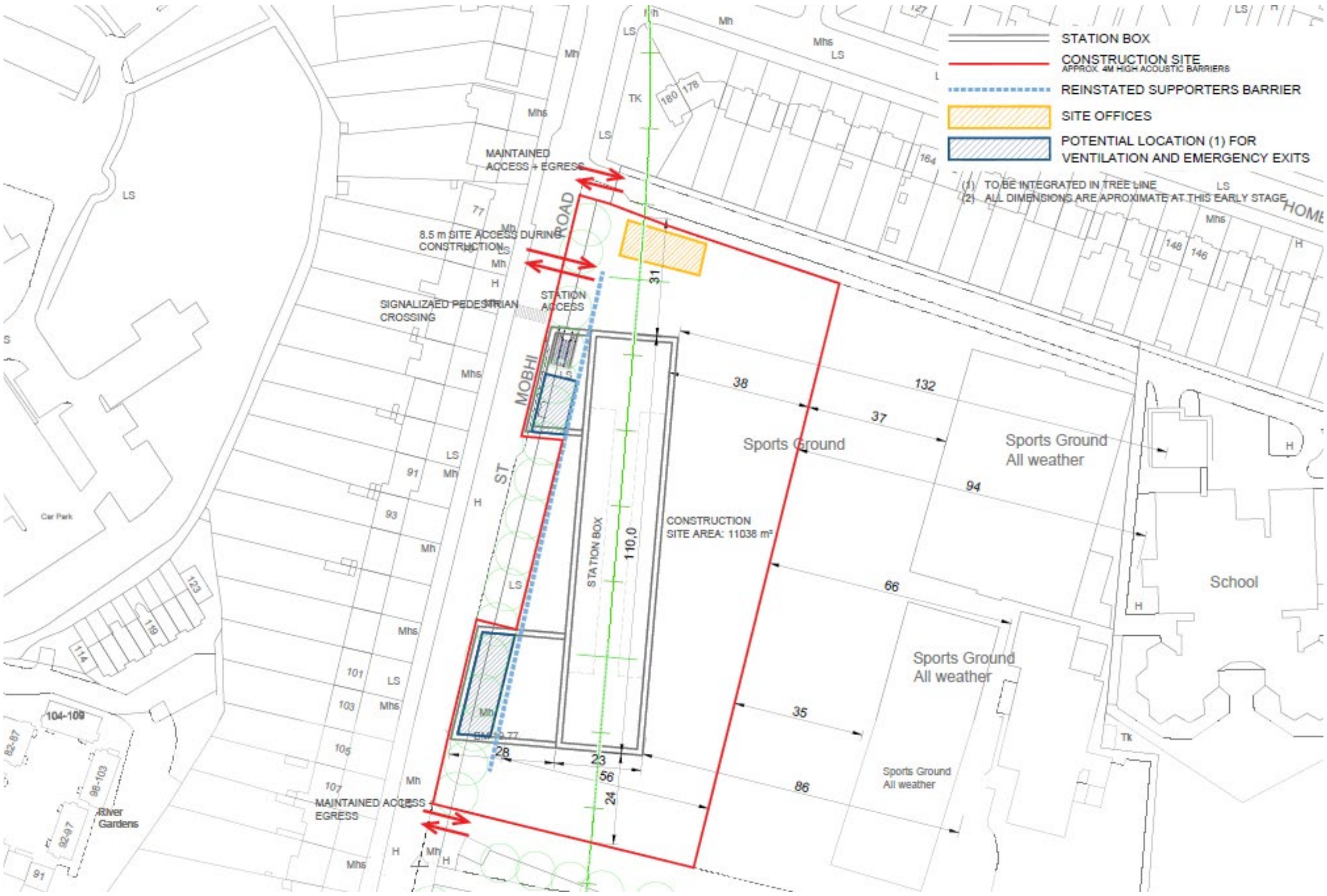

Figure 4 - CLG Na Fianna station concept site layout

The type, height and location of the site hoarding will play a crucial role in mitigation of construction noise. Before the installation of the station box retaining walls commences the site would be levelled to form a working platform levels to suit the topography. The site would be topped by a piling mat to enable the piling rigs to work in a safe manner.

4.3 Option B – Station Only at Home Farm FC Grounds

4.3.1 Description

This Option B would consist of a new station box situated beneath the playing pitch in Home Farm FC grounds with a size and design similar to that described in Option A.

To accommodate the station in this location, the MetroLink route would need realignment compared to the EPR and would have to pass under additional housing to the south of the station.

As with Option A, this option has no provision for a TBM launch site at this location.

The proposed station is located parallel to the Mobhi Road and the main station box is fully contained within the playing pitch as shown in Figure 5 below.

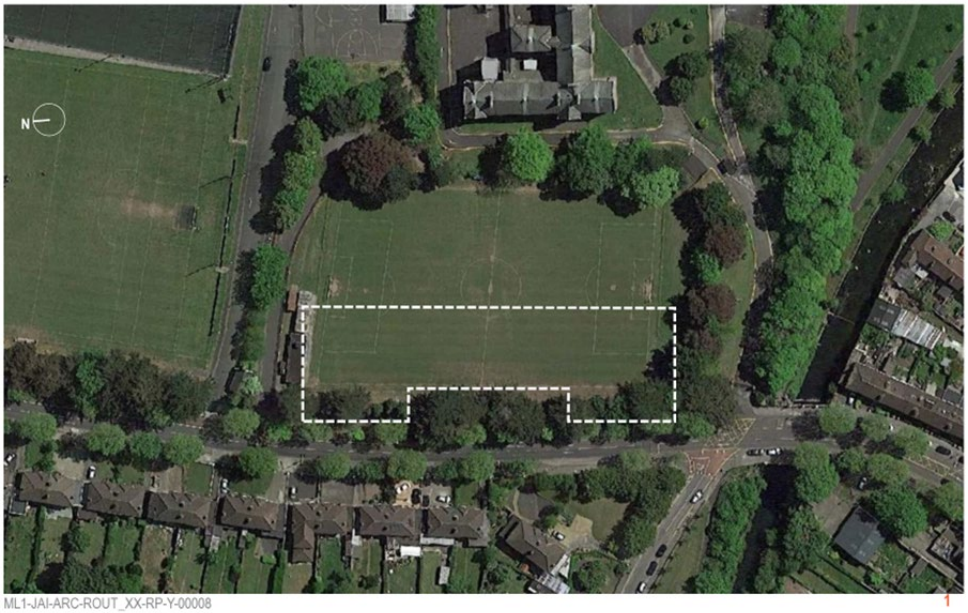

Figure 5 – Indicative Station Location at Home Farm FC

A cross section through the station construction is shown in Figure 6 below. The works required to construct the station box structure are as Option A and would therefore require similar construction works and programme duration.

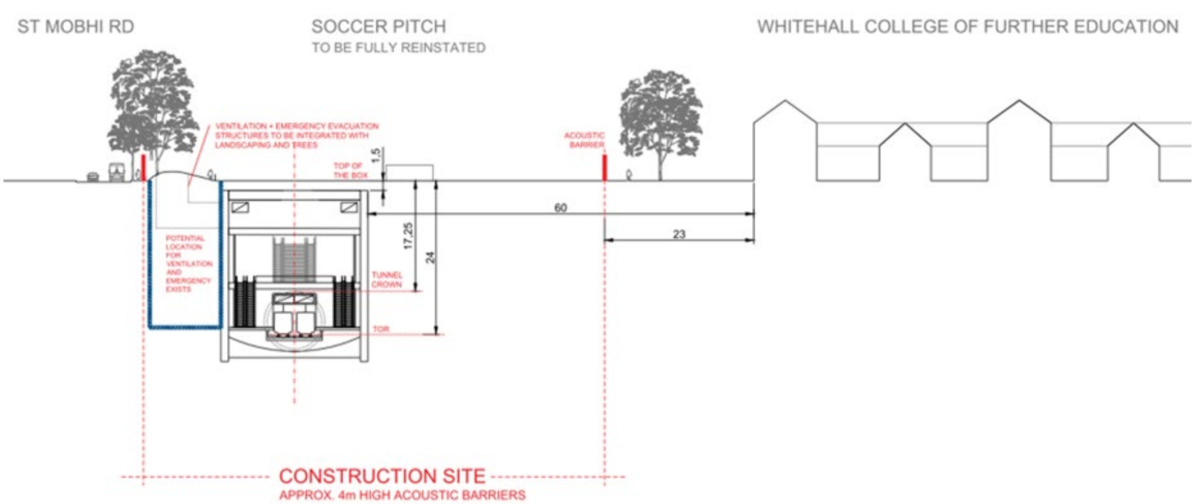

Figure 6 – Indicative Station Cross Section

4.3.2 Potential Environmental Considerations

An environmental assessment has been undertaken of the different options to identify any potential significant environmental constraints and opportunities to the development of the site. These findings were considered when identifying the preferred option. The following are the principal environmental considerations and opportunities identified for Option B:

- A TBM launch site will not be located at this site and therefore the scale and duration of construction impacts are significantly less than that for the EPR. Further details on the identification of the tunnel launch site is assessed in detail in Appendix B of the Preferred Route Design Development Report.

- The proposed station box location at Home Farm is located adjacent to Mobhi Road and beneath one of the Home Farm Football Club playing pitches, which will result in a direct property and amenity impact. Construction works at this location will result in the closure of the pitch during station construction. The possibility of providing alternative playing facilities at the home grounds of Home Farm F.C is being explored with the relevant stakeholders;

- Similar to Option A, there are several sensitive receptors in this area including churches, hospitals, schools, Montessori and local clubs. In addition, there are a number of residential properties on Mobhi Road and across the Tolka River off Botanic Avenue. The provision of a station at this location would result in potential impacts in terms of noise, vibration, dust during construction phase in the absence of effective mitigation.

- The proposed station location lies north of the Tolka River with a potential risk of contaminated run-off during construction to the Tolka catchment. However, this location lies approximately 50m from the Tolka River and will require additional mitigation measures to avoid run off or any discharge during construction. There are also several historic rivers in this area and feedback during the EPR public consultation identified an underground culverted river running nearby under the Na Fianna grounds.

- The development of a station at this location would also result in potential biodiversity impacts at a local scale due to vegetation clearance and lighting during construction. Recent surveys indicated greater ecological activity found in the EPR and Option A site with regard to winter bird and invasive species.

- The River Tolka has conservation value in terms of having connectivity with coastal designated sites (North Dublin Bay pNHA, South Dublin Bay and River Tolka Estuary SPA). Therefore, the River Tolka is found to be an important ecological corridor and would require the implementation of mitigation measures to avoid run off from construction works.

- Construction works at this location may result in additional traffic flow and congestion on Mobhi Road and surrounds. Any potential impacts on the access road to Scoil Mobhi will require mitigation measures. However, it should be noted that impacts on traffic flow during construction would be much less than for the EPR due to the absence of a TBM launch site. In addition, once the project is complete and in operation the area will have significantly improved public transport.

- Due the relocation of the TBM launch site to Northwood, the duration of construction impacts in this area would be significantly reduced.

4.3.3 Planning Considerations

Option B is proposed on lands with the zoning objective ‘Z15: Community and Institutional Resource Lands (Education, Recreation, Community, Green Infrastructure and Health)’ in the Dublin City Development Plan 2016-2022.

The site would be returned to its existing condition and use through consultation with Home Farm FC officials and a representation of what might be achieved is shown in Figure 7 below.

Figure 7 – Possible Return to Use

4.3.4 Construction Traffic Management

Pedestrian/cyclist safety would be the greatest priority in designing for construction stage traffic management. For that reason, the footpath on the east side of the Mobhi Road would need to be closed between CLG Na Fianna and the Whitehall College gates. A consideration should be given to installing a temporary pedestrian crossing near to the CLG Na Fianna gate to reduce the risk of pedestrians crossing in this location in an uncontrolled manner. At the same time, the existing crossing near the bridge over the Tolka River should remain operational.

The access gate to Scoil Mobhi would have to be closed due to space limitations within the Home Farm FC pitch, although an alternative access through CLG Na Fianna gate or through Whitehall College could be accommodated. Construction Traffic Impacts would be the same as Alternative A.

The traffic volume generated by the site would vary through the construction phases. The heaviest traffic flow is expected to fall during the station excavation phase where the large volume of spoil must be removed to an off-site location.

4.3.5 Site & Compound Layout

The site compound arrangements would be similar to Option A but would be adapted to the constraints of this site.

The proposed access and egress to the site could potentially use the existing Scoil Mobhi access road. An alternative Scoil Mobhi access could be provided in consultation with school authorities and stakeholders. The CLG Na Fianna and Whitehall College access roads would remain fully operational and independent from the site operation.

The final design of the site layout will be influenced by the contractor responsible for the site, but an indicative concept layout is shown on Figure 8 below.

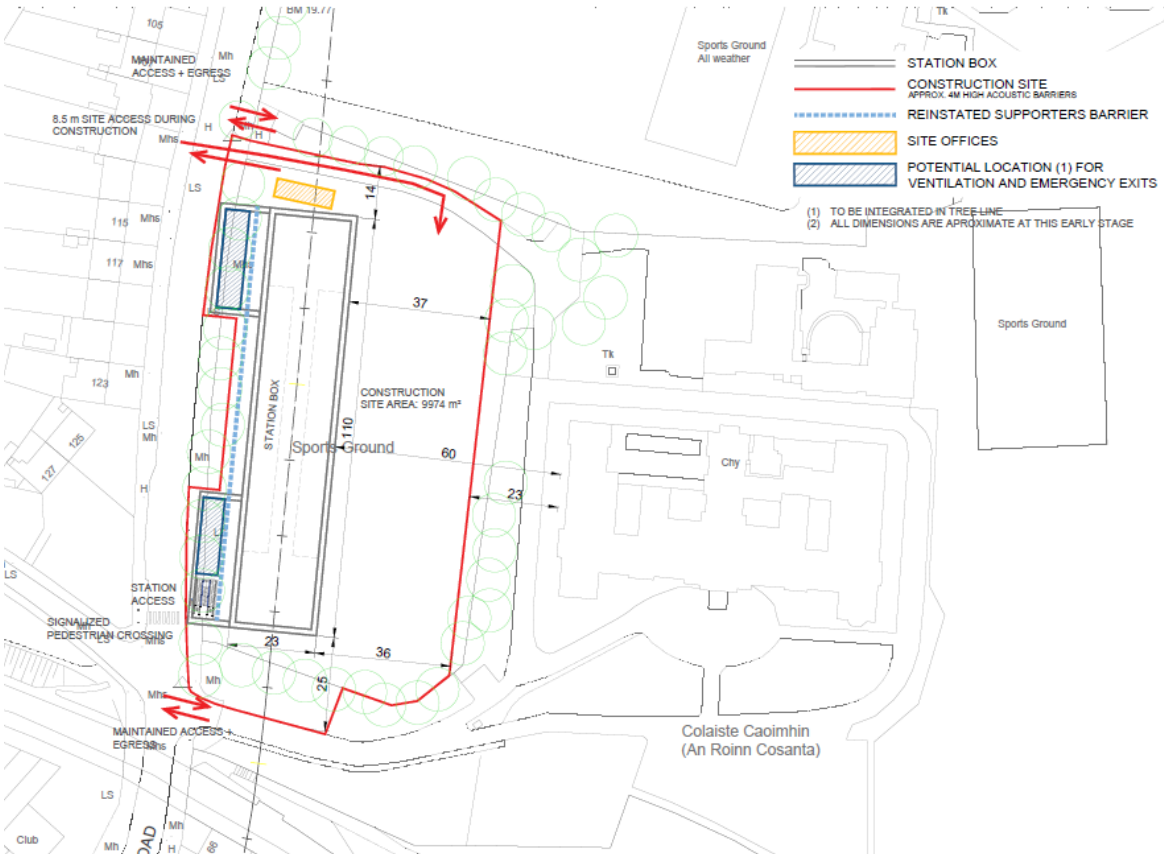

Figure 8: Home Farm FC station concept site layout

Before the installation of the retaining walls can commence, the site will be prepared in a similar manner to Option A. The rising level at the southern end of the site might cause additional problems with the bank stability which might need to be enhanced during piling platform installation.

4.4 Option C – No Station

4.4.1 Description

This option considers the implication of not including a station at Griffith Park, which means that metro trains would run directly between Collins Avenue Station and Glasnevin Station. This would result in a reduction in patronage for MetroLink services, which would negatively affect the project business case.

As for other Options there will be not be a TBM launch site in the locality.

The metro tunnel design must comply with appropriate fire safety standards. The single bore tunnel configuration requires evacuation shafts to allow safe egress from the tunnel in controlled zone lengths. In an emergency situation, surface level is reached by evacuation shafts that are connected to the tunnel including, if necessary, an interconnection between the tunnel and the evacuation shaft. The Safety in Railway Tunnels document, SRT-TSI (EU Legislation), establishes a maximum distance between lateral and/or vertical emergency exits of 1000m. As the distance between the stations on each side of Griffith Park is approximately 2600m, a minimum of two intervention/ventilation shafts would be required between the proposed Collins Avenue Station and Glasnevin Station.

The works required to construct the intervention shafts would be less than the construction of a station box but would still require a significant engineering effort involving mobilisation of a substantial quantity of machinery, materials and other auxiliary equipment. However, the requirement to install ventilation equipment in the shaft would increase its complexity and could pose planning permission issues should the fans require to be housed in an over-ground structure.

The size of the shaft, depending on its purpose, could be between 10m diameter for the emergency access to around 15m diameter for the access and ventilation shaft. Rectangular or oval shaped shafts have been constructed throughout the world, although it is widely agreed that the circular shafts present the best value for money, where there are no significant space constraints. The shafts are usually designed as a one of the following options:

- Diaphragm /piled wall;
- Underpinning (precast segments);
- Caisson sinking; and
- SCL, or a mix of any of the above.

An example of a circular shaft using secant piling is shown in Figure 9 below.

Figure 9: Shaft constructed by secant piling method

Another issue requiring consideration during the site selection would be the area to be made available for the emergency services access and parking.

4.4.2 Potential Environmental Considerations

An environmental assessment has been undertaken on Option C to identify any potential significant environmental constraints and opportunities. These findings were considered when identifying the preferred option. The following are the principal environmental considerations identified:

- Option C would result in no station construction or operational phase environmental impacts.
- However, the implication of not having a station at Griffith Park would result in negative socio-economic impacts in the absence of sustainable transport services in the area. The provision of a station here would enhance socio-economic activity in the area and allow for improved public transport (to Dublin airport and the city centre). The absence of a station in at Griffith Park would result in a gap of over 2.5km between station on the MetroLink route leading to a reduction in the walkable catchment of the project.
- In the absence of a station at Griffith Park, there would be a Health & Safety requirement to provide two intervention/evacuation shafts between Collins Avenue and Glasnevin Stations. The development of intervention shafts would require land take and excavation works at two locations in the area.

4.4.3 Construction Traffic management

The traffic volume generated by the shaft sites would vary over the construction programme. The heaviest traffic is expected during the excavation phase where large volumes of spoil must be removed to an off-site location. The following are the main sources of the construction traffic identified:

- Muck-away during the excavation
- Delivery of materials
- Waste removal

5. Recommendations

Having assessed the Public Consultation submissions and completed a multi-discipline analysis, it was accepted that the EPR option for a Station and TBM Launch site would not progress and that **Option B** - Station Only at Home Farm FC Grounds is the most favourable and preferred option at this location.

The preferred option was chosen having regard to the potential positive and negative impacts that were identified in the multidiscipline assessment of all the options. The change to a single bore tunnel configuration using only one TBM relaunched at Northwood instead of four TBMs for the twin bore tunnel option has removed the need for a TBM launch site at the Griffith Park location. As a result, the EPR station design for Griffith Park is no longer the appropriate solution.

Our analysis demonstrates that **Alternative B-Station Only at Home Farm FC Grounds** is the most favourable option for further development because it balances the temporary surface impacts with the necessity to place a station or at least an access shaft in this locality and the community facilities can be reinstated following completion of the construction works. Therefore, this is the option that is recommended for inclusion in the Preferred Route developed by Jacobs/Idom.

The other options considered can be summarised as:

- **Option A- Station only on CLG Na Fianna Grounds** is discarded due to the major construction impact and disruption it would cause to the use of the more heavily used CLG Na Fianna Grounds and to the community it serves.

- **Option C - No Station** is discarded due to the excessive separation between metro stations that would lead to a poor level of service in the Griffith Park area. An additional factor is that construction and permanent land take would still be needed for the required intervention / ventilation shafts and their associated access, utility services provision and parking for emergency services to meet tunnel fire safety requirements.

Potential impacts arising from the preferred option will be minimised during the development of the preliminary design and on the basis of the detailed environmental assessment presented in the Environmental Impact Assessment Report.

Appendix K. Glasnevin Station

Contents

Executive Summary

During the public consultation programme led by the NTA/TII between 22nd March and 11th May 2018, many submissions were received regarding Glasnevin Station. The concerns in the submissions related to:

- Proposals to acquire private property;
- Anticipated construction impacts on the surrounding environment relating to vibrations, ground movement, noise and dust;
- Potential relocation to the previous Metro North location proposed in Drumcondra; and
- Potential traffic disruptions generated during construction activities.

This report presents the changes to the planning of the proposed Glasnevin Station to take account of the concerns raised.

The location of Glasnevin Station for the EPR and Preferred Route was selected because of the better interchange capability with the Maynooth and Kildare Irish Rail lines that serve Connolly Station and the Docklands Station. The proposed interchange station is located to the west of Prospect Road (R135) on the northern side of the Royal Canal with the MetroLink rail level situated below the existing railway lines.

Jacobs and Idom JV (Jacobs/Idom) were commissioned by the NTA/TII to provide ongoing engineering design services to develop the scheme. Jacobs/Idom undertook a review of the Emerging Preferred Route (EPR) that was developed through the Route Alignment Study with the associated Tunnel Configuration Study and several design changes were recommended. These recommendations were accepted by the NTA/TII and were incorporated into the preliminary design process. A significant change was to adopt a single-bore tunnel instead of twin-bore tunnels and this has had a major impact on the EPR station design at Glasnevin. The two Metro railway tracks occupy the single bore and side platforms are required rather than the previous island platform and internal arrangements for horizontal and vertical circulation inside the station box are revised to suit.

The Preferred Route design is considered an improvement when compared to the EPR because it improves accessibility for passengers changing between Metro and Irish Rail lines as well as bus and taxi services at street level.

The Preferred Route and station design include vertical alignment changes on the Maynooth and Kildare lines to the west to accommodate new side platforms for this new Irish Rail station. Major civil engineering works will be necessary to re-align and re-construct the high retaining walls and cut and cover tunnel to the west of Cross Guns Bridge and these works are proposed to be included in the Railway Order for MetroLink.

The proposed high-floor trains and the 90 second peak headway made possible by automated trains mean that shorter trains can be used. For Glasnevin Station the reduced platform length needed results in a shorter underground station box and this means that the Dalcassian Court residences to the north of the station do not need to be demolished. It is still not feasible to build the station without demolition of the Brian Boru public house.

1. Introduction

1.1 MetroLink Route Development

Metro North was the project name of the original proposal for a metro railway system connecting Swords and Dublin Airport with Dublin City Centre at St Stephen's Green. This scheme was developed by the Railway Procurement Agency through the Railway Order process to successful planning approval by An Bord Pleanála (ABP) in 2010. The global economic downturn intervened, and in 2011 the Government postponed the Metro North project.

Figure 1 – MetroLink Route Map with Glasnevin Station highlighted

The National Transport Authority's (NTA) Transport Strategy for the Greater Dublin Area, 2016-2035 identified a Metro service as the preferred public transport mode to address the transport needs of the Swords-Airport-City Centre corridor. It also envisaged the upgrading of the existing Luas Green Line between Ranelagh and Sandyford to a Metro level of service.

Project Ireland 2040 included the National Development Plan (2018-2027), which combined those two projects to form MetroLink. MetroLink will provide a fast, high capacity, high frequency, modern and efficient public transport service for people travelling along the Swords/Airport to City Centre corridor. In addition, the Scheme will ultimately connect to the existing Luas Green Line in the South City area, enabling through running metro services from Swords to Sandyford as shown in Figure 1.

The metro route length is approximately 19km and the completed system will have 15 new stations, 3,000 Park and Ride spaces, and a journey time of approximately 25 minutes from the City Centre to Swords.

The NTA/TII commissioned Arup Consulting Engineers to undertake a Route Alignment Options Study for the Scheme in 2016. The objective of the study was to identify an Emerging Preferred Route (EPR) including a Concept Design. The study was completed at the end of February 2018.

Separately, in January 2018, the NTA/TII commissioned Jacobs and Idom JV (Jacobs/Idom) to provide ongoing engineering design services through to scheme completion.

1.2 Public Consultation

A programme of public consultation led by the NTA/TII was conducted between 22nd March and 11th May 2018, during which members of the public and other stakeholders were invited to submit their views and observations of the EPR.

The main concerns expressed in the consultation submissions in relation to the Glasnevin Station location were:

- Property acquisition at Dalcassian Court, Brian Boru pub and the office buildings and Des Kelly Carpets retail shop;
- Preference for the location proposed in Drumcondra as part of the old Metro North route;
- Construction impacts on the surrounding areas in terms of ground movement and vibration with respect to houses which were originally constructed without foundations;
- Suggestion to move the station west into CIE owned lands;
- Health and safety concerns for surrounding areas related to noise and dust generated during construction; and
- Disruption to residents due to traffic congestion generated during construction activities.

Alternative station location options were suggested during the consultation phase with the main points summarised below:

a. Re-locate the EPR station from Glasnevin to the original location at Drumcondra as per the previous Dublin Metro North scheme;

b. Move the station box under the road to avoid property acquisitions; and

c. Move the station box west to CIE lands to avoid property acquisitions.

The NTA/TII and its advisors have carefully considered the many statements and submissions made from the interested and affected parties along with other proposed route improvements. A multi-disciplinary analysis of these submissions has resulted in several proposed changes to the MetroLink scheme.

This report presents the changes to the planning of the proposed Glasnevin Station.

2. Emerging Preferred Route Design

2.1 Glasnevin Station for MetroLink

Glasnevin Station is one of the fifteen new stations on the MetroLink route. The station location is shown in Figure 2 below with the MetroLink route passing through Phibsborough rather than Drumcondra as proposed in the previous Metro North scheme. This location was selected because of the better interchange capability with the Maynooth and Kildare Irish Rail lines that serve Connolly Station and Docklands Station.

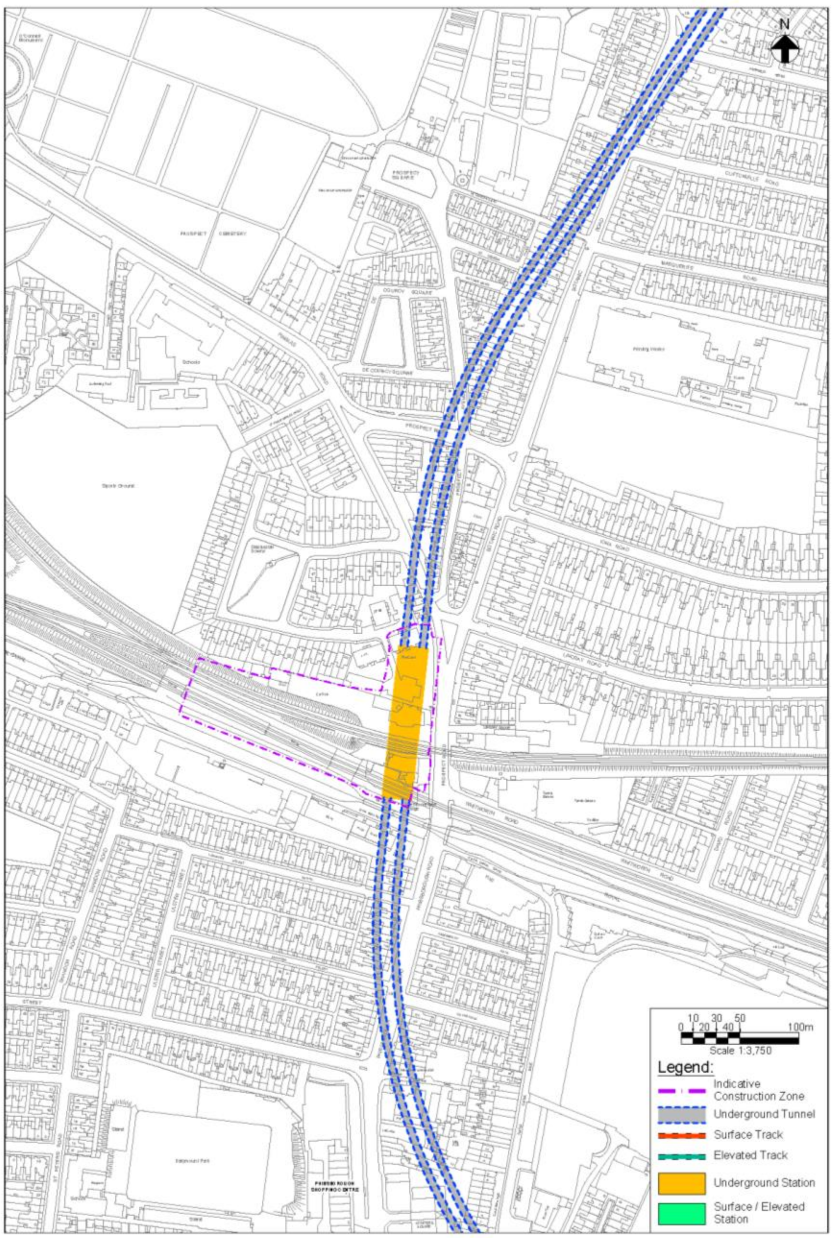

Figure 2 – Glasnevin Station EPR alignment and Interchange with Irish Rail

The proposed interchange station is located to the west of Prospect Road (R135) on the northern side of the Royal Canal and is situated below the existing Irish Rail Maynooth and Kildare railway lines. The new metro interchange station is designed to have connectivity with the existing railway lines and this is shown in Figure 3 below.

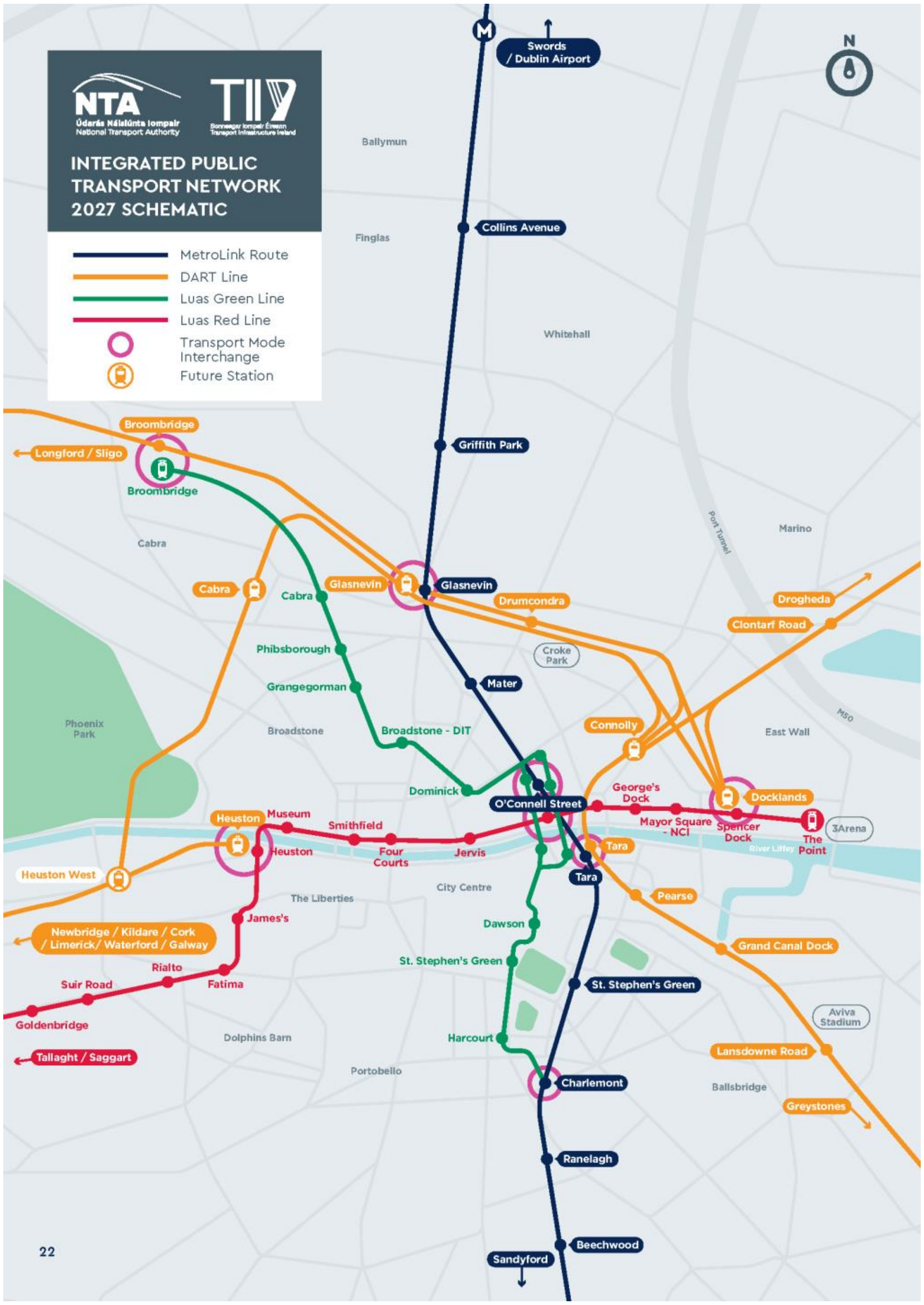

Figure 3 – Integrated Public Transport Network 2027

2.2 Station Location

The Emerging Preferred Route (EPR) positioned the proposed Glasnevin Interchange Station in a low density residential urban environment on the west side of Cross Guns Bridge on Prospect Road and north of the Royal Canal. The 18m deep station box was proposed to be constructed under both the Kildare and Maynooth railway lines.

The EPR station design was based on a twin-bore tunnel arrangement with central island platform. Each of the Irish Rail lines were designed to have new side platforms extending west of Prospect Road at their existing level of approximately six metres below the road. The MetroLink and the Irish Rail lines were to be accessed from road level. The EPR design required passengers from Metro services to ascend to street level before descending once again to access the Irish Rail platforms.

As well as Metro and Rail connectivity, intermodal connections were planned with the current Number 9 Dublin Bus (Charlestown - Limekiln Ave), a bike station / bicycle path, and the provision of a taxi parking area.

The construction of the station interchange for EPR would have required land to be acquired as shown in yellow on This would have needed the acquisition and demolition of the 3-storey residential block known as Dalcassian Downs together with the Brian Boru public house.

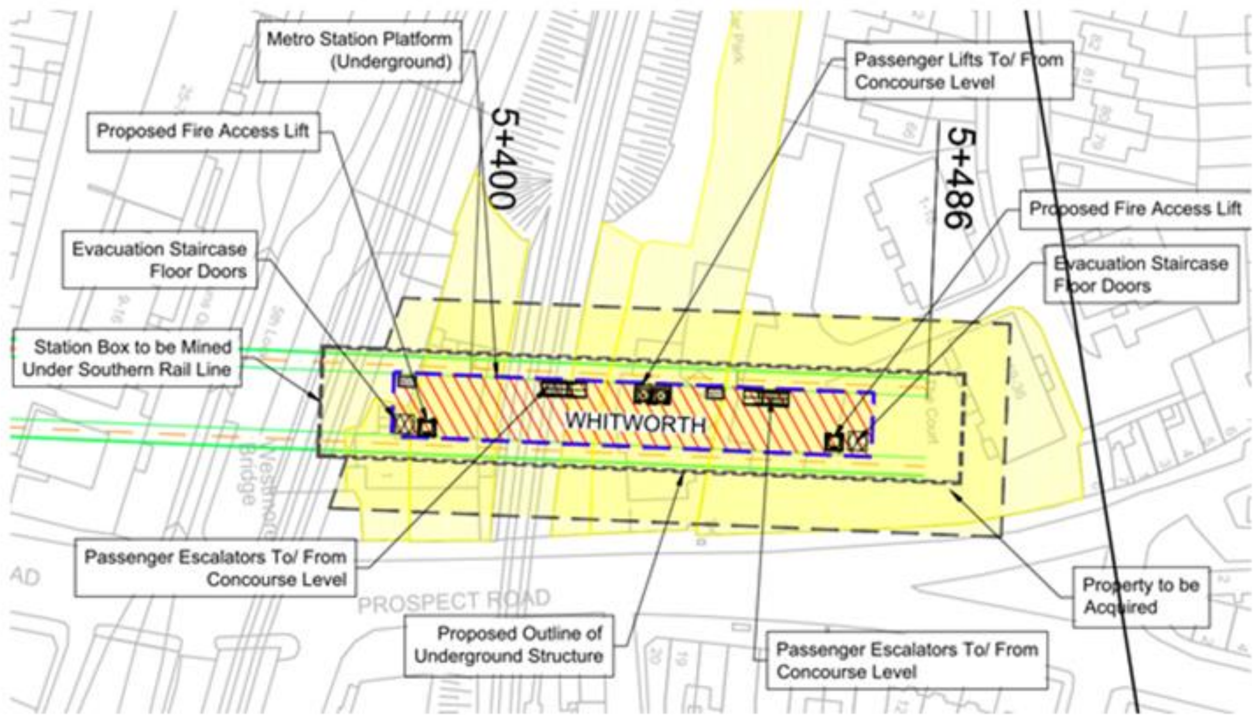

Figure 4 – Land to be Acquired for Glasnevin Interchange Station (formerly Whitworth)

Other impacted properties would have included a retail unit, a warehouse, a private garden and the car park area for the Dalcassian Downs.

2.3 Concept Design

The EPR Concept Design is indicated on Figure 5 and Figure 6 below.

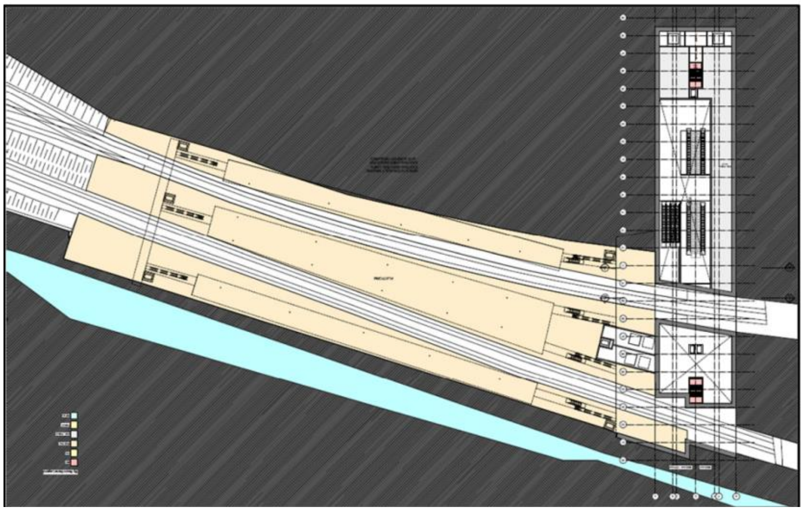

Figure 5 – EPR Concept Design Plan

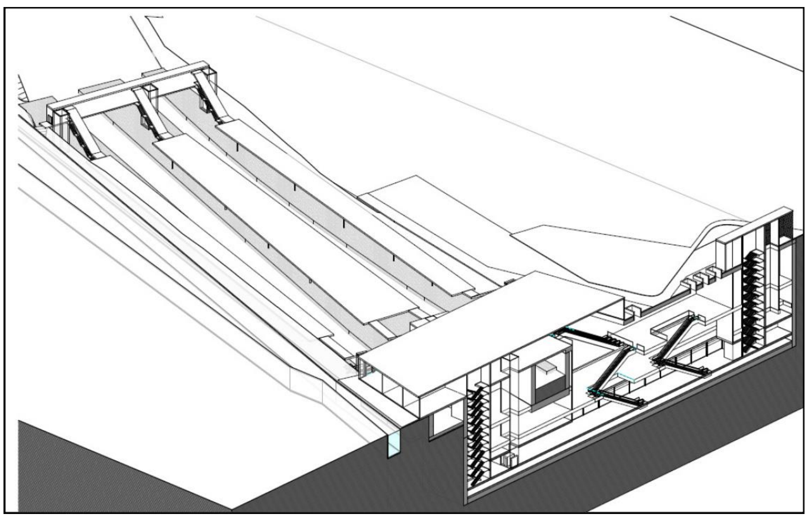

Figure 6 – EPR 3-D Model

2.4 Train Operations and Passenger Capacity

DART Network service capacities and patterns on the two Irish Rail lines are yet to be finalised but indicative transport modelling outputs suggest the following target operational capacities at Glasnevin.

MetroLink: 90 second frequencies in peak (20,000 passenger per hour); 3 min frequencies in off-peak (10,000 passenger per hour).

Irish Rail: Maynooth – Connolly/Docklands:15 trains per hour per direction (tphpd); Phoenix Park Tunnel – Connolly / Docklands: 10 tphpd

The boarding figures at Glasnevin MetroLink Station as developed from the current transport modelling are indicated in Figure 7 below

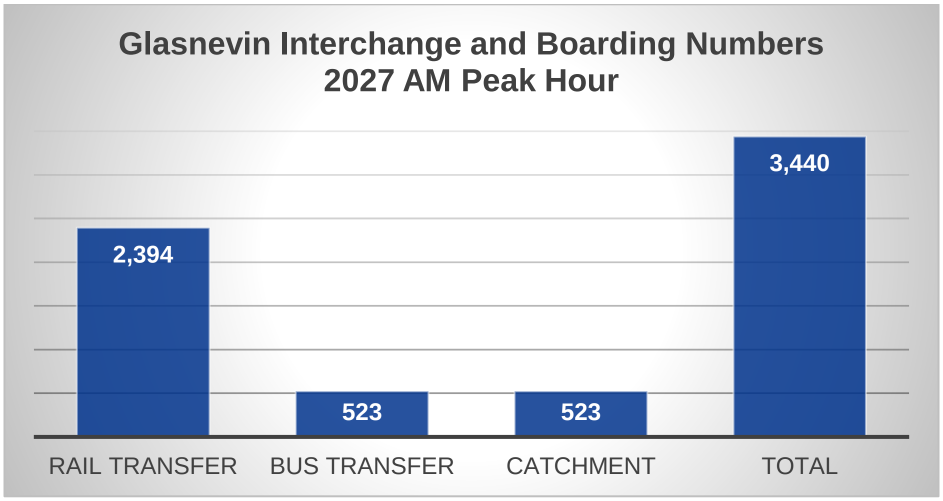

Figure 7 – Glasnevin Interchange and Boarding Numbers 2027 AM Peak Hour ***(Source: Alignment Options Study for New Metro North, Arup)***

3. Preferred Route Design

3.1 The Preferred Route Alignment

The review of the Route Alignment Study and the Tunnel Configuration Study led to significant changes being proposed that were subsequently accepted by the NTA/TII for adoption into the preliminary design. These changes included:

- The route alignment would run above ground from the relocated Northwood Station, pass over the M50 motorway before returning to tunnel under Dublin Airport. This effectively split the tunneling works into two separate sections.
- A change from twin bore tunnels to a single bore tunnel carrying trains running in both directions,
- Confirmation that the trains would be of high-floor design and be fully automated, operating at a 90 second interval/headway (time between trains).

There were several implications arising from the changes noted above but two of them affect the design of Glasnevin Station in particular, namely:

a) **Single-bore instead of Twin-bore Tunnels**: This change has a major impact on the station design. The two railway tracks occupy the single bore and flank platforms are required rather than the previous island platform and the internal arrangements for horizontal and vertical circulation inside the station box are revised to suit

b) **Reduction in length of underground stations.** High floor trains have more capacity than low floor trains and this combined with the 90 second peak headway made possible by the planned use of (GoA4) driverless train technology, enables the scheme to satisfy the target demand of 20,000 passengers per hour per direction (pphpd) with shorter trains. This means that instead of the 90m long low-floor trains required for the previously developed EPR, the high-floor trains are proposed to be shorter at 65m. This reduction in train length gives more flexibility on the size and placement of the station box so that the surface impact can be minimised.

It was not proposed to alter the centre line of the EPR alignment in the Glasnevin area.

3.2 MetroLink Interchange Station

3.2.1 Plan Layout and Sections

The Preferred Route follows the centre-line of the EPR but it has a single bore tunnel instead of the previous twin bore tunnel arrangement. The underground station box remains in the same location under the Irish Rail lines, and to the north of the Royal Canal and to the west of Cross Guns Bridge (R135).

The outline of the underground station box is shown indicatively as the white dotted line in Figure 8 below, from which the key features of the Irish Rail lines, the Royal Canal and Prospect Road can be seen. Please note that GSWR, refers to the Kildare Line and the MGWR refers to the Maynooth Line.

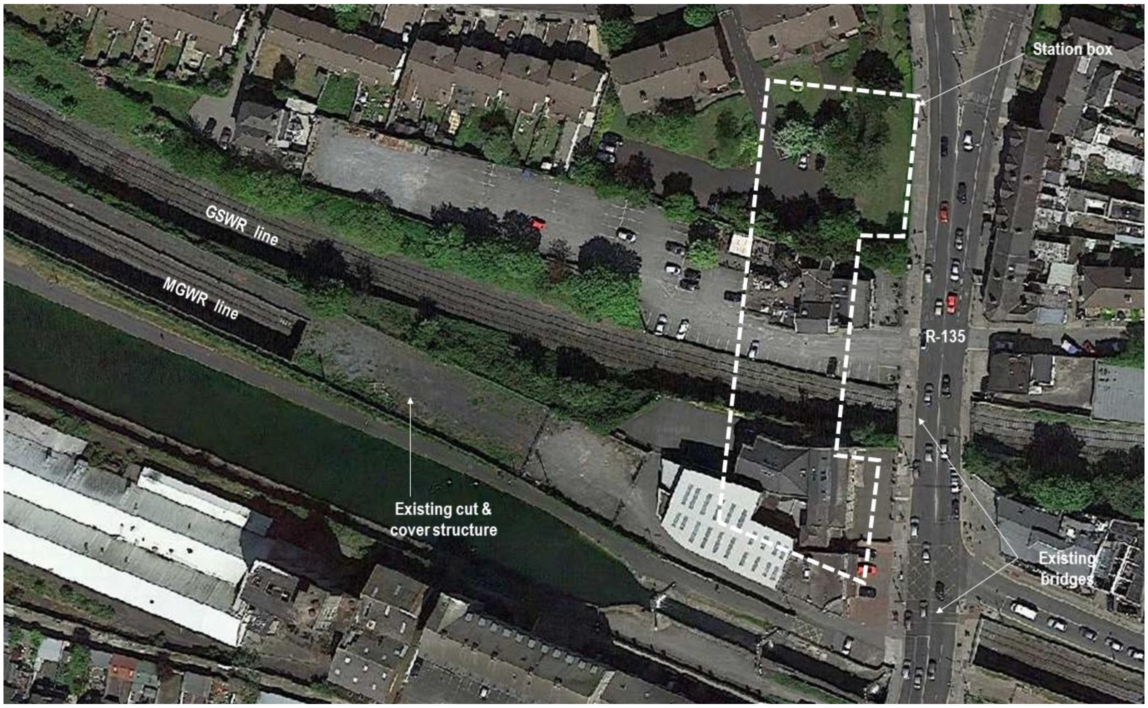

Figure 8 – Preferred Route Underground Station Box location

A more detailed plan of the indicative Station Layout is shown in Figure 9 below for the Preferred Route. This is based on the single bore tunnel arrangement and takes advantage of the reduced length of platforms. This layout is subject to further refinement during preliminary design process.

This reduction in length has the benefit of removing the need to demolish the three-storey Dalcassian Downs residential building, as was required for the EPR. It should be noted that the gardens / landscaped area to the south of the building will still need to be acquired for the station construction.

Furthermore, the preferred route design does not need an excavation under the Maynooth Line for the construction of the underground station box but a pedestrian underpass under the line will be required to access the southern railway platform.

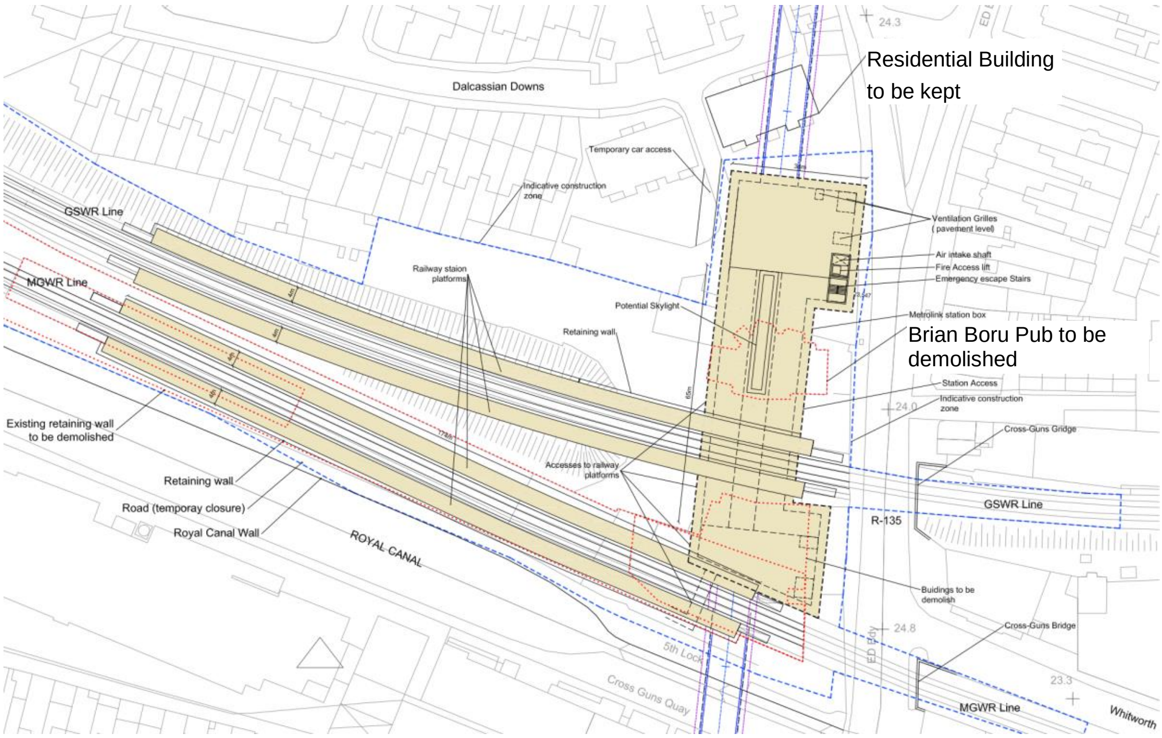

Figure 9 – Plan of Preferred Route Glasnevin Interchange Station

In addition, and because most of the proposed works are west of the Cross-Guns Bridge, it is anticipated that there will be a reduced level of traffic disruption on Prospect Road when compared to the EPR.

A cross section through the proposed Glasnevin Station box from west to east is shown on Figure 10 below.

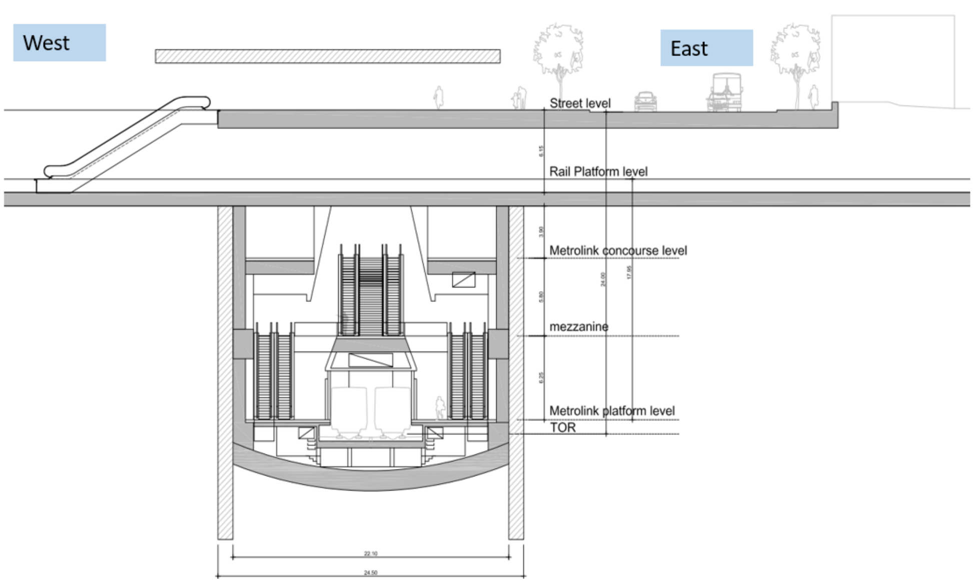

Figure 10 – Station Box Indicative Cross Section

The cross section shows the vertical circulation by stairs, escalator and lift from the MetroLink platforms to the MetroLink concourse via a mezzanine level, to the Irish Rail platforms, and from there to street level on Prospect Road.

3.2.2 Circulation Routes

The proposed circulation routes for are indicated on the 3-D images on Figure 11 below.

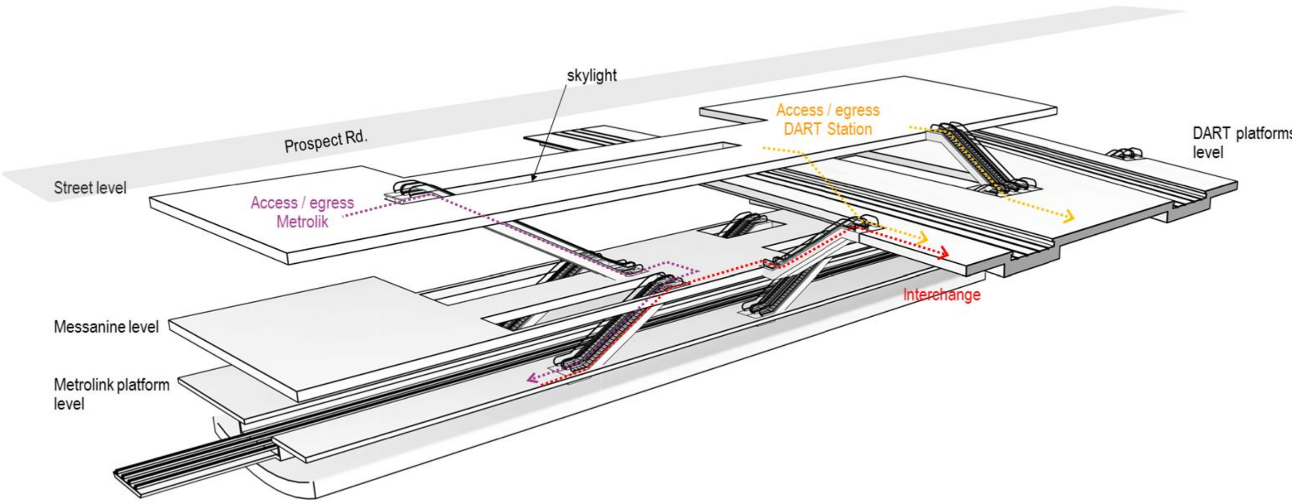

Figure 11 – Circulation Facilities in 3-D Image.

The aim of the station design is to achieve easily understood wayfinding and interchange flows assisted by locating the platforms to the west of the station box. The proposed Interchange functionality is an improvement when compared to the EPR design by removing the need for passengers interchanging from MetroLink to Irish Rail having to ascend to street level before descending once again to the Irish Rail platforms. This facility is demonstrated in the cross section shown in Figure 12 below.

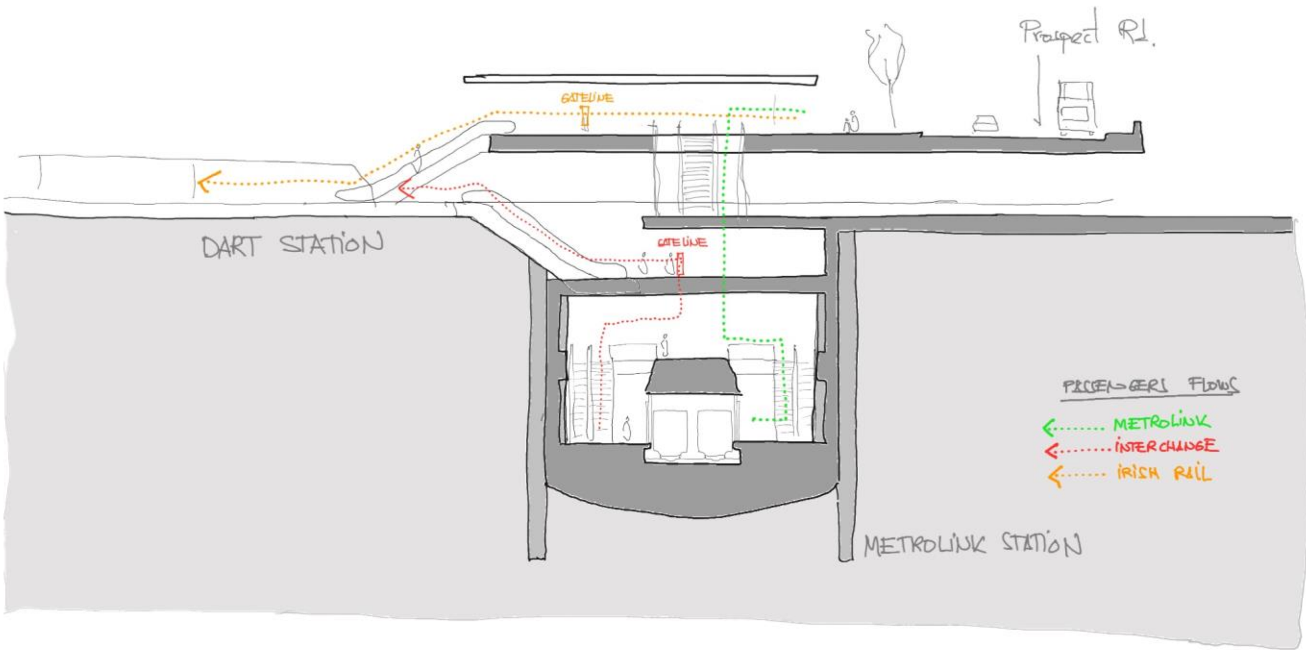

Figure 12 – Vertical Circulation Routes in Cross Section

Further clarity on passenger flows is provided on Figure 13 below from which we see that MetroLink passengers can leave platform level by first using escalators (or stairs or lift) up to the Mezzanine Level, then by another set of escalators to the Intermodal Concourse where a choice can be made to access the Irish Rail system via a gate line, or to continue up to street level.

For passengers entering the system from street level they can either pass through a gate line to the DART system or go directly to MetroLink using a Leapcard or similar system. Similarly, passengers from the Irish Rail lines can access MetroLink using the Leapcard system. This arrangement is shown on Figure 13 and Figure 14 below.

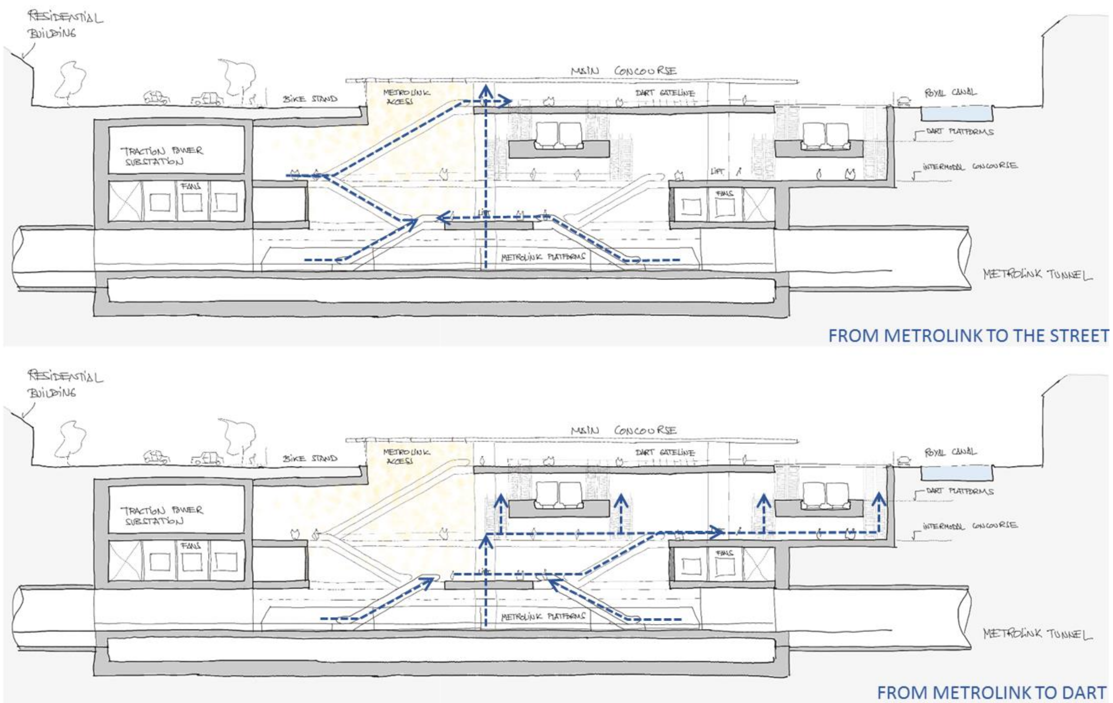

Figure 13 – Circulation Routes in Longitudinal Sections (MetroLink to Irish Rail & Street)

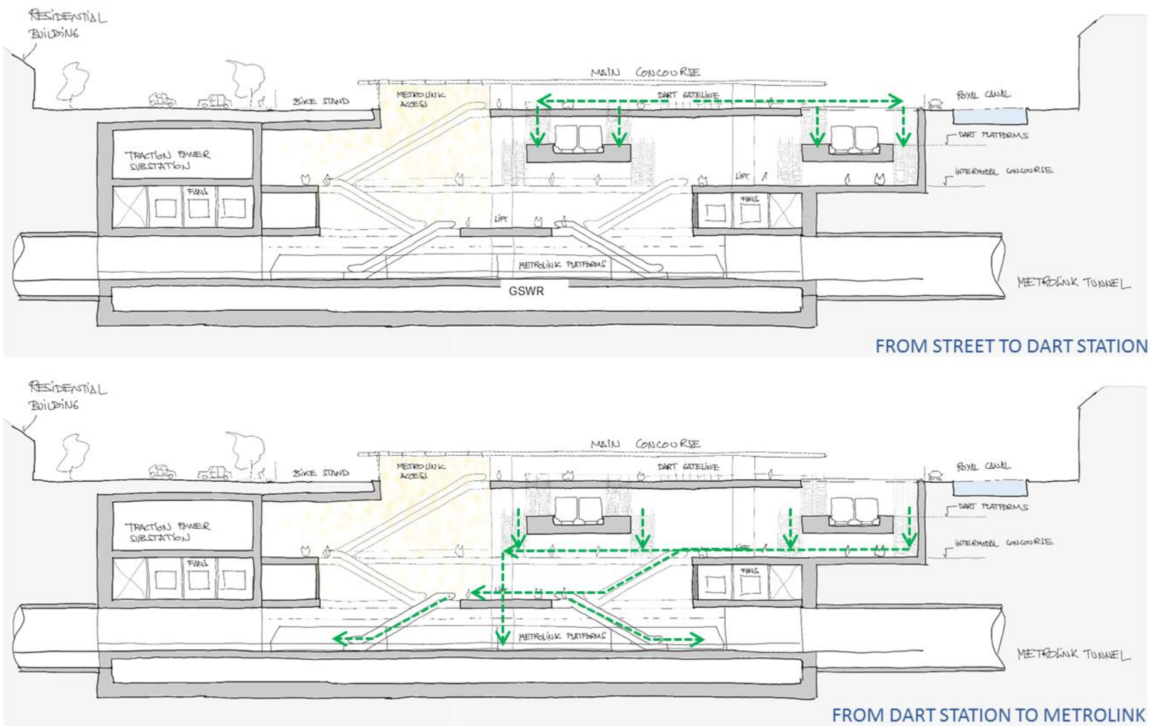

Figure 14 – Circulation Routes in Longitudinal Section (Street to Irish Rail to MetroLink)

3.3 Irish Rail Interface

To deliver an integrated intermodal Station at Glasnevin that is compatible with the proposed MetroLink station arrangement, extensive works on the existing Irish Rail lines are required. It is anticipated that the design of these works will be included as part of the MetroLink Railway Order.

The works along the Irish Rail lines will be designed to take account of Irish Rail requirements. Currently, Irish Rail is preparing plans under the DART Enhancement Project that might include the re-modelling of Glasnevin Junction. The scope of the works partly depends on how Connolly Station is to operate in the future and the pattern of trains using the Maynooth and Kildare lines. Discussions are progressing with Irish Rail to finalise the design.

3.3.1 Irish Rail Platforms on Maynooth and Kildare lines

The preliminary design for Glasnevin Interchange Station has all four Irish Rail platforms on the Maynooth and Kildare lines to the west of Cross Guns Bridge on Prospect Road (R135) as shown on Figure 15 below, which generally follows the EPR indicative platform location. The underground station box remains on the west side of the bridge and the required vertical realignment of both Irish Rail lines provide an approximate 1:120 gradient along the platforms.

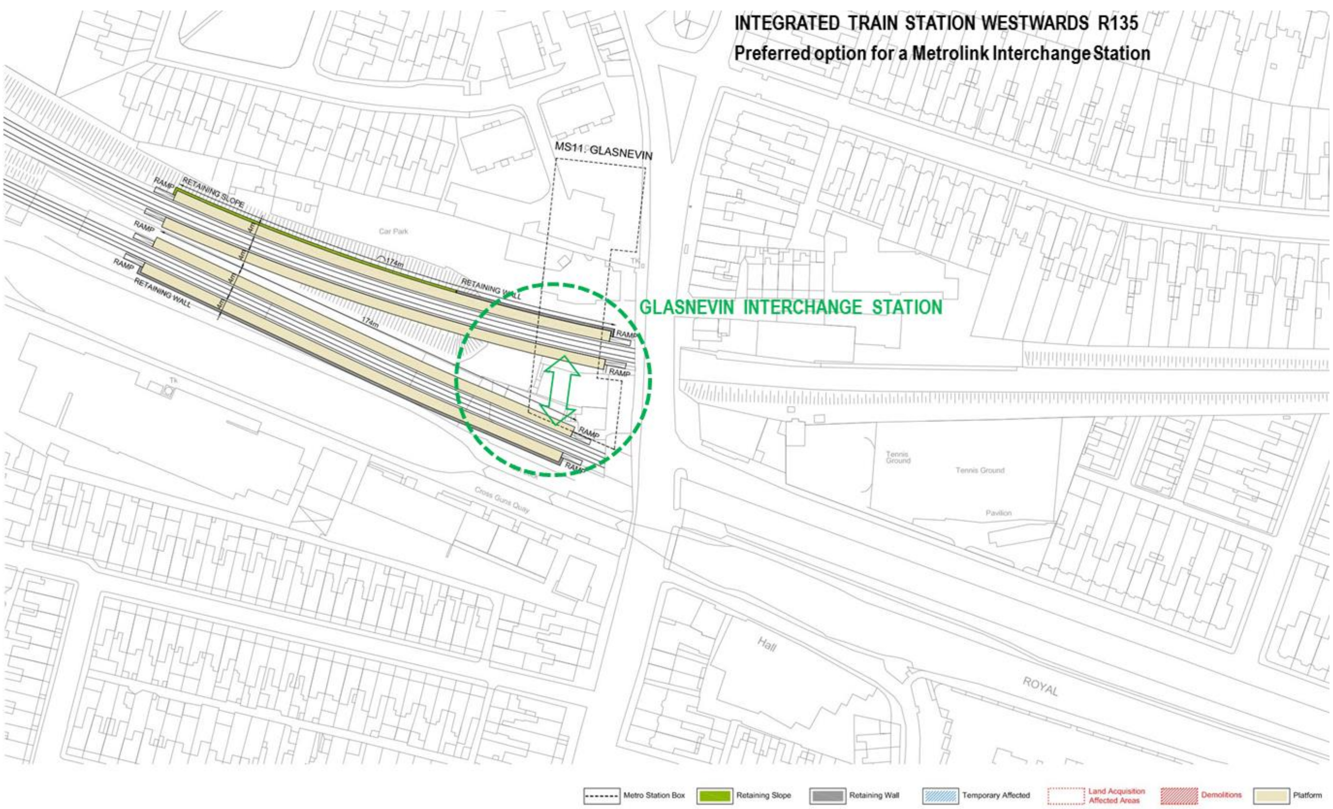

Figure 15 – Sketch of proposed Irish Rail Platforms

A schematic cross section for the proposed platforms is shown below on Figure 16 below. This indicates a minimum platform width of four metres. An island platform is proposed to enable interchange between the Maynooth and the Kildare lines.

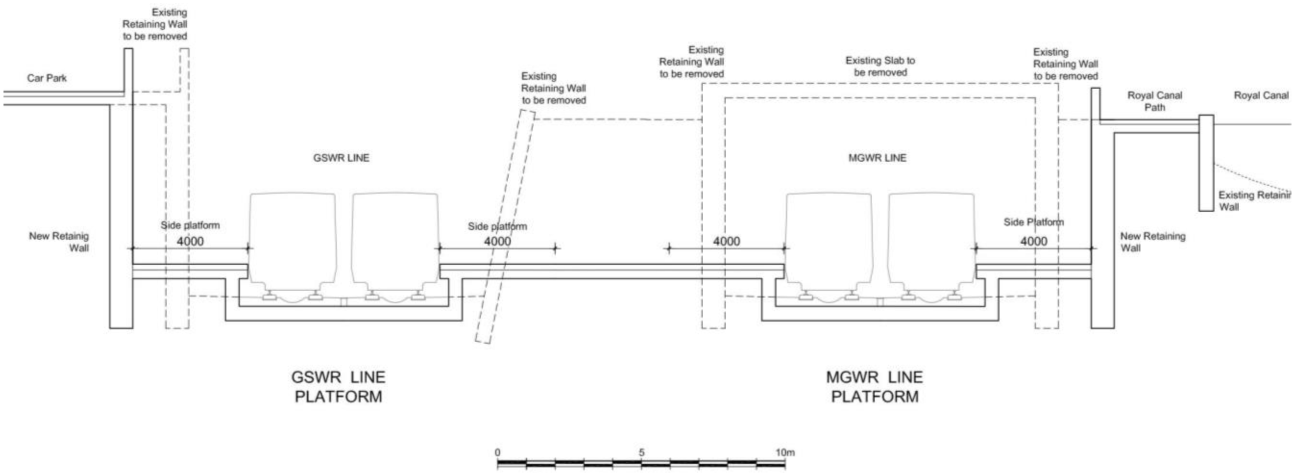

Figure 16 – Cross Section through Irish Rail Lines and Royal Canal (looking east)

From the cross section indicated on Figure 16, it can see that substantial civil engineering works are required to provide the space needed to the side platforms and the island platform.

3.4 Urban Integration

The interchange station will be an important part of the Urban scene and the concept plan shown in Figure 17 below gives an idea of what is possible. Some of the concept ideas include:

- Intermodal Concourse at street level, designed as an open space under a light canopy.
- Reconstruct at grade car park (Dalcassian Downs) on the station box roof slab.
- Drop-off lane in front of the station main entrance for taxis and drop-off cars.
- Widened footpath in front of the station for a segregated cycle path on the west side of R135
- Potential for a car park / large bike park area located on the existing Brian Boru’s car park.
- Landscaping with green-integration on slopes and central platform.
- Station ventilations grilles integrated into green areas.

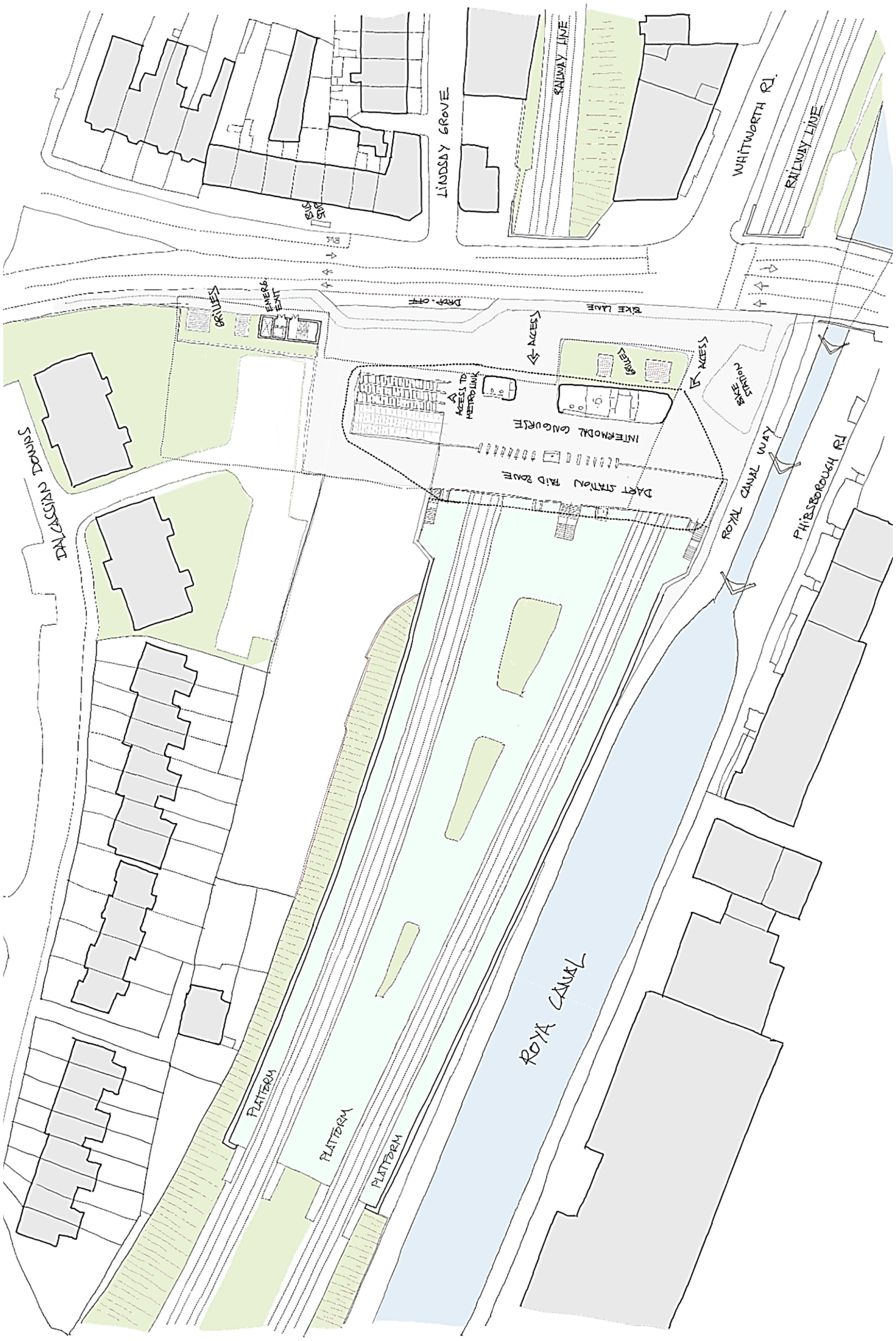

Figure 17 - Urban Integration of Interchange Station

3.5 Environmental Considerations for Glasnevin Interchange Station

An environmental assessment has been undertaken on the proposed station location for the Glasnevin Interchange Station to identify any potential significant environmental constraints to the development. The principal environmental constraints and opportunities have been identified and these have been considered below:

- The station location is similar to that for the EPR but the design has the advantage of being smaller in size. The reduction in footprint area means that 'The Court, Dalcassian Downs' can be retained and will not need to be demolished although the garden in front of the property will be absorbed into the station footprint.

- Potential impacts on property along the Royal Canal including access and egress during construction phase.

- The Maynooth and Kildare Lines require re-grading to the west of the proposed station location to provide a suitable platform gradient.

- The proposed regrading works require the construction of new retaining walls in close proximity to the Royal Canal with potential for impacts on the Royal Canal's water quality and biodiversity if appropriate mitigation is not implemented. It should be noted that the canal is a proposed Natural Heritage Area (Site Code: 002103).

- The amenity value of the Royal Canal could be impacted during the construction phase. The Royal Canal Greenway runs along the north bank of the canal and will be potentially impacted by construction of the station box and horizontal realignment works to the Maynooth and Kildare Lines.

- The proposed bridge replacement and station construction works will have a potential impact on traffic flows on Prospect Road (R135) during the construction phase.

- The location of an interchange station at this location offers significant socio-economic benefits to the area by providing enhanced public transport provision and interchange opportunities with the Irish Rail Maynooth and Kildare lines.

3.6 Planning Considerations

3.6.1 Development Plan Context

All station location options at Glasnevin are within the functional area of Dublin City Council. It largely comprises the zoning objective of Z3 (Neighbourhood Centres) – 'to provide for and improve neighbourhood facilities', while a small part of the land take is zoned Z1 (Sustainable Residential Neighbourhoods) – 'to protect, provide and improve residential amenities', in the Dublin City Development Plan 2016-2022.

The Z3 zoning where the majority of the site is located has the key development principle to form a focal point for the neighbourhood and provide a range of services to the local community.

A Metro station is not identified as 'Permissible Uses' nor as 'Open for Consideration Uses' under this zoning objective. Its use will need to be assessed in terms of role in helping to achieve the zoning objectives and their compliance with the policies and objectives of the Dublin City Development Plan. It is considered that a Metro Station will help to deliver on the objectives of the zoning in supporting amenities in the neighbourhood for its catchment community.

Lands to the west of the proposed station along the banks of the Royal Canal and adjacent to the existing rail line are zoned Z9 – 'To preserve, provide and improve recreational amenity and open space and green networks.

The Royal Canal lies within a Conservation Area in the Development Plan.

The lands adjacent to the Royal Canal, largely comprising the northern towpath form a part of the Galway to Dublin route of the National Cycle Network, which is part of EuroVelo Route 2. Within the Dublin Region, this route is also identified as route N2 Royal Canal Greenway in the Greater Dublin Cycle Network Plan. It is also a Blue / Green Corridor in the city's Strategic Infrastructure and part of the network of Green Routes in the Dublin City Development Plan 2016-2022.

3.6.2 Planning Commentary

No planning permissions are extant for the area proposed for the Glasnevin Station. There have been a number of historical permissions in the wider area of proposed station.

Key planning features for the Station are:

- The station location will enable a high-quality interchange between the existing train services and MetroLink. Station design will need to account for increased passenger numbers as this area becomes an important transport hub.

- The station location sits adjacent to Prospect Road (R135), a suburban arterial route. This offers a good opportunity to provide good connectivity to other modes of transportation including car, Dublin Bus, biking and walking.

- The proposed station location is largely zoned to provide for and improve neighbourhood facilities, in the Dublin City Council Development Plan 2016-2022. The proposed station design reduces the extent of land zoned for residential use that is required to deliver the station and facilitates the reinstatement of the open space serving the existing development on site.

- The area is also zoned as a conservation area which recognises the Royal Canal Greenway and its importance as Green Infrastructure. The station design and horizontal track realignments will ensure the Greenway is maintained.

4. Conclusions

The Preferred Route has several improvements to the previous EPR and, although no alteration to the previous centre line of EPR metro alignment is proposed, these changes do have a major effect on the design of Glasnevin Station.

The change from twin bore tunnels to a single-bore tunnel mean that side platforms in the underground station box are required rather than the previous island platform. This means that the internal arrangements for horizontal and vertical circulation inside the station box have been revised to deliver an efficient intermodal change capability with improved wayfinding between transport modes. The design improves the EPR concept for the internal passenger circulations and the connection between MetroLink and Irish Rail. Previously in the EPR, passengers from MetroLink had to ascend to street level before descending again to the Irish Rail platforms.

The potential environmental impacts have been identfied and these will be assessed along with mitigations developed in the Environmental Impact Assessment Report for the project. However, it is recognised that these impacts are signficantly reduced due to the smaller metro station box size, when compared to the EPR, and this means that the residential block at Dalcassian Downs to the north does not need to be demolished. Also, the impact of the works on the Maynooth Line to the south is reduced because there is no need to excavate the station box under the line.

In addition, the proposed layout of the interchange station, with the four Irish Rail platforms and the MetroLink station box all located to the west of Cross Guns Bridge, helps to limit the disruption to traffic in the area.

To deliver an integrated intermodal station at Glasnevin and to be compatible with the proposed MetroLink station arrangement, it is proposed to include the following works on the Irish Rail lines as part of the MetroLink Railway Order:

- Location of platforms for both Irish Rail lines west of R135 in an open cut section.
- Minimum platform width of 4 m curved on the Kildare Line (800m radius) and straight on Maynooth Line.
- Vertical realignment westwards on both lines. The horizontal alignment and any Glasnevin Junction modelling is to be assessed by Irish Rail under the DART Expansion Scheme.

Other features include:

- MetroLink can operate independently to Irish Rail, with different opening and closed hours.
- Irish Rail lines can have direct access both from street level and the MetroLink intermodal concourse with improved interchange flows.

We advise that ongoing consultation with Irish Rail is essential to obtain the following information:

- Confirmation of Irish Rail demand figures;
- Confirmation of the final design of the Glasnevin Junction for both passenger services and freight; and,

- Specific requirements / facilities for the proposed Irish Rail station.

Appendix L. O’Connell Street Station

Contents

Executive Summary

The Emerging Preferred Route (EPR) placed the proposed O’Connell Street Station underground in the median of O’Connell Street Upper, in Dublin City Centre. The challenges presented in the planning of such major works on the main city thoroughfare were well recognised and the Public Consultation submissions made the public concerns apparent.

After the public consultation, TII and Hammerson made contact to discuss the possibility of relocating the station box by agreement under the adjacent Carlton Cinema site and integrating it with Hammerson’s proposed development.

The availability of the historic Carlton Cinema site as a planned development location by Hammerson on the west side of O’Connell Street made the relocation of the station as part of an integrated construction solution attractive for several reasons. These include addressing the concerns raised during the Public Consultation; reducing traffic and business disruption; and improving public safety by taking construction work away from the public road. A further important consideration is maintaining and avoiding disruption to Luas Cross City operations.

As instructed by TII/NTA, the Jacobs/Idom Joint Venture examined and compared the features and constraints of both locations. It was concluded that it was feasible to realign the route at this location to enable the O’Connell Street Station to be integrated with the planned development and that this should be progressed in conjunction with Hammerson. Discussions between TII and the Developers have been positive and development of the station in this location is proposed to be continued.

1. Introduction

1.1 MetroLink Development

Metro North was the project name of the original proposal for a metro railway system connecting Swords and Dublin Airport with Dublin City Centre at St Stephen's Green. This scheme was developed by the Railway Procurement Agency through the Railway Order process to successful planning approval by An Bord Pleanála (ABP) in 2010. The global economic downturn intervened, and in 2011 the Government postponed the Metro North project.

Figure 1 – MetroLink (2018)

The National Transport Authority's (NTA) Transport Strategy for the Greater Dublin Area, 2016-2035 identified a Metro service as the preferred public transport mode to address the transport needs of the Swords-Airport-City Centre corridor. It also envisaged the upgrading of the existing Luas Green Line between Ranelagh and Sandyford to a Metro level of service.

Project Ireland 2040 included the National Development Plan (2018-2027), which combined those two projects to form MetroLink. MetroLink will provide a fast, high capacity, high frequency, modern and efficient public transport service for people travelling along the Swords/Airport to City Centre corridor. In addition, the Scheme will ultimately connect to the existing Luas Green Line in the South City area, enabling through running metro services from Swords to Sandyford as shown in Figure 1.

The metro route length is approximately 19km and the completed system will have 15 new stations, 3,000 Park and Ride spaces, and a journey time of approximately 25 minutes from the City Centre to Swords.

The NTA commissioned Arup Consulting Engineers to undertake a Route Alignment Options Study for the Scheme in 2016. The objective of the study was to carry out a comprehensive route option selection to identify an Emerging Preferred Route (EPR) for the Scheme. The study was completed at the end of February 2018 and it included a Concept Design for the EPR.

Separately, in January 2018, the NTA/TII commissioned Jacobs and Idom JV (Jacobs/Idom) to provide engineering design services through to scheme completion.

1.2 Methodology

A programme of public consultation led by the NTA/TII was conducted between 22nd March and 11th May 2018, during which members of the public and other stakeholders were invited to submit their views and observations of the EPR. Many submissions were made during this process although the number relating to the O'Connell Street Station was relatively low.

The NTA/TII and Jacobs/Idom have carefully considered the many statements and submissions made from the interested and affected parties along with other proposed route improvements. A detailed multi-disciplinary analysis of these submissions has resulted in several proposed changes to the MetroLink scheme as promoted for the EPR.

This report considers the relative merits of the proposed O'Connell Street Station location as presented in the EPR versus the option being currently developed as part of the preliminary design. The outcomes of a multi-disciplinary analysis of the options having regard to the identified constraints is presented having particular regard to the following:

- Potential traffic impacts during construction;
- Potential for increased impacts on the Rotunda Hospital, the Gate Theatre, the Ambassador Theatre and other sensitive buildings due to tunnel alignment changes;
- Potential impacts on architectural heritage; and
- Other environmental and planning constraints.

2. Emerging Preferred Route and O’Connell Street Station

2.1 Location and Constraints for the EPR Concept Design

The EPR in the city centre was developed as a twin-bore tunnel with an alignment approaching O’Connell Street Station northwards from the proposed Tara Street Station. It joins O’Connell Street below street level near its junction with Henry Street and continues north to the Station located in the centre of the road just south of Parnell Street. This alignment is shown in Figure 2 below, which also indicates the presence of the recently commissioned north-bound track of the Luas Cross City Line that runs in the central median of the road.

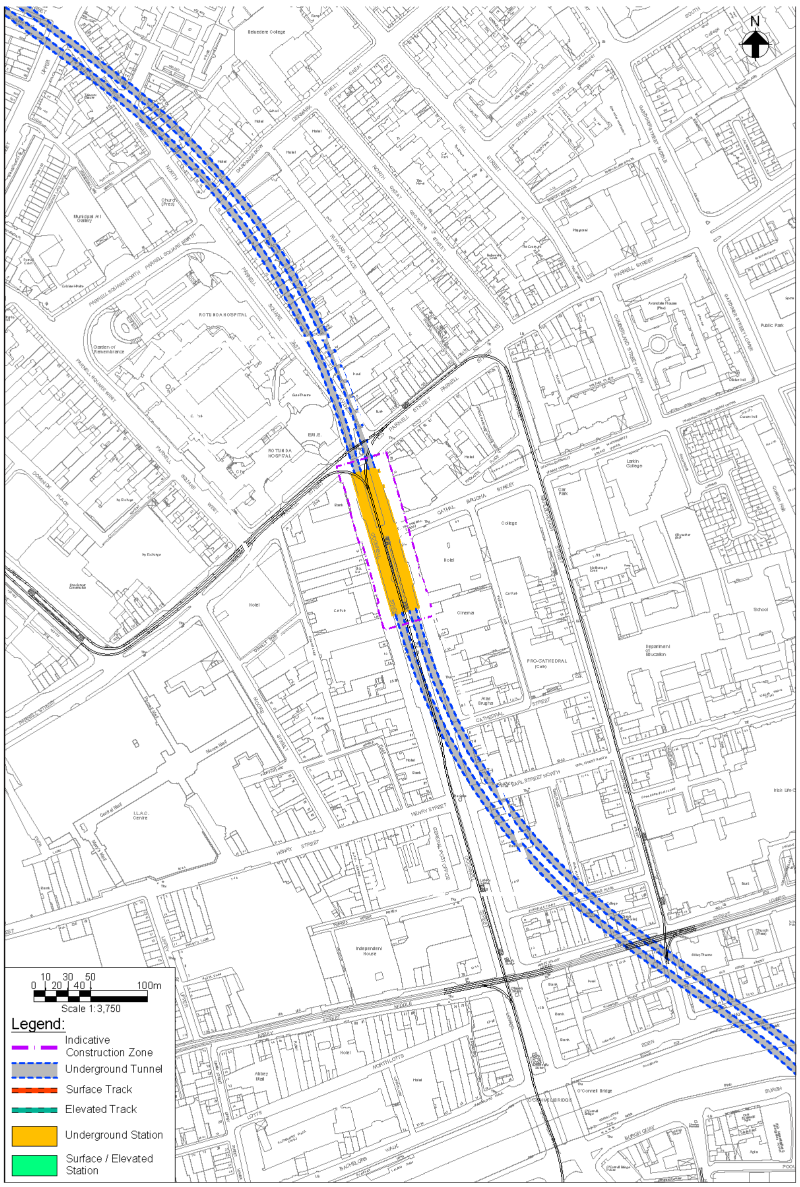

Figure 2 – EPR and O’Connell Street Station

The key benefit of locating the tunnel and station box along a public right of way such as O'Connell Street is that the impact on buildings and land under private ownership is typically reduced compared to an alignment that passes under buildings and other structures.

However, it must be recognised that O'Connell Street is the main thoroughfare in Dublin City Centre and it is the main route connecting the city across the River Liffey. The inevitable traffic congestion during construction of the underground station would potentially bring severe disruption to the heart of the City. Much of this disruption would arise from the enabling works including relocation of utilities and the necessary closure or service reduction of the Luas Cross City Line during these works together with the subsequent station construction.

2.2 Environmental Considerations on EPR

An environmental assessment has been undertaken of the EPR station location on O'Connell St in order to identify any potential significant environmental constraints and opportunities arising from this option. The findings of this assessment were considered when identifying the preferred option. The following are the principal environmental considerations identified:

- Potential for significant disruptions to traffic and public transport including Dublin Bus and LUAS along O'Connell Street during the construction of the station box;

- The proximity of the proposed station location to a number of commercial buildings including several hotels means that construction activity could result in potential construction phase impacts such as restricted access, construction phase dust, noise and vibration generation. In the absence of appropriate mitigation measures this could result in an impact on socio-economic activity in the area during the construction phase;

- The alignment proposed in the EPR also has potential to impact on important architectural heritage in the area due to the location of the development including on the Charles Stewart Parnell Monument which is a National Monument (DU018-425). Furthermore, it should be noted that the EPR proposed station site is located within the O'Connell St Architectural Conservation Area;

- The construction of the station within O'Connell St would result in potential visual impacts during the construction phase due to the significant construction activity required at this location in the absence of appropriate mitigation; and

- The EPR route option alignment has potential to impact on sensitive buildings along Parnell Square East during the advancement of the TBM as a result of groundborne noise and vibration and ground settlement in the absence of appropriate management. The alignment would also pass in close proximity to the Rotunda Hospital, the Gate Theatre and the Ambassador Theatre. This means that there would be a risk of potential groundborne noise and vibration and ground settlement impacts during the construction phase if not effectively mitigated. The proximity to these sensitive locations also raises the potential for electromagnetic interference and ground borne noise and vibration impacts during the operational phase.

2.3 Utility Impacts Associated with the EPR

The position of the station box on O'Connell Street would have had a significant on existing utility services along O'Connell Street. The potential impacts on utilities associated with the EPR are summarised as follows:

- 110 kV ESB cable & number of medium and low voltage cables;
- 400mm water main;
- 180mm medium pressure gas main + number of low pressure gas mains; and
- Number of telecommunication ducts and cables.

The following services are also located in close proximity to the EPR station location and may also have been impacted depending on the detailed design of the station:

- Combined foul sewer 1670mm;
- Combined foul sewer 1020mm;
- 200mm water main; and
- Further telecommunication and electric cables and ducts.

2.4 LUAS and Traffic Impacts Associated with the EPR

The position of the station box on O'Connell Street would have had a significant impact on the operation of the LUAS Green Line as it passes along O'Connell Street. The EPR would have required a major diversion of this key piece of transport infrastructure including the relocation of O'Connell Upper Station.

The construction of the new station on O'Connell Street would have a significant impact on traffic including buses, taxis and cyclists. Significant temporary traffic management would be required to mitigate this impact including medium to long term diversions.

2.5 Public Consultation Outputs

Similar concerns were also expressed during the Public Consultation process and the key points recorded are listed below:

- Disruption to O'Connell Street during construction from a reduction in the number of traffic lanes;
- Impacts on surrounding properties during construction due to vibration and ground movement;
- Disruption during construction due to increases traffic movements from construction traffic accessing the site;
- Health and Safety concerns due to construction generated dust and noise, and
- Disruption to the Luas Cross City service, should the service be severed or run with reduced services, to facilitate construction of the station box.

Since the development of the EPR and the Public Consultation period the situation has changed in that a parcel of land has become available for development on the west side of O'Connell Street Upper just south of the EPR station location. Discussions are being progressed with the developer of the Site (Hammerson) to enable the proposed station to be relocated from O'Connell Street Upper onto the development site, so that it becomes part of an integrated transport building zone. The image on Figure 3 below presents the situation.

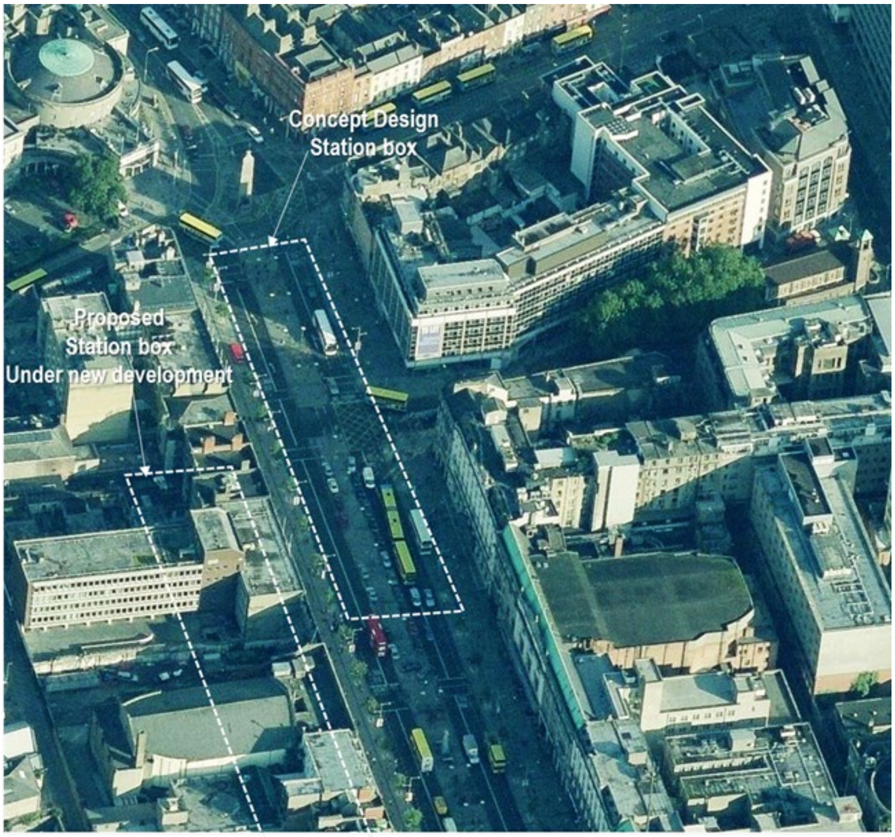

Figure 3 - EPR Station Location and Alternative Site to West

Acknowledging these changed circumstances and taking account of the consultation outputs, TII/NTA instructed Jacobs/Idom to examine the alternative arrangement made possible by the newly available site. The following sections consider this relocation in more detail.

3. Preferred Route Option

3.1 The Development Site

The historic Carlton Cinema site on the west side of Upper O'Connell Street and adjacent to the proposed EPR station location is likely to be developed by Hammerson, a UK based development company who were behind Dundrum Town Centre and the Ilac Centre. The six-acre area stretches from Upper O'Connell Street to Parnell Street (excluding the bank at the north end of the site) to Henry Street and to Moore Street as can be seen from the map in Figure 4 below.

Hammerson have planning permission valid to 2022 to build a large shopping centre at the site but it is understood that the development is more likely to focus on urban regeneration and would take account of Moore Street's heritage connection with the 1916 Easter Rising. Several listed facades are intended to be retained along the O'Connell Street frontage.

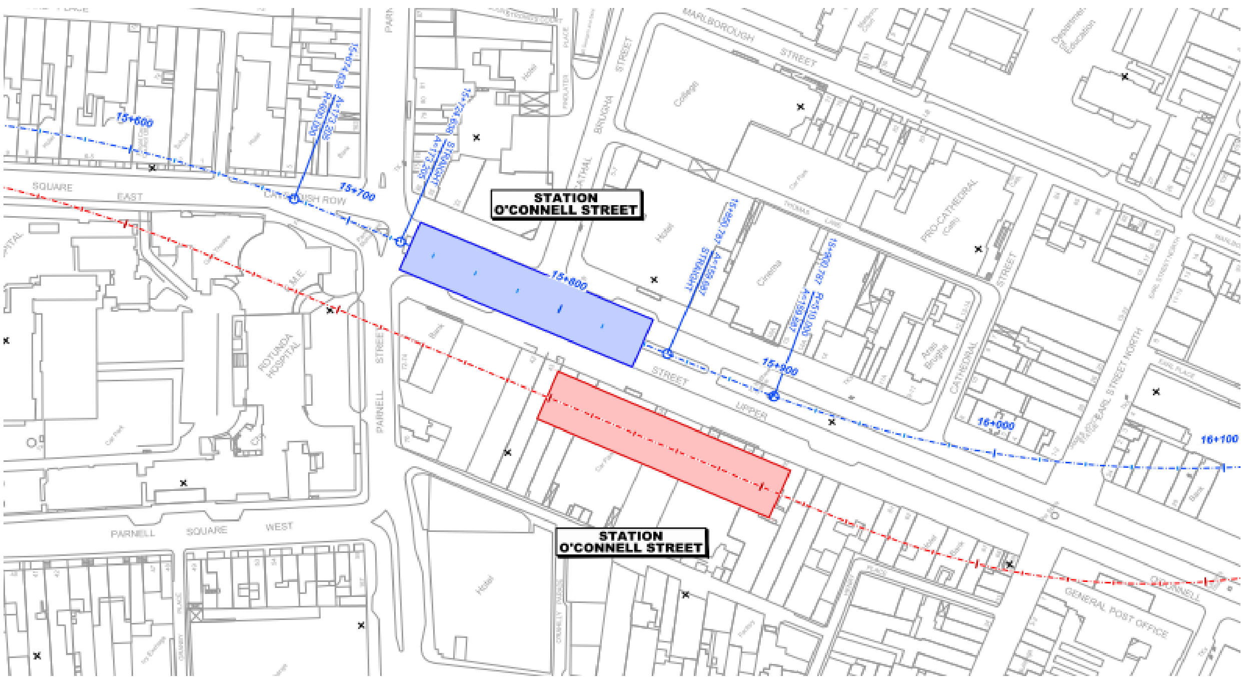

Figure 4 – Relocation of Station onto Development Site

The EPR Station is shown shaded blue in Figure 4 above while the proposed relocated station on the development site on the west side of O'Connell Street is shaded in red, complete with re-aligned tunnel approaches.

TII/NTA are continuing discussions with the developer with a view to formalizing the relocation of the proposed EPR O'Connell Street Station from the median of O'Connell Street Upper onto the development site so that the station can become integrated with the planned "Dublin Central" zone as a new and vibrant part of Dublin.

3.2 Tunnel Re-alignment

Relocating the O'Connell Street Station under the planned development site means that the tunnel horizontal alignment needs to be altered. Figure 4 above shows the alignment required to achieve the station relocation. This places the station at the edge of the development area and just clear of the O'Connell Street footpaths to minimise disruption during construction, whilst also minimising the length of tunnel re-alignment required compared to the EPR. This revised alignment is approximately 30m further west than the EPR alignment at the station. The tunnel alignment to the north will pass more closely to the Rotunda Hospital, with the tunnel crown remaining at around 18m below ground level at this point.

3.3 Environmental Considerations on Preferred Route

An environmental assessment has been undertaken on the proposed new location for the O'Connell Street Station in order to identify any potential significant environmental constraints and opportunities to the option. These findings were considered when identifying the preferred option. The following are the principal environmental considerations identified:

- Potential for disruptions to traffic and public transport including Dublin Bus and LUAS along O'Connell Street during the construction of the station box. However, the movement of the station off O'Connell St will mean that traffic impacts are significantly reduced when compared to the EPR;

- The proximity of the proposed station location to a number of commercial buildings including several hotels means that construction activity could result in potential construction phase impacts such as restricted access, construction phase dust, noise and vibration generation. However. the movement of the station off O'Connell St will mean that potential construction phase impacts are significantly reduced when compared to the EPR;

- The proposed station box location is close to or underneath a number of buildings listed on the Record of Protected Structures including 42-44 O'Connell St, 52-54 O'Connell St, 57 – 58 O'Connell St and 60 – 61 O'Connell St. Each of these buildings is to be retained or have the façade retained/preserved as part of the proposed OSD development (by a third party). The station location is closer to 14-17 Moore St than the EPR option. These buildings are of historical interest due to associations with the 1916 Rising and each of these buildings is listed on the Record of Protected Structures. However, the station box is separated from these buildings by Moore Land and will not impact on any of these properties;

- The revised alignment also requires the tunnel to progress under the General Post Office (GPO) buildings just south of the station location. These buildings are also listed on the Record of Protected Structures (Ref No. 8746 – 8750). Furthermore, it should be noted that the EPR proposed station site is located within the O'Connell St Architectural Conservation Area;

- The construction of the station within O'Connell St would result in potential visual impacts during the construction phase due to the significant construction activity required at this location in the absence of appropriate mitigation. However the visual impacts on the setting of O'Connell St will be significantly reduced due to the movement of the station off the street underneath the proposed OSD development; and

- The new alignment will pass more closely to the Rotunda Hospital, the Gate Theatre and the Ambassador Theatre resulting in increased risk of groundborne noise and vibration and ground settlement impacts during the construction phase if not effectively mitigated. The proximity to these sensitive locations also raises the potential for electromagnetic interference and ground borne noise and vibration impacts during the operational phase. However potential impacts are not considered to be significantly increased when compared to the EPR and effective mitigation will be developed should it be required during the development of preliminary design and the Environmental Impact Assessment process.

3.4 Planning Considerations

A planning assessment has been undertaken of the proposed new location for the O'Connell St station which considers development plan context and relevant planning history. The principal planning considerations are detailed below.

3.4.1 Development Plan Context

The station location options at O'Connell Street, both in the EPR and in the preferred route design, are within the functional area of Dublin City Council and have the zoning objective of 'Z5 (City Centre)

– to consolidate and facilitate the development of the central area, and to identify, reinforce, strengthen and protect its civic design character and dignity' in the Dublin City Development Plan 2016-2022.

The lands are part of the Special Planning Control Scheme with an objective to preserve or enhance of an area considered to be of special architectural importance. O'Connell Street is a conservation area within the Dublin City Development Plan. The lands also form part of the city centre retail core (category 1 shopping street) with the key development principles to maintain and strengthen the retail character.

It is considered that a Metro Station will help to deliver on the objectives of the zoning in supporting architectural character, civic design, retail and transportation for its catchment community.

3.4.2 Relevant Planning History

The location of O'Connell Street Station is situated in an area of "High heritage value" with the Carlton cinema site listed as protected structure. A planning permission under (ref 2479/08) was granted on 24-Mar-2010 for the proposed OSD development.

3.4.3 Commentary

Location of a station under potential mixed-use development on O'Connell Street is consistent with the site's zoning objective;

The design of the proposed station, particularly in relation to connectivity to the public streets will need careful consideration. The proposed station location gives greater flexibility to provide public access without compromising the public realm and pedestrian environment of O'Connell Street; and

The proposed alignment of the tunnel as it approaches the proposed station passes under different lands when compared to the EPR. Design of the tunnel route will need to ensure that future development on lands over which the tunnel passes can continue to be developed appropriately, in line with their zoning objective.

4. Conclusions

Relocating the station to the old Carlton cinema site enables some of the key environmental impacts of the EPR proposed station location to be significantly reduced or avoided. Furthermore, it allows for concerns raised at the Public Consultation about the O’Connell Street Station to be addressed. The proposed station relocation opens us the possibility of a design solution that can be integrated into a prestigious new city centre development. The opportunity to integrate MetroLink into this new development will greatly enhance the entire north city centre area.

Relocation of the station out of O’Connell Street and into the development area immediately to the west will retain the benefits of this city centre location and its interchange opportunities with the Luas Cross City line. The location of the station as proposed as part of the Preferred Route avoids impacting the operation of the LUAS Green Line.

The new off-street location will also avoid the need for significant traffic diversions and temporary traffic management along O’Connell Street.

In terms of impacts to underground utilities, the location as proposed for the Preferred Route will have significantly less impact to utilities when compared with the EPR station location. The EPR station location would have directly impacted a 110 kV ESB cable & number of medium and low voltage cables, a 400mm water main, a 180mm medium pressure gas main together with a number of low pressure gas mains. A number of telecommunication ducts and cables would also have directly been impacted by the EPR station location.

The tunnel realignment required to relocate the station location can be incorporated into the overall alignment with limited change to the EPR alignment, with a maximum deviation of just over 30m at the station location. The alignment will pass closer to the Rotunda Hospital, but with appropriate mitigation this is not envisaged to introduce significant new impacts compared to the EPR. Overall, the proposed change, including the realignment and relocation of the station reduces the potentially significant construction impact to traffic on O’Connell Street.

It is recommended that the Preferred Route design should relocate O’Connell Street Station onto the development site as part of an integrated development solution.

Potential impacts arising from the preferred option will be minimised during the development of the preliminary design and on the basis of the detailed environmental assessment presented in the Environmental Impact Assessment Report.

Appendix M. Tara Street Station

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Contents

Executive Summary

Tara Street Station will be a key interchange between the MetroLink station and the current Tara Street DART Station and the station design must provide appropriate connectivity between these stations to facilitate interchange demand. The MetroLink station itself is forecast to be the busiest station on the MetroLink route, with close to 12,000 passengers using this station in the morning peak hour by 2057.

The EPR located the proposed underground Tara Street Station adjacent to the DART Station on its west side, necessitating acquiring and demolishing the College Gate Apartment Building and the Sport and Fitness Markievicz Centre owned by Dublin City Council. While the site would be available afterwards for new development, the loss of the apartment block and a valued public amenity raised concerns during the public consultation process.

To address these concerns and particularly those relating to the demolition of College Gate Apartment building, eight further route options were investigated using a multi-disciplinary assessment, including three options submitted by residents as well as a mined option and alternative realignments of the route to the east of the Tara Street DART Station. These comprise:

- Option 1 - Locating the station under the Hawkins House development;
- Option 2 - Moving the station north such that it is predominantly located beneath Ashford House, Tara Street and buildings immediately north west of Tara Street;
- Option 3 - Moving the station south so that it is predominantly beneath Townsend Street;
- Option 4 - An option incorporating mining beneath the College Gate Apartment block, between two shafts, so that the building need not be demolished;
- Options 5 & 6 - Two options looking to realign the metro to the east of Tara Street DART station with the station located east of the St. Georges Quay complex;
- Option 7 - An alignment running to the east of the Tara Street DART Station with the MetroLink station located south of Townsend Street; and
- Option 8 - A similar alignment to the east of the Tara Street DART Station but with the MetroLink station immediately adjacent to the DART station, under St George’s Quay.

All options were assessed against the EPR proposed station location as a base case, adjusted to suit the single bore tunnel design.

While these eight options if implemented would avoid the College Gate Apartment building and Markievicz Centre, each would involve the demolition of other significant residential and/or commercial developments and in most cases remove the close interchange required between the DART and MetroLink stations. In addition, during construction, there would be closure of city streets to traffic and under some options diversion of large sewers, critical to Dublin’s drainage network, affected by station construction activities. The assessment of the options indicated that those with least overall impact were the original EPR route, as modified slightly for the revised station size; and the mined tunnel option under College Gate Apartments.

The potential for mining under the College Gate Apartment building was considered in detail, as this option, Option 4, would provide a station arrangement in a comparable location to that proposed in the EPR and with the aim of avoiding demolition of the apartments. However, this would need to be undertaken in a very constrained working site for construction purposes and many construction activities would be undertaken very near to the apartment building. Particular activities associated with this option would require the sinking of two large shafts either side of and in close proximity to the building, before tunnel mining would be undertaken between the shafts. These construction activities are estimated to take up to two years. During this period there would be risk to the building from the mining activities including potential for structural damage, and significant construction disturbance, including noise and vibration, such that it is envisaged that this would require moving everyone out of the building during construction for a period of up to two years.

Although the mined option would appear to have merit, given the construction impacts and the long period of disturbance envisaged, the significant additional risk associated with this form of construction, including risk to cost, it is concluded that the original proposal remains the most feasible and safest option for construction of the MetroLink station at Tara Street and this option is retained as the Preferred Route.

1. Introduction

1.1 MetroLink Route Development

Metro North was the project name of the original proposal for a metro railway system connecting Swords and Dublin Airport with Dublin City Centre at St Stephen's Green. This scheme was developed by the Railway Procurement Agency through the Railway Order process to successful planning approval by An Bord Pleanála (ABP) in 2010. The global economic downturn intervened, and in 2011 the Government postponed the Metro North project.

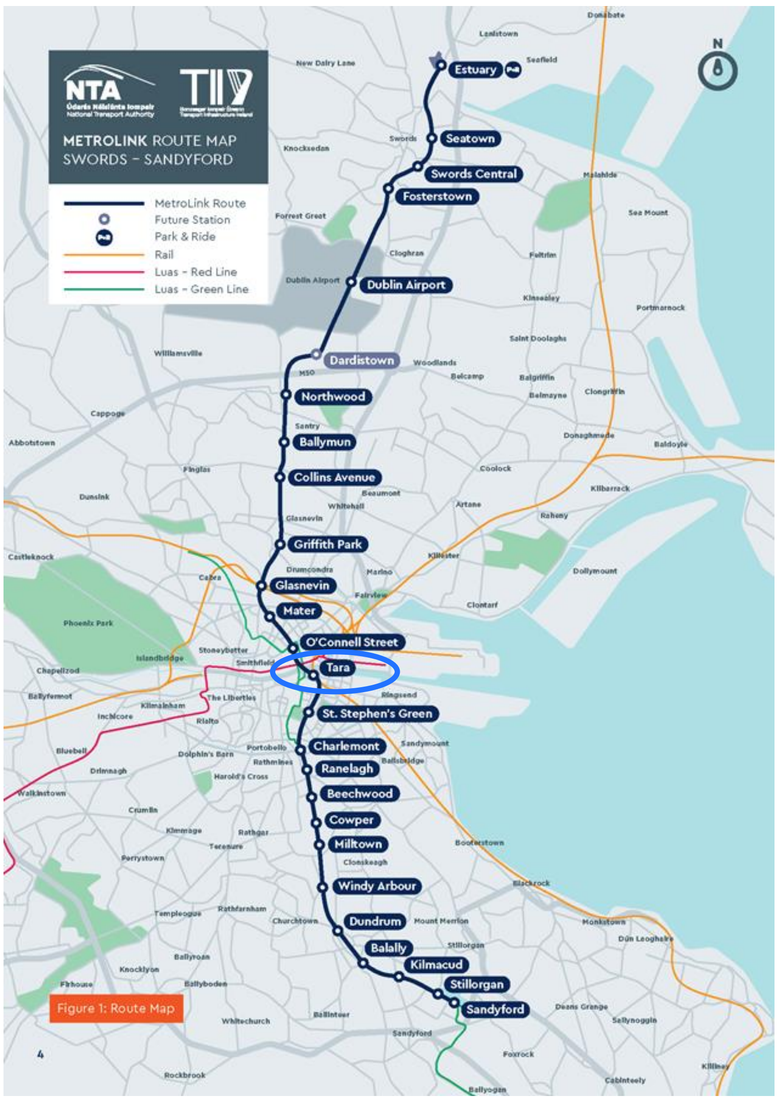


Figure 1 – MetroLink Route Map with R132 highlighted

The National Transport Authority's (NTA) Transport Strategy for the Greater Dublin Area, 2016-2035 identified a Metro service as the preferred public transport mode to address the transport needs of the Swords-Airport-City Centre corridor. It also envisaged the upgrading of the existing Luas Green Line between Ranelagh and Sandyford to a Metro level of service.

Project Ireland 2040 included the National Development Plan (2018-2027), which combined those two projects to form MetroLink. MetroLink will provide a fast, high capacity, high frequency, modern and efficient public transport service for people travelling along the Swords/Airport to City Centre corridor. In addition, the Scheme will connect to the existing Luas Green Line (an existing surface light rail line) in the South City area, enabling through running metro services from Swords to Sandyford. MetroLink will result in a north-south segregated metro system from Estuary to Sandyford as shown in Figure 1 here.

The metro route length from Swords to City Centre is approximately 19km and the completed system will have 15 Stations, 3,000 Park & Ride spaces, and a journey time of approximately 25 minutes.

The NTA commissioned Arup Consulting Engineers to undertake a Route Alignment Options Study for the Scheme in 2016. The objective of the study was to carry out a comprehensive route option selection to identify an Emerging Preferred Route (EPR). The study was completed at the end of February 2018 and it included a Concept Design for the EPR.

Separately, in January 2018, the NTA/TII commissioned Jacobs and Idom JV (Jacobs/Idom) to provide ongoing engineering design services through to scheme completion.

1.2 Public Consultation

A programme of public consultation led by the NTA was conducted between 22nd March and 11th May 2018, during which members of the public and other stakeholders were invited to submit their views and observations of the EPR.

There were 26 submissions in relation to the proposed Tara Station. As shown in Figure 2 below the station was located on the western side of the existing Tara Street DART Station. This plot of land is currently occupied by some residential town house units, a mixed-use building with approximately 70 apartments and a leisure centre and an office building as well as some vacant plots directly beside the rail line embankment.

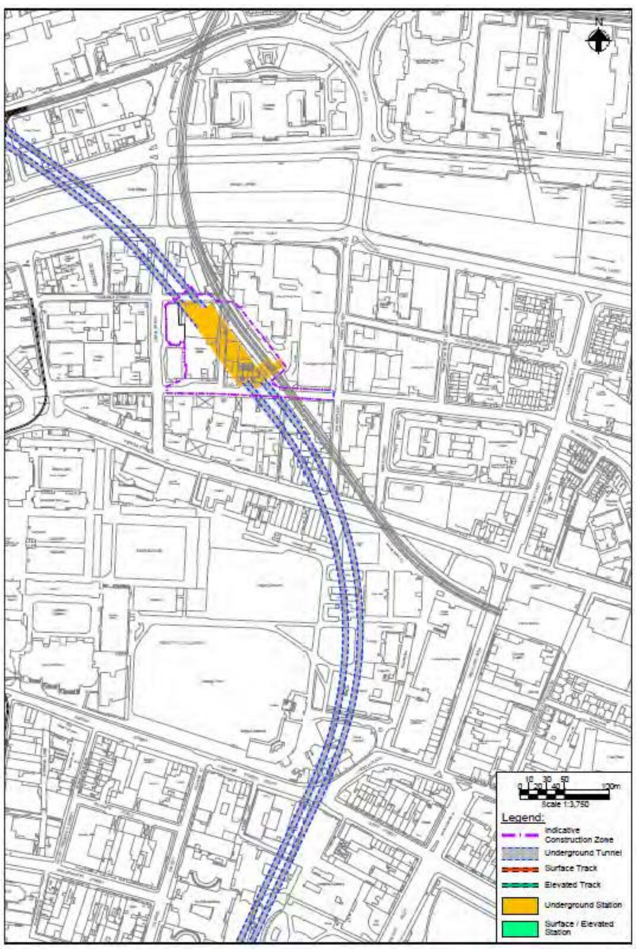


Figure 2 – Tara Street Station for EPR

The main concerns raised for the Tara Street proposals related to:

- Property acquisition of residential units including College Gate apartments, the Markievicz centre and office building;
- Impacts on surrounding properties during construction due to vibration and ground movement;
- Disruption during construction due to increases traffic movements from construction traffic accessing the site; and
- Health and safety concerns due to construction generated dust and noise.

An alternative option was suggested during the consultation phase to move the station northwards to avoid acquisition of College Gate

The Public Consultations also raised a Scheme-wide issues and from the total of 573 submissions some of them related to Tara Street Station as listed below.

- Concerns from several stakeholders on how the EPR will impact on their proposed developments or planning application;
- Ensuring integration with the cycling, walking and bus networks;
- Additional park & ride locations should be considered;
- Impacts on surrounding properties during construction due to vibration and ground movement;
- Disruption during construction due to increases traffic movements from construction traffic accessing the site; and
- Health and safety concerns due to construction generated dust and noise.

The public consultations process prompted the "Save College Gate Group" to submit a document called, "Analysis, concerns and alternative MetroLink station options based on documents published by MetroLink and other public sources." To avoid the demolition of College Gate Building, the document proposed the following alternatives:

OPTION 1: Station under Hawkin House/Apollo House proposed redevelopment

OPTION 2: Station moved northwards under Tara Street and a proposed new CIE development

OPTION 3: Station moved southwards

The document '*New Metro North Alignment Options Report, Volume 1: Main Report*' issued in March 2018 as prepared by ARUP on behalf of the NTA had already identified and assessed a number of alternative route options for the Metro through the city centre. These included options that would avoid Tara Station (see 'Figure 5.6 Study Area A – Feasible and Practical Route Options') which illustrates the alternative options considered.

In addition to these earlier assessed alternatives to the EPR station location, the MetroLink project team has undertaken assessment of these submitted suggestions from the 'Save College Gate Group' and has also considered further options that would potentially avoid demolition of College Gate apartments as follows:

OPTION 4: Mined station at the concept design location

OPTIONS 5 and 6: Alignments passing to the east of the existing Tara Street DART Station, with station locations aligned with Moss Street (to avoid the St Georges Quay complex)

OPTION 7: A Metro alignment passing to the east side of Tara Street DART Station, with the station located south of Townsend Street

OPTION 8: A Metro alignment passing to the east of Tara Street and aligning the Metro station directly adjacent to Tara Street Dart station

2. Tara Street Station for EPR

2.1 Proposed Station and Surroundings

For the EPR the underground station at Tara Street was located close to the existing Tara Street DART Station in a high-density city office area. It was designed to be at 24m depth and was to include a traction power substation as well as providing key interchange facilities with the DART station.

The station would have transport Integration with Bus services (four service lines) and a bike station was to be provided along with taxi rank & drop off bays. The DART and Dublin Commuter services on the twin track heavy rail line are high frequency, currently at 12 trains per hour per day (tphpd) and with a future capability for up to 18tphpd.

The City Centre location gives potential for Over Site Development (OSD) to integrate with the interchange station, commercial properties, and retail areas. A new public realm space might be feasible above the station box.

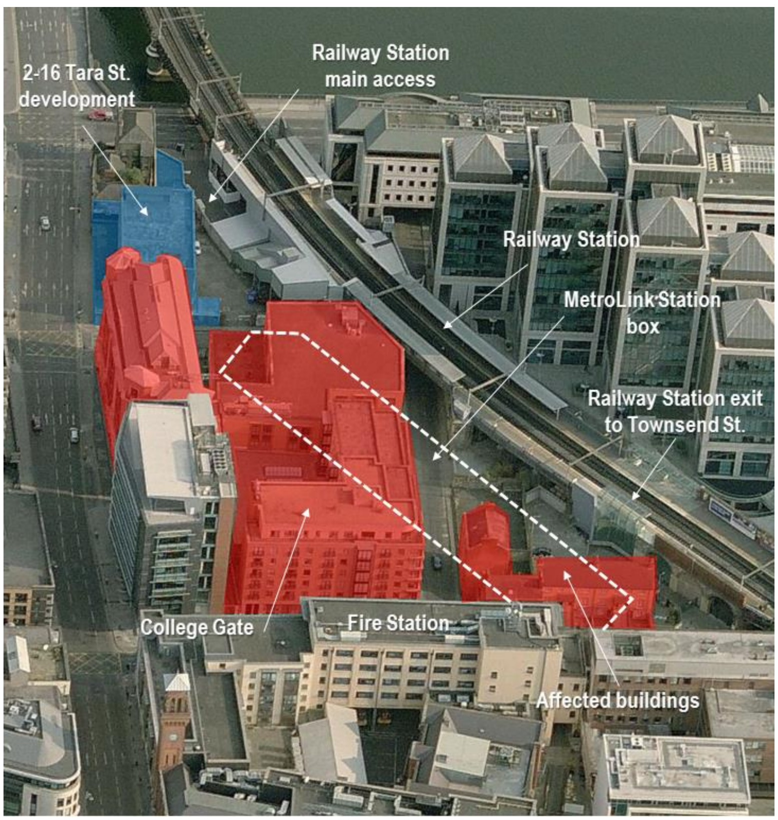


Figure 3 – EPR Station Surroundings

Development constraints include the existing buildings in the area as shown in Figure 3 above as well as the new developments that are affected. Demolition of buildings is necessary and housing owners are affected at College Gate apartments.

There will be some traffic disruption in the local area during construction in this city centre area. The Fire Station's alternative access onto Townsend Street will be affected along with the George's Quay Plaza underground parking during implementation of temporary traffic management measures.

Affected utilities include as a minimum a large diameter sewer, an underground (38kV) ESB Power Line and a trunk watermain of 400mm diameter.

2.2 Existing Tara Street DART Station

The plan layout of the DART Station is shown in Figure 4 below. It indicates the two station entrances; the main one is accessed off Georges Quay (R105) near to and east of its junction with Tara Street on the south side of the River Liffey. There is another secondary southern entrance giving access off Tara Street, which is currently only made available during week-day peak hours.

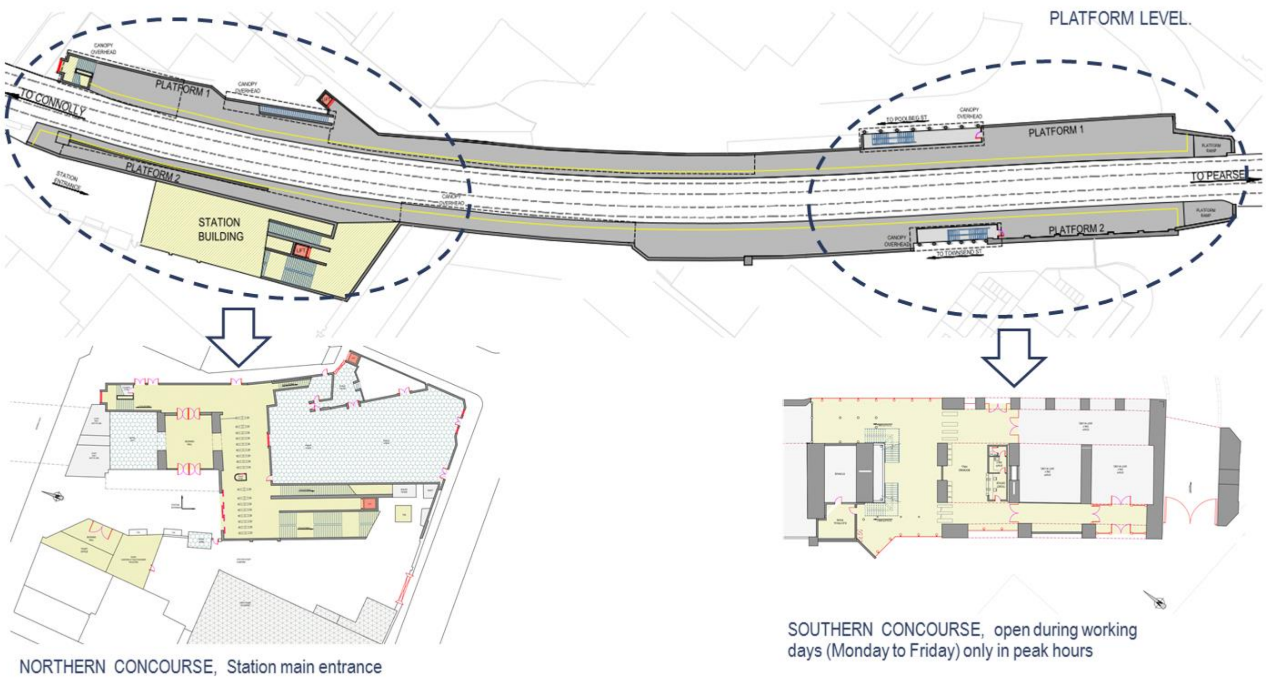


Figure 4 – Tara Street DART Station.

2.3 Planned Developments and Affected Buildings in Area

There are several planned developments and affected buildings around the Tara Street Station and the proposed MetroLink interchange station. These are listed below and illustrated on Figure 5.

- 2-16 Tara Street: Office and hotel, twenty-storey building, two basements, MetroLink Tunnel under the site. Site was recently denied planning permission.

- 157-164 Townsend Street: Office development, seven-storey building, two basements, MetroLink Tunnel under the site.
- Hawkins House: Site is not affected by MetroLink alignment

Buildings directly affected by the proposed station construction works are:

- College Gate Apartment Building: 70 apartments on 6 upper stories, basement level residential car park, bicycle storage and waste management (see Figure 6)
- Number 25-32 Townsend Street duplex properties
- Markievicz Leisure Centre: Ground level, renovated completely in 2016, owned by Dublin City Council, only public leisure centre with 25m swimming pool in Dublin City Centre. (see Figure 6).
- Ashford House office building
- Two derelict Georgian buildings

Figure 5 – Aerial View on Tara Station with Planned Developments and Affected Buildings

Figure 6 – College Gate Apartments and Markievicz Centre

2.4 EPR Station Concept

The key benefits of this proposal were that at construction stage it limits disruption to the DART station and train services and for train operations the wayfinding for passengers is clearly signed through the intermodal concourse.

Demolition of existing buildings is necessary for construction and this includes College Gate building, Ashford House office building, two derelict Georgian buildings and Number 25-32 Townsend Street duplex properties.

There is a potential lack of space in the EPR Station proposals for back-of-house facilities and the required traction power substation because of the constraints of the surrounding Poolbeg Street and Townsend Street. The location is illustrated in Figure below.

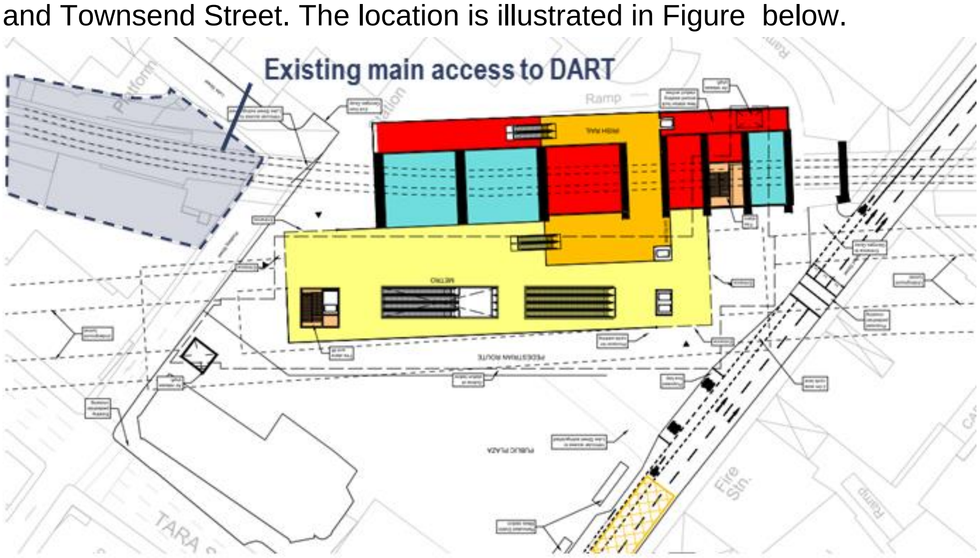


Figure 7 - EPR Station Constraints

3. Preferred Route and Tara Street Station

3.1 Key Design Changes for Preferred Route

Arising from the review of the Route Alignment Study and other associated documentation including the Tunnel Configuration Study, significant changes were proposed by Jacobs/Idom, which were subsequently accepted by the NTA/TII and which have been carried forward into the preliminary design. These changes include:

- The alignment would run above ground from the proposed Northwood Station, pass northwards over the M50 motorway, before returning to tunnel under Dublin Airport. This effectively splits the tunnelling works into two separate sections. Previously this section of the alignment had all been in tunnel;
- A change from twin bore tunnels to a single bore tunnel carrying trains running in both directions;
- Confirmation that the trains would be of high-floor design and be fully automated, operating at up to a 90 second interval/headway (time between trains);
- Revised station box layout to suit the single bore tunnel and necessary 'back of house' and safety requirements; and
- Changed integration arrangements with the existing Tara station to suit the revised station design. These will not constrain future Tara Station development opportunities to be undertaken by Irish Rail.

There were several implications arising from the changes noted above but the key changes for the Tara Street Station are:

1) **Single-bore instead of Twin-bore Tunnels**: This change has a major impact on the station design. The two railway tracks occupy the single bore and side platforms are required rather than the previous island platform and the internal arrangements for horizontal and vertical circulation inside the station box are revised to suit.

2) **Reduction in length of underground stations.** High floor trains have more capacity than low floor trains and this combined with the 90 second peak headway made possible by the planned use of (GoA4) driverless train technology, enables the scheme to satisfy the target demand of 20,000 passengers per hour per day (pphpd) with shorter trains. This means that instead of the 90m long low-floor trains required for the previously developed EPR, the high-floor trains are proposed to be shorter at 65m. This reduction in train length gives more flexibility on the size and placement of the station so that surface impact can be minimised.

3.2 Preferred Route Alignment

At this location, the Preferred Route alignment for the single bore MetroLink tunnel follows the centre line of the EPR route alignment and the proposed Tara Street Metro Station is almost parallel to Tara Street DART Station as shown in Figure 8 below.

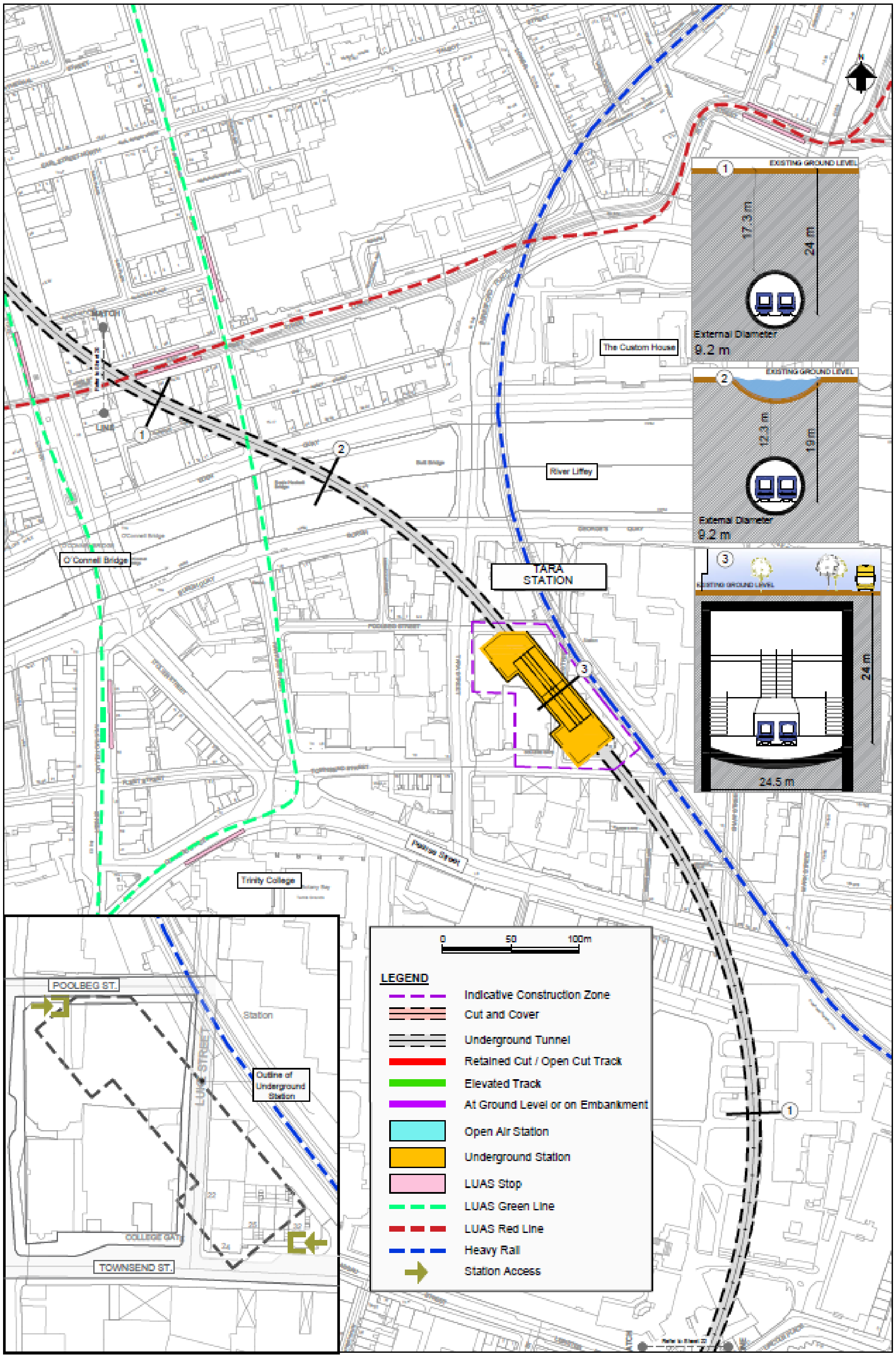


Figure 8 – Preferred Route at Tara Street

3.3 Option 0: Base Scheme with Station Box and Building Demolition

We have retained the EPR concept design as the base case but with the tunnel arrangement changed to single bore and the station box reduced in length because of the shorter trains and platforms required. This is known as Option 0: Base scheme with Station Box and Building Demolition, and the layout is shown in Figure 9 below.

The proposed construction method for the station box is "top-down" and this requires all properties to be acquired on the station footprint. The Option retains good connectivity with the associated Dart Station, a key requirement of this Option.

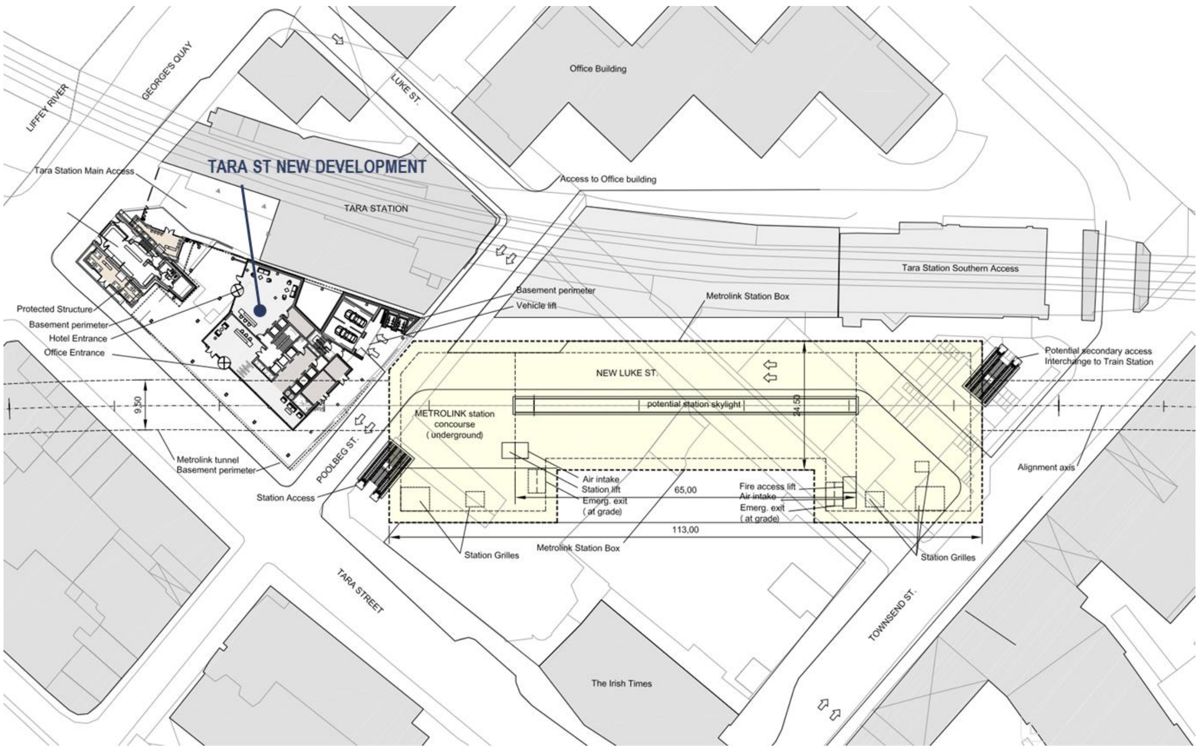


Figure 9 – Preferred Route and Tara Street Interchange Station

As for the EPR proposal, and as shown in Figure 10 below, demolition of the College Gate building, the Ashford House office building, two derelict Georgian buildings, and 25-32 Townsend Street duplex properties will be necessary. Poolbeg Street, Luke Street and Townsend Street are affected during construction with road closures and traffic management requirements to be agreed with Dublin City Council.

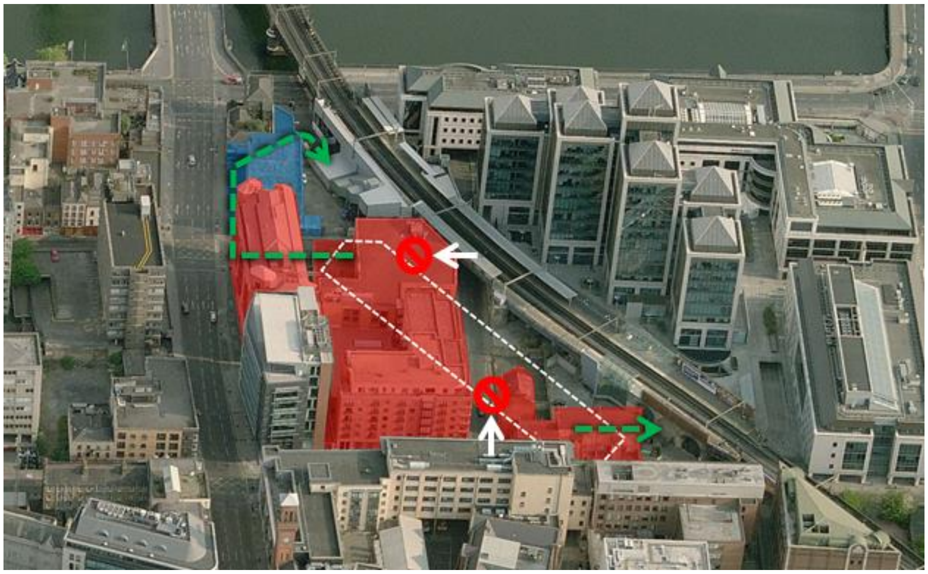


Figure 10 – Interchange Station Environment

A cross section of the proposed MetroLink station looking North is shown below in Figure 11. College Gate apartments must be demolished, and the proximity of the DART infrastructure will need careful engineering design and construction.

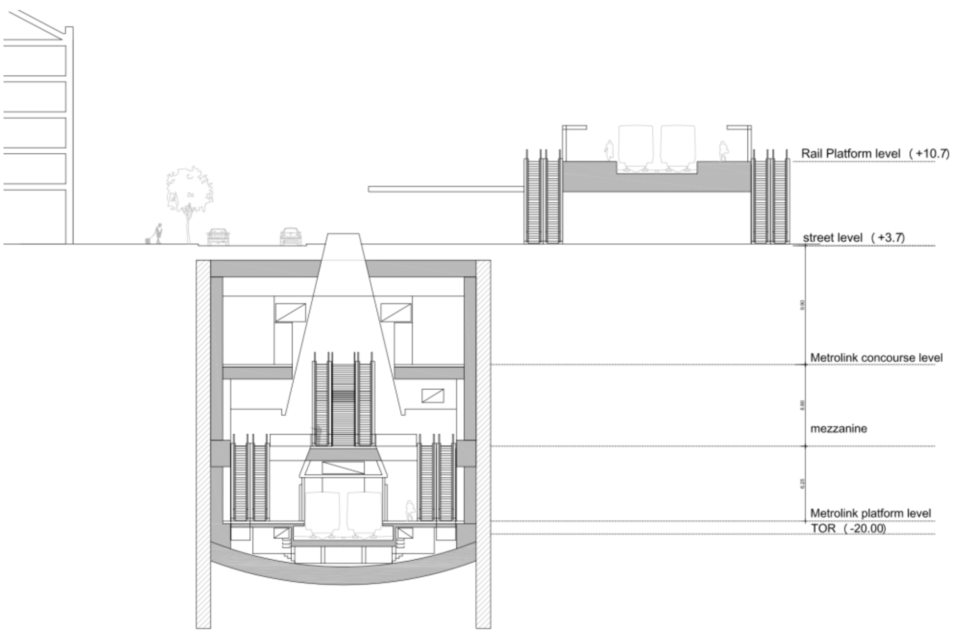


Figure 11 – Cross Section of MetroLink Station (looking North)

Surface restoration is necessary and once the station box is completed there will be opportunities for new developments and / or public realm initiatives. An indication of the possibilities is shown in Figure 12 below.

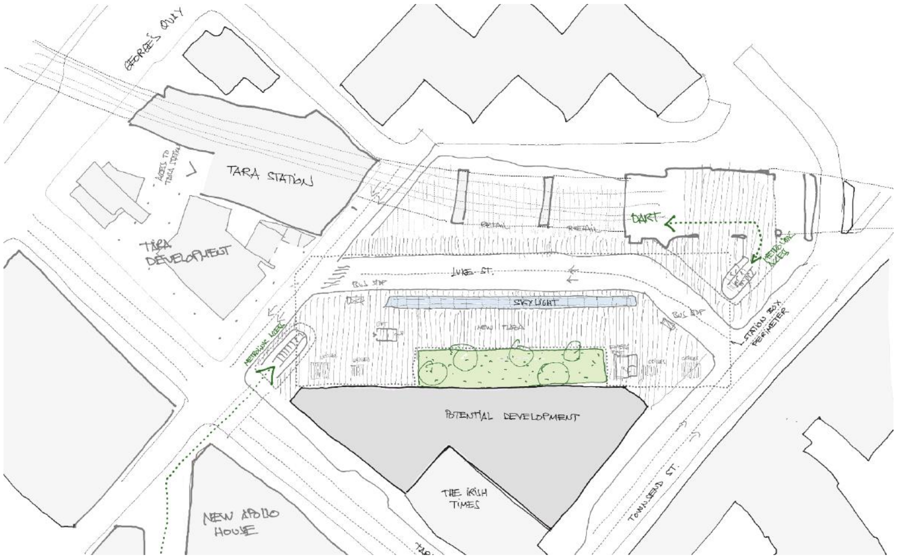


Figure 12 – Urban Setting

3.4 Alternative Options west of Tara Street Station

Figure 13 – Alternative Option Locations

In order to address concerns raised during the EPR consultation process, Jacobs/Idom have considered further options. Three specific alternative options suggested, in addition to the EPR Concept location, are presented in Figure 13 above. These, and further options which have also been considered, are presented in the following sections.

3.4.1 Option 1 – Station under Hawkins Development

A MetroLink station located parallel to Tara Street and integrated into the new Hawkins development would require a complete re-alignment of the tunnel approaches as can be seen from Figure 14 below. To achieve this would make it impossible to reach the proposed O'Connell Street station because of the unacceptably low track radii needed to align both stations, which are incompatible with TBM tunnel construction. As such, this Option 1 is not viable.

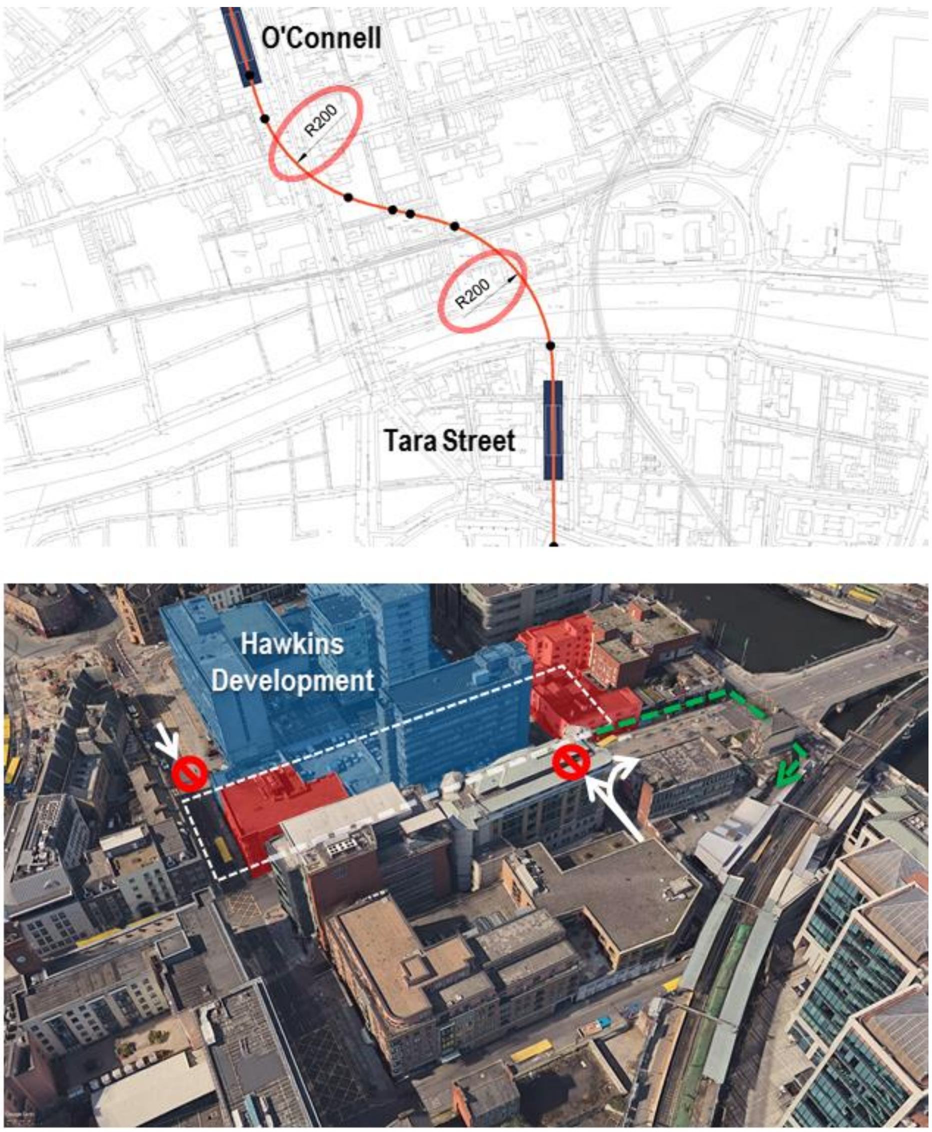


Figure 14 – Option 1 Location and Track Alignment

3.4.2 Option 2: Station moved northwards

The orientation of the station box is altered to one that can enable a feasible alignment with acceptable track curvature (but is less desirable due to increased maintenance requirements and poorer ride quality due to the sharper radius curves required) but which would connect with the proposed O'Connell Street station. This is shown in Figure 15 below.

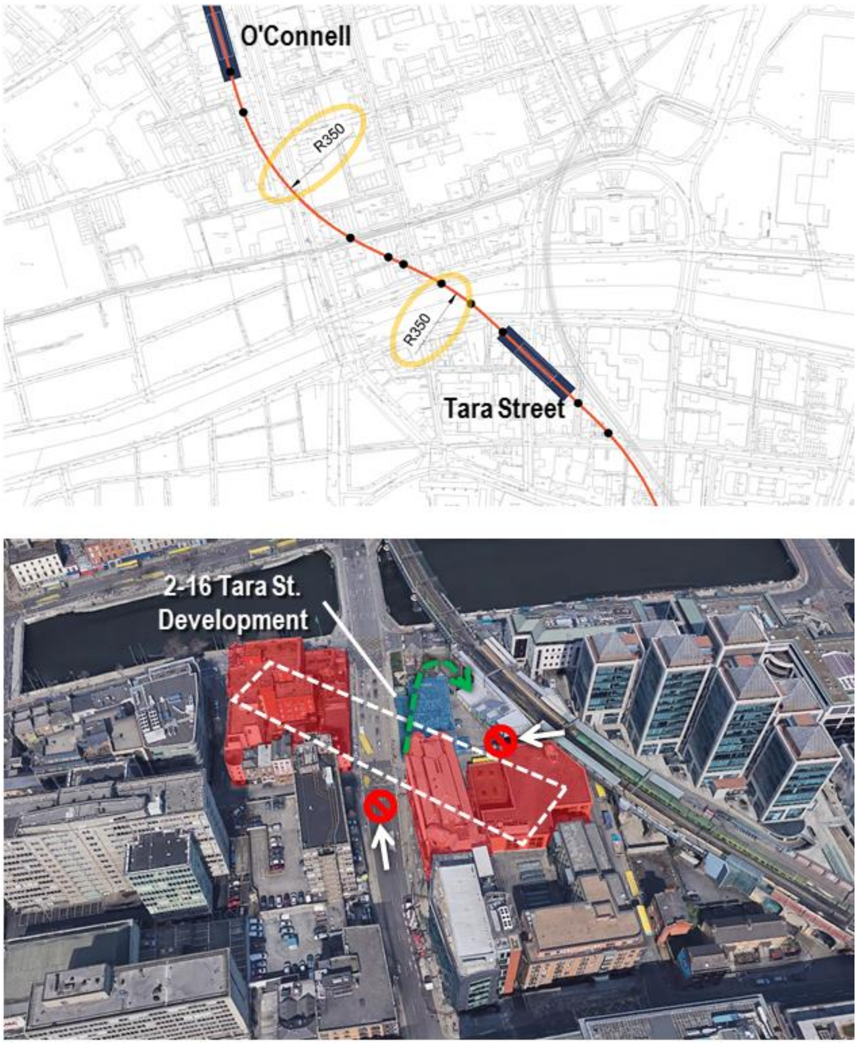


Figure 15 – Option 2 Location and Track Alignment

Open box construction would be used to create the station shape and all properties on the station footprint would need to be acquired. Ashford House office building and the entire city-block defined by Tara Street, George's Quay, Corn Exchange Place and Poolbeg Street would need to be demolished.

Agreement and design details would need to be finalised with the owners of relevant properties and buildings fronting on to Poolbeg Street to integrate the station box and above ground elements in the development, including access points, emergency exits and ventilation shafts.

Poolbeg Street would be closed during construction and Tara St. would be either closed or significantly restricted with extensive traffic management required and widespread traffic disruption.

Passenger transfer to the DART Tara Street Station would use the existing main access.

3.4.3 Option 3: Station moved southwards

Moving the station box towards the south means changing the existing alignment and this can be achieved with acceptable track curvatures while also connecting to the proposed O'Connell Street station. The situation is shown in Figure 16 below.

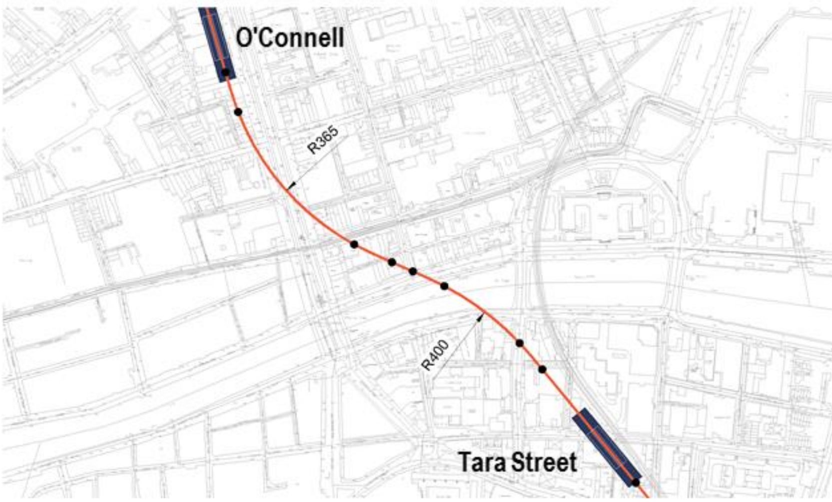


Figure 16 - Option 3 Location and Track Alignment

Open box construction would be used to create the station shape and all properties on the station footprint would need to be acquired. Buildings at Townsend Street and Spring Garden Lane would need to be demolished with Townsend St. and Spring Garden Lane closed during construction.

Agreement and design details would need to be finalised with adjacent property owners to integrate the station box and above ground elements in the development, including access points, emergency exits and ventilation shafts. Suitable surface restoration will be needed on completion and interchange flows would need to be coordinated with other developments.

Passenger transfer to the DART Tara Street Station would use the existing southern access, which would need to change from a peak hour access to a permanent access.

This option would also directly impact existing large sewers along Townsend Street (including a 2.4m circular brick foul sewer and 1.2m circular concrete foul sewer) which would require diversion; a significant engineering challenge in this built-up area and an important constraint on this option.

3.4.4 Option 4: Excavated (mined) station

This solution would involve mining a gallery (or cavern) in rock between two access shafts, which would be placed each side of the College Gate building. The arrangement is shown in Figure 17 overleaf.

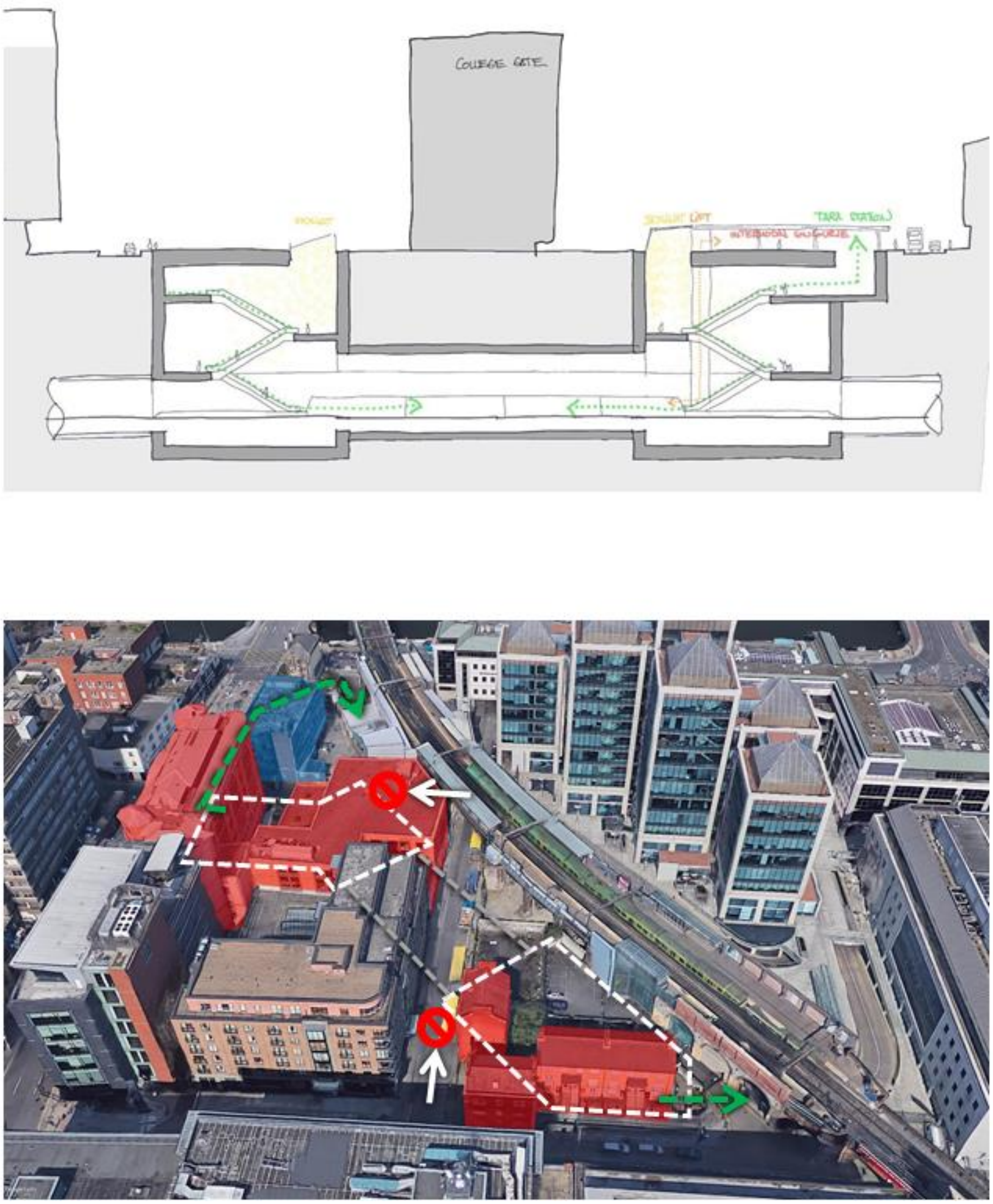


Figure 17 – Option 4 Shaft Locations and Access Gallery

This option was intended to remove the need for the demolition of the College Gate apartments.

The EPR route alignment would be unchanged apart from the single bore tunnel design. The shafts at each end of the station end would enclose the escalators, stairs, lifts and back-of-house facilities. The side platforms would be inside the excavated gallery between shafts at track level. A similar sized gallery or cavern is shown in the photograph in Figure 18 below. This design would be influenced by the piled foundation details of College Gate.

Figure 18 – Similar-sized Gallery Example

Construction of the two shafts (between which the mined section would be constructed) would be from the surface and properties on the shaft footprints would need to be acquired. The Ashford House office building, two derelict Georgian buildings and Number 25-32 Townsend Street duplex properties would need to be demolished. Poolbeg Street and Luke Street would need to be closed during construction and Townsend Street would be affected requiring traffic management, subject to agreement with DCC regarding appropriate traffic management proposals.

Construction of the two shafts would lie very close to the College Gate structure due to the space constraints of the site. As such, shaft construction and also the mined section between the shafts would produce noise and vibration during excavation work and disturbance is likely to residents during construction. The College Gate foundations are constructed on piles and there could be interference with the mined tunnel section where it would pass under the edge of the existing building, resulting in more construction disturbance. It should be noted that this method of construction typically carries higher construction safety risks than the open box construction and is thus a less preferable form of construction if other options are available.

There would be two points of access to the underground station; one from Tara Street and the other connecting to Tara Station, similar to Option 0.

3.5 Alternative Options east of Tara Street Station

A further four Options have also been assessed, taking the Metro alignment and Metro station to the east of the existing Tara Street DART Station. These are shown on Figure 19 below and described in the following sections. The multi-disciplinary assessment of these Options is included in the following chapter.

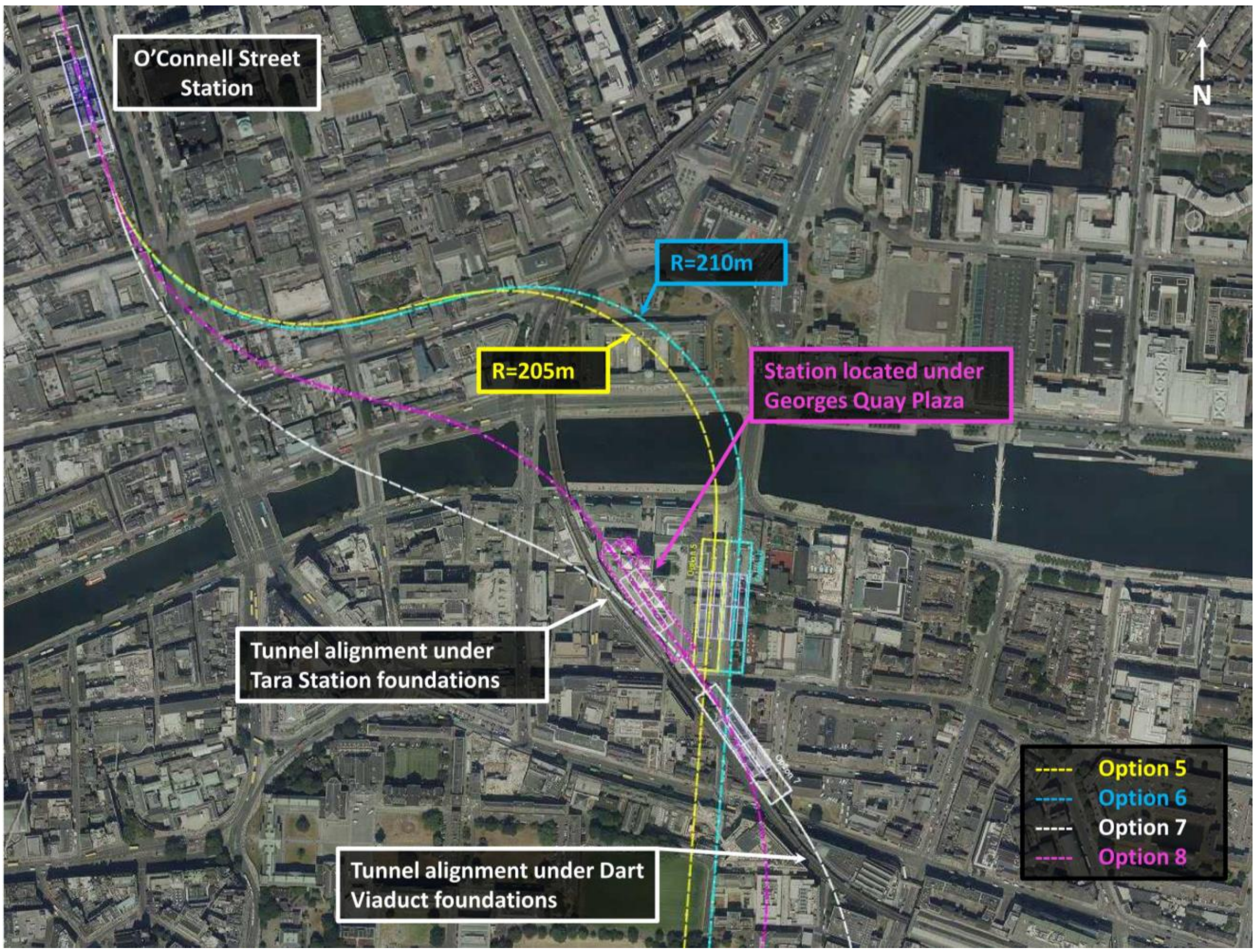


Figure 19 – Options considered east of existing Irish Rail Tara Street Station

3.5.1 Option 5: Railway Alignment to the East of Tara Street Station. Metro station alongside Moss Street

Option 5 looks to change the metro alignment running southwards from O'Connell Street Station to pass to the east of the Tara Street DART Station. The proposed route is aligned to avoid the Georges Quay development but would place the underground station alongside Moss Street requiring road closure during construction and demolition of frontage buildings. The alignment would continue southwards and re-join the Preferred Route alignment before St Stephen's Green Station.

3.5.2 Option 6: Railway Alignment to the East of Tara Street Station. Metro station alongside Moss Street

This Option is very similar to Option 5 but attempts to reduce the sharp radius curve introduced into the alignment whilst still maintaining a Metro Station close to the Tara Street DART Station and avoiding the Georges Quay development. The Option would retain the Metro station along Moss Street with similar construction disturbance as Option 5.

3.5.3 Option 7: Railway Alignment to the East of Tara Street Station. Metro station located south of Townsend Street

This Option is based on a Metro alignment with compliant alignment standards which runs close to the east of the existing Dart station. It would provide a viable railway alignment but would pass under the existing Tara Street DART Station foundations and passes under the Dart viaduct foundations twice with potential compromise to these structures. To avoid Georges Quay Plaza buildings and the sewers under Townsend Street the station box would need to be located on a straight section of track remote from the existing Tara Street Station, providing poor interchange opportunity. The station box construction would also extend under Shaw Street, affecting buildings to the east of Shaw Street.

3.5.4 Option 8: Railway Alignment to the East of Tara Street Station. Metro station located under St Georges Quay

This Option is aligned directly to the east of the existing Tara Street Dart station and locates the Metro Station directly adjacent to the existing station to maximise the desired interchange facility. Under this Option, the Metro station location is directly under the Georges Quay development, requiring demolition of this business complex to accommodate the station construction. In addition, the alignment would pass under the DART viaduct foundations twice and the open cut station construction would take place in close proximity to the foundations of the Irish Rail DART Station

4. Assessment of Options

4.1 Multi-disciplinary assessment methodology

Jacobs/Idom has considered the submissions made during the Public Consultation process and examined several alternative options to that proposed in the EPR. We have taken account of the design changes made since the EPR was developed, including the proposed single bore tunnel and reduced platform lengths made possible by the greater capacity of the proposed high-floor trains.

The Option characteristics as described above have been assessed against the following disciplines:

- Alignment – is the proposed option feasible based on metro alignment standards or the ability of the tunnel boring machine to achieve the tunnel alignment
- Demolition of buildings – an assessment of the number and type of buildings that would require demolition during construction of the Option at the Tara Street Station location (it is assumed that the revised tunnelling alignment would not require new demolitions)
- Interference with On-going developments – does the Option impact on current or proposed developments in the area
- Metro-Rail transfer – how well does the Option retain good interchange connectivity between the Metro station and the Tara Street DART Station, as this is a key requirement at this location
- Urban integration – how well will the Metro station integrate into the urban environment
- Traffic Impacts – an assessment of the main traffic impacts locally during construction for road users and pedestrians
- Utilities – the impact of an option on the key utilities in the existing area, i.e. those utilities that would have significant disruption costs and impacts if they required diverting
- Environment & Planning – a summary of the main potential impacts associated with option development
- Construction Health & Safety – a comparative assessment of the relevant differences between the options in respect of safety during construction
- Costs – a comparative assessment of the Metro station costs, including construction, risk and property costs.

A high-level summary of the Option assessment is shown in Figure 20 below.

Figure 20 – Summary of Options Assessment: Stage 1

	OVERALL OPTIONS SUMMARY COMPARISION								
	Base Scheme (0)	1	2	3	4	5	6	7	8
Alignment	All parameters within normal values	Alignment radius coming from O'Connell Street station incompatible with tunnel boring needs.	Exceptional parameters	All parameters within normal values	All parameters within normal values	Alignment radius coming from O'Connell Street station incompatible with tunnel boring needs.	Alignment radius coming from O'Connell Street station incompatible with tunnel boring needs.	All parameters within normal values	All parameters within normal values
Demolition of Buildings / Impact on existing structures	College Gate building, Ashford House office building, 2 derelict Georgian buildings and Number 25-32 Townsend Street duplex properties	Alignment not feasible - impacts not assessed	Ashford House office building, entire city-block between Tara St. and Corn Exchange Pl.	2 derelict Georgian buildings and Number 25-32 Townsend Street duplex properties, office buildings at Spring Garden Lane	Ashford House office building, 2 derelict Georgian buildings and Number 25-32 Townsend Street duplex properties.	Alignment not feasible - impacts not assessed	Alignment not feasible - impacts not assessed	Impacts buildings on Shaw Street and Mark Street, including impact on St Marks church. Alignment crosses under Irish Rail viaduct twice.	Georges Quay office block and part of Citizens Information Board Head Office / Alignment crosses under Irish Rail viaduct twice / Open cut station box in proximity to Tara Street Station foundations
Interference with ongoing developments	None	Alignment not feasible - impacts not assessed	Yes, Tara Station development	Yes, 157-164 Townsend St.	None	Alignment not feasible - impacts not assessed	Alignment not feasible - impacts not assessed	None	None
Metro - Rail Transfer	Using both existing accesses	Alignment not feasible - impacts not assessed	Only with current main access	Only with current south access (requires refurbishment and changes in operation)	Using both existing accesses	Alignment not feasible - impacts not assessed	Alignment not feasible - impacts not assessed	Poor integration with existing Tara Dart Station.	Directly adjacent to Dart station
Urban Integration	New Public realm improving integration of all station pop-ups	Alignment not feasible - impacts not assessed	Requires coordination to integrate station pop-ups with streetscape	New Public realm improving integration of all station pop-ups	New Public realm improving integration of all station pop-ups	Alignment not feasible - impacts not assessed	Alignment not feasible - impacts not assessed	Requires integration into surrounding streetscape	Requires coordination to integrate station pop-ups with streetscape
Traffic Impacts	Poolbeg St. and Luke St. closed during construction. Townsend St. affected. Significant impacts on Fire Brigade Emergency Routes	Alignment not feasible - impacts not assessed	Tara St. and Poolbeg St. closed during construction. Significant impacts on North/ South pedestrian movements, North South Cycle movements, bus routes and wider traffic. Closure unlikely to be obtained from DCC	Townsend St. and Spring Garden Lane closed during construction. Significant impact on East/ West cycle movements	Poolbeg St. and Luke St. closed during construction. Townsend St. affected. Significant impacts on Fire Brigade Emergency Routes	Alignment not feasible - impacts not assessed	Alignment not feasible - impacts not assessed	Shaw St and Mark St closed during construction. Significant impact on North/South Pedestrian/Cycle movements.	Luke St between the Quays and Poolbeg St closed during construction. Impacts on the northbound Fire Brigade routes.
Utilities	Potential for localised diversions	Alignment not feasible - impacts not assessed	Significant diversions required	Major trunk sewer diversions required. Irish Water unlikely to agree diversion or any interference with sewer.	Potential for localised diversions	Alignment not feasible - impacts not assessed	Alignment not feasible - impacts not assessed	Potential for localised diversions	Potential for localised diversions
Environment & Planning	Direct impacts on commercial and residential properties, Loss of community infrastructure. Increased construction phase noise, vibration and dust due to building demolition. Additional C&D waste generation. Signficant changes to the urban landscape with potential to create public realm opportunity. Direct impacts on RMPs (DU-018-020648 & DU-018-0020061).	Alignment not feasible - impacts not assessed	Direct impacts on commercial and residential properties. Increased construction phase noise, vibration and dust due to building demolition. Additional C&D waste generation. Signficant changes to the urban landscape with potential to create public realm opportunity. Direct impacts on RMPs (DU-018-020648) & close proximity to RPS (50020311). Potential impacts on water resources due to close proximity to Historic River Stiene and River Liffey.	Direct impacts on commercial and small no. of residential properties. Increased construction phase noise, vibration and dust due to building demolition. Additional C&D waste generation. Signficant changes to the urban landscape with potential to create public realm opportunity. In close proximity to RMPs (DU-018-020648 & DU-018-0020061) & to 7 RPS's on Pearse St.	Direct impacts on commercial and small no. of residential properties. Construction phase noise, vibration and dust impacts on residents of College Gate due to tunnelling and building demolition, likely to require temporary re-housing. Signficant changes to the urban landscape. Direct impacts on RMPs (DU-018-020648 & DU-018-0020061).	Alignment not feasible - impacts not assessed	Alignment not feasible - impacts not assessed	Station location provides poor interchange with Tara St station. Direct impacts on a number of residential and commercial properties on Shaw Street and Mark St including Hyde Court Apartments. Direct impact on St Marks Church which is an RMP (DU-018-020347) and on an industrial buildings which is designated as an RPS (Ref 50020346). Increased construction phase noise, vibration and dust due to building demolition. Additional C&D waste generation. Direct imapct on the historic River Gallows which drains to the River Liffey.	Direct impacts on a number of commercial properties including Georges Quay Office Block. Signficantly increased construction phase noise, vibration and dust due to building demolition. Additional C&D waste generation. Direct imapct on the historic River Gallows which drains to the River Liffey.
Construction Health and Safety Risk		Alignment not feasible - impacts not assessed			Mining is inherently more dangerous than other typical forms of construction	Alignment not feasible - impacts not assessed	Alignment not feasible - impacts not assessed		
Costs (including construction, risk & property)		Alignment not feasible -costs not assessed		Not costed but would exceed Option 2 costs due to significant additional utility costs	Construction method incurs higher risk costs	Alignment not feasible -costs not assessed	Alignment not feasible -costs not assessed		Not costed but very high property costs
Summary assessment									

4.2 Assessment Summary

The assessment of Options from the multi-disciplinary review (refer to Figure 20 above) highlights the key impacts of each option. These have been colour coded to indicate:

(red)	Major constraint/impact
(orange)	Significant impact
(light yellow)	Moderate impact
(green)	No or Low impact

Figure 20 above indicates that:

- Option 0 – This was the original solution proposed for the EPR and whilst the station box and station arrangement have been modified to suit the single bore tunnel, the station arrangement remains essentially in the same location as the EPR scheme and retains the required benefits of good interchange with the Irish Rail Tara Street Station. This option also has the lowest construction costs, is safer to build and is much less disruptive to traffic and existing utilities. However, this option has significant property impacts on the College Gate Apartment building and would result in a loss of important leisure facilities at the Markievicz Centre.

- Option 1 – Requires a significant change to the tunnel alignment and is not viable due to the unacceptably low track radii needed to align O'Connell Street and Tara stations, which are incompatible with TBM tunnel construction. This option is not recommended.

- Option 2 - Would have significant impacts on Tara Street during construction with traffic disruption over an extended period affecting wider city traffic movements. There would also be significant impacts arising from utility diversions and environmental impacts. Overall construction costs are likely to be higher than the other options considered. This option also has significant property impacts to the entire city block between Tara Street and Corn Exchange Place. As such, this option is not recommended.

- Option 3 –This option cannot be delivered without significant disruption to key elements of the Dublin sewer network running along Townsend Street (including an old 2.4m circular brick foul sewer and 1.2m circular concrete foul sewer). Diversions would be a major engineering challenge in this built-up area, with significant local disruption and risk to maintaining the integrity of the systems being an important constraint on this option. These are considered a key concern against this option. As such, this option is not recommended.

- Option 4 – This option involves the mining of a cavern below the existing College Gate buildings, which carries substantially more safety risks during its construction than all the other options. Whilst the initial construction cost would be slightly more than Option 0, the potential for additional risk and cost associated with mining could easily lead to increased costs during construction and it could be expected that the tendered cost would make allowance for such risk. While Option 4 would retain the College Gate building there would be significant disturbance to residents because of the shaft construction directly adjacent to the building and the mining of the tunnel directly underneath part of the building. These construction activities are estimated to take up to 2 years. During this period there would be risk to the building from the mining activities including potential for structural damage, and significant construction disturbance, including noise and vibration, such that it is envisaged that this would require moving everyone out of the building during construction for a period of up to two years. For these reasons this option is not recommended.

- Option 5 - In order to achieve this alignment, there is a very sharp radius curve introduced into the Metro alignment coming from O'Connell Street station. The curve radius of 205m is incompatible with the ability to construct a bored tunnel using a tunnel boring machine and in addition the radius is outside of the preferred rail track alignment horizontal criteria. For these reasons this option is not recommended.

- Option 6 - There is a similar sharp radius (210m) required as for Option 5 making this option similarly not viable. This option is not recommended.

- Option 7 - The lack of direct station connectivity between DART and Metro at this location fails the strategic objective of building a station at this location. In addition, the alignment passes under the Dart viaduct foundations twice. The disruption associated with this option will impact on existing structures and buildings including the frontage of St Marks church. For these reasons this option is not recommended.

- Option 8 – Would require demolition of the Georges Quay business blocks with significant business disruption and high associated costs. In addition, the alignment would pass under the DART viaduct foundations twice and the open cut station construction would take place in close proximity to the foundations of the Irish Rail DART Station. For these reasons this option is not recommended.

5. Conclusions & Recommendation

Given the results of the multi-disciplinary assessment undertaken on Options suggested from the EPR public consultation and the further options identified and assessed, it is concluded that **Option 0: Base scheme with Station Box and Building Demolition** should remain as the Preferred Route Option.

It provides the best combination of cost certainty, restricted impact on traffic and utilities and will adopt a safe form of construction. This location retains a good interchange facility with the Tara Street Dart Station, a key requirement of a metro station in this location. It is accepted that this has significant impacts on property and community leisure facilities and TII/NTA will work closely with residents whilst developing this option.

For Option 5 & 6, a very sharp radius curve is introduced into the Metro alignment coming from O'Connell Street Station. The curve radius of 205m (Option 5) and 210m (Option 6) is incompatible with the ability to construct a bored tunnel using a tunnel boring machine and in addition the radius is outside of the preferred rail track alignment horizontal criteria.

For Option 7, the lack of direct station connectivity between DART and Metro at this location fails the strategic objective of building a station at this location. In addition, the alignment passes under the Dart viaduct foundations twice. The disruption associated with this option will impact on existing structures and buildings including the frontage of St Marks church.

For Option 8, this would require demolition of the Georges Quay business blocks and similar to Option 7, the alignment would pass under the DART viaduct foundations twice and in addition, would require the construction of an open cut station in close proximity to the foundations of the Irish Rail DART Station.

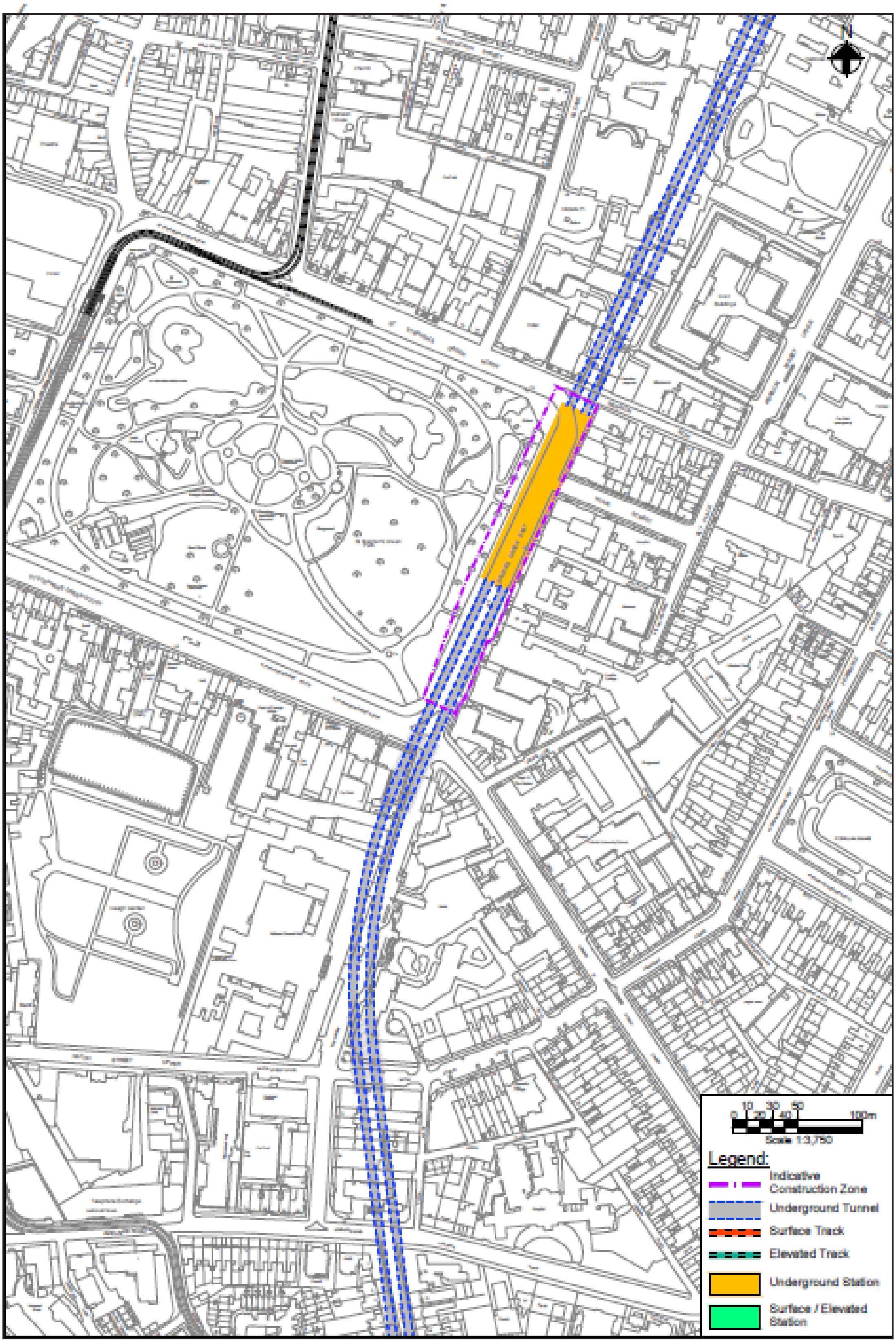
For Option 4, a mined tunnel between two shafts adjacent to College Gate apartment building, performs similarly to Option 0 with respect to traffic disruption and utilities impact, but has more safety risks during construction and significantly is likely to require extensive temporary rehousing of College Gate residents for a period of up to two years due to significant construction activities directly adjacent to, and under, the building with associated noise and vibration.

For Option 2, this would result in significant impacts along Tara Street which would be difficult to manage effectively and gain approval from bus operators and Dublin City Council. There would also be significant impacts arising from utility diversions and significant property impacts to the entire city block between Tara Street and Corn Exchange Place.

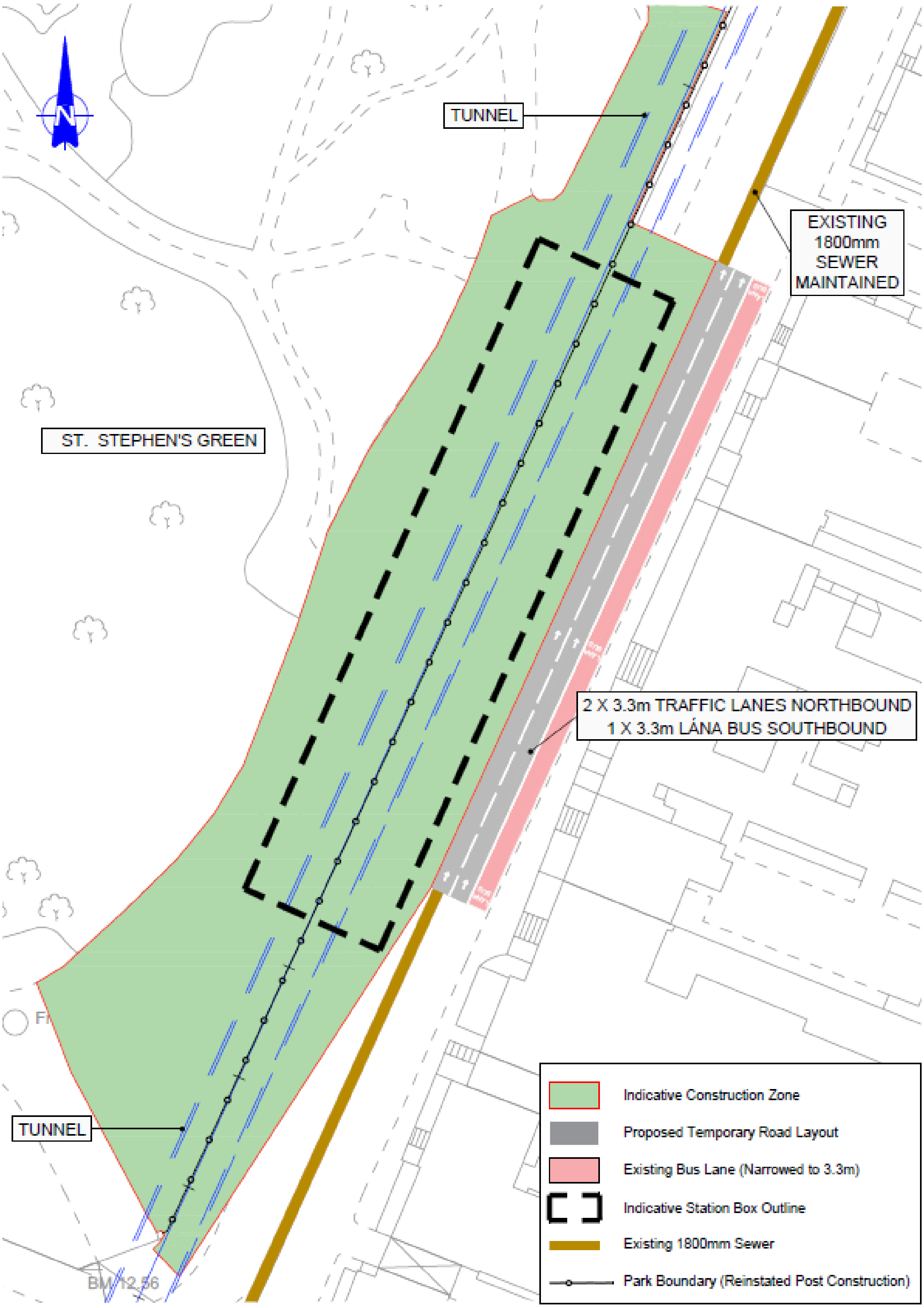
We conclude that Option 2 and Option 4 have more constraints and risk for their construction when compared to Option 0, without compensating benefits, and therefore Option 0 is the proposed option to be progressed as part of the Preferred Route.

Appendix N. St. Stephen's Green Station

This appendix shows the original EPR route alignment and St Stephen's Green Station. It also shows a potential option under consideration for the Preferred Route alignment.



EPR alignment at St Stephen's Green



Preferred Route – Indicative layout for St Stephen's Green station – subject to further assessment

Appendix O. Charlemont Station

Contents

Executive Summary

This report has been prepared to outline the design evolution process of Charlemont Station from the Emerging Preferred Route (EPR) to Preferred Route.

The EPR placed the proposed Charlemont Station underground to the south of the Grand Canal in an area subject to new development. The public consultation on the EPR drew out several concerns regarding the location and impact on adjacent properties. Key among these were impacts on adjacent Dartmouth Terrace, impact on the office development proposals for the area and the impacts of the southern connection to the existing LUAS Green Line.

The Preferred Route proposals for Charlemont Station both amend the depth and adjust the station box width, length and layout compared to the EPR. The tunnel approach to the station from the north has been lowered to pass safely under the Grand Canal and the major combined sewer running under Grand Parade, which would otherwise require significant intervention work to avoid the tunnel. The station box depth has been increased to suit this revised tunnel alignment.

The station box layout has also been developed to retain the ability to construct the full station box and internal fit-out in close proximity to a proposed office development overhead, including some advanced station box works to ensure the station can be safely constructed at a later date.

Design is on-going for this station, to accommodate the necessary station requirements, to minimize environmental impacts and to mitigate impacts on adjacent properties. Some additional construction impacts are currently envisaged on the gardens of Dartmouth Terrace properties due to potential station size requirements, but we will be seeking to ameliorate these impacts to property as much as possible as part of the design process.

The MetroLink Charlemont Station will continue to act as an interchange station with the adjacent LUAS Green Line Charlemont stop, with a pedestrian connection via Grand Parade between the two stations. Pending future extension of the Metro southwards, the station will now provide the temporary southern terminus for MetroLink, but with the tunnel extended southwards to facilitate the future Metro extension and temporary turn-back requirements for the Metro services.

1. Introduction

1.1 MetroLink Development and Consultation

Metro North was the project name of the original proposal for a metro railway system connecting Swords and Dublin Airport with Dublin City Centre at St Stephen's Green. This scheme was developed by the Railway Procurement Agency through the Railway Order process to successful planning approval by An Bord Pleanála (ABP) in 2010. The global economic downturn intervened, and in 2011 the Government postponed the Metro North project.

Figure 1 – MetroLink Route and Stations (2018)

The National Transport Authority's (NTA) Transport Strategy for the Greater Dublin Area, 2016-2035 identified a Metro service as the preferred public transport mode to address the transport needs of the Swords-Airport-City Centre corridor. It also envisaged the upgrading of the existing Luas Green Line between Ranelagh and Sandyford to a Metro level of service.

Project Ireland 2040 included the National Development Plan (2018-2027), which combined those two projects to form MetroLink. MetroLink will provide a fast, high capacity, high frequency, modern and efficient public transport service for people travelling along the Swords/Airport to City Centre corridor. In addition, the Scheme will connect to the existing Luas Green Line (an existing surface light rail line) in the South City area, enabling through running metro services from Swords to Sandyford. MetroLink will result in a north-south segregated metro system from Estuary to Sandyford as shown in Figure 1.

The metro route length is approximately 19km and the completed system will have 15 new stations, 3,000 Park and Ride spaces, and a journey time of approximately 25 minutes from the City Centre to Swords.

The NTA commissioned Arup Consulting Engineers to undertake a Route Alignment Options Study for the Scheme in 2016. The objective of the study was to carry out a comprehensive route option selection to identify an Emerging Preferred

Route (EPR). The study was completed at the end of February 2018 and it included a Concept Design for the EPR.

Separately, in January 2018, the TII/NTA commissioned Jacobs and Idom JV (Jacobs/Idom) to provide ongoing engineering design services through to scheme completion.

1.2 Public Consultation

A programme of public consultation led by TII/NTA was conducted between 22nd March and 11th May 2018, during which members of the public and other stakeholders were invited to submit their views and observations of the EPR. Many submissions were made with some related to Charlemont Station. The key issues raised are listed below;

- Disruption to the Green Line service during connection and upgrade works between Charlemont and Ranelagh;
- Impacts on the heritage embankment wall from the old Harcourt Rail Line due to construction works at the tie-in;
- Property acquisition of residences and back gardens to facilitate the connection;
- Retention of existing right-of-way providing access to rear of properties on West Cambridge Terrace to the south of Dartmouth Road;
- Concerns on pedestrian routes interconnecting the future MetroLink with the terminated Green Line and level of access for mobility impaired users on these pedestrian desire lines;
- Clarity required on interaction with the current planning permission under review by An Bord Pleanála on this site, and
- Introduction of a new passenger transfer movement to switch from the metro to the existing Green Line for those travelling into the city centre.

TII/ NTA and Jacobs/Idom have carefully considered the many statements and submissions made from the interested and affected parties. Furthermore, other opportunities for improvements for the proposed route have been identified during the preliminary design. A multidisciplinary analysis of potential options arising has resulted in a number of proposed changes to the MetroLink scheme.

This report considers the relative merits of the proposed Charlemont Station location as presented in the Emerging Preferred Route (EPR) versus the option being currently developed as part of the preliminary design, as well as other options considered. The assessment used a multi-disciplinary analysis of the options, having regard to the identified constraints with particular consideration of the following:

- Potential architectural heritage impacts during construction and operation;
- Potential Impacts with foundations of new development;
- Impacts on nearby residential receptors

- Constructability & Access; and
- Other environmental and Planning Constraints.

This report takes account of the consultation submissions and further assessment undertaken for the Charlemont Station site and presents the changes proposed in the Preferred Route for the Charlemont Station stop.

2. Emerging Preferred Route (EPR) Charlemont Station

2.1 Charlemont Station EPR Location and Constraints

The Emerging Preferred Route (EPR) proposed that the underground Charlemont Station be located near the existing Charlemont Luas Stop, on the south side of and next to the Grand Canal. It is the last underground stop before the Metro would join the Luas Green Line alignment running southwards to Sandyford.

The location of Charlemont Station is shown in orange on the map in Figure 2 below, which also indicates the area of work needed on the Green Line so that Metro trains could operate to and from the twin-bore tunneled section shown in blue, as proposed for the EPR.

Figure 2 – EPR Charlemont Station and Green Line Connection

The proposed station at Charlemont is designed to be an interchange station with the existing Green Line to the south and LUAS Cross City services from the north. Figure 3 below shows the general location of the proposed Charlemont Station, indicated by the white dotted line, with key features affecting the design and location considered for the station also highlighted. These include a planned development site, a traction sub-station, and the properties that are protected or potentially affected by the works. The Grand Canal passes in an east-west direction just to the north of the station site.

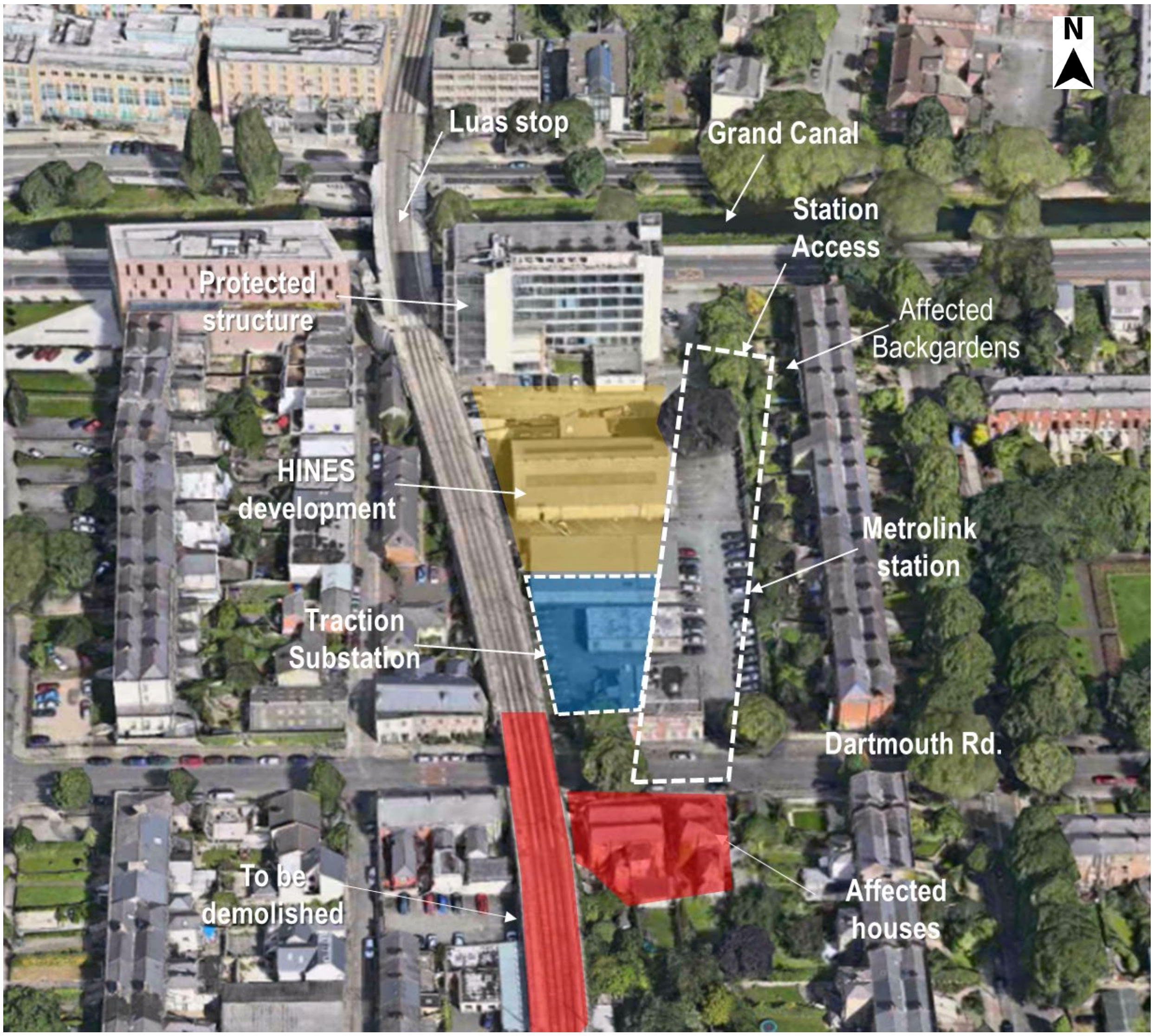


Figure 3. Station Location and Constraints

The station site is adjacent to the Carroll's Building, the former Irish Nationwide building alongside Grand Parade. The Hines Group has received planning approval (Ref. 2373/17) to refurbish this building and to develop a new office building on the site coloured yellow requiring an integrated Over Station Development (OSD) as discussed later in this report.

In the EPR the site of the proposed Charlemont underground station was located just south of the Grand Canal and Grand Parade Road. From this point the Metro alignment rises onto the existing Luas Green Line embankment before proceeding to Ranelagh Station and other stations to the south.

2.2 Concept Design for the EPR Charlemont Station

The EPR Charlemont Station concept proposals and tie-in details to the LUAS Green Line corridor to the south are constrained by the following:

- Grand Canal to the north;
- Dartmouth Terrace buildings to the east;
- Dartmouth Road to the South;
- Proposed office developments; and
- The presence of a 3.6m diameter combined foul and storm water sewer running along and under Grand Parade.

Figure 4 below shows the EPR station layout together with details of buildings which would be required to be demolished. These buildings are indicated as red hatching. The buildings were required to be demolished as a result of the station construction and the need to connect to the Luas Green Line.

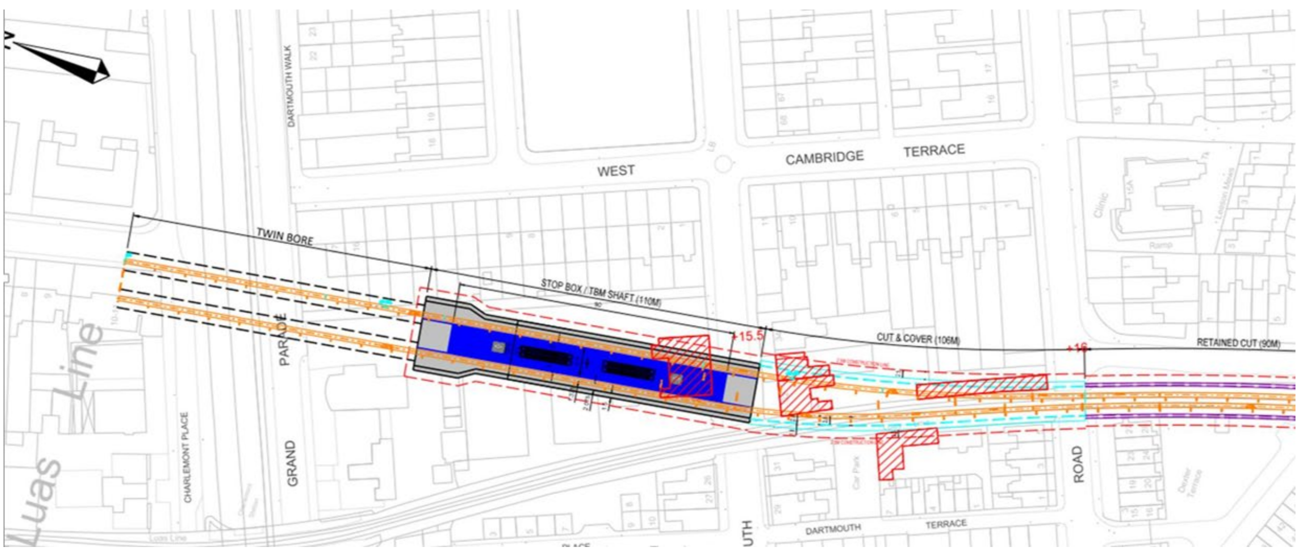


Figure 4 - EPR Station & Green Line Connection Impacts on the Area

3. Preferred Route Charlemont Station

3.1 Key Changes for Preferred Route

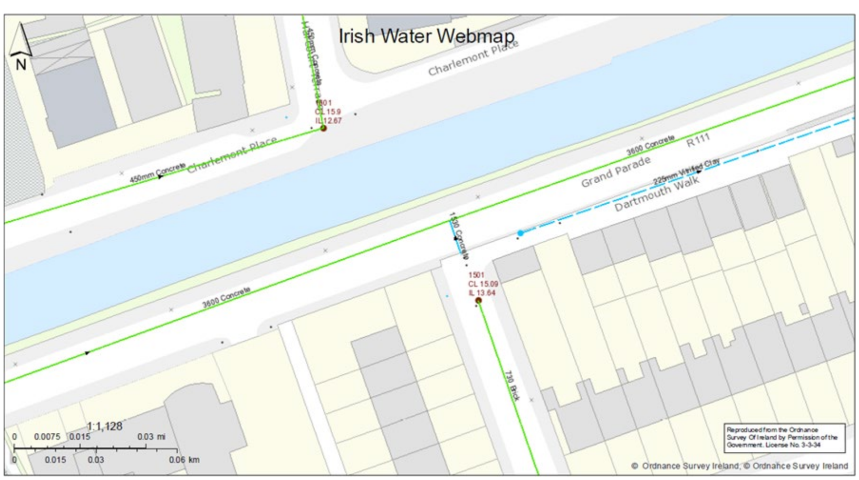
Several changes have been proposed to the Charlemont Station layout as now proposed for the Preferred Route. These changes have been incorporated to reflect:

- The proposed change from twin bore tunnel to a single bore tunnel;
- Development of appropriate space for ‘Back of House’ station requirements including M&E, ventilation and other support facilities;
- Mitigation of some of the property impacts that would have occurred with the EPR station arrangement, there is no need to demolish the buildings located to the south of the station;
- The proposed office development which will partially lie over the station box; and
- Construction issues associated with passing under the major sewer along Grand Parade based on more accurate information of its line and level.

3.2 Station Design

The Preferred Route tunnel design change from twin-bore to single-bore means that the design for the interchange station at Charlemont is altered from a central platform to side platforms.

Given the importance of the major combined sewer (3.6m diameter) along Grand Parade, a detailed site survey was undertaken to confirm its line and level to support the Preferred Route tunnel alignment design at Charlemont Station. Number of potential diversions and regrading options (including a syphon) were considered for the 3.6m combined sewer but were found unfeasible due to the complexity, cost, disturbance caused to the traffic on Grand Parade Road and future sewer maintenance issues. Therefore, it was confirmed to be unfeasible to keep the tunnel level in the position envisaged in the EPR and the tunnel was required to be lowered to pass under the sewer. Figure 5 below shows a plan view and cross-section of the existing sewer. Figure 6 indicates the proposed Preferred Route alignment showing how the railway alignment will pass under the sewer whilst keeping the station box construction clear of Grand Parade, a busy traffic route, and the sewer.



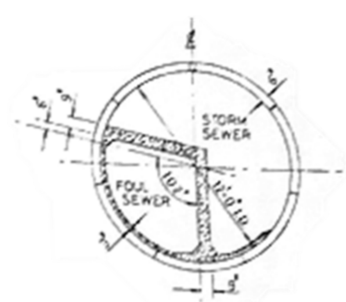


Figure 5 – Plan of Sewer along Grand Parade and Sewer Cross Section (from Irish Water records)

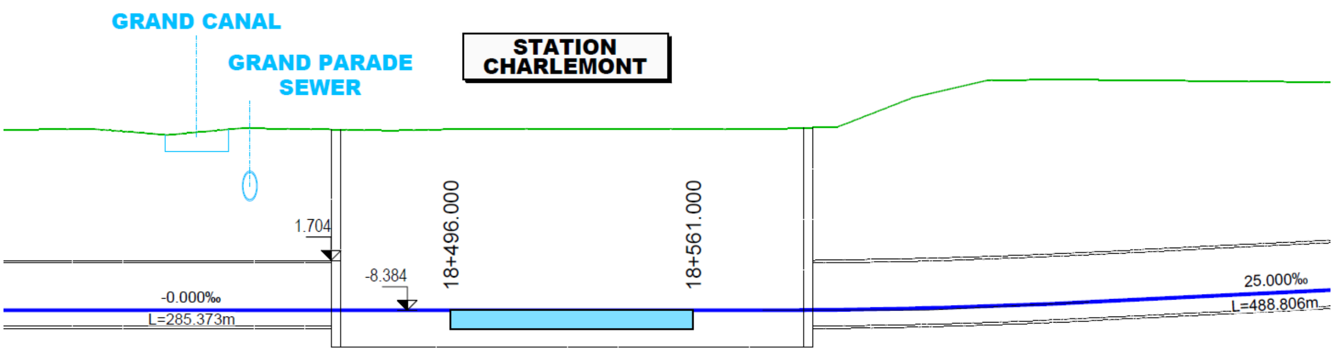


Figure 6 – Vertical Alignment of MetroLink tracks and location of the Sewer.

Confirmation of the existing sewer levels has necessitated the lowering of the tunnel alignment where it passes under Grand Parade to ensure safe clearance can be provided to the sewer. Alternatives to lowering the metro tunnel would require significant works on the 3.6m diameter combined sewer while simultaneously keeping the sewer in service. These alternatives included the following:

- Permanent pumping over the metro tunnel.
- An inverted siphon under the metro tunnel, or:
- A vertical realignment of the sewer over several hundreds of meters with an aim of increasing the invert level at the tunnel crossing points.

All these high complexity works would have a significant impact on the local road network and would require temporary or permanent pumping (which required digging large pumping wells). The works could also result in an increased the risk of sewer failure / severe interruption. Given the strategic nature of this sewer this risk was deemed unacceptable. The lowered tunnel alignment results in the Preferred Route having a deeper station compared to the earlier EPR design.

The station location itself is in a similar location to that envisaged in the EPR, aligned between Dartmouth Terrace properties to the east and a proposed office development to the west, lying adjacent to and partly over the station. Development of the station design to accommodate the necessary station requirements currently indicates the need for a slightly longer station box than envisaged at EPR stage. The southern end of the station box is retained in the same location as in the EPR scheme, under Dartmouth Road but avoiding properties on the south side of the road; however, the longer box gives rise to some additional construction impact on the gardens of Dartmouth Terrace properties. Design is on-going for this station and we will be seeking to ameliorate these impacts to property as much as possible as part of the design process.

The station arrangement also includes for an underground Traction Power Substation to be provided on the site.

With regard to the adjacent proposed office development of the Carroll's Building, which will commence before MetroLink has completed its statutory process, TII/NTA has entered into discussions to reach an agreement with the developer, Hines Group, to incorporate some early station box wall works into their building development. This is to ensure that the station can be safely constructed at a later stage around and partially under the new office development.

The lowered tunnel and rail alignment to pass under the sewer also mean that the subsequent southern tie-in envisaged to the LUAS Green Line cannot now be undertaken in the same way as envisaged in the EPR study, as the gradients to achieve the same tie-in location as proposed at Ranelagh would be too steep. Therefore, further tunneling southwards to provide potential for a future tie-in nearer Beechwood will be required The Preferred Route station outline is indicated on the image in Figure 7 below. An indicative station layout is shown in more detail in Figure 8, although the final station layout/design is subject to further development.

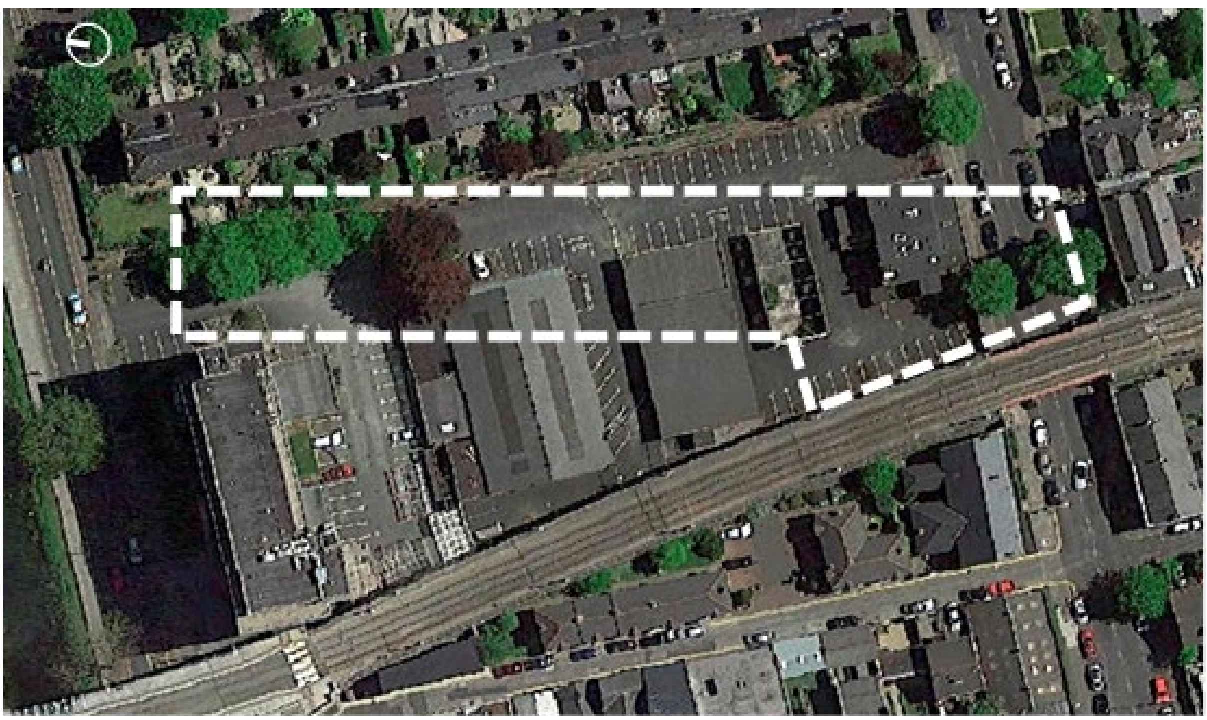


Figure 7 – Image of Station Boundary

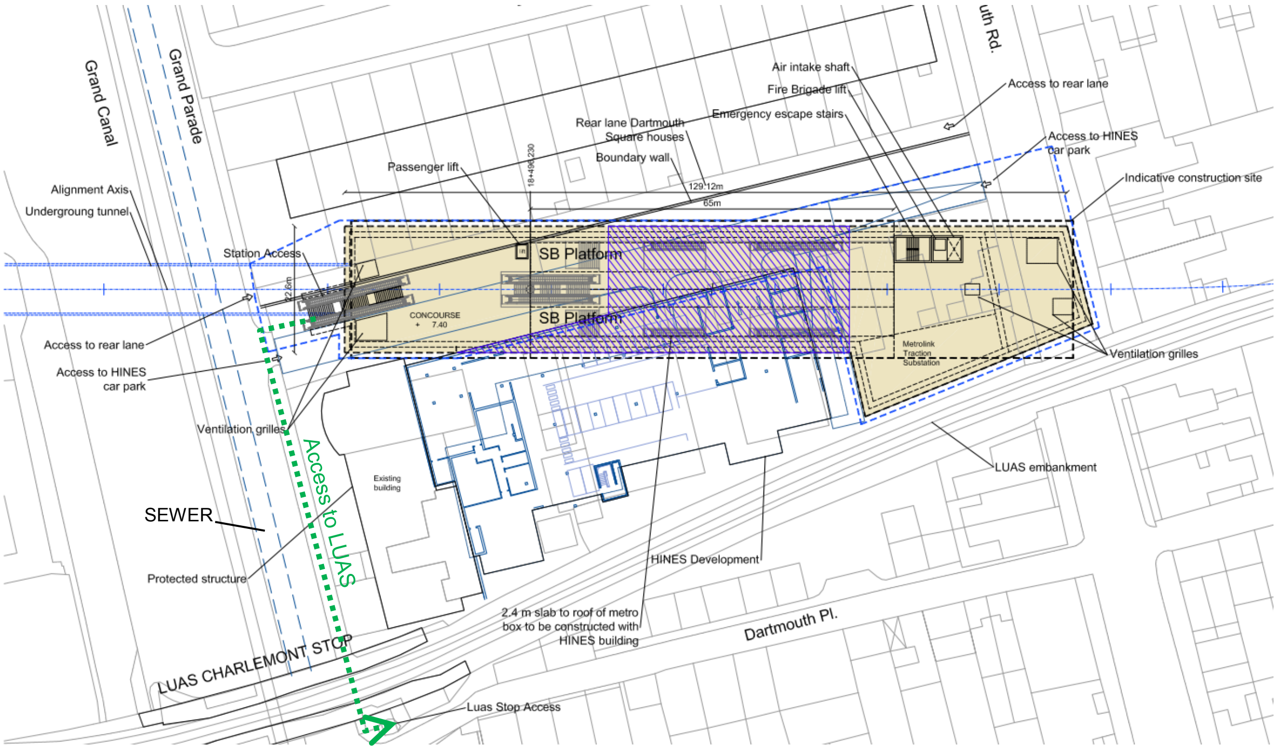


Figure 8 - Indicative Layout of Proposed Charlemont Station (Note: subject to change due to ongoing preliminary design)

The Charlemont Metro Station access and egress points are to be provided at the north end of the station to provide direct access to Grand Parade Road. This then provides a short and direct walking route (as shown in Figure 8 above as a green dotted line to the nearby existing Charlemont Luas station where step and lift access is proposed.

The longitudinal section in Figure 9 shows the vertical access route using steps, escalators and lifts from Grand Parade Road level to the platforms.

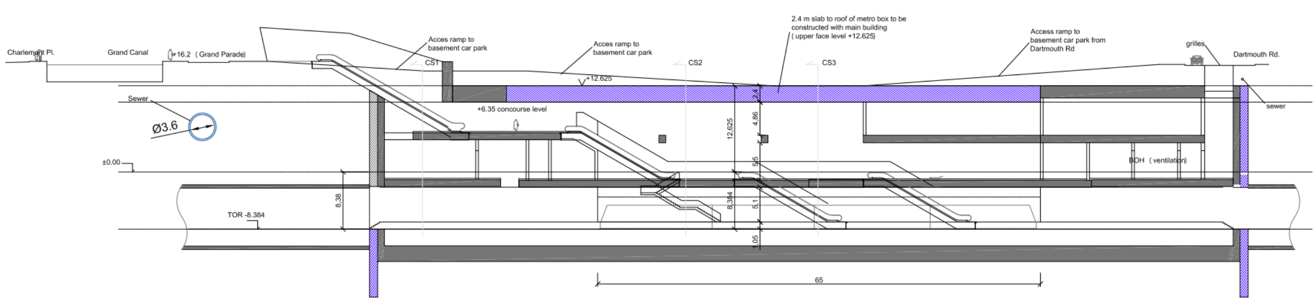


Figure 9 – Indicative Longitudinal Section of Station and Tunnel

A cross section through the station and the planned commercial development to the west is shown in Figure 10 below. This is subject to further design discussions and agreement with the developer, regarding construction programming and integration.

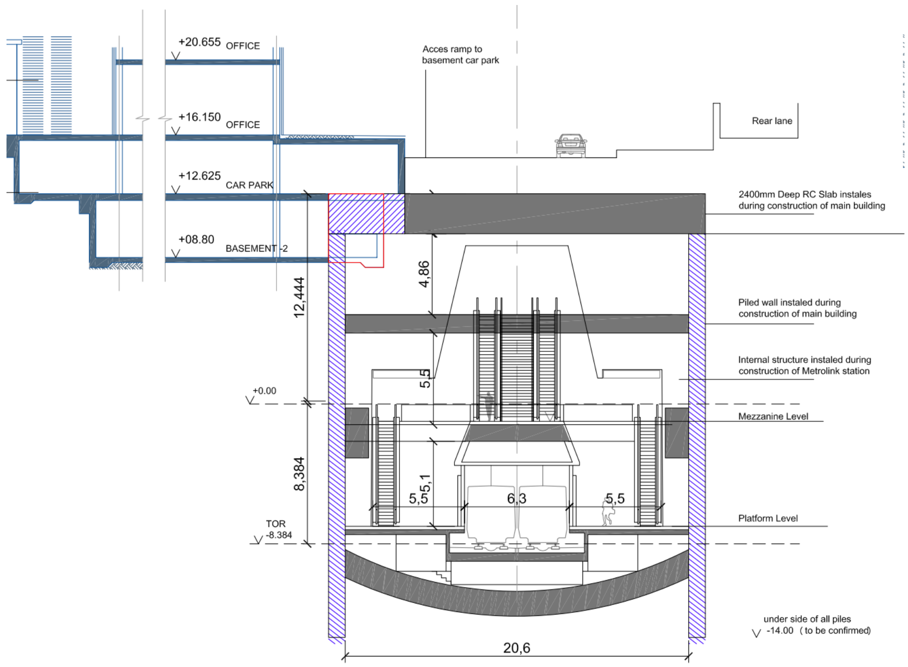


Figure 10 – Indicative Cross Section through Station and Commercial Development

3.3 Urban Setting

The proposed Charlemont Station is one where there is potential to add to the urban setting enhanced by the Grand Canal and the planned commercial development. This aspect will be further developed as the design is progressed. Figure 11 provides one typical option as to how the station could be integrated at street level.

Figure 11 – Potential Urban Setting and connection to existing LUAS Stop (Note: subject to change due to ongoing preliminary design)

3.4 Environmental Considerations for the Revised Station Design

The primary environmental advantages of the preferred station design is the avoidance of impacts on the sewer and railway embankment. However, the station location has the potential to result in some negative environment impacts which will be assessed in full in the Environmental Impact Assessment Report. The main potential impacts are as follows:

- Potential for noise and vibration impacts during construction of the station box. The revised station design will still have impacts due to significant excavations in very close proximity to residential and other properties. However, the impacts will be less than those generated for the EPR as that option required the excavation of a significant railway embankment in close proximity to a number of residential properties.
- Potential for groundborne noise and vibration impacts to advancement of TBM through the station block and south towards termination point.
- Reduced impacts from demolition works when compared to the EPR as the railway embankment remains in place. However, potential for air quality impacts due to dust and emissions during construction remain. Impacts due to construction work, excavations, soil movement, demolition in close proximity to residential and sensitive buildings also remain.

- Property impacts due to the requirement to demolish 25 Dartmouth Road. However, 32 and 34 Dartmouth Road and 16A Northbrook Road will be retained. The station box construction will require construction space within boundaries of Dartmouth Square West, affecting 12-17 Dartmouth Square West although the final construction working space requirements remain to be confirmed following further design development. The proposal to integrate the station box with foundations of the Carroll's Building redevelopment reduces potential for future commercial property impacts.

- Potential for impacts on Dartmouth Architectural Conservation Area (ACA) with a number of buildings listed on the Record of Protected Structures (RPS) directly impacted. The proposed station is located behind Carroll's Buildings, a designated RPS on Grand Parade (a protected structure RPS Ref. 3280).

- Potential for impacts on the urban landscape in the vicinity of Charlemont. The metro station design, yet to be fully developed will seek to reduce impacts with a sympathetic and appropriate design.

- To avoid the sewer the station will be deeper and as such will result in the excavation of a larger volume and rock than was proposed for the EPR. This material will require removal from the site resulting in the generation of additional traffic during the construction phase.
- Potential remains for impacts on the historical river Swan (which is located in close proximity to the station box) and surface water impacts on Grand Canal.

3.5 Planning Considerations for the Revised Station Design

3.5.1 Development Plan Context

The station location options at Charlemont, both in the EPR and in the preferred route design, are within the functional area of Dublin City Council. It has the zoning objectives of:

- Z6 (employment/enterprise zones) – to provide for the creation and protection of enterprise and facilitate opportunities for employment creation. This forms the majority of the site;
- Z1 (sustainable residential neighbourhoods) – to protect, provide and improve residential amenities; and
- Z2 (residential neighbourhoods conservation areas) - to protect and/or improve the amenities of residential conservation areas.

Within the EPR the Z1 and Z2 lands are more extensive than under the proposed station location.

It is considered that a Metro Station will help to deliver on the objectives of improving public transport infrastructure in supporting the sustainable movement needs of both employees and residents in the neighbourhood.

3.5.2 Relevant Planning History

Planning permission was granted (Ref. 2373/17) for development at the existing Carroll's Building (a protected structure RPS Ref. 3280). Planning condition 3 parts A and B are relevant to MetroLink as the applicant prior to the commencement of their development, must enter into an agreement with

TII/NTA in respect of the requirements to accommodate the construction and operation of a MetroLink on, at or near their approved development site and to ensure the structural stability and safety of rail infrastructure.

Locating a metro station here is being coordinated with the site's development. It is noted that a metro station is likely to enhance the attractiveness of the proposed scheme.

3.5.3 Planning Commentary

Relevant planning issues include:

- The proposed station option has a reduced extent of footprint in lands zoned Z1 and Z2 and does not result in the closure of Dartmouth Road when compared to the EPR;
- The proposed station at Charlemont will be integrated with the permitted development on site;
- The proposed option is well located to ensure high quality urban integration with the development above;
- The proposed station location provides good connectivity to businesses on the northern side of the canal and other modes of transportation including the Luas Green Line, Dublin Bus, car and bike; and
- The alignment of the tunnel in its approaches to the proposed station passes through further lands zoned for mixed-use facilities. Design of the tunnel route will need to facilitate future overhead development to ensure that these lands can be developed appropriately, in line with their zoning objective.

4. Conclusions

Charlemont Station for the Preferred Route is in the same location as that shown in the EPR but the station layout and depth has been modified to reflect both the change to a single bore tunnel under the Preferred Route and the need to adjust the tunnel and station arrangement to ensure the large combined sewer along Grand Parade can be left undisturbed above the tunnel bore. The development of the station design and subsequent increase in space requirements for station equipment results in a longer station than that proposed as part of the EPR and this results in increased temporary impacts on the gardens belonging to a number of properties along Dartmouth Square west.

In addition, the development of the station at this location is planned in the same place as the planning application for development of an office building for the Hines Group, to be built partially over the station in a first stage. The office development is envisaged to be completed before the start of construction of the metro and so an agreement is in place between TII/NTA and the developer for some necessary preliminary station box construction to be undertaken as part of the development.

The location of the Charlemont Station is further constrained by the adjacent housing to the east, Dartmouth Road to the south, Grand Canal to the north and the presence of the major combined sewer running under Grand Parade to the immediate north of the station location.

These constraints have led to a detailed investigation of options to mitigate impacts arising from both the tunnel alignment near the station and the station box location itself, whilst retaining the requirement to continue the metro southwards to subsequently connect with the LUAS Green Line.

The result is that the tunnel alignment has been lowered to enable the tunnel to pass below the sewer which will avoid any impact to the sewer. This sewer is considered a strategic piece of drainage infrastructure in Dublin City therefore the metro design has been amended to avoid any impact to the sewer. The design change results in a lowering of the rail level and a consequently deeper Charlemont Station.

The station box size and placement has also been adjusted to:

- Avoid the need to demolish the buildings to the south of Dartmouth Road;
- Minimize the impact on the private gardens of houses along Dartmouth Square west during construction and operation. On-going station sizing and design will seek to minimize the impact on these particular properties;
- Retains the ability to construct the full station box and internal fit-out later;
- Minimise permanent impacts on Dartmouth Road to the south; and
- Minimise impact on Grand Parade.

Further design work will continue to ensure the most appropriate station layout and size is proposed within the constraints noted above. The proposed Preferred Route and Charlemont Station location will be further developed to minimise environmental impacts and property impacts including those of the Hines Group Development, properties on the Record of Protected Structures (RPS) and those associated with the adjacent Dartmouth ACA.

Following construction, the station will provide a key interchange point with the Luas Green Line and Cross City services set within an urban setting integrated with the new Hines Group building development.

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