ARUP

DART+ Coastal North
Howth Junction & Donaghmede Station Improvements
Phase 2 Concept Design Report

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Revision P02

21/04/2023

Iarnród Éireann Irish Rail

DART+ Coastal North

NTA Údarás Náisiúnta Iompair National Transport Authority

Rialtas na hÉireann Government of Ireland

Tionscadal Éireann Project Ireland 2040

ARUP

Contents

Introduction

Major Modifications

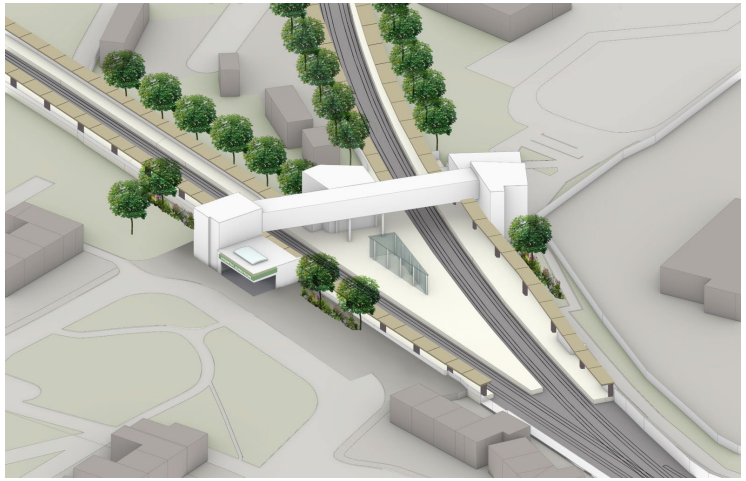
Background

In the summer of 2022, Arup developed three high-level costed options for the redevelopment of Howth Junction and Donaghmede Station as part of the initial Phase 1 (scope and approval) stage of work. This was in response to the feedback received at Public Consultation 1 regarding the use of the station as a interchange for the proposed Howth shuttle service. Each option presented a different level of intervention as follows:

- Minor Modifications
- Major Modifications
- Replacement

Following review with both Irish Rail | Iarnród Éireann (IÉ) and the National Transport Authority | Údarás Náisiúnta Iompair (NTA), it was decided to progress the proposed major modifications as well as certain minor modifications to Phase 2 - concept, feasibility and options stage.

The major modifications included proposals such as removing the gateline to the ticket halls, removing the central wall to the existing footbridge, replacing the central connection from the footbridge down to the central platforms, and replacing the stairs to the entrances. Minor modifications such as the inclusion of artwork, new lighting, signage and planting were also to be considered as part of the proposed options.



Combination of major & minor modifications proposed in Phase 1

This report presents the development of the major and minor modifications to a Phase 2 (concept, feasibility and options) level of detail, providing a series of options for each area of the station and explaining the reasoning and design process behind them.

The report is multidisciplinary and although architecturally led, input is provided from bridge designers, structural, civil, geotechnical, mechanical, electrical, public health and fire engineers.

Approach

The study is split into seven sections. Following the *Introduction* section, the *Existing Station* section provides context to the options presented by giving an overview of the existing design and the constraints and areas for improvement at a station-wide level.

The *Design Approach* section covers the ‘double diamond’ design process that has been applied during Phase 2 of the project, the research involved, and the key objectives that have informed the proposed designs. The next three sections present the proposed options, split into the different station elements as follows:

- Footbridge
- Central Connection
- Station Entrances

Each of these sections provide further information on the specific issues in those areas of the station, any engineering constraints, the design development process, and then the proposed options with axonometric layouts and visuals. All options are also covered in the 1:100 architectural plans in Appendix A. The final *Summary* section summarises the findings of the report, the key considerations and proposes a Preferred Option for all areas of the station to progress to Phase 3 (Preliminary Design).

Existing Station

Key Interchange

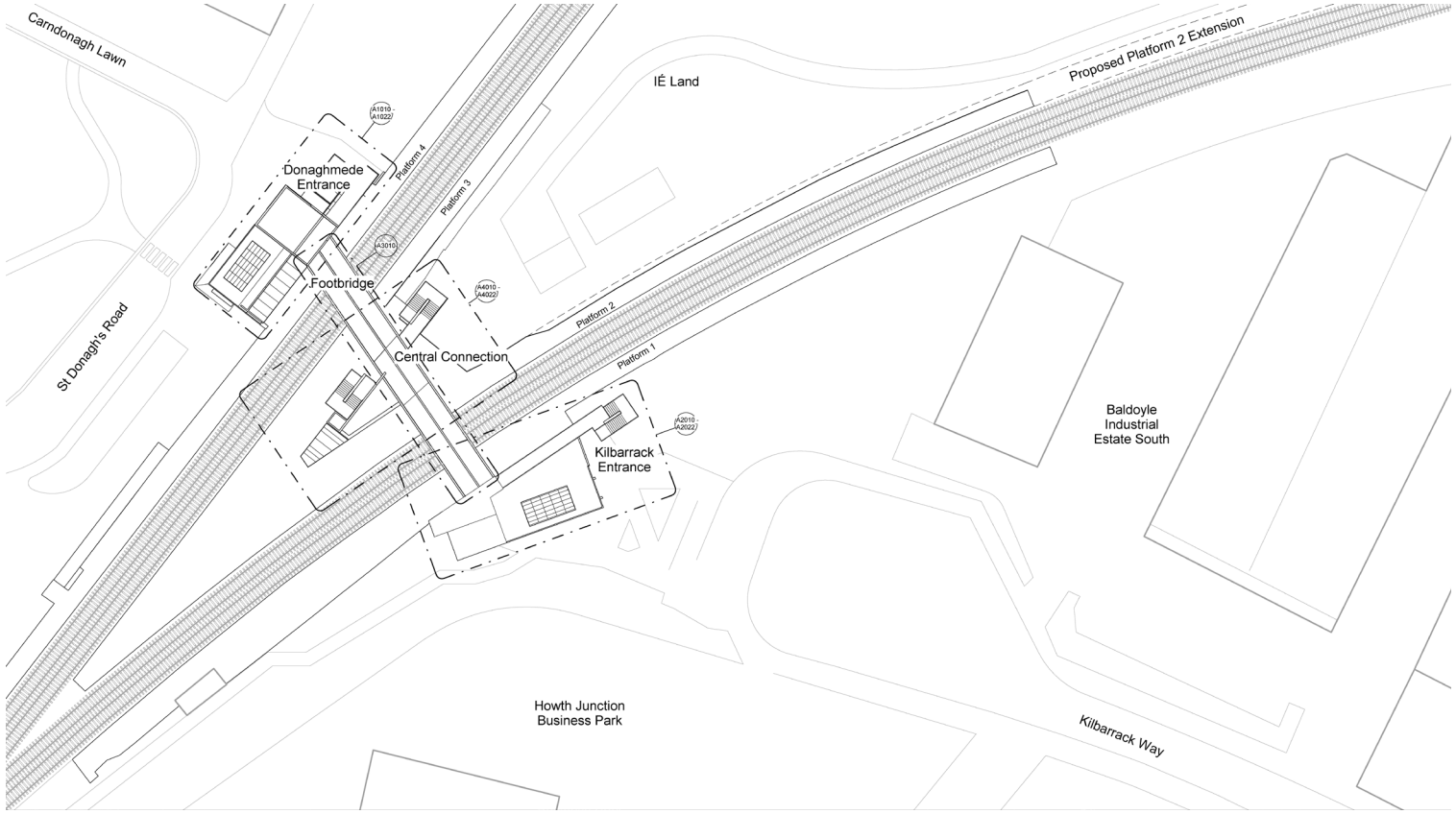
Overview

Howth Junction and Donaghmede Station is on the Dublin to Belfast main line. It serves the area of Donaghmede to the northwest and Kilbarrack to the southeast. The station is located where the line to Howth branches off the Dublin to Belfast line, making it the key interchange station on the northern section of the DART railway system.

The station consists of four platforms; platforms 1 and 2 which serve the Howth branch, and Platforms 3 and 4 which serve the Dublin to Belfast line. Platforms 2 and 3 form a central triangular platform island.

There are two station entrances: one on the Donaghmede side of the station adjacent to Platform 4, and one on the Kilbarrack side adjacent to Platform 1. Both entrances connect to each other via a footbridge, which also connects to the central Platforms 2 and 3 via stair and lift access. The level of the station entrances is approximately 2m lower than the platform and therefore a staircase and lift in each entrance connect to both the platform and the footbridge from the entrance level.

The footbridge is split in two via a central wall to serve the station users and the general public travelling between Donaghmede and Kilbarrack. A separate set of stairs at each entrance is provided for public access to the footbridge.



Site plan of the existing station

Existing Station

Assessment

Issues to address

There are two primary issues to address at Howth Junction and Donaghmede Station:

- The convoluted routes through the station. This is intrinsic due to the ground/railway levels in and around the site. For example the entrance level on both the Donaghmede and Kilbarrack entrances is 2m+ below the platform level, adding two additional stair flights and a lift stop to get to the immediate (non-central) platforms from the entrances. However, it is also created by the design with switchback stairs throughout, no direct link between platforms and stairs, and poor lines of site and intuitive wayfinding.
- The perception of an unsafe environment. This is partially created by the convoluted routes and poor lines of site as noted above, but also the scale of some of the internal spaces - the narrow footbridge, for example. There are also low maintenance and sometimes hostile finishes such as security fences and square grid mesh that do not give a sense of an open and inviting station environment. There is a lack of communication in the form of help points or posters for reporting anti-social behaviour incidents.

More detailed analysis of the issues affecting specific areas of the station are included in the *Footbridge*, *Central Connection*, and *Station Entrances* sections as this analysis forms the brief for the proposed options which directly address the issues in these areas of the station.

External view of the station from Platform 4

Design Approach

Double Diamond

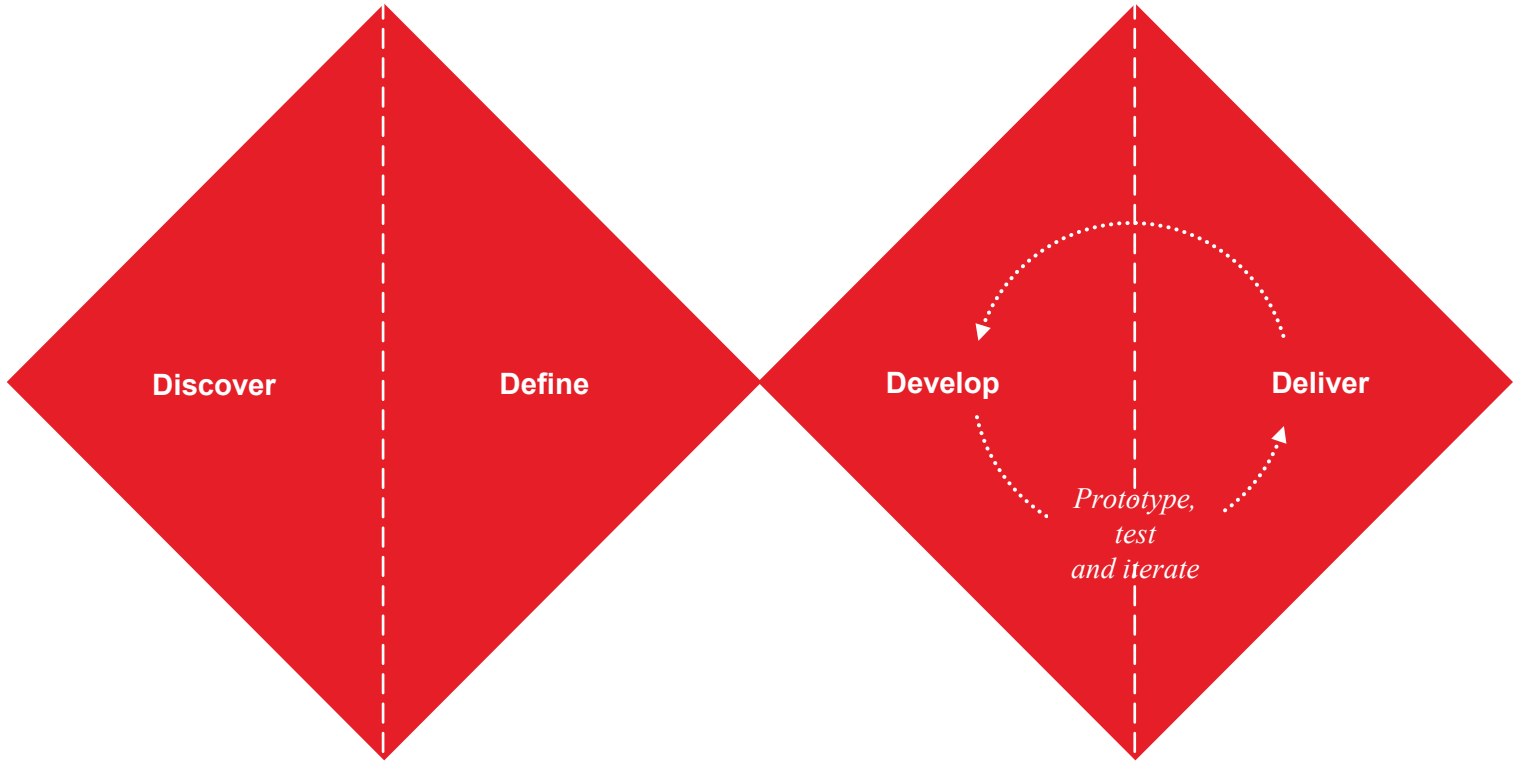
Process

A ‘double diamond’ design approach has been used to develop the Phase 2 design of Howth Junction and Donaghmede Station. This approach has two main stages:

- An Explore stage that aims to fully understand the problem to ensure that once the design process starts, the solutions developed are achieving the aims of the project.
- A Design stage that provides focused design solutions to address the problem(s) defined in the *Explore* phase, which are then thoroughly tested until the preferred solutions are agreed and delivered.

These stages are split into four key phases:

- **Discover** - involving research, site visits and speaking to clients and building users to fully understand the issues.
- **Define** - the insight gathered from the discovery phase is used to clearly and collectively define the problem.
- **Develop** - give a broad range of answers to the problem with input from as wide a range of contributors as possible such as the various engineering disciplines and client.
- **Deliver** - test and refine the solutions, rejecting those that won’t work and improving those that do.



Explore

Design the *right* thing

Design

Design the *thing* right

Design Approach

Double Diamond

Discover

The brief that had been developed during Phase 1 (Scope and Approval) gave a series of major interventions that could be implemented to improve the design of the station. To build on the work done at Phase 1 (Scope and Approval) we have carried out a site visit that included::

- travelling to and from the station on the existing Howth DART train.
- Meeting the station staff in both the Donaghmede and Kilbarrack entrances, as well as maintenance staff.
- A full tour of the front and back of house of the station and photographic survey.

The site visit was followed by the first project workshop with IÉ entitled 'Initial Requirements Workshop' that focused on asking a series of questions about the DART network more broadly, as well as the station.

This gave a more detailed insight into issues such as trespassing and anti-social behaviour and the function of key elements such as the lifts. It also helped to establish what was possible in terms of station re-design, such as not requiring a separate public footbridge, not needing a gateline and potential to move and add ticket machines.

Photo from the site visit on 15/12/2022

During this stage, research took place into how the station could be viewed beyond just a place to catch a train. A sense of ownership is needed by the station users and the local communities of Donaghmede and Kilbarrack that would help to address the anti-social behaviour issues and the insecure feeling in the station. This was looked at on a broad conceptual level as well as a detail level.

The recent successful integration of artwork in the station has demonstrated how art can change perceptions, particularly using local artists and community groups. Precedents (see example figures on page 9) were investigated, demonstrating how art could be incorporated on a more permanent basis as part of the modification work.

The feedback from IÉ in the first workshop was clear that involving the community would be very important as part of the design process. Station precedents that involved the community, whether as a community garden or input into the design and manufacture of some of the station finishes, were researched.

The history of Howth Junction and Donaghemede Station was also investigated to see if that could inform the proposed modifications. Historic images showed palm trees previously planted on the island platform and led to the consideration of options that proposed the station as a garden with successful international precedents such as Madrid Atocha Station referenced.

Design Approach

Double Diamond

Discover (continued)

Station as art gallery? Howth Junction artwork | Stockholm Metro

Station as a community asset? Station garden | Community facade

Station as a garden? Howth Junction 1977 | Madrid Atocha Station

Design Approach

Double Diamond

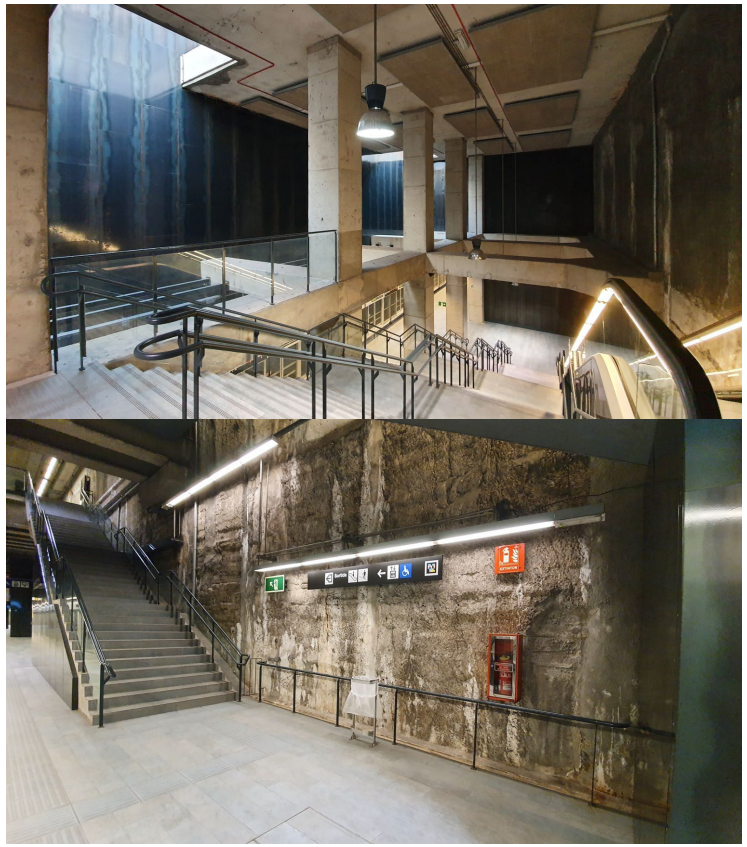
Discover (continued)

In combination with a high level look at how the station could be perceived, precedents were investigated that deal with anti-social behaviour issues such as graffiti, and create a stripped back front of house environment for ease of maintenance and to save on the cost and carbon impact of finishes.

New stations on the Barcelona Metro line 9 only include finishes and features where absolutely required (for safety reasons such as a slip resistant tiled floor), and focus on the fundamentals of creating efficient routes through the stations supported by high quality and well planned lighting and signage.

Where cladding is required, this is either profiled with staggered joints to not provide a clean surface for the application of graffiti, or a high quality material that is easy to clean such as vitreous enamel.

Overall, although it is quite an extreme approach, it shows that a highly maintainable and robust station environment can be created whilst still providing a pleasant and welcoming passenger environment.



Barcelona Metro line 9 Stations

Define

The research and discussions during the *Discover* phase were then used to establish the project objectives, which focused on:

- **Safety and Security** - proposed designs should look to mitigate crime and the fear of crime throughout the station environment.
- **Usability** - proposed designs should maximise the clarity, speed and efficiency of passenger journeys.
- **Community** - developing a sense of ownership and local identity through the station modifications should be central to the proposed designs.
- **Value for Money** - all proposed design should be directly addressing a specific problem in a cost-effective way.
- **Sustainability** - station modifications should apply circular design principles, minimising the carbon impact and reusing existing station elements where possible.
- **Maintainability** - all proposed designs should either remove or minimise maintenance requirements.
- **Buildability** - all proposed designs should allow for safe and practical construction, whilst minimising disruption to the rail services.

Design Approach

Double Diamond | Sustainability

Develop and Deliver

The following three sections of the report cover both the *Develop* and *Deliver phases* of the project, but for the specific areas of the station that they are addressing.

Each section contains a series of *Design development* pages that show the key options considered before finalising the proposal and reasoning as to why any options were discounted.

The *Proposal* pages present and explain the selected options supported by the scaled drawings included in Appendix A.

Circular Building Design

A key consideration when developing the design options was sustainability and the application of circular building design principles. This section provides context and information on this process and its application on Howth Junction and Donaghmede Station.

The goal of circular building design is to create buildings that are not only environmentally sustainable but also socially and economically sustainable. By designing buildings that prioritise resource efficiency and reuse, circular building design aims to minimise the negative impacts of construction and reduce the environmental footprint of buildings over their entire lifecycle.

Additionally, it promotes social and economic sustainability by creating spaces that are adaptable, flexible, and long-lasting, improving the well-being and quality of life of building occupants and users and reducing the need for frequent renovations or demolitions.

Circular building design seeks to shift away from the traditional linear "take-make-dispose" model, where resources are extracted, processed, and ultimately disposed of as waste, and instead move towards a regenerative model that emphasises resource recovery, reuse, and renewal.

Building for long term value is key to achieving a more sustainable outcome. This involves increasing building utilisation, designing for longevity, design for adaptability and design for disassembly/ ease of maintenance.

The project brief to improve and refurbish Howth Junction and Donaghmede Station is apt for applying circular building design principles. The '*hierarchy to low carbon design*' helped the design team to structure and interrogate design decisions to ensure that proposed interventions align with the project brief and achieve significant outcomes whilst minimising new construction and/or waste as well as cost.

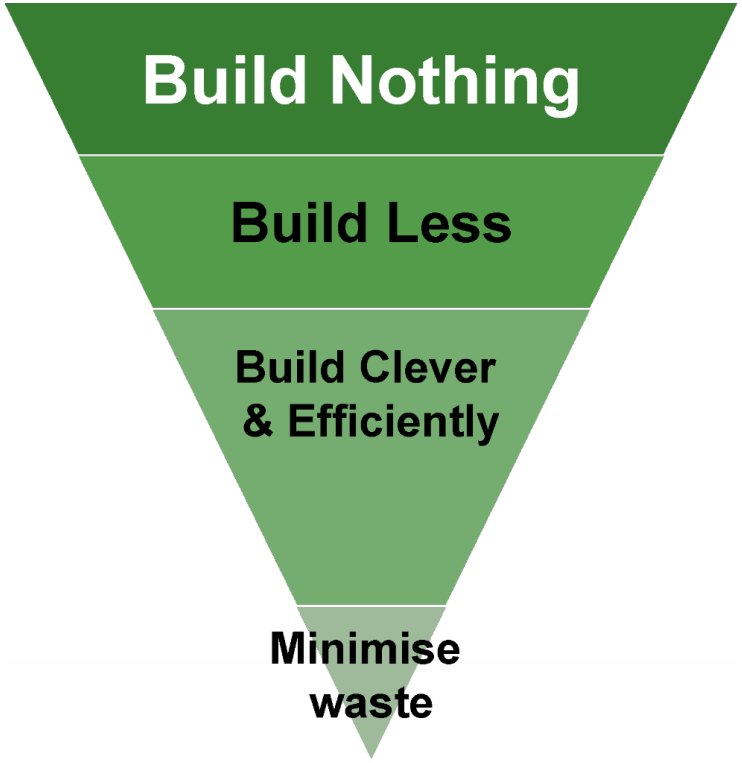


Diagram showing hierarchy to low carbon design

Design Approach

Sustainability

Circular building design (continued)

During the initial stage of the design process (Phase 1 scoping), the station components that urgently need improvements were pinpointed. By doing so, the design team was able to adopt a strategy where all other elements in the station were presumed to remain unchanged unless deemed impractical. Essentially, any superfluous new construction was rejected during the iterative process. This approach ensures any proposed interventions are necessary to improve users' spatial experience (including sense of safety, ease of navigation and visibility).

To ensure that existing structures are indeed suitable for retention, a timely survey of the existing structures should be carried out to identify if there are defects or any other factors that make retention challenging. A pre-demolition survey will also help identify any additional opportunities for reuse of materials that are removed, whether it is reuse on this site or other sites.

Longevity and social value

Enhancing the user experience of the footbridge is a crucial aspect of the proposal. This involves eliminating the partition wall that currently separates public access from station access. By promoting the shared usage of the footbridge, the station is integrated into the community experience, providing a more enjoyable connection between the Donaghmede and Kilbarrack areas. Eventually, the building asset will appreciate in value for the community, serving a purpose beyond being a mere train interchange.

Materiality also plays a significant role in the improvement proposals and will be further interrogated in the preliminary design phase. The following principles will govern the selection of materials:

- Anti-vandalism (profiled surfaces, easy to clean finishes etc)
- Durability (long lifespan, impact resistant, weather-resistant etc)
- Easy to maintain, disassembled, repaired / replaced if and when required
- Standardised/off the shelf products preferred (for ease of replacement)
- Preference over materials locally sourced to reduce transportation emissions and support local economies
- Preference over recycled and upcycled materials, or reuse of materials to reduce virgin material consumption.
- Avoidance of materials that are harmful to the environment or human health.

Furthermore, engaging local communities and artists to create artwork to embellish the new surfaces of the footbridge, lift shafts and other areas could strengthen the feeling of community ownership and generate social value.

Footbridge

Existing Bridge

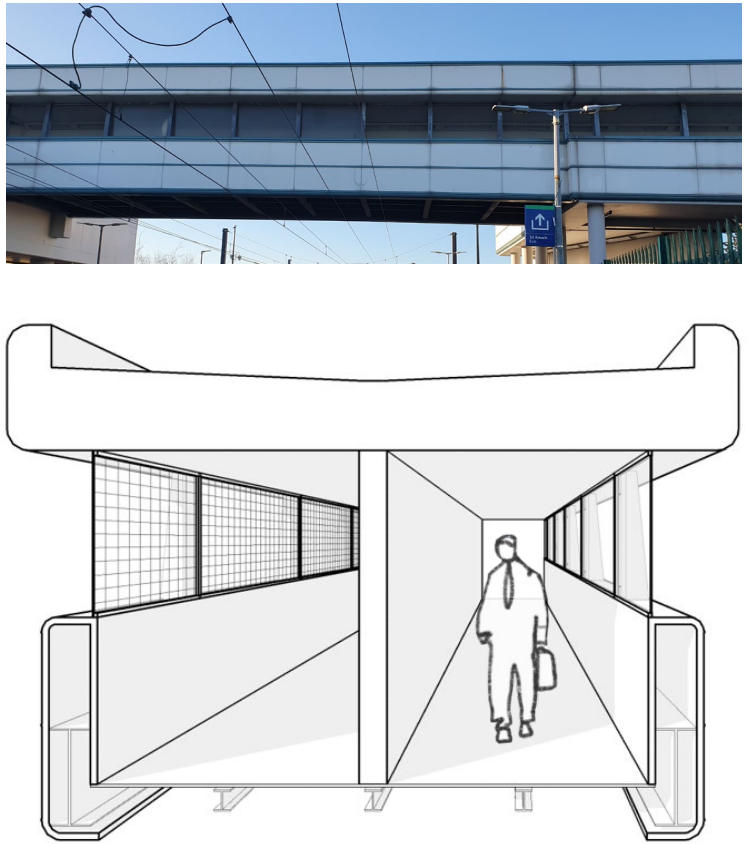
Confined passenger route

The existing footbridge spans approximately 19m linking the two station entrances to the central access stair and lift that connect to Platforms 2 and 3. The footbridge also connects the external stairs adjacent to each entrance to provide public access between Donaghmede and Kilbarrack 24/7.

The access route to the station entrances and platforms is separated from the public access route between Donaghmede and Kilbarrack by a central wall. Although the footbridge is a large structure, the central wall creates a narrow passage to each side of the bridge with only views and natural light from one side.

Simple low maintenance materials are used for the internal finishes with white ceramic steel panels to the walls and ceiling, a galvanised mild steel mesh to the windows, and a polyurethane based dark grey slip-resistant floor finish. There is minimal wayfinding signage or communication (posters) to provide passengers reassurance, and no seating at lift entrances or along the footbridge for resting.

These features and issues combine to create a relatively unpleasant environment for passengers when changing platform, and the public when travelling between Kilbarrack and Donaghmede. It also isn't a practical layout with twice the amount of lighting and CCTV required to cover both sides of the bridge, and limited space available if two pushchairs, bikes or wheelchairs are travelling in opposite directions.



Cross section of existing footbridge

Photo of existing footbridge (station side)

Footbridge

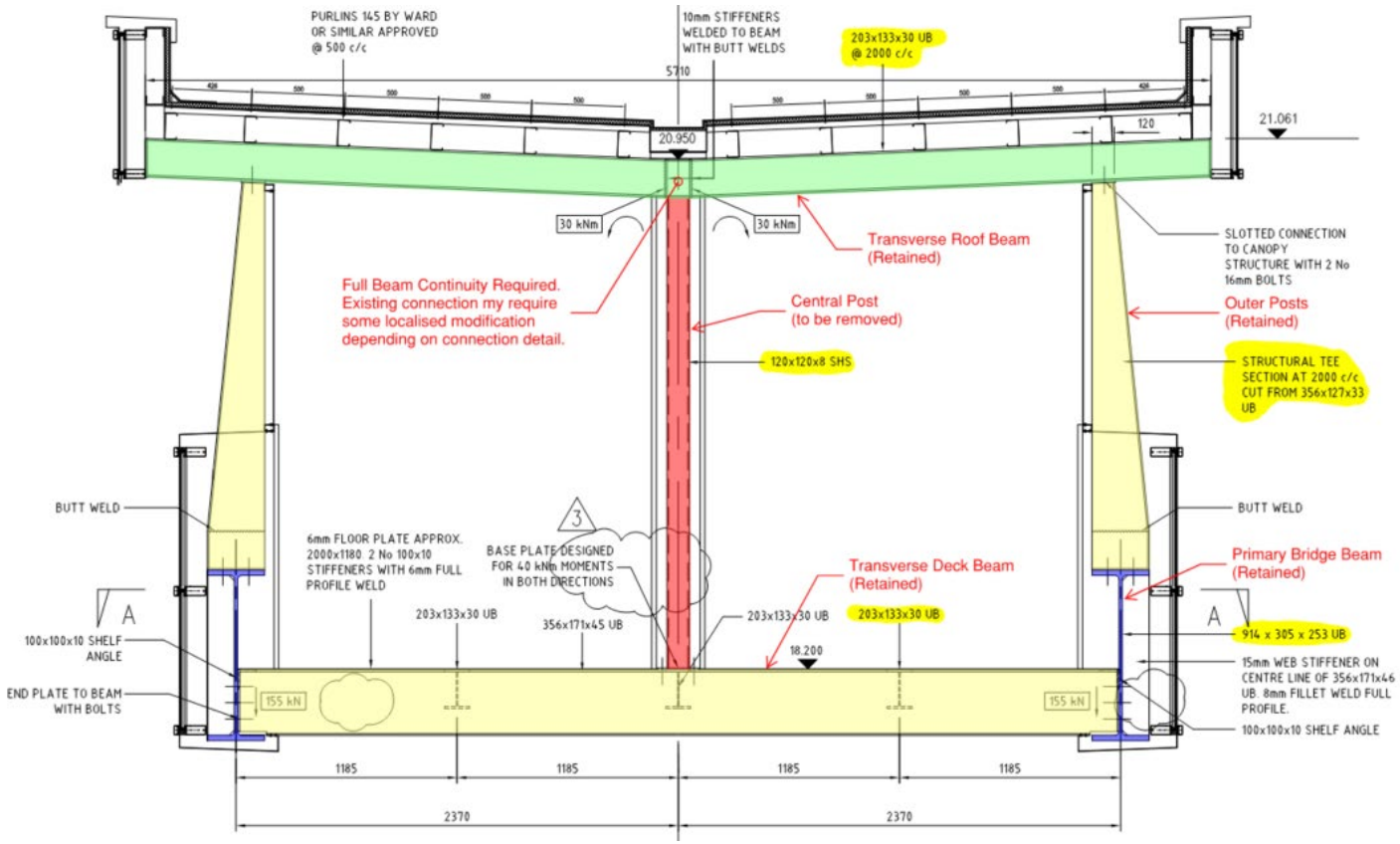
Existing Bridge

Structure

The primary structural members of the bridge comprise two Universal Beams (914x305x253 UB) running along each edge of the bridge. All bridge loads are transferred to these beams which span to the supports at each end. The bridge beams are supported on elastomeric bearings and comprise a simply supported connection.

The deck slab comprises a 6mm floorplate with transverse stiffeners, supported on a grid system of transverse and longitudinal beams. The loads are transferred to the primary longitudinal beams via transverse beams (356x171x45 UB) spaced at 2m centres.

The roofing system is supported on transverse roof beams (203x133x30 UB). These are supported vertically by outer posts and propped internally by a central post (120x120x8 SHS). The outer posts transfer the loads directly to the primary longitudinal bridge beams. The vertical post is supported by the transverse deck beam below, which then transfers the load to the primary longitudinal beams.



Marked-up section of the existing bridge indicating the structure taken from construction drawing CE837/5B/S/281

Footbridge

Design Development

Key tasks

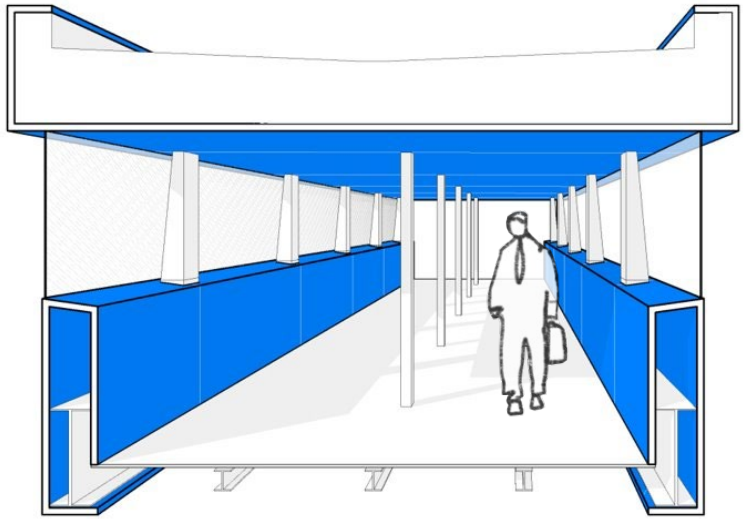
- Remove the central wall and combine the station and public use of the footbridge.
- Maximise views out and natural daylight in.
- Create a more pleasant space for passengers and the public through modifications to the finishes and installations such as lighting and signage.

Considerations

- **Accessibility:** the new space created should be as accessible as possible with a well-lit space, colour contrasting finishes and a slip-resistant floor.
- **Maintenance:** self-finished materials should be used where possible. No glass. Services are to be easily accessible and modifications designed for disassembly.
- **Safety:** 1.2m high solid balustrade to remain with IP2X rated mesh finish above to the ceiling of the footbridge.
- **Sustainability:** existing footbridge structure, finishes and services to be retained or reused where possible to reduce the carbon impact.
- **Buildability:** due to the location of the footbridge over the live railway, the intent is to limit external modifications.

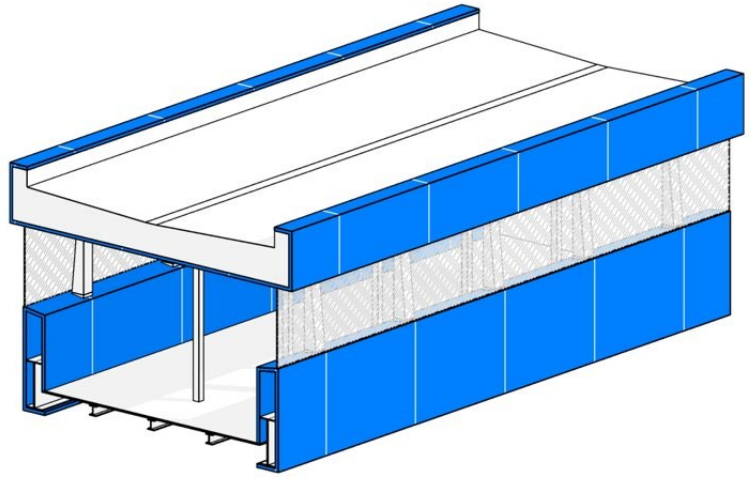
Option development

The initial concern when developing the design options was the structural posts within the central wall. Whilst structural analysis of the bridge was taking place options to remove the wall were looked at, whilst retaining the posts to minimise cost, carbon and disruption. The space still benefits from additional natural light, views, finishes and services, but with central posts located approximately every 1.5m.



Cross section of initial option - blue represents modified finishes

Proposed new finishes include a stainless steel architectural mesh to the windows to replace the existing square-grid steel mesh. The location of the mesh has been moved to the exterior of the bridge such that it is not as close to passengers when walking through the space and to give a more open feeling. The retention of the posts, however, does cause a potential obstacle within the space, particularly when crossing from one side to the other, and for persons with reduced mobility. Options to remove the posts altogether have therefore also been investigated.



Cross section of initial option showing modifications to exterior

Footbridge

Design Development

Option development (continued)

Three main approaches were taken for removing the central posts:

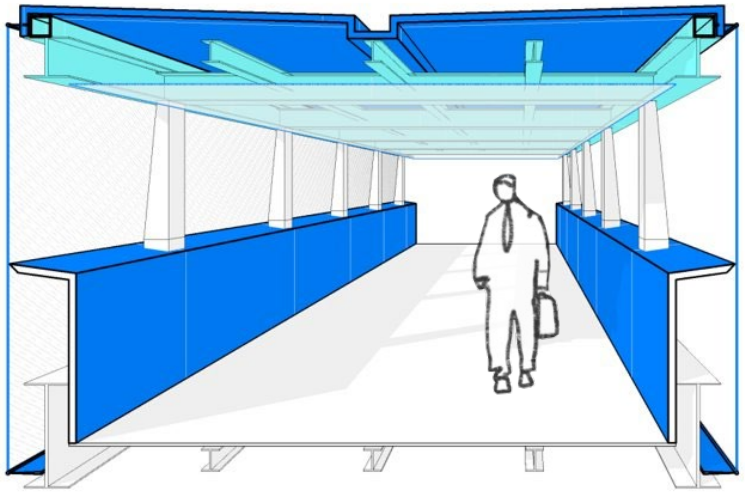
- Modify the existing roof structure
- Replace the roof
- Replace the roof and side wall structure

The intent for the modification option was for the works to take place beneath the roof to avoid affecting the drainage and finishes above, whilst minimising any reduction in headroom.

The roof replacement option looked to retain the structural tee sections to the side of the bridge, but replace the roof structure, roof finishes and internal ceiling in their entirety.

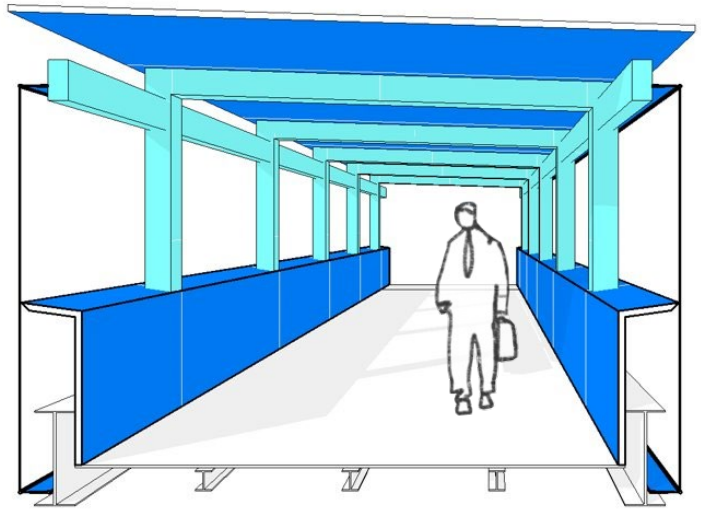
The third option entails replacement of everything apart from the structural bridge deck, including structure and finishes.

Although the replacement options come with a greater associated cost, carbon impact, and amount of disruption, they provide a significant opportunity to change the feel of the bridge. The introduction of new, softer and more sustainable materials such as timber was investigated. However, the structural analysis of the bridge demonstrated that no structural modifications were required if the central posts were removed, therefore making the selection of a preferred option that avoided the cost and disruption an easy decision.



Cross section of option to replace the existing roof structure

Cross section of option to replace the existing roof & wall structure



Cross section of option to replace the existing roof & wall structure

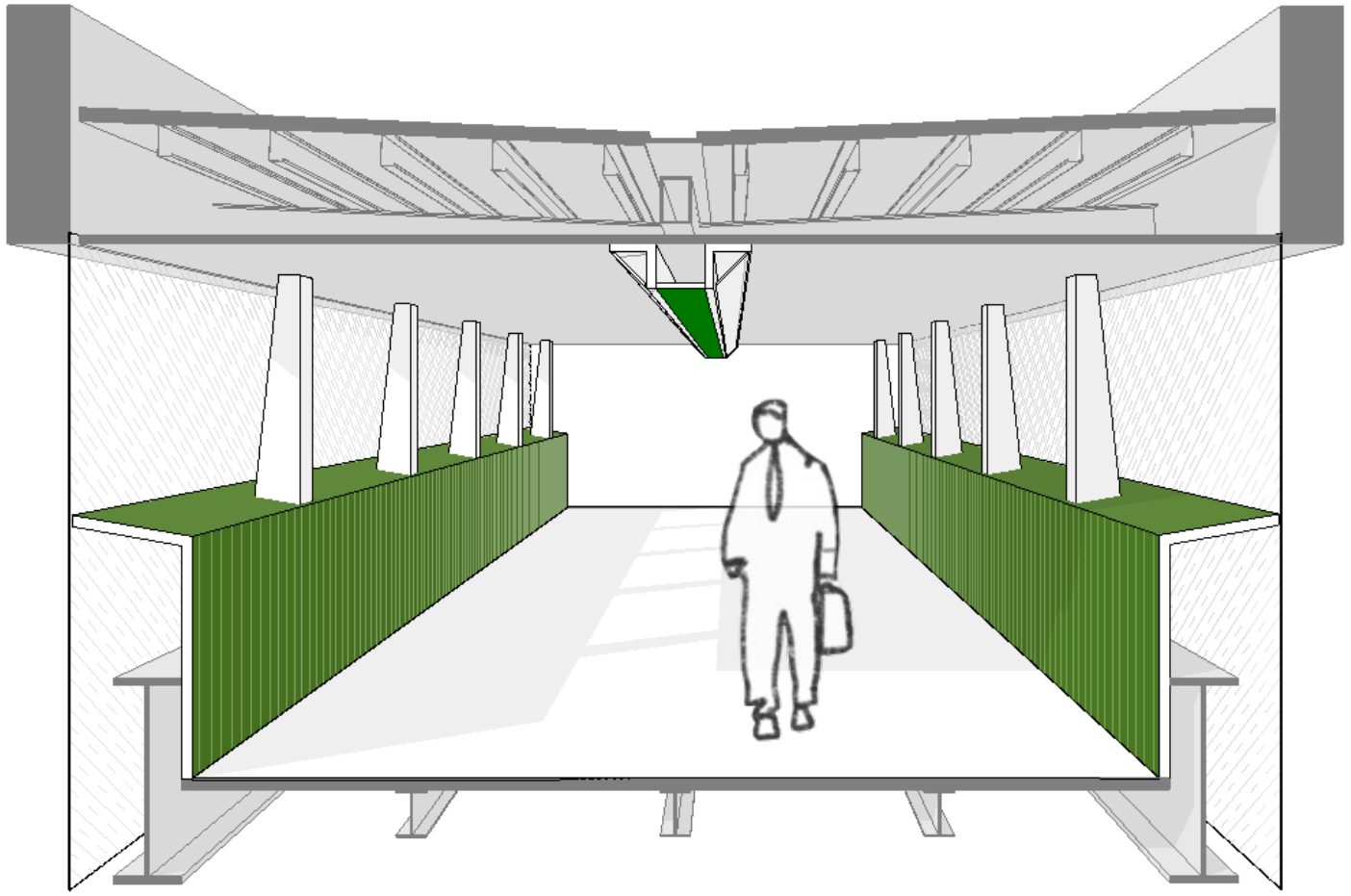
Footbridge

Proposal

An open, light & inviting space

The preferred design option removes the central wall and columns.

- The floor finish will be fully replaced with a like-for-like slip resistant dark grey finish.
- The existing mesh panels will be removed and replaced with a new architectural stainless steel mesh that will be located on the outside face of the bridge to give more width and space internally and maximise natural light and views.
- The existing flat white parapet cladding will be replaced with new green profiled vitreous enamel cladding that will also form a chamfered sill to the edge of the bridge. The profile will increase the strength of the panels, give visual rhythm along the internal façade, not provide a clean surface for graffiti, and conceal vertical joints. The chamfer will prevent litter being left on the top of the parapet.
- The existing ceiling, lighting, fire detection and CCTV fittings within the ceiling are to be retained, unless faulty or in need of replacement. The open area where the central wall was located will be infilled with a green vitreous enamel infill to match the parapet cladding.



Cross section of proposed footbridge (right)

Footbridge

Proposal

External view of proposed footbridge from Platform 2

Footbridge

Proposal

Internal view of proposed footbridge at the junction with the Central Connection

Footbridge

Proposal

Structural and geotechnical considerations

The proposal considers removing the internal steel post and opening up the space internally. This has been assessed to be a feasible proposal, noting the following:

- Vertical load distribution resisted by the primary longitudinal beams is unaffected.
- The outer vertical support columns have sufficient capacity to resist the additional loads due to the removal of the central post.
- The transverse roof beam has sufficient capacity to resist the additional load effects developed from the increased span, assuming beam continuity.
- Beam deflections have been assessed to be within acceptable limits upon removal of the central post.
- The available information does not show connection details. The removal of the central post may require some localised works at the connection with the transverse roof beam depending on the current configuration. Full moment continuity of the transverse beam is required following removal of a central post.

Proposed loadings for the upgrade works are not yet available. It is envisaged, however, that similar foundation solutions to those of the existing structures will be used. Where tension loads occur, small diameter piling may be required. The proposed foundation strategy will be reviewed at subsequent design stages based on the location, ground conditions and loadings associated with the proposed works.

Please refer to Appendix C for a summary of the ground conditions at the station.

MEPC and fire

The location of the footbridge lighting is to remain in the existing location as indicated on the proposed footbridge internal visual on page 19. A survey of the existing luminaries will be required to establish their condition and if they are due for replacement. If replacement is required/desired, similar angled lighting and emergency lighting will be selected to provide illumination levels, uniformity, glare, quality and colours that adhere to IÉ standards and recommendations. LED fittings shall be used, wherever possible. Enhanced illumination will be provided at key decision points such as the connection with the Station Entrances and Central Connection.

Similar surveys of existing installations will take place for:

- the existing CCTV to check the condition of the cameras and whether any additional cameras are required for full sight of the footbridge.
- the public address system to check the condition of the speakers and associated controls, as well as to check full coverage is provided within the footbridge.
- The fire detection and alarm system to check its condition and if any additional or replacement fittings are required.

Please refer to Appendix D for the implications of the proposed design on the fire strategy.

Central Connection

Existing

Poor visibility & connectivity

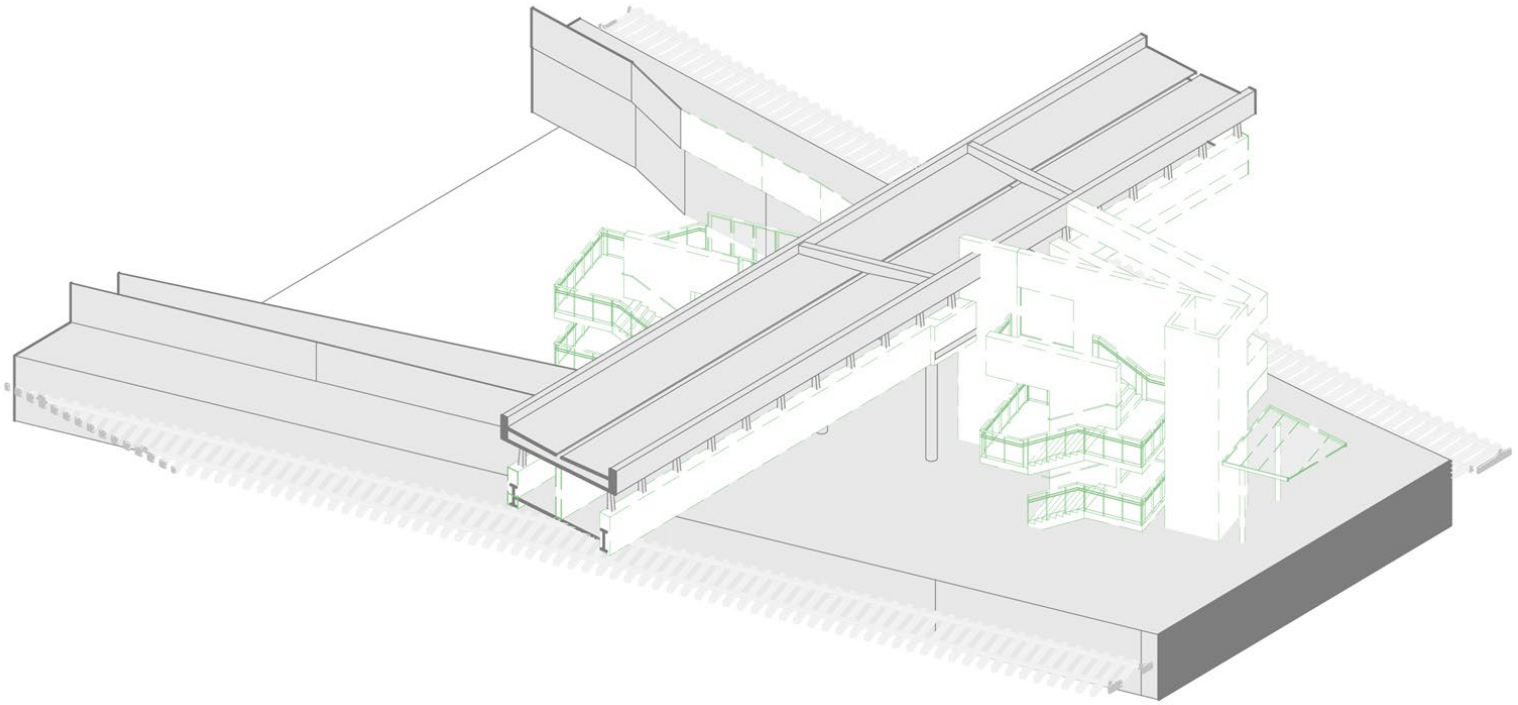
The Central Connection connects the footbridge down to Platforms 2 and 3 via a lift and switchback stair to the station-side of the footbridge. On the public side, a stair connects the footbridge to a walkway that leads to the Baldoyle Industrial Estate.

The central wall to the Footbridge means that visibility of the opening that leads to the stair and lift is poor. This is compounded by the lack of signage and any variation in lighting or finishes to indicate a destination or an access route down to the platforms. Refer to the photos on page 23 and 24.

Both sets of stairs are concrete switchback stairs with a large central concrete wall. Although this provides a small stair footprint on the platform, the visibility is very poor in terms of both seeing the end destination and general visibility to provide a feeling of safety.

The lift is located to the end of the Central Connection structure which narrows in line with the triangular island platform. This means that the space and waiting area in front of the lift is very small at footbridge level and insufficient for a turning wheelchair or pushchair considering that the existing lift is not a through lift. At platform level concrete columns reduce visibility and the available waiting area.

Generally, the structures are also very large, which blocks physical access and views between Platforms 1/2 and 3/4.

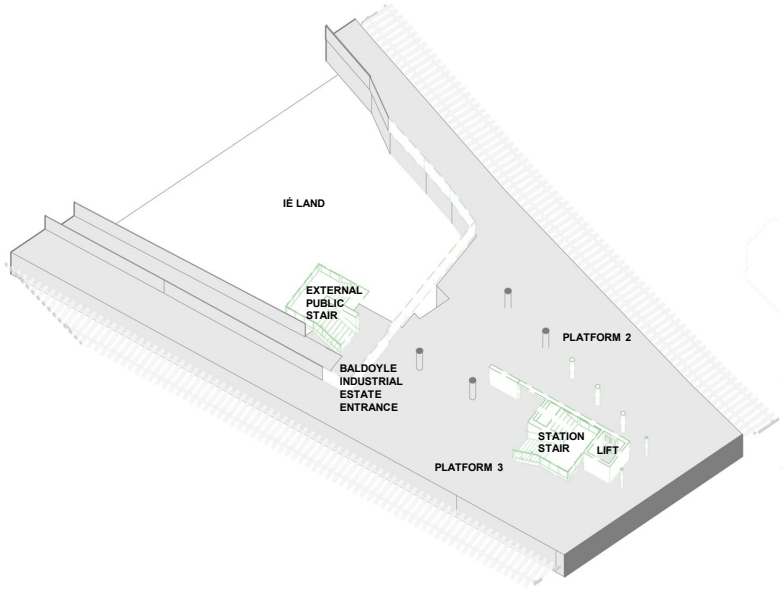


Overhead view of the existing Central Connection - proposed areas for demolition highlighted in green

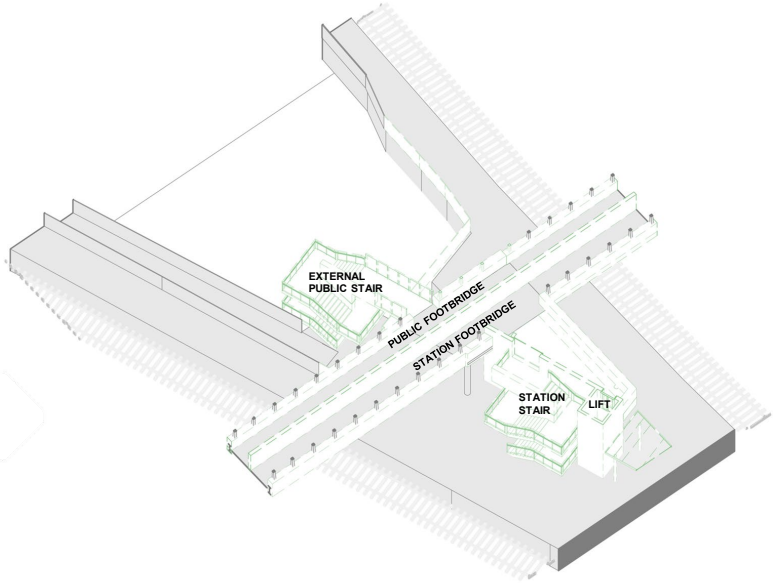
Central Connection

Existing

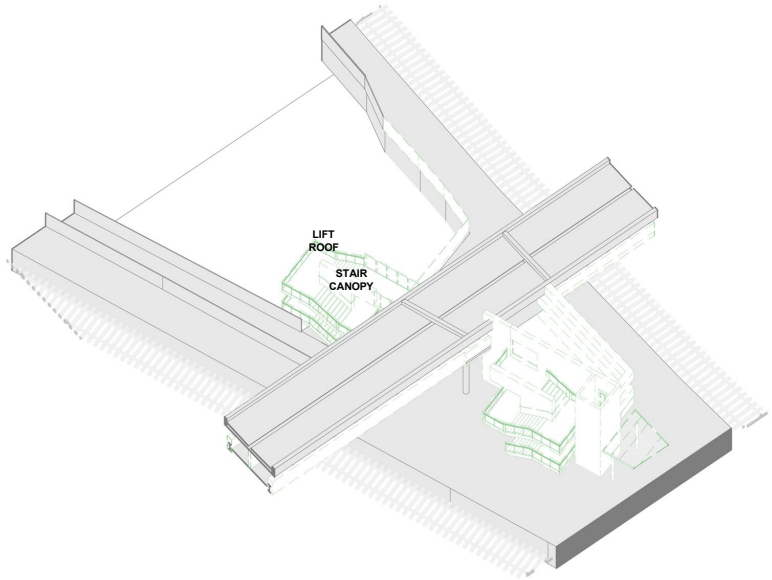
Axonometric layouts



Platform level - proposed areas for demolition highlighted in green



Footbridge level - proposed areas for demolition shown in green



Roof level - proposed areas for demolition highlighted in green

Central Connection

Existing

Photo of existing stairs demonstrating the poor visibility

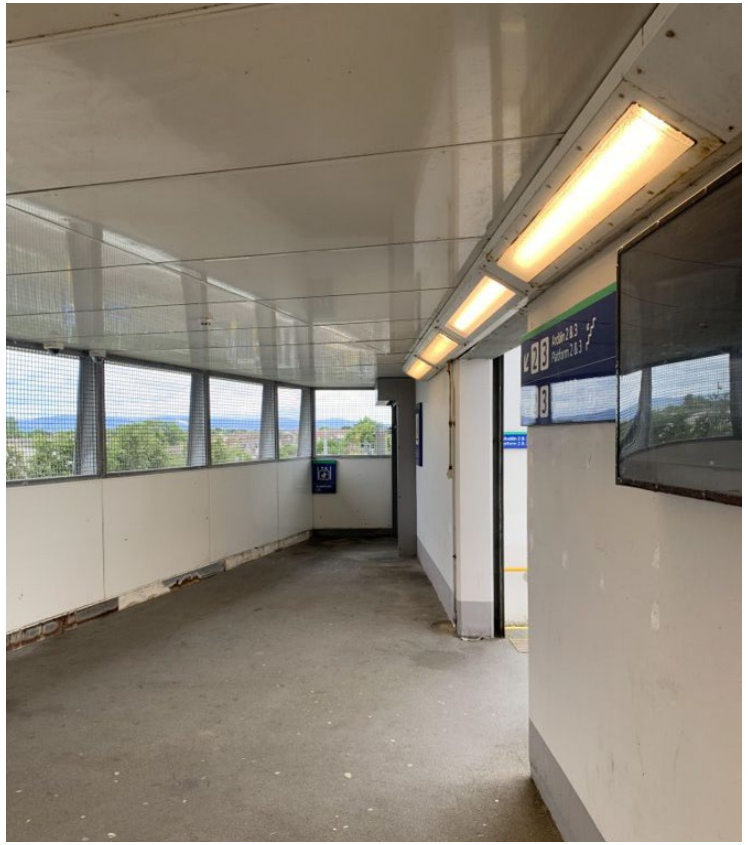


Photo of existing lift entrance at footbridge level

Photo of existing lift entrance at platform level

Central Connection

Existing

Photo of the existing Central Connection from Platform 4 demonstrating the poor visibility to Platforms 1 and 2

Central Connection

Existing

Structure - general

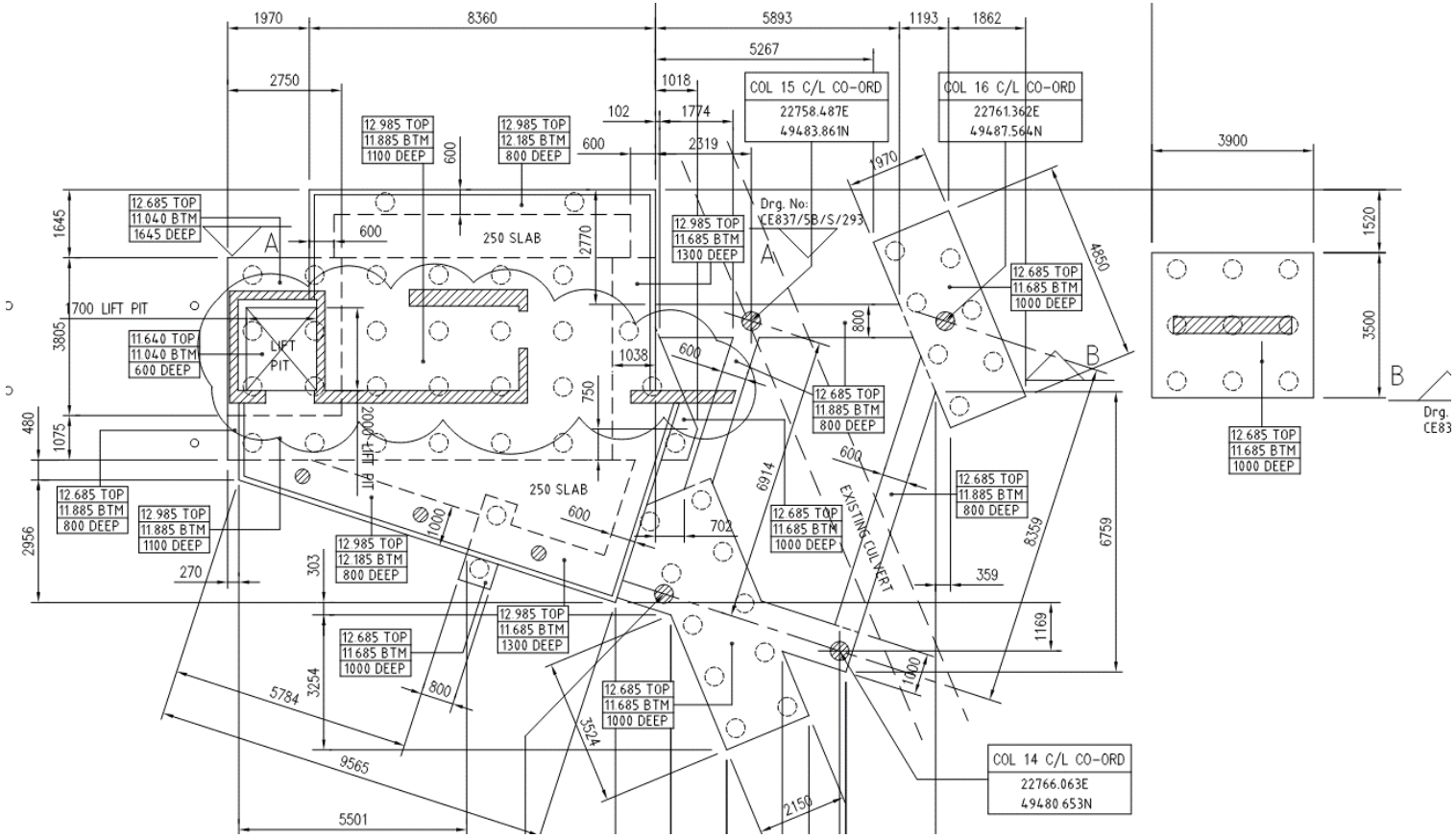
The building structure of the existing Central Connection is made from RC columns, walls and slabs. All the structure is supported on RC pile caps supported on piles.

The roof is a lightweight steel structure covered with metal cladding.

Structure - foundations

In the central area between the railway lines, preliminary design drawings indicate 450mm diameter pile foundations may have been used, likely due to the notable depth of made ground present (see Appendix C for summary of ground conditions). However, no construction records are available on the as-built pile diameter, number of piles, layout and length. Pile testing is understood to have been completed; however, no results from this are available.

All the RC columns and walls are supported on RC pile caps supported on piles. A concentration of piles is located under the lift and internal stair. These piles are topped by a large pile cap and capping beams. Two other pile concentrations are located under two main columns supporting the Footbridge. The other two Footbridge supporting columns are supported on capping beams running between large pile caps. The external stair supporting wall is supported on a pile cap on top of piles.



Central Connection foundations

Central Connection

Existing

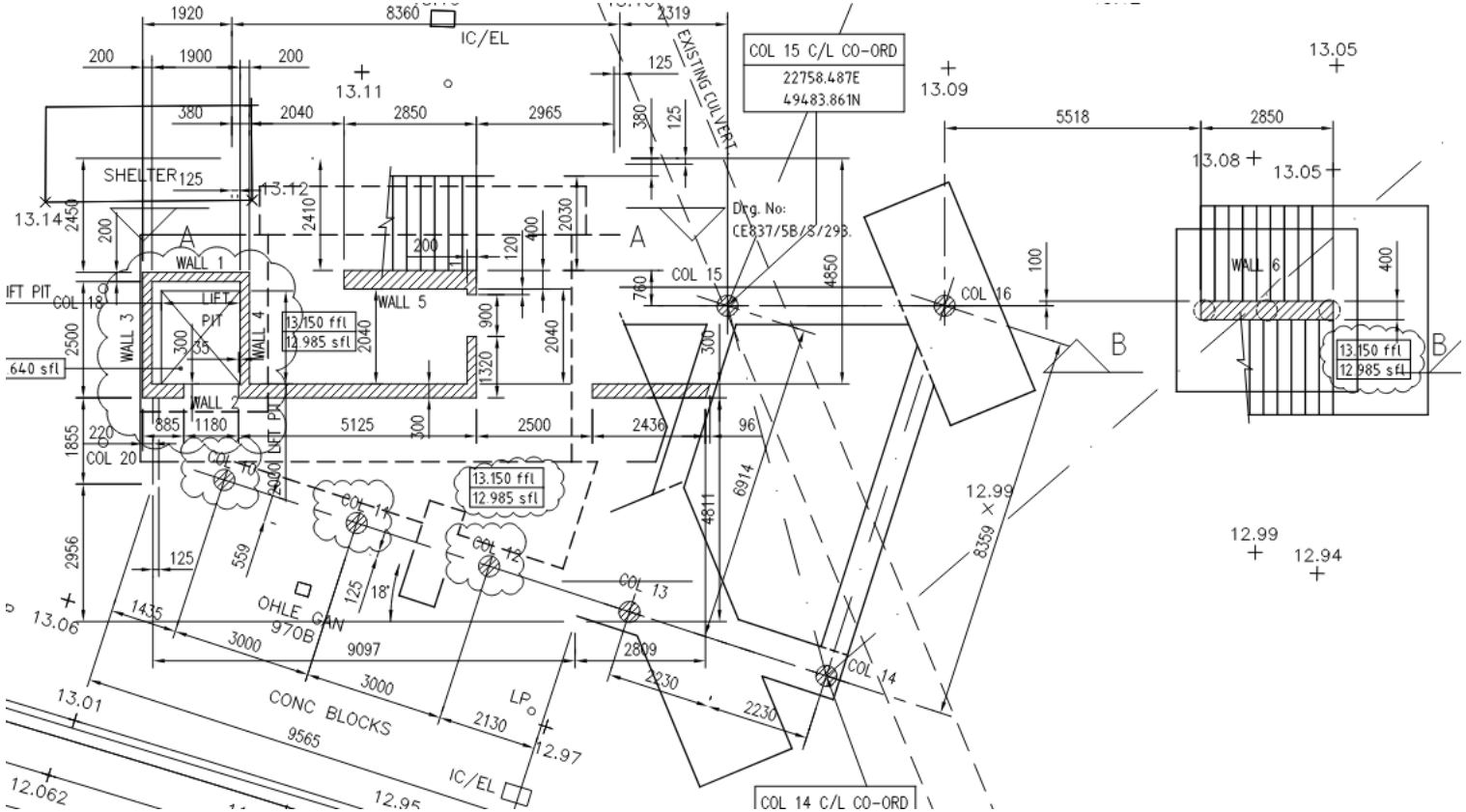
Structure - platform level

The general arrangement of the RC walls at the platform level (structural level +12.985m) is shown in the adjacent figure. RC walls have thicknesses varying from a minimum of 200mm for some of the lift core walls to 400mm for main walls.

The two stairs are supported on 400mm thick RC walls which are supported on RC pile caps.

Four 450mm diameter RC columns are arranged in a trapezoidal configuration to support four beams supporting a slab at the Footbridge level.

Three similar columns are arranged along a line supporting a slab that provides a concourse to the lift. All columns are supported on capping beams running between piles.



Central Connection RC walls and columns at platform level

Central Connection

Existing

Structure - footbridge Level

The general arrangement of the RC walls at the Footbridge level (+18.250m) is shown in the figure. The RC wall thicknesses vary from a minimum of 200mm for some of the lift core walls to 400mm for main walls.

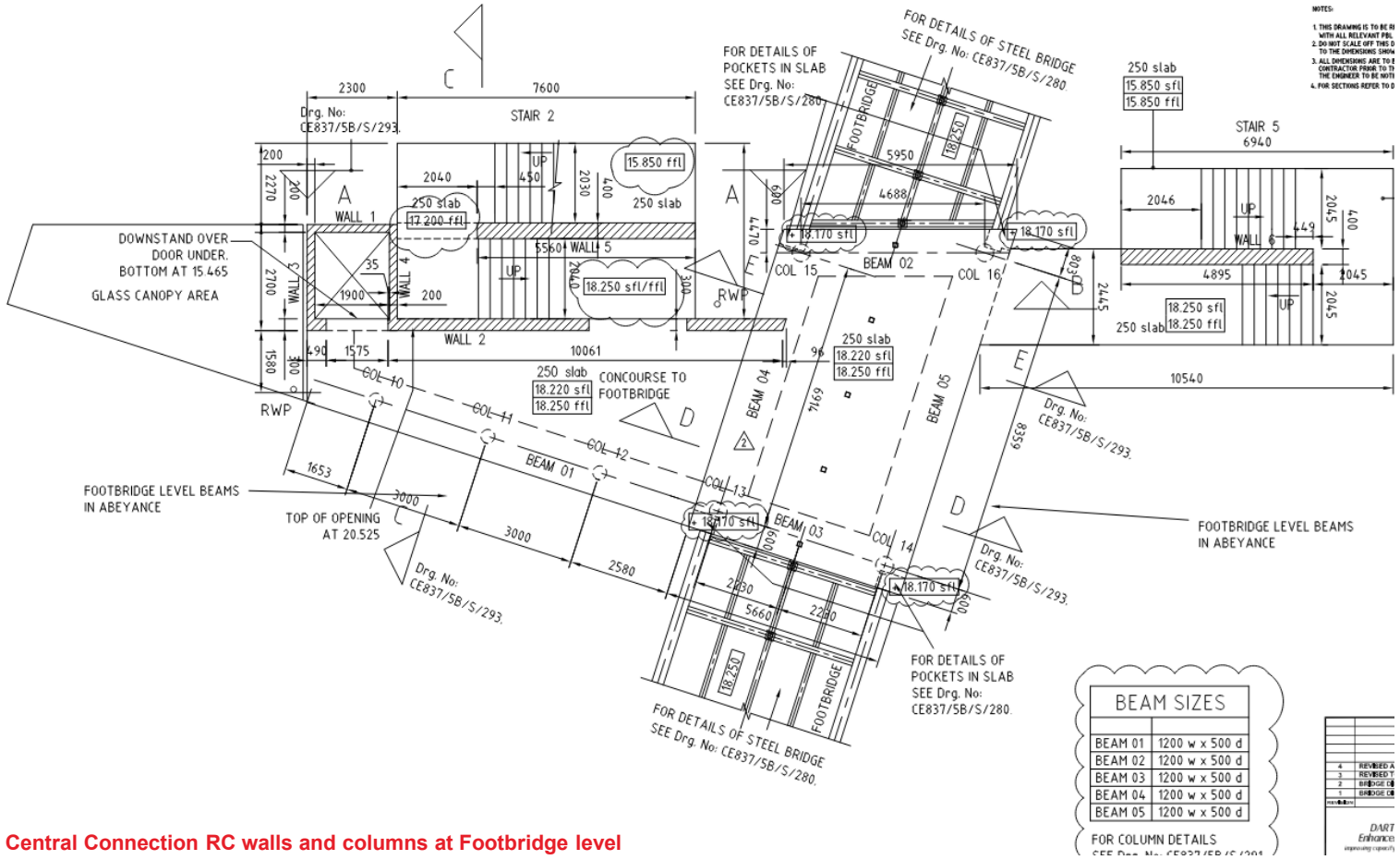
The two stairs are supported on 400mm thick RC walls. The four 450mm diameter RC columns arranged in a trapezoidal configuration are supporting four beams which form a frame to support a slab at the Footbridge level.

The slab-beam is used to support the Footbridge on the two sides of the slab. The other two sides are connected to slabs which provide access to the internal stair and lift on one side and to the external stair on the other side.

Three similar columns arranged along a line support a concourse to the lift. These columns stop below the slab level. The RC slab at this level is laterally restrained by the RC walls on the two sides of the Footbridge.

Structure - roof

At roof level of the stair and lift core, a lightweight roof metal decking is supported by an arrangement of steel beams which are supported on RC walls and steel columns. This roof covers the area on top of the concourse to the Footbridge and is connected to the Footbridge roof.



Central Connection RC walls and columns at Footbridge level

Central Connection

Design Development

Key tasks

- Remove the existing Central Connection lift and stairs to both sides of the footbridge.
- Build a new single stair and lift(s) to improve the efficiency of passenger transfer between the Footbridge and Platforms 2 and 3.
- Maximise visibility when accessing and using the new stair and lift.

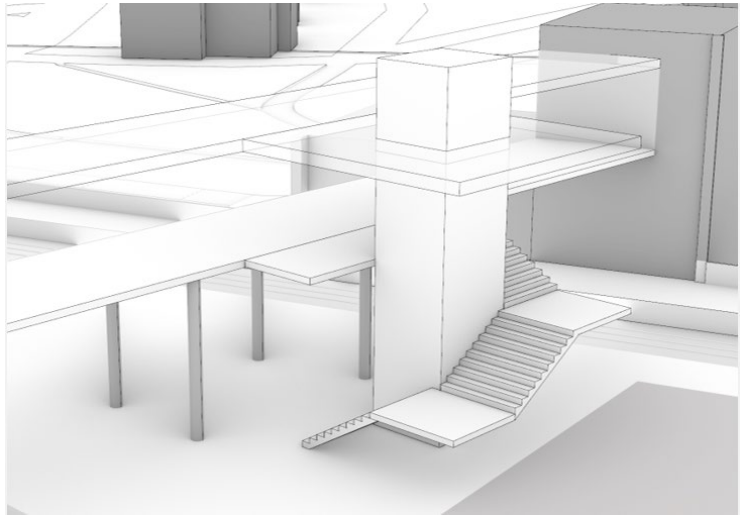
Considerations

- **Wayfinding:** new route between Footbridge and Platform 2 and 3 should be intuitive by both using form and finishes.
- **Accessibility:** new stair to be compliant with TGD M, and new lift to be a through-lift.
- **Maintenance:** self-finished materials should be used where possible. No glass. Services are to be easily accessible and modifications designed for disassembly.
- **Safety:** Stairs and lift to 'land' parallel with the platforms.
- **Sustainability: s**tructures to be as minimal as possible.
- **Disruption:** layout to allow for full passenger use of the station during construction.

Option development

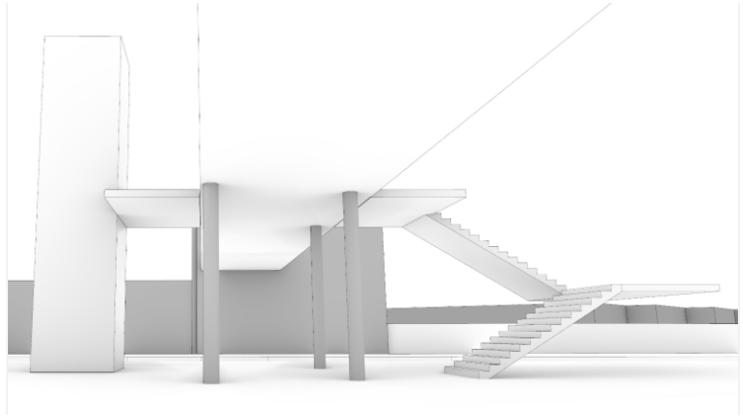
Three initial options were developed:

1. Spiral Stair - a single lift shaft connected to the northeast side of the footbridge with a stair that spiralled around the footbridge. The intent was to minimise the footprint of the new structure and avoid moving the existing platform fence line.



Initial overhead view of the spiral stair option

2. Straight Stair - a single lift shaft connected to the northeast side of the footbridge with an adjacent straight stair leading to Platforms 2 and 3. The intent was to maximise efficiency and visibility, but this did require altering the existing platform fence line and building new sections of platform.
3. Switchback Stair - a single lift shaft connected to the northeast side of the footbridge with a switchback stair opposite to the southwest side of the bridge. The intent was to split the passenger flow and not build too much new structure on one side of the bridge.



Initial view of the switchback stair option from Platform 4

Central Connection

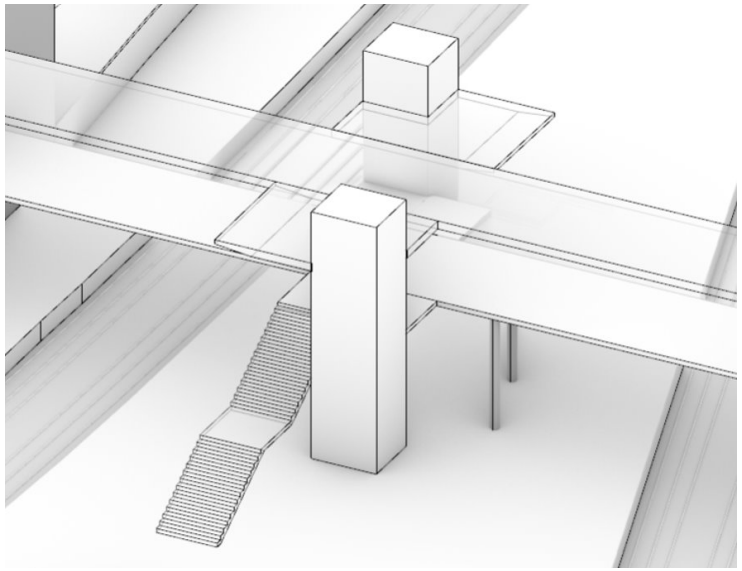
Design Development

Option development (continued)

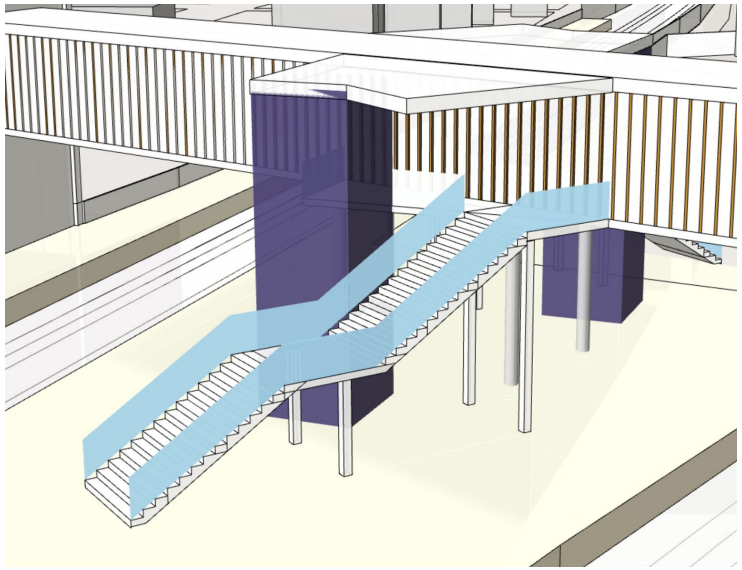
Initial IÉ feedback gave a clear preference for option 2 – Straight Stair - due to the direct nature of the design and visibility provided. It was also suggested to investigate the inclusion of two lifts for the proposed options to provide redundancy if one of the lifts was out of service.

The inclusion of second lifts for all options was investigated, but it is only possible for the straight and switchback stair options. Although the spiral option would benefit from a second lift, it would still maintain the most efficient footprint and minimal disruption to the fence line. Other modifications were also investigated such as angling the straight stair to reduce the impact on the platform fence line (see below).

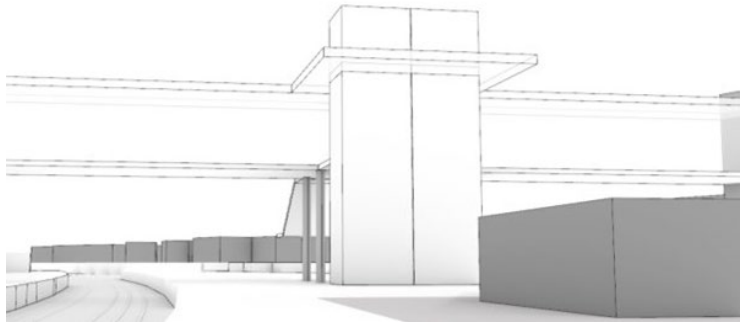
Further consideration was given to the construction sequencing, particularly in allowing for the use of the central lift and stair during construction. This was straight forward for the straight and spiral stair options as the new lift and stair would be built on the opposite side of the existing lift and stair meaning that the existing could be used during construction of the new, and demolished once complete.



Variation of the straight stair option with a second lift



Study for an angled straight stair option



Variation of the switchback stair option with a second lift

However, due to the lift and stair being on opposite sides of the Footbridge in Option 3 - Switchback Stair - this sequencing was not possible and maintaining access to Platforms 2 and 3 during construction would be difficult and could involve building temporary facilities. For this reason, this option was not progressed.

Central Connection

Proposal - Option 1

Spiral stair

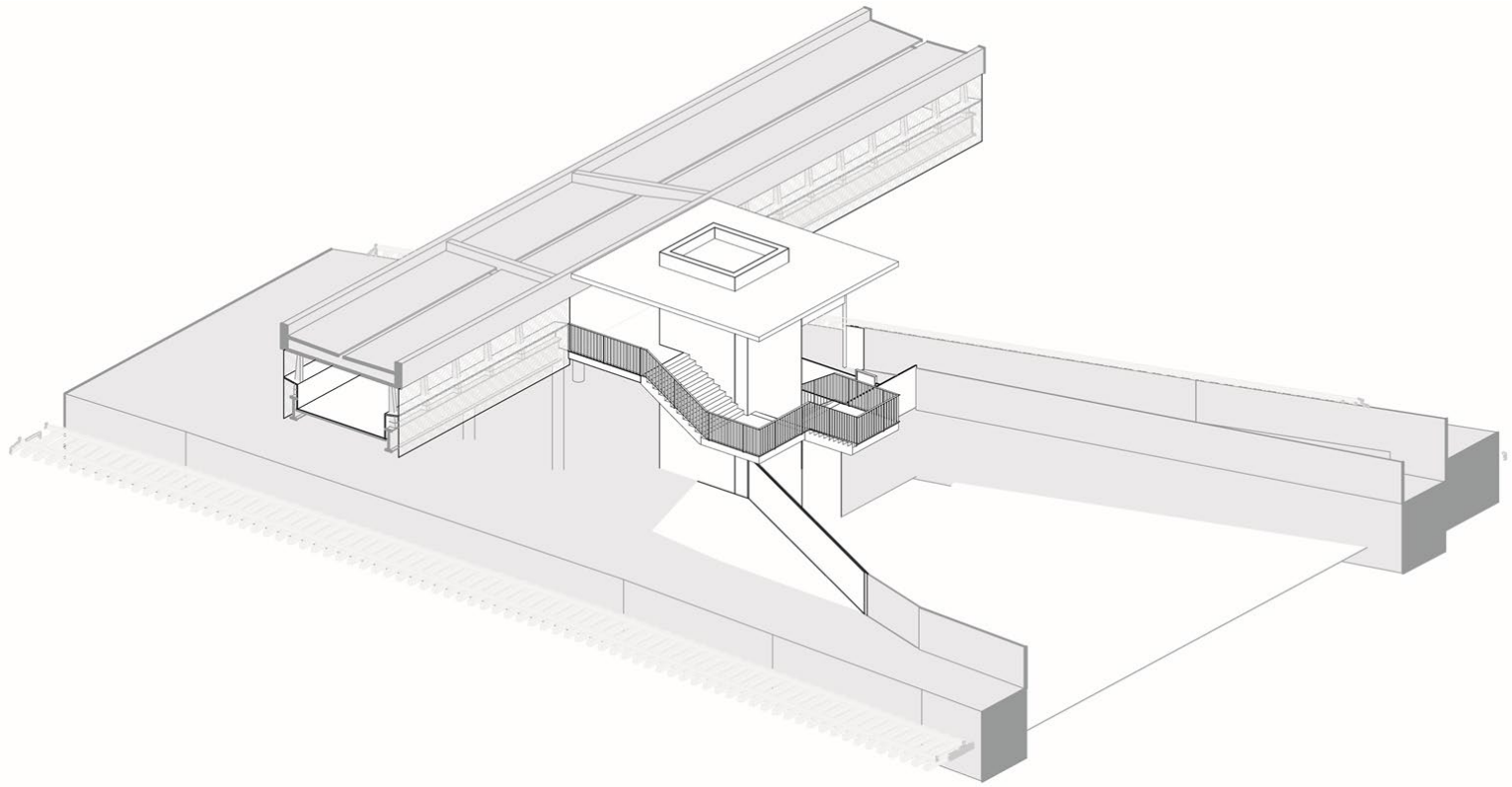
Option 1 proposes a new single lift connected to the northeast side of the Footbridge. A 2.8m deep landing is provided to the lift at Footbridge level to provide ample space for waiting, turning and seating. Similar clear space for waiting is provided at platform level.

The stairs wrap around the proposed lift shaft in three equal flights. The stairs provide a 2.4m clear width (handrail to handrail) with 4m clear run-off at platform and Footbridge level. Drainage channels will be included to all landings.

A canopy projects from the lift shaft to provide weather protection for passengers using the lift and stairs. Recessed strip lighting within the ceiling to the underside of the roof will be provided at Footbridge level. Wall mounted and handrail lighting will illuminate the stair at landing and platform level.

Other features of the option are:

- the inclusion of a chamfered fence line so that Platform 2 opens out towards the Central Connection for improved access and visibility.
- a new entrance ‘portal’ with accompanying signage, ticket vending machine, validator post and lighting where the access route to Baldoyle Industrial Estate meets Platforms 2 and 3.

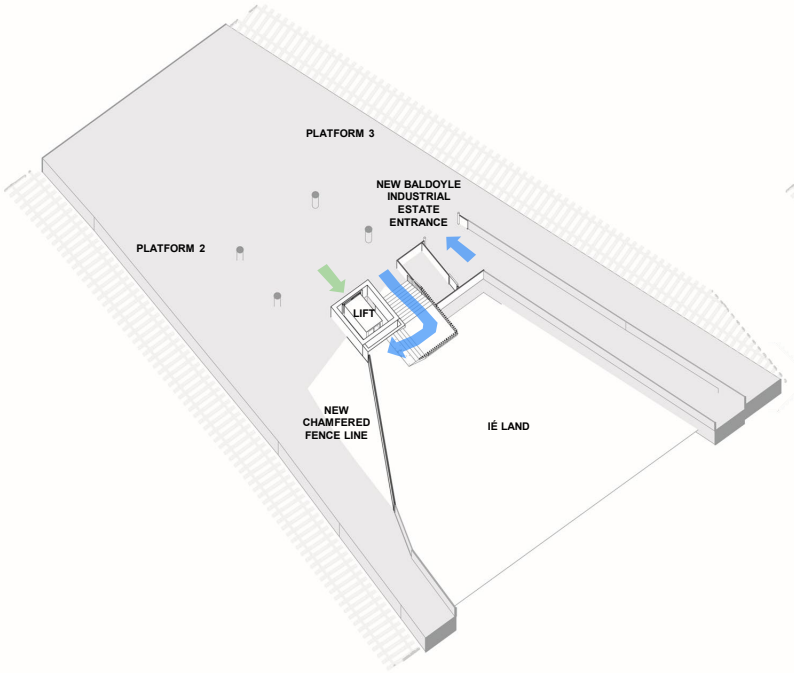


Overhead view of Option 1

Central Connection

Proposal - Option 1

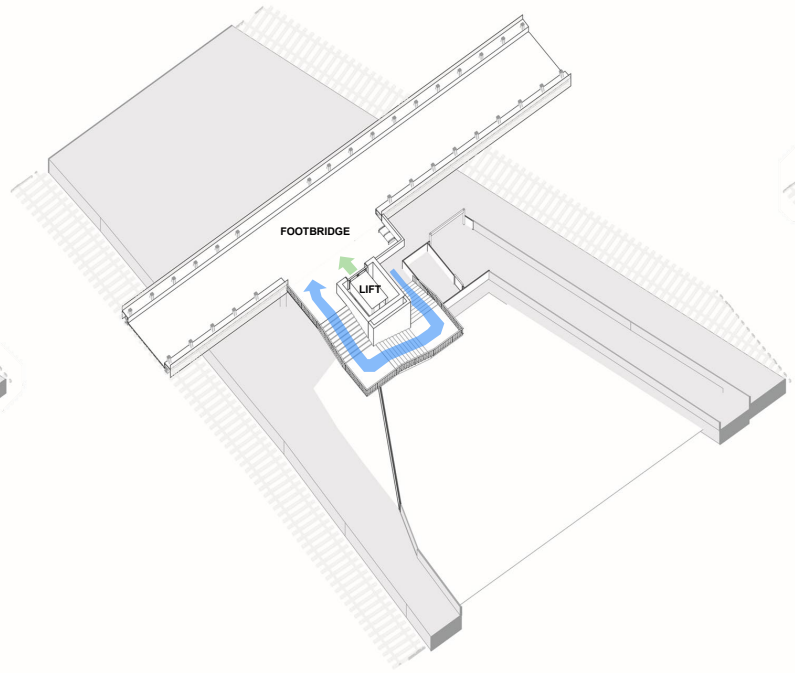
Axonometric layouts



Key

- Main circulation
- Lift access

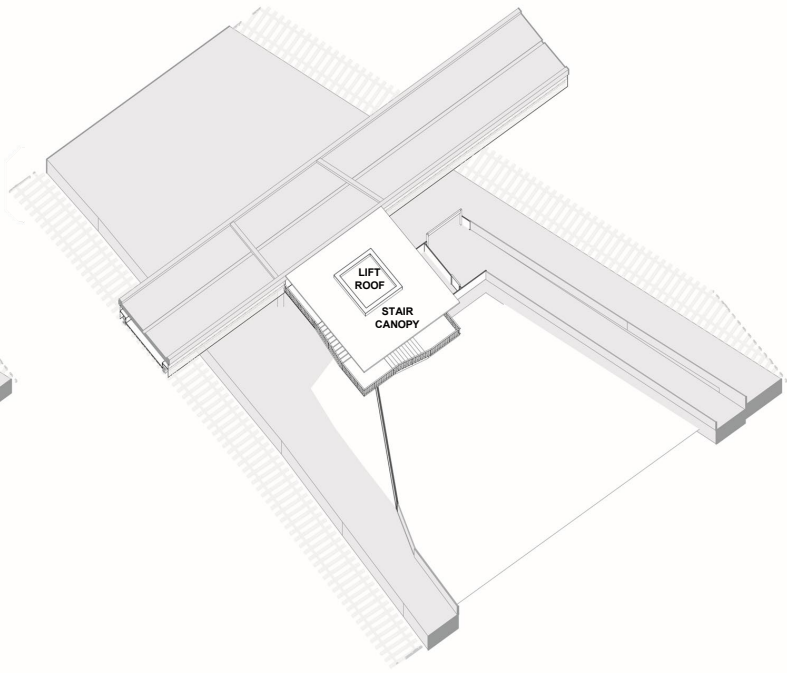
Platform level



Key

- Main circulation
- Lift access

Footbridge level



Roof level

Central Connection

Proposal - Option 1

External view of Proposed Central Connection Option 1 from Platform 2

Central Connection

Proposal - Option 1

Structure - demolition

The changes proposed for option 1 require the removal of the two existing stairs and the walls supporting them. The existing lift core is also to be removed, as well as the small canopy at the southwest end of the existing Central Connection. The middle RC slab and its four supporting columns will remain in place.

The foundations of the removed walls and columns can remain in place, unless they clash with the new foundations.

The removal of the majority of the existing structure will have the following consequences:

1. The lateral stability of the remaining middle slab supported by the remaining four columns needs to be enhanced in the temporary constructing stage due to the inability of the remaining four columns to resist all lateral loads.

2. In the final stage, the middle slab needs to be linked to the lateral stability system provided by the RC core walls. The best level at which such link can be achieved is the Footbridge level.

3. The new lift core is the only lateral stability element. Its strength and stiffness, and the strength and stiffness of its foundation need to be adequate to provide stability of the Footbridge.

Structure - new construction

The completed new stair and lift core structure is linked with the existing Footbridge at the Footbridge level and possibly at the roof level. The new roof is envisaged to be made from a light steel structure covered by metal cladding.

All steelwork is expected to arrive to site already corrosion protected, painted and ready to be connected to its final position. Connections are expected to be bolted with minimum site welding.

The foundation of the new structure will clash with some parts of the existing foundation. Further detailed study is necessary to determine the possible alternatives to manage this clash. Some of the possible options are to remove the existing foundation part that clashes with the new foundation, or linking the new foundation to the existing one following assessment of the existing foundation from durability, stiffness and strength view points.

Please refer to Appendix C for a summary of the ground conditions at the station.

MEPC & fire

The new Central Connection will require new lighting, public address speakers, CCTV cameras, and LV power.

At Footbridge level, these services will be incorporated into the stair canopy and then wall mounted for the stair and ground level areas. Lighting will be selected to provide illumination levels, uniformity, glare, quality and colours that adhere to IÉ standards and recommendations. LED fittings shall be used, wherever possible. Enhanced illumination will be provided at key decision points such as the connection with the Footbridge and platforms.

The modifications to the Baldoyle Industrial Estate entrance will also require an electrical connection to feed the new ticket machine and validator post, as well as external lighting along the full length of the access route from the central platforms to the connection into the industrial estate.

Please refer to Appendix D for the implications of the proposed design on the fire strategy.

Central Connection

Proposal - Option 2

Straight stair

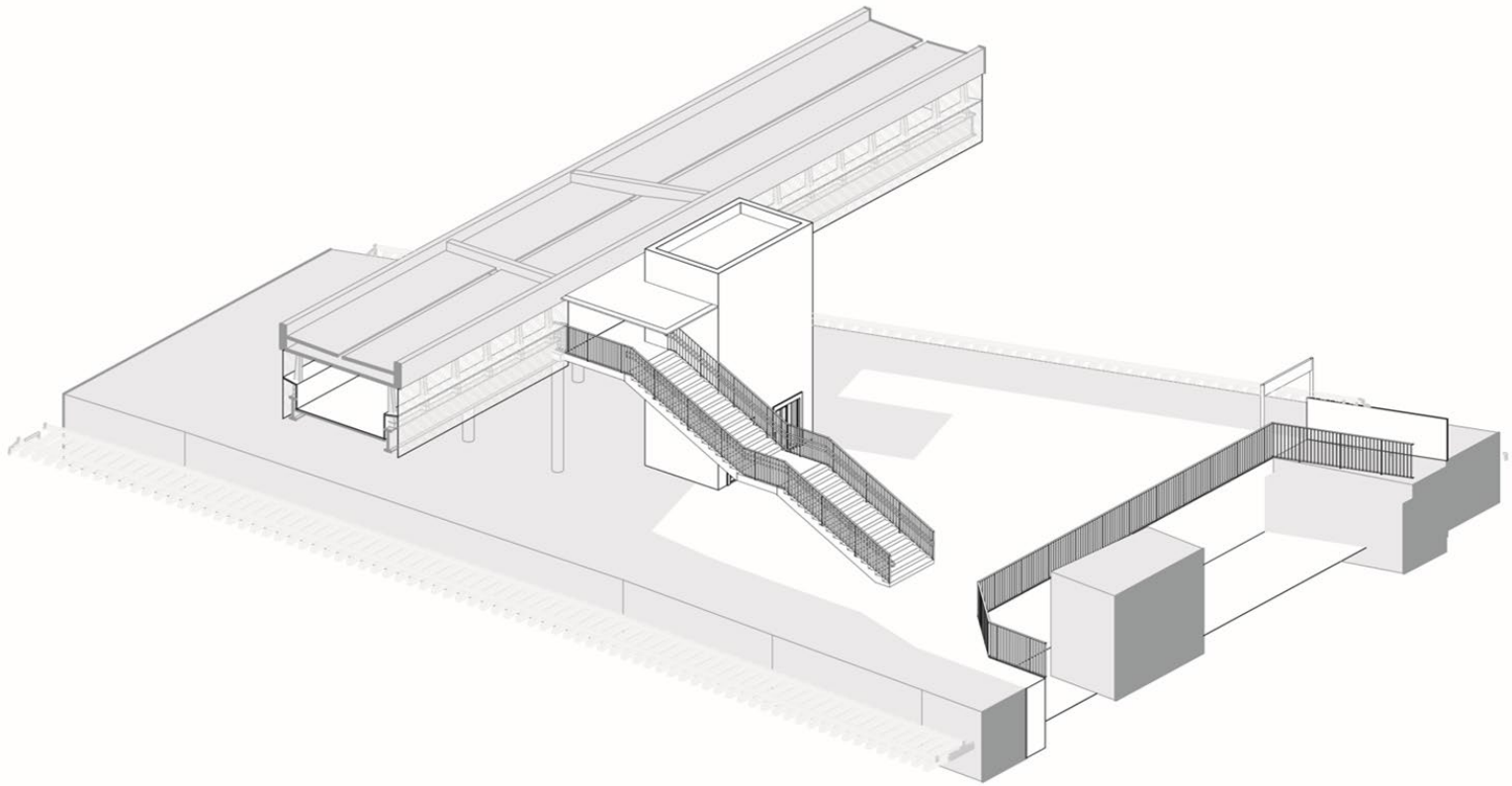
Option 2 proposes two new through lifts connected to the northeast side of the Footbridge. A 2.8m deep landing is provided to the lifts at Footbridge level to provide ample space for waiting, turning and seating. Similar clear space for waiting is provided at platform level.

A straight stair is located directly adjacent to the lifts. It is split into two flights with 350mm deep steps (to allow for resting) and a 2.4m deep central landing. The clear width is 2.4m (handrail to handrail) with a 4m clear run-off at platform and Footbridge level. Drainage channels will be included to the top and bottom of the stair as well as to the landing.

To enable the straight stair, new areas of platform will need to be built-up (taken from existing IÉ land) and the fence line adjusted.

A canopy projects from the lift shaft to provide weather protection and lighting for passengers using the lift and stair at Footbridge level. Handrail lighting will illuminate the stair at landing and platform level.

Option 2 also incudes the new entrance ‘portal’ with accompanying signage, ticket vending machine, validator post and lighting where the access route to Baldoyle Industrial Estate meets the new fence line to Platforms 2 and 3.

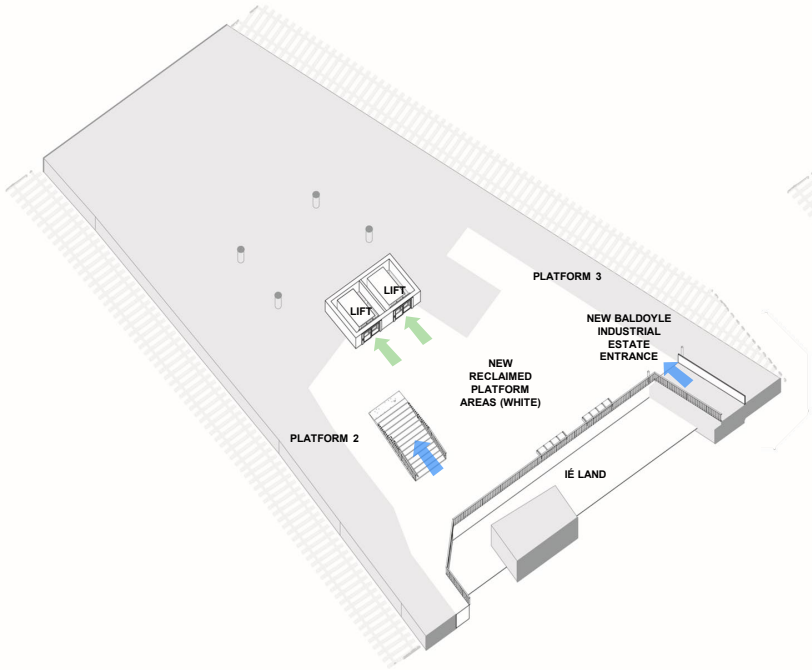


Overhead view of Option 2 at platform level

Central Connection

Proposal - Option 2

Axonometric layouts

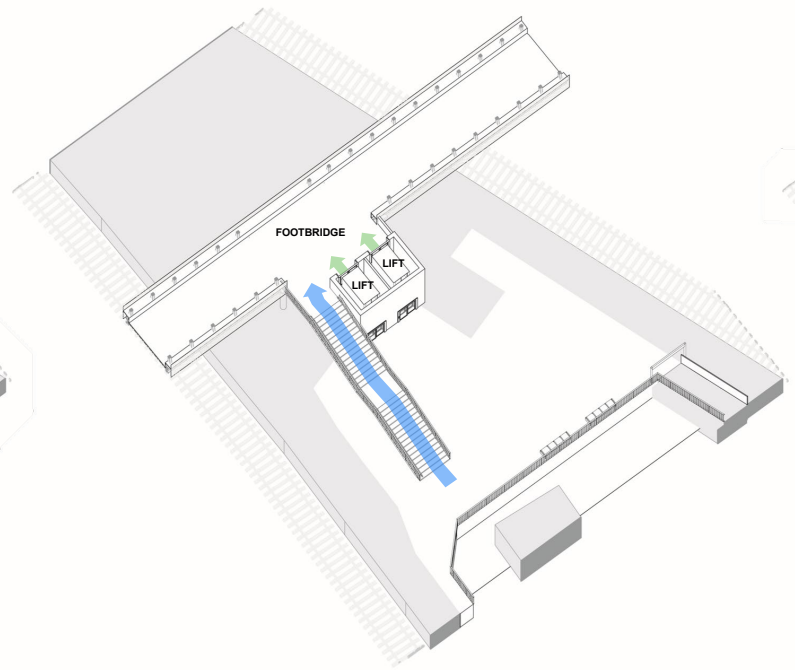


Key

Main circulation

Lift access

Platform level

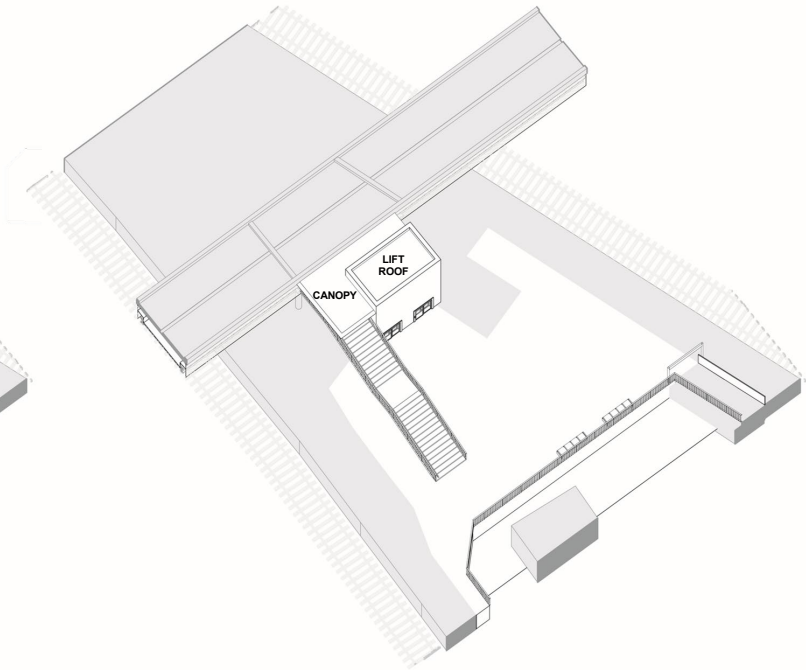


Key

Main circulation

Lift access

Footbridge level



Roof level

Central Connection

Proposal - Option 2

External view of Proposed Central Connection Option 2 from Platform 2

Central Connection

Proposal - Option 2

Structure - demolition

The changes proposed for option 2 require the removal of the two existing stairs and the walls supporting them. The existing lift core is also to be removed, as well as the small canopy at the southwest end of the existing Central Connection. The middle RC slab and its four supporting columns will remain in place.

The foundations of the removed walls and columns can remain in place, unless they clash with the new foundations.

The removal of the majority of the existing structure will have the following consequences:

1. The lateral stability of the remaining middle slab supported by the remaining four columns need to be enhanced in the temporary constructing stage due to the inability of the remaining four columns to resist all lateral loads.

2. In the final stage, the middle slab needs to be linked to the lateral stability system provided by the RC core walls. The best level at which such link can be achieved is the Footbridge level.

3. The new lift core is the only lateral stability element. Its strength and stiffness, and the strength and stiffness of its foundation need to be adequate to provide stability of the Footbridge.

Structure - new construction

The completed new stair and lift core structure is linked with the existing Footbridge at the Footbridge level and possibly at the roof level. The new roof is envisaged to be made from a light steel structure covered by metal cladding.

All steelwork is expected to arrive to site already corrosion protected, painted and ready to be connected to its final position. Connections are expected to be bolted with minimum site welding.

The foundation of the new structure will clash with some parts of the existing foundation. Further detailed study is necessary to determine the possible alternatives to manage this clash. Some of the possible options are to remove the existing foundation part that clashes with the new foundation, or linking the new foundation to the existing one following assessment of the existing foundation from durability, stiffness and strength view points.

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The modifications to the Baldoyle Industrial Estate entrance will also require an electrical connection to feed the new ticket machine and validator post, as well as external lighting along the full length of the access route from the central platforms to the connection into the industrial estate.

Please refer to Appendix D for the implications of the proposed design on the fire strategy.

Station Entrances

Existing

Poor visibility & connectivity

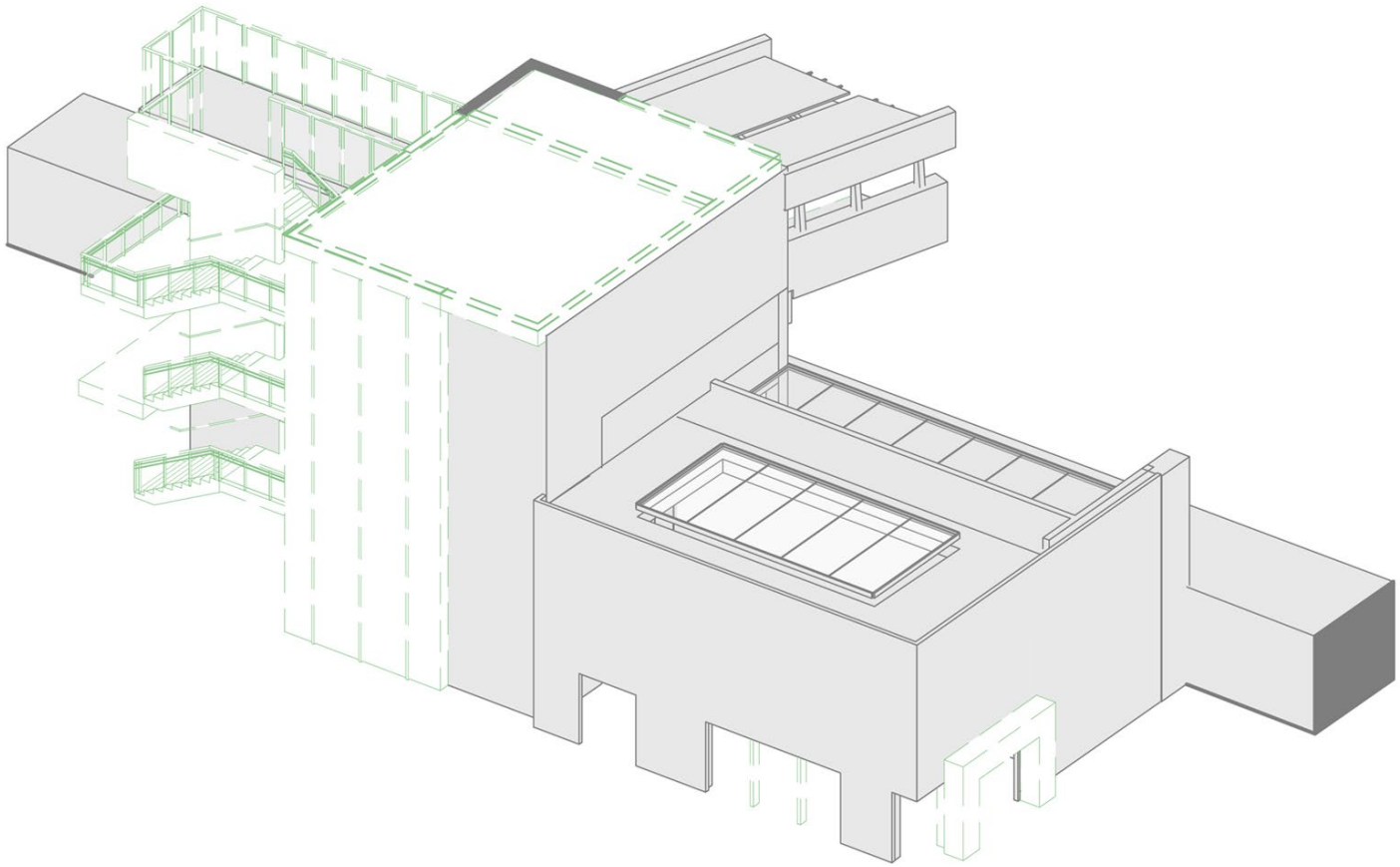
There are two station entrance buildings to Howth Junction and Donaghmede Station. Both entrances are similar in concept, containing:

- Small entrance ‘door’ with roller shutter.
- Ticket hall containing 2 ticket machines and a gateline.
- Lift connecting the Ticket Hall level to the platform and Footbridge levels.
- Internal stair connecting the Ticket Hall level to the Platform and Footbridge levels.

Both entrances also suffer from similar issues of poor visibility, poor connectivity and poorly located ticket machines and gateline that creates potential passenger flow clashes.

The poor visibility starts at the entrance ‘door’ which due to it’s size and the surrounding solid cladding prevents visibility into and out of the ticket halls (refer to the figures on p37). From the ticket hall, due to the orientation in the Donaghmede Entrance, and the location in the Kilbarrack Entrance, access to and visibility of the stairs and lift is poor and does not provide an intuitive route on to the platforms or Footbridge.

For details of the existing structure, refer to Appendix B.



Overhead view of the existing Donaghmede Entrance - proposed areas for demolition highlighted in green

Station Entrances

Existing

Photo of existing Donaghmede Entrance

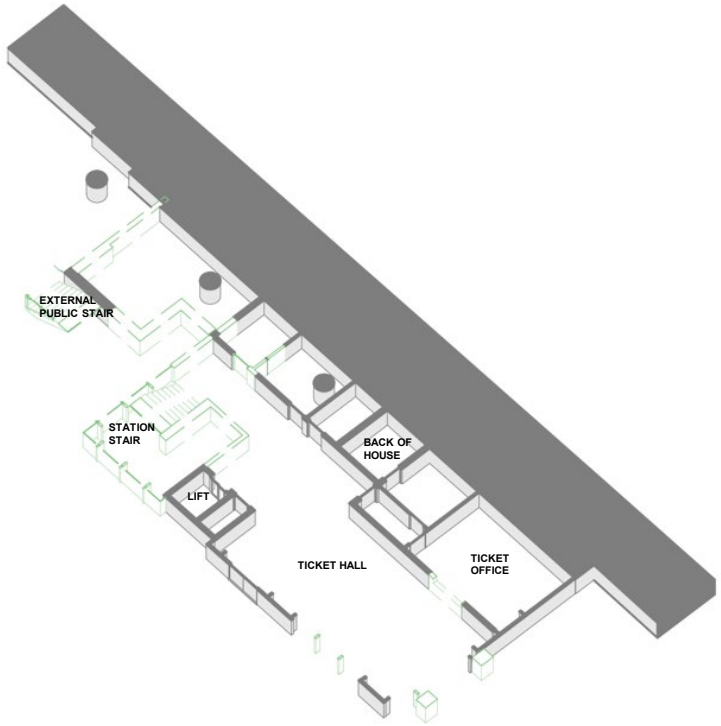
Photo of existing Donaghmede Entrance ‘door’

Photo of existing Donaghmede Entrance ticket hall

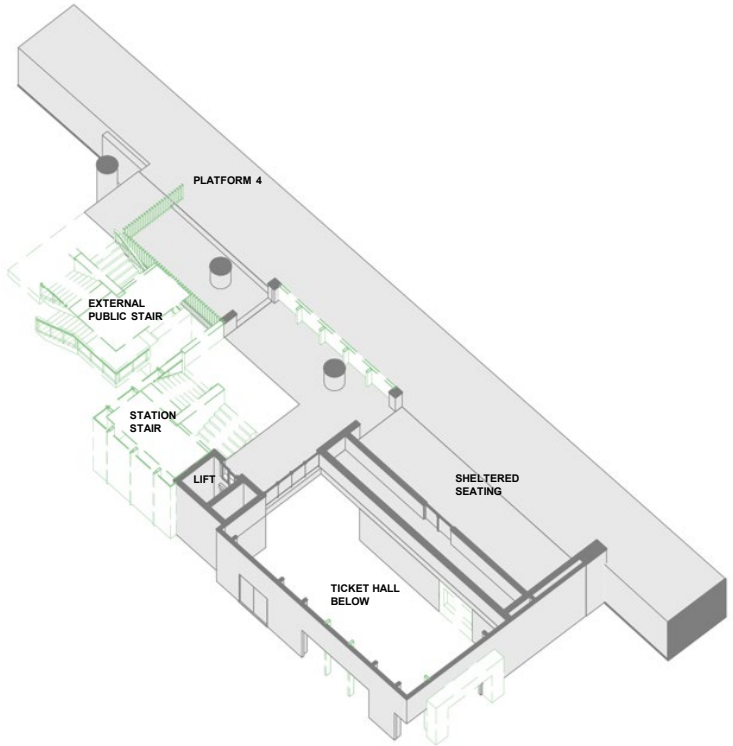
Station Entrances

Existing - Donaghmede

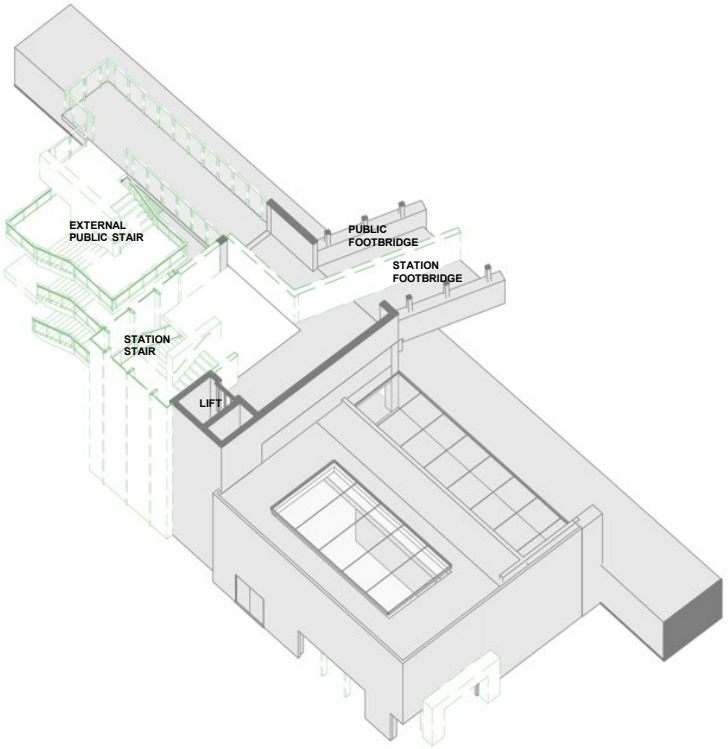
Axonometric layouts



Entrance level - proposed areas for demolition highlighted in green



Platform level - proposed areas for demolition highlighted in green

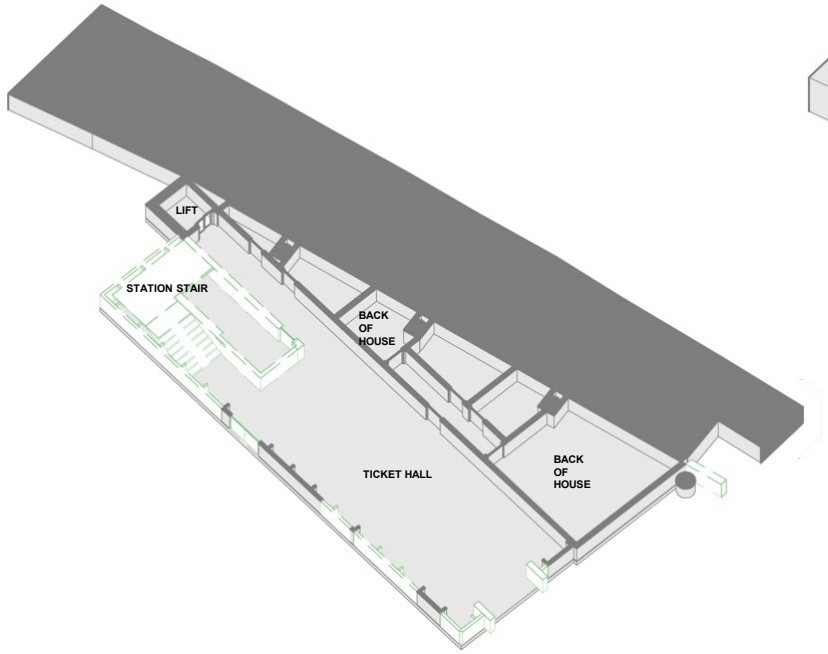


Footbridge level - proposed areas for demolition highlighted in green

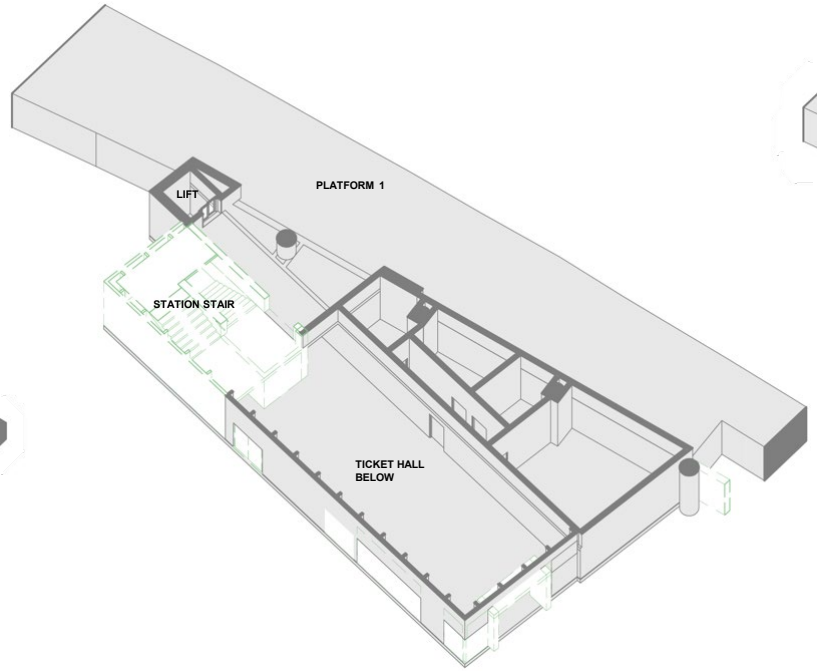
Station Entrances

Existing - Kilbarrack

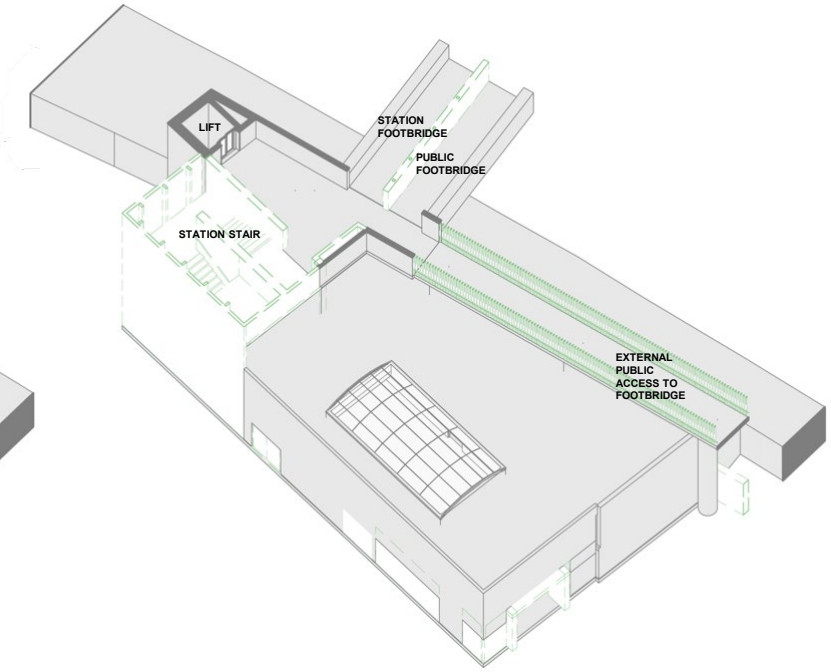
Axonometric layouts



Entrance level - proposed areas for demolition highlighted in green



Platform level - proposed areas for demolition highlighted in green



Footbridge level - proposed areas for demolition highlighted in green

Station Entrances

Design Development

Key tasks

- Improve the entrance 'door' to give clear views in/out, improve station identity, external signage and lighting.
- Remove gateline and relocate ticket machines.
- Replace the stair and potentially the lift to improve visibility, accessibility and efficiency of passenger journeys.
- Maintain back of house and service runs as far as possible.

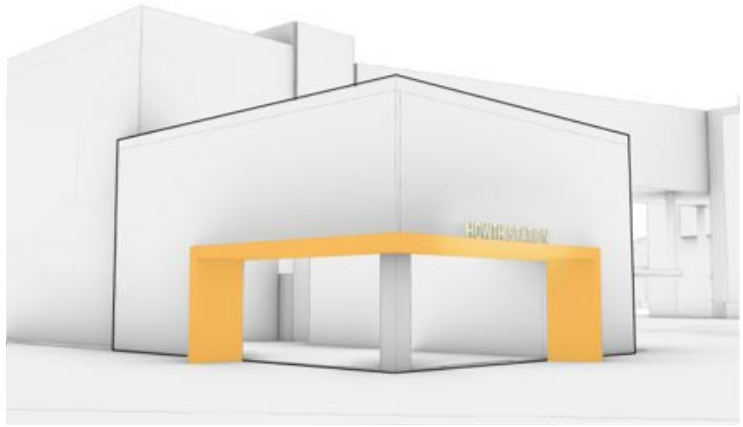
Considerations

- **Wayfinding:** route from the entrance exterior through to the platforms and footbridge should be intuitive with maximum visibility by both using form and finishes.
- **Accessibility:** new staircase to be compliant with TGD M, and new lifts to be through-lifts where possible.
- **Maintenance:** self-finished materials should be used where possible. No glass. Services are to be easily accessible and modifications designed for disassembly.
- **Sustainability: s**tructures to be as minimal as possible.
- **Disruption:** layout to allow for full passenger use of the station during construction.

Option development - ticket hall door

Two initial options were developed for the entrance door that would apply to both the Donaghmede and Kilbarrack entrances. Both options involved opening up two sides of the station ticket hall with a corner column and internal bulkhead to contain a new beam (to facilitate opening up the façade) and a roller shutter for closing the station at night:

1. Projecting canopy with illuminated signage
2. Wrap canopy with 3D signage



Option 2 with wrap canopy & 3D signage

3D signage precedent at Wapping Station, London

Due to the blind corners created by the sides of the new canopy for option 2, option 1 was progressed, but with 3D signage above.

Following a structural assessment, it was not possible to locate a column to the corner of the opening, but two columns with bracing adjacent to the opening that were key structural elements in supporting the roof would instead need to be retained. These columns would be clad to match the canopy cladding and to make a feature of the retained structure.

This formed an asymmetric opening to the corner of the entrance buildings in a similar way to Hackney Wick Station, which had been used as a precedent for creating an open and inviting station entrance (see figure on page 43).

Station Entrances

Design Development

Option development - ticket Hall door (continued)

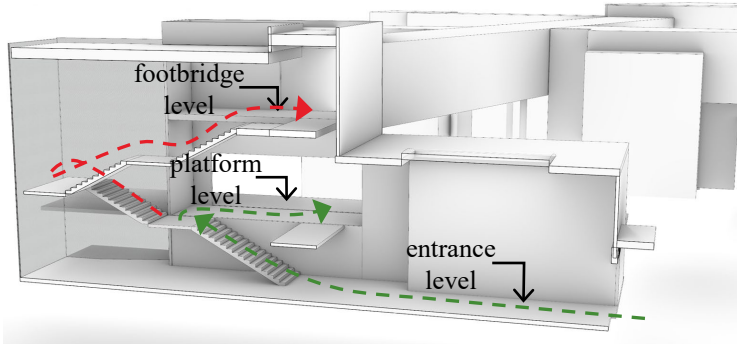
Entrance to Hackney Wick Station, London

IÉ feedback during Workshop 4 held on 24/03/2023 was that it is preferable to use the IÉ logo as a 3D sign above the canopies as opposed to the station name lettering.

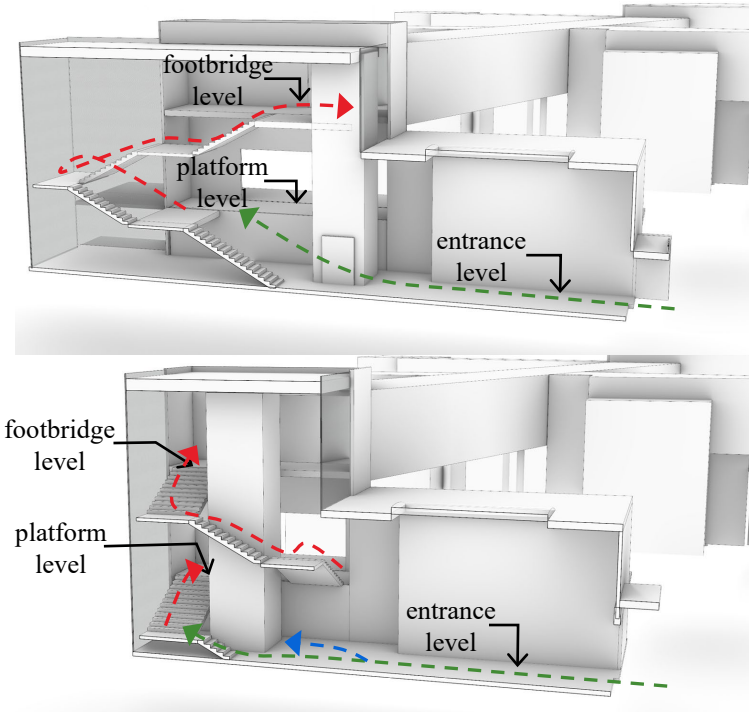
Option development - Donaghmede Entrance

Three initial options were developed:

1. Maintain the existing lift and replace the stairs with a single U-shaped stair.
2. Replace the existing lift so that the entrance faces towards the ticket hall door, and replace the stairs with a single U-shaped staircase.
3. Replace the existing lift with a central lift so that the entrance faces the ticket hall door, and replace the stairs with a new staircase that wraps around the new lift shaft.



Option 1 perspective section



Option 2 (top) & option 3 (bottom) perspective sections

Due to the poor visibility created by wrapping the stairs around the lift, option 3 was discounted.

Station Entrances

Design Development

Option development - Donaghmede Entrance (continued)

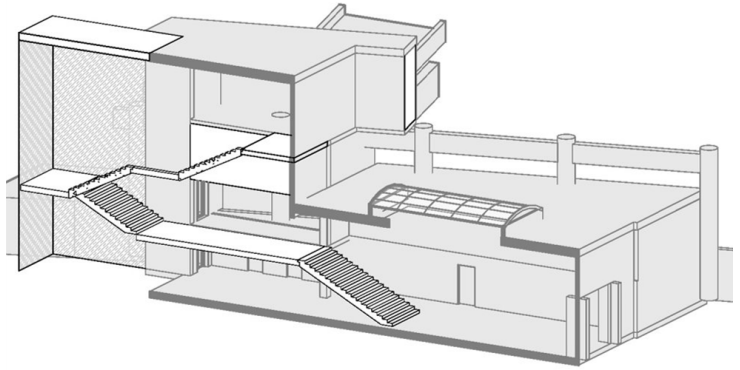
For the finishes to the replacement stairs, mesh was investigated as an option to provide a sense of enclosure to the staircase whilst allowing for views and light in/out. It would also assist in expressing the function of the stairs externally which would aid with intuitive wayfinding.

Architectural mesh applied to external stairs

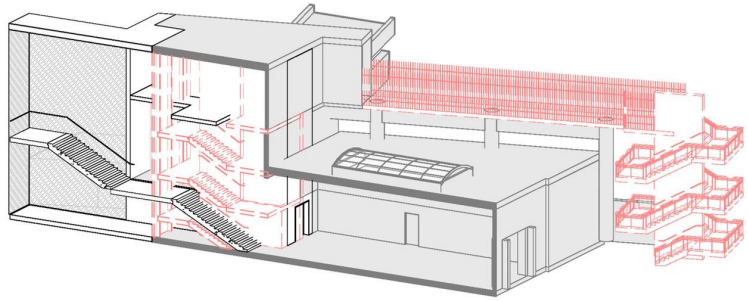
Option development - Kilbarrack Entrance

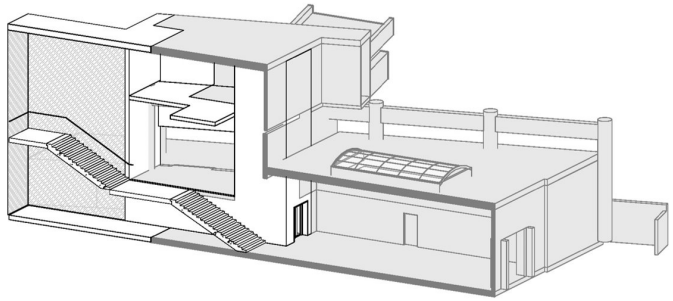
For the Kilbarrack Entrance, a similar set of three options was investigated, but with the added benefit for option 1 that the existing lift faces the ticket hall entrance door (although set back by a long way).

These options were developed in a different software so the graphics differ slightly. As with the Donaghemede Entrance, the third option with stairs wrapping around the new lift shaft was discounted due to the poor lines of sight created. Proposals were also developed for the inclusion of a bike store beneath the new stairs for both option 1 and 2.



Option 1 perspective section





Option 2 existing with demolition (red - above) & proposed (below)

Station Entrances

Proposal - Ticket hall door

Prominent & visible station entrance

The proposed ticket hall door opens up both public facing sides of the ticket hall as far as possible. This creates maximum views into and out of the station, as well as more natural light to the interior during the day.

The ticket machines, lifts and stairs beyond are immediately visible when entering to provide intuitive wayfinding for passengers.

The new opening within the cladding will be treated in the profiled vitreous enamel cladding as proposed for the interior of the footbridge. This will create a feature of the intervention and differentiate it from the existing external finishes. The underside of the canopy will be clad with a treated timber to soften the proposal slightly, with recessed lighting to fully illuminate the entrance at night.

A 3D IÉ symbol is proposed to the top of the canopy to clearly identify the building as a station with full IÉ compliant station name signage included beneath the canopy (to be developed and agreed during Phase 3).

A bulkhead to the rear of the external cladding will contain a new beam that provides support for the new opening and canopy as well as contain roller shutters to close the entrances off at night.

Proposed ticket hall door

Station Entrances

Proposal - Donaghmede Option 1

New staircase | lift retained

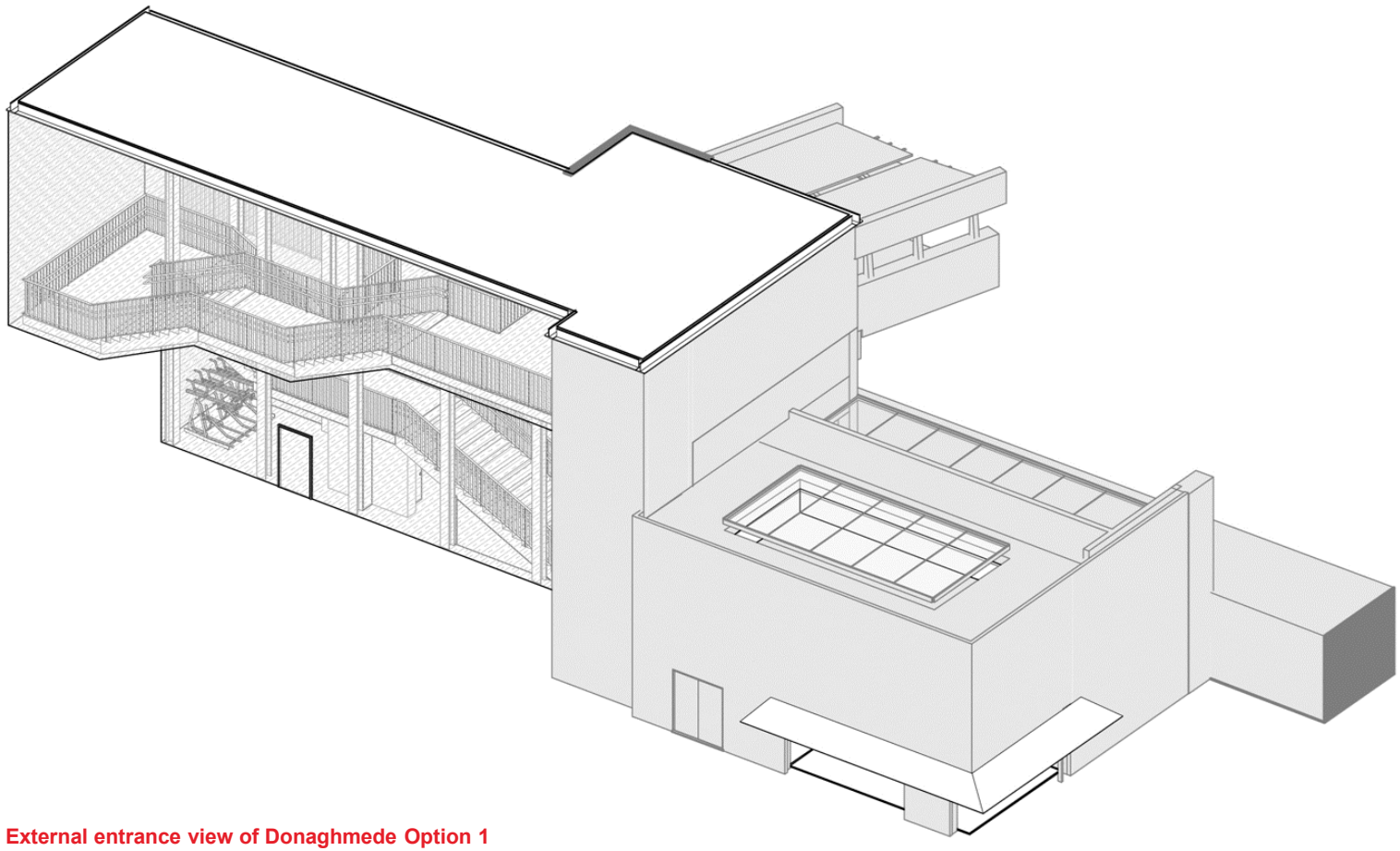
Option 1 for the Donaghmede Entrance proposes to remove both sets of existing access stairs and replace them with a new single covered staircase. The existing lift is to remain.

The new staircase provides a straight single flight from Ticket Hall level up to platform level so that Platform 4 is visible when approaching the base of the stairs. The staircase then continues from the platform up one flight to a landing where the stairs return and continue with two more equal flights to Footbridge level.

The staircase is designed to be as open and inviting as possible. Externally, the landing and top two flights are expressed so that the staircase is clearly visible to aid intuitive wayfinding. The staircase provides a 2.4m clear width (handrail to handrail) with 4m clear run-off at Ticket Hall, platform and Footbridge level. Drainage channels will be included to all landings.

The existing lift is retained with supergraphics to the side facing the entrance door to assist in intuitive wayfinding. The new stair allows for a minimum 1500mm square waiting area to each entrance.

A secure bike store is located below half of the new stair and a roof supported by central columns provides shelter. An architectural stainless steel mesh is hung from the edge of the roof and fixed to the base of the stair to enclose the new structure and provide some further weather protection.

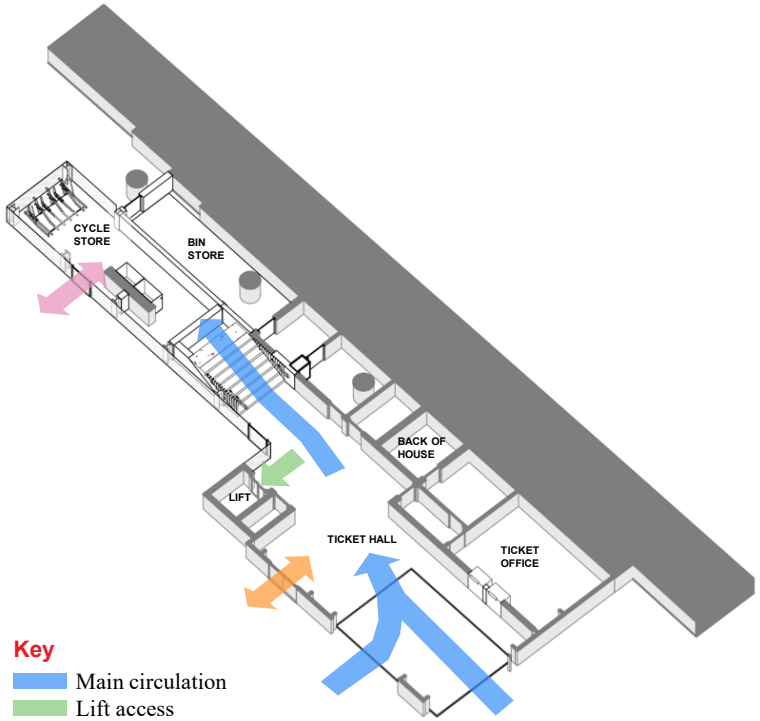


External entrance view of Donaghmede Option 1

Station Entrances

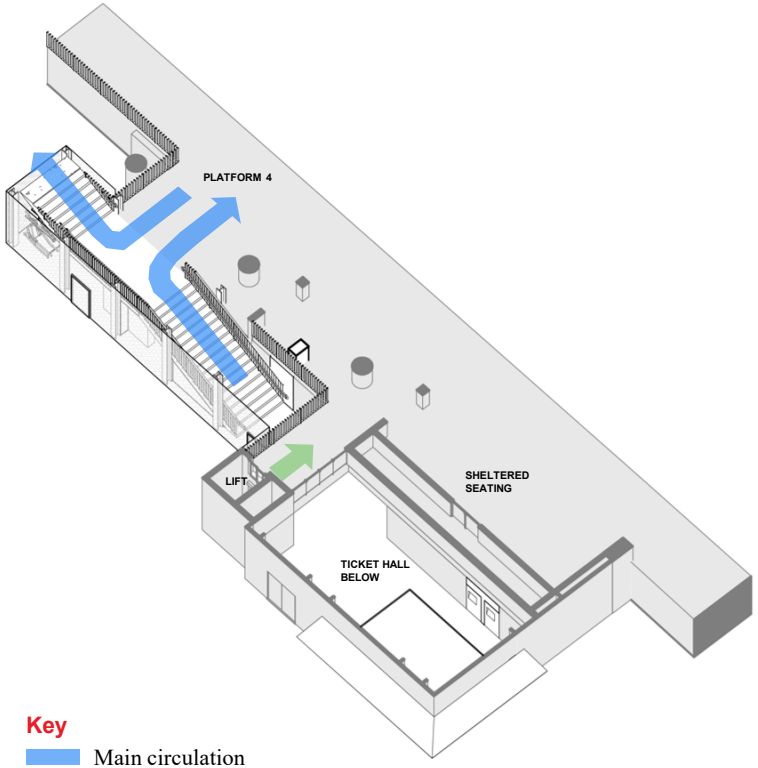
Proposal - Donaghmede Option 1

Axonometric layouts



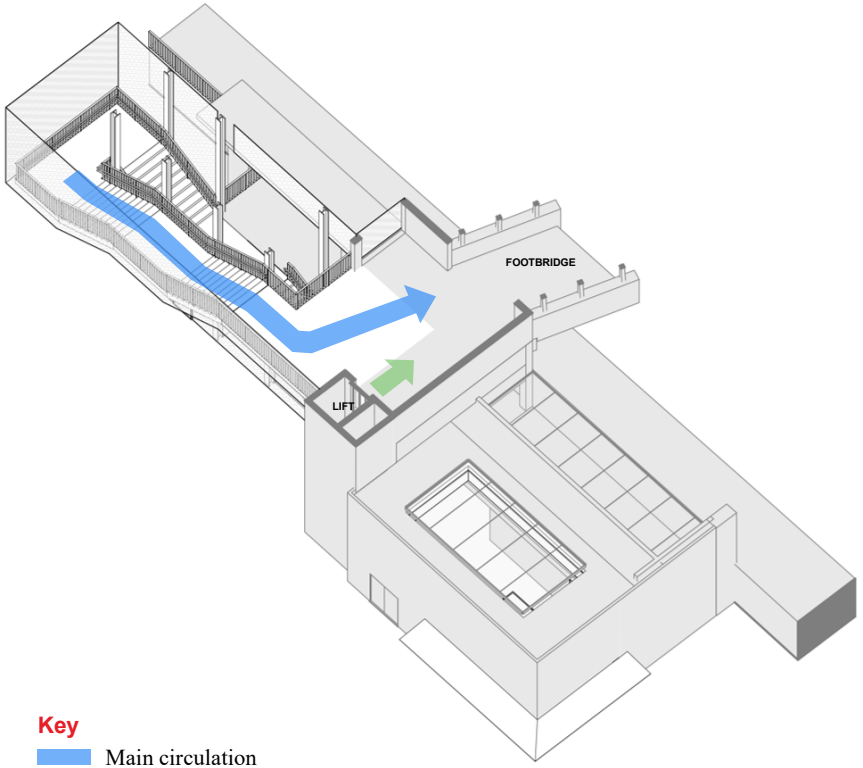
Key
- Main circulation
- Lift access
- Cycle access
- Out of hours access

Entrance level



Key
- Main circulation
- Lift access

Platform level



Key
- Main circulation
- Lift access

Footbridge level

Station Entrances

Proposal - Donaghmede Option 1

Internal view of proposed Donaghmede Entrance Option 1

Station Entrances

Proposal - Donaghmede Option 1

Structure - demolition

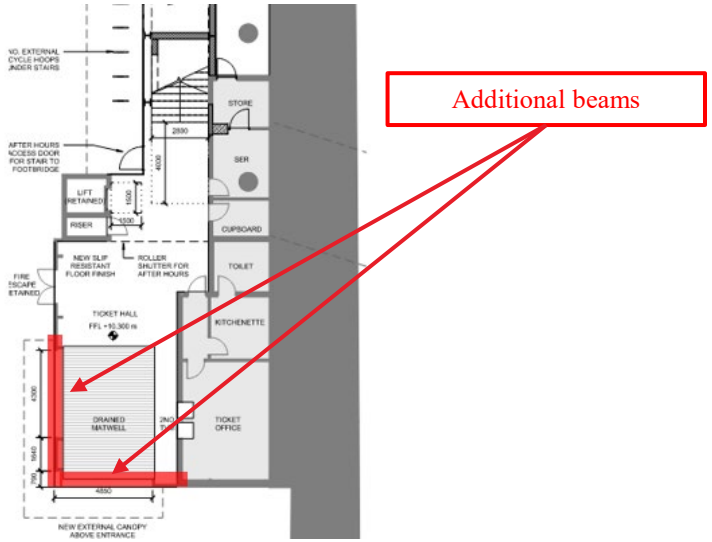
Donaghmede Option 1 requires the removal of the two existing stairs and the walls supporting them and the ticket hall extended entrances will require the removal of some of the existing steel columns (refer to figure on page 38).

The Footbridge supporting system made from the three RC main columns, the main spine beam, and the two corbels will not be affected and will remain in place. The lift and its RC lift core walls are to be retained also.

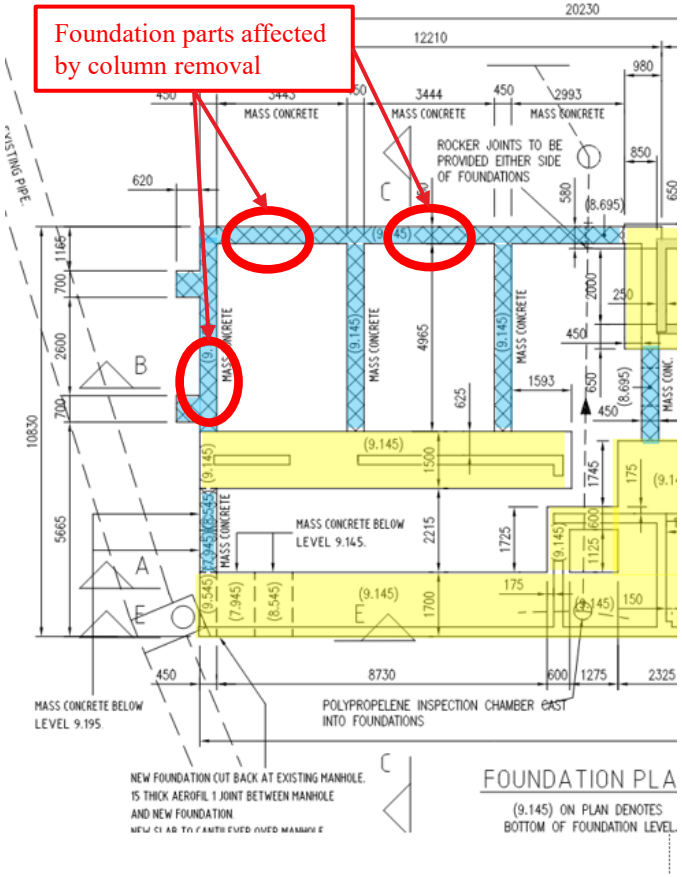
The removal of some steel columns from the entrance building is arranged such that the columns forming part of the vertical bracing system are kept in position. This will reduce the alternations required to the existing roof structure which will remain mostly the same.

The removal of some of the ticket hall columns will have the following consequences:

1. The foundation of the remaining columns will carry more load than they currently do. Strengthening measures are expected to be required to enhance the existing mass concrete foundation. Depending on the ground conditions, this strengthening might be in the form of new RC spread footings of piled foundations.
2. The remaining columns need to carry more load. Their ability to carry the new larger loads needs to be confirmed. Strengthening measures are made if required.
3. Spans between the remaining columns will be larger the current spans. Additional steel beams will be required to span over the removed columns.
4. The column removal and foundation strengthening will require the existing Ticket Hall structure to be temporarily supported until the strengthening and modifications works are completed.



Additional beams required to entrance of ticket hall



Foundation locations expected to require strengthening

Station Entrances

Proposal - Donaghmede Option 1

Structure - demolition (continued)

The removal of the two existing stairs will require the removal of the stairs and their supporting walls. Such removal should not affect the Footbridge supporting system, and as such, the extent of structural changes are limited to the less significant parts of the building.

The roof on top of the existing internal stair and lift core will be revised to match the extent of the revised structure.

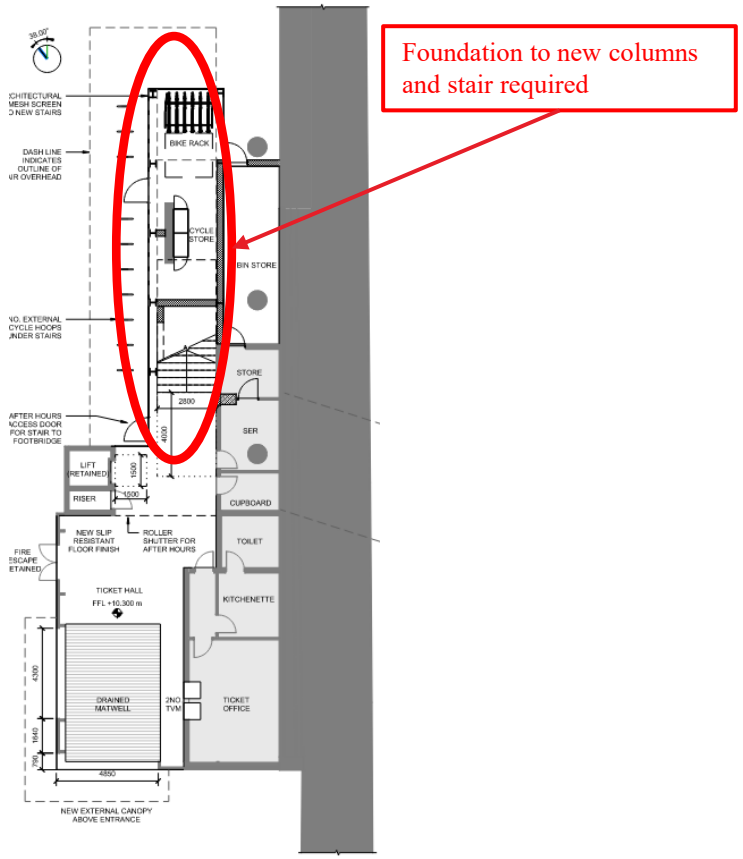
Structure - proposed

Following the removal of the two existing stairs, the new proposed stair can be added. This will require the addition of the new foundations to the new supports of the revised building. Part of the existing walls can be retained where appropriate. New steel columns are added to support the stair, landings, and new roof structure. Additional vertical bracing can be added to provide lateral stability to the new structure. Moment connections between the steel members can also be used to provide for the lateral stability.

It is envisaged that most of the new structure is made from steel in order to reduce the site construction time. All steelwork is expected to arrive to site already corrosion protected, painted and ready to be connected to its final position. Connections are expected to be bolted with minimum site welding.

The structure is completed with a new roof over the new stair. The roof is envisaged to be made from a light steel structure covered by metal cladding.

Proposed loadings for the upgrade works are not yet available however it is envisaged that similar foundation solutions to those of the existing structures will be used. Where tension loads occur, small diameter piling may be required. The proposed foundation strategy will be reviewed at subsequent design stages based on the location, ground conditions and loadings associated with the proposed works. This applies to all options.



New foundations required

Station Entrances

Proposal - Donaghmede Option 2

New staircase & adjacent lift

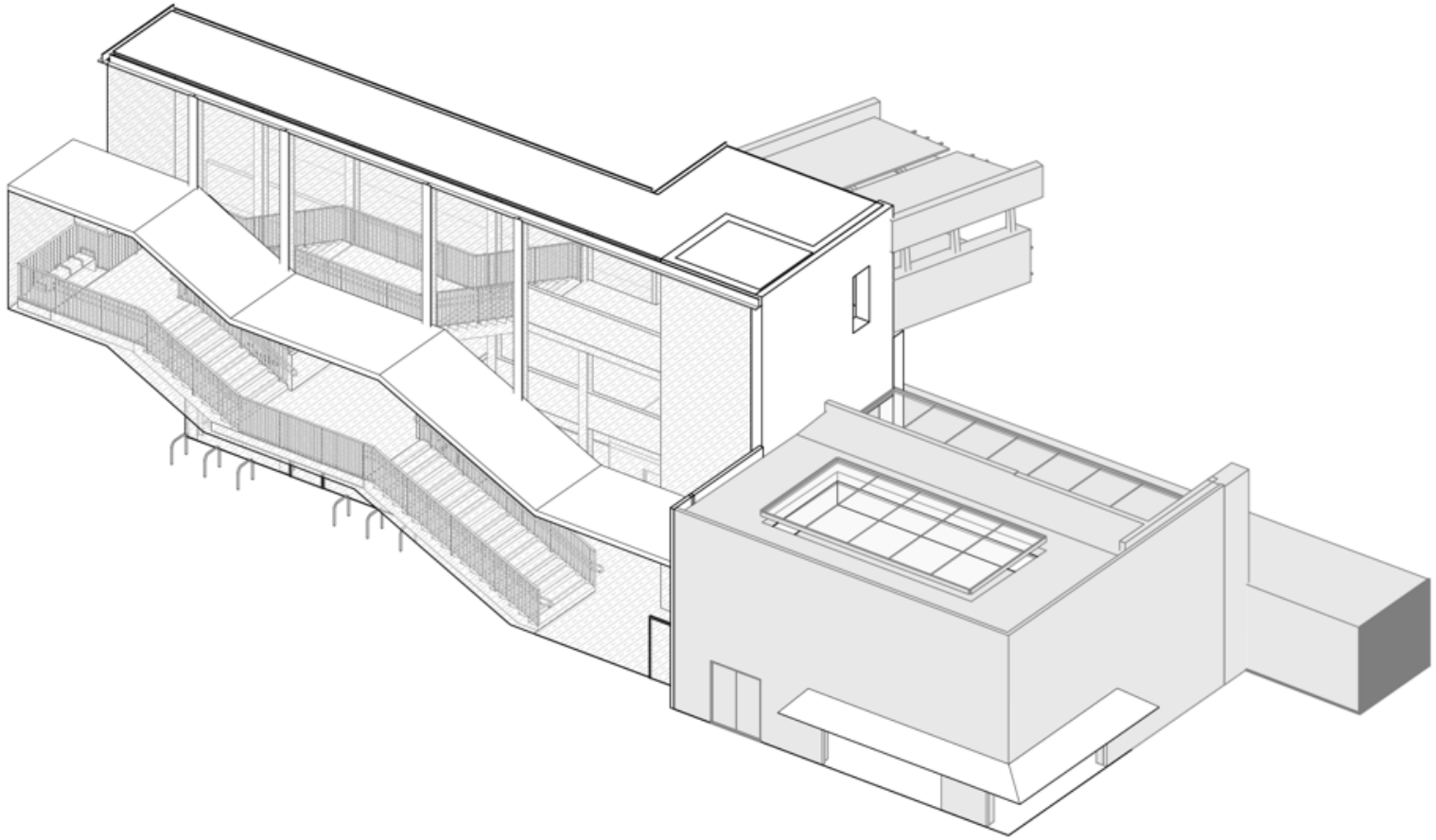
Option 2 for the Donaghmede Entrance removes both sets of existing access stairs and replaces them with a new single covered stair. The existing lift is to be removed and replaced.

The new staircase provides a straight, single flight from Ticket Hall level up to platform level so that Platform 4 is visible when approaching the base of the stairs. The stairs then continue from the platform up one flight to a landing where the stairs return and continue with two more equal flights to Footbridge level.

The staircase is designed to be as open and inviting as possible. Externally, the landing and bottom two flights are expressed so that the stair is clearly visible to aid intuitive wayfinding. The stair provides a 2.4m clear width (handrail to handrail) with 4m clear run-off at Ticket Hall, Platform and Footbridge level. Drainage channels are at all landings.

The proposed lift is an adjacent opening lift so that the lift doors at Ticket Hall level are facing the entrance, and then face the platform and Footbridge at those levels. A minimum 1500mm square waiting area is provided to each lift entrance.

A secure bike store is located below half of the new staircase and a roof supported by central columns provides shelter. An architectural stainless steel mesh is hung from the edge of the roof and fixed to the base of the staircase to enclose the new structure and provide some further weather protection.

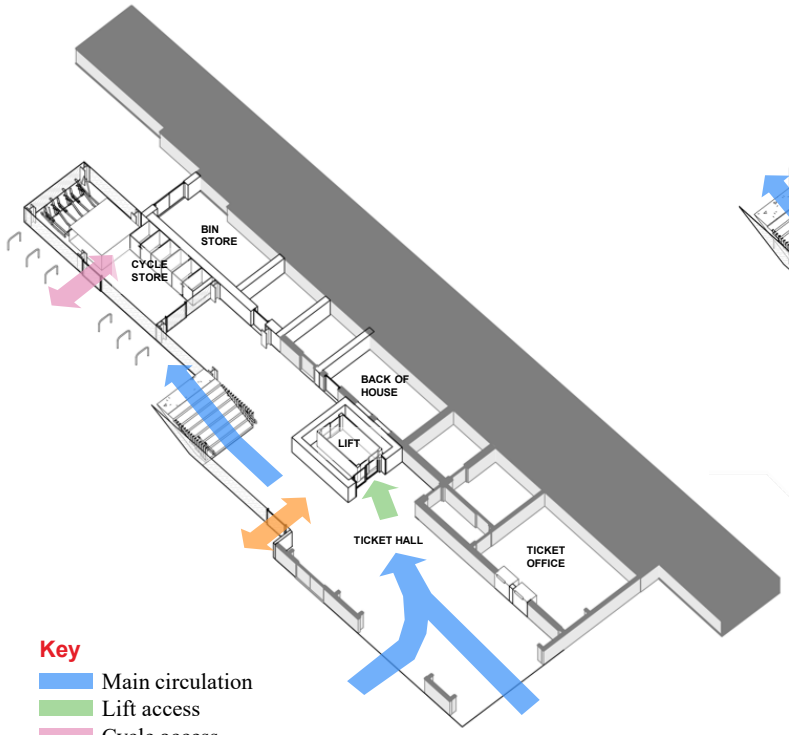


External entrance view of Donaghmede Option 2

Station Entrances

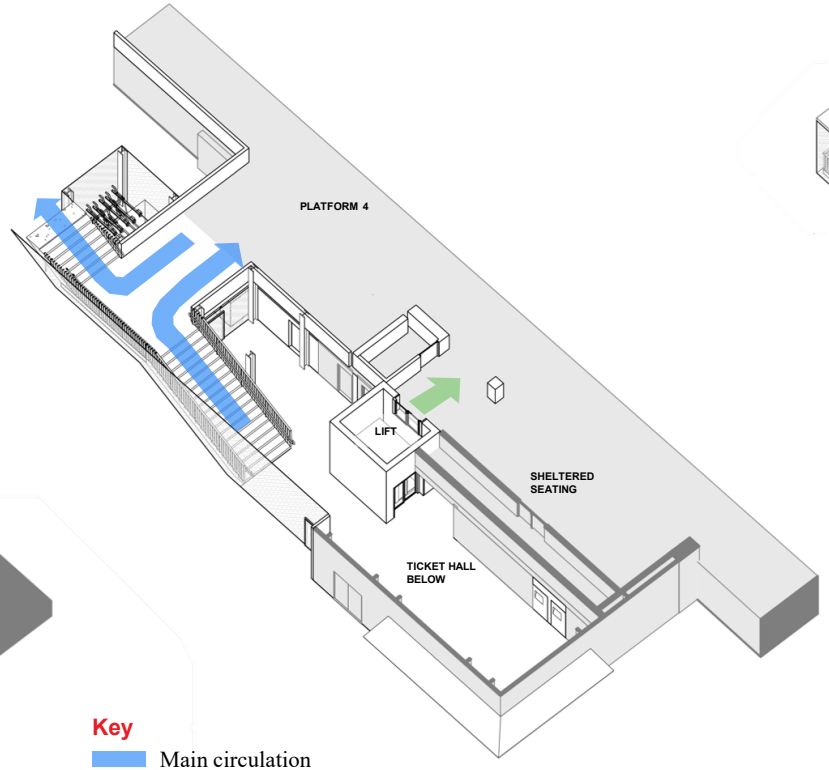
Proposal - Donaghmede Option 2

Axonometric layouts



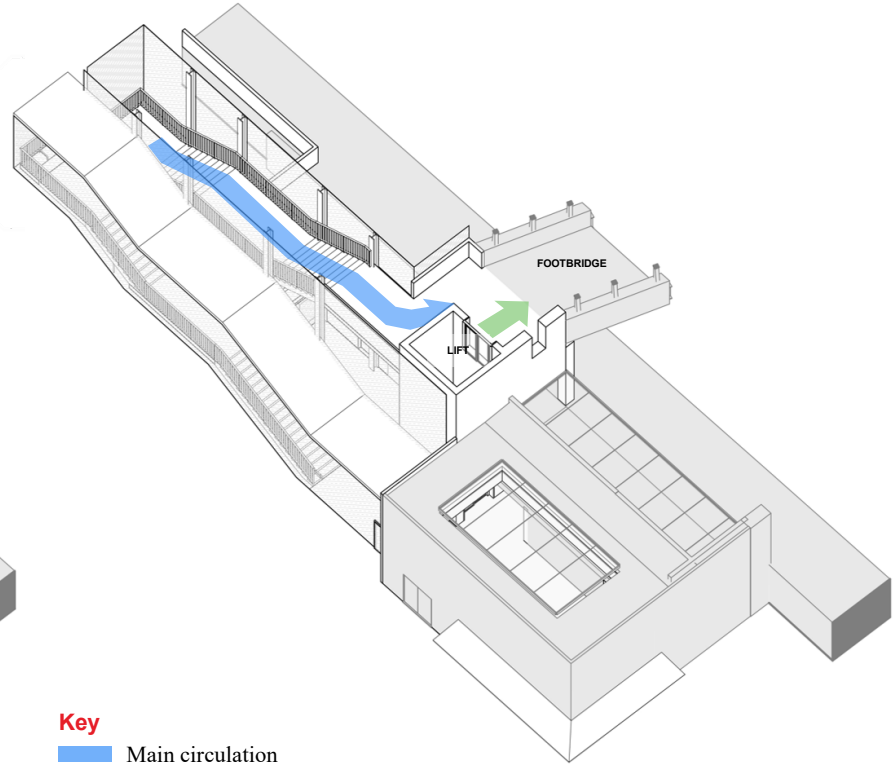
Key
- Main circulation
- Lift access
- Cycle access
- Out of hours access

Entrance level



Key
- Main circulation
- Lift access

Platform level



Key
- Main circulation
- Lift access

Footbridge level

Station Entrances

Proposal - Donaghmede Option 2

Internal view of proposed Donaghmede Entrance Option 2

Station Entrances

Proposal - Donaghmede Option 2

Structure - demolition

Donaghmede Option 2 involves the removal of both existing stairs and replacing them with a new single stair. The existing lift will be removed from its current location to a new more appropriate position.

The ticket hall is altered by widening the existing entrance and adding another open entrance from the side.

The Footbridge supporting system made from the three RC main columns, the main spine beam, and the two corbels will be completely removed.

The removal of some steel columns from the entrance building in the ticket hall is arranged in a similar way to that of Option 1. This will result in the same consequences and will require the same measures as presented in Option 1 to the foundations, columns, and beams.

The removal of the two existing stairs, lift, and Footbridge supporting structure will require the removal of the RC walls supporting the stairs, the RC walls of the lift core. Furthermore, the three columns supporting the Footbridge supporting structure, the main spine beam, the two corbels, and the 250 mm thick RC slab are to be removed also.

The extent of structural changes are more substantial than that for Option 1.

Structure - proposed

Following the removal of the existing structural elements as described, the new additional elements can be added. This will require the addition of the new foundations to the new columns and walls of the revised building. New steel columns are added to support the stair, landings, and new roof structure. Additional vertical bracing can be added to provide lateral stability to the new structure. Moment connections between the steel members can also be used to provide for the lateral stability.

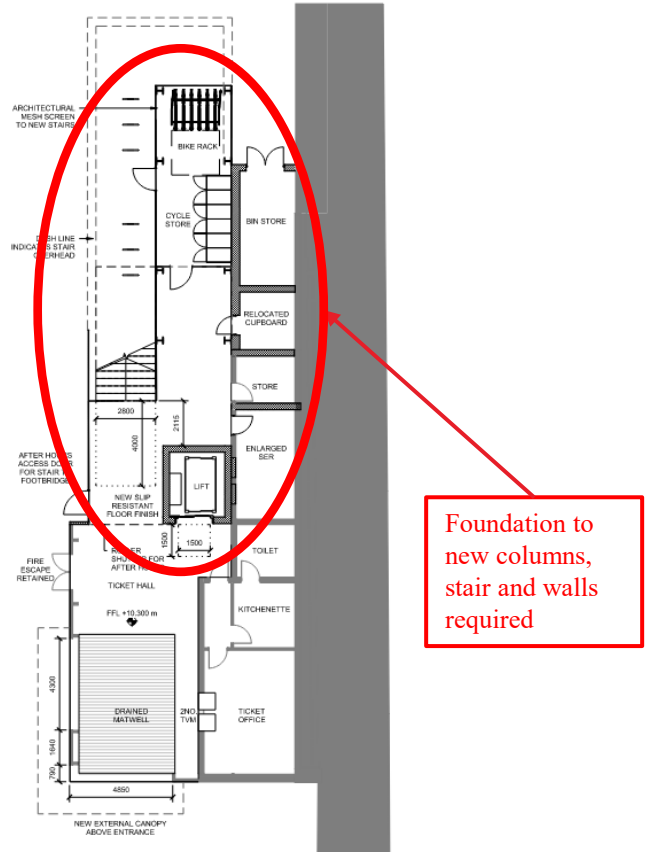
It is envisaged that most of the new structure is made from steel in order to reduce the site construction time.

New RC walls are built for the lift at its new location. New column and walls are added to support the slab and the Footbridge at the Footbridge level.

A new RC slab is added to connect the lift and stair to the Footbridge.

The structure is completed with a new roof over the new stair and lift core. The roof is envisaged to be made from a light steel structure covered by metal cladding.

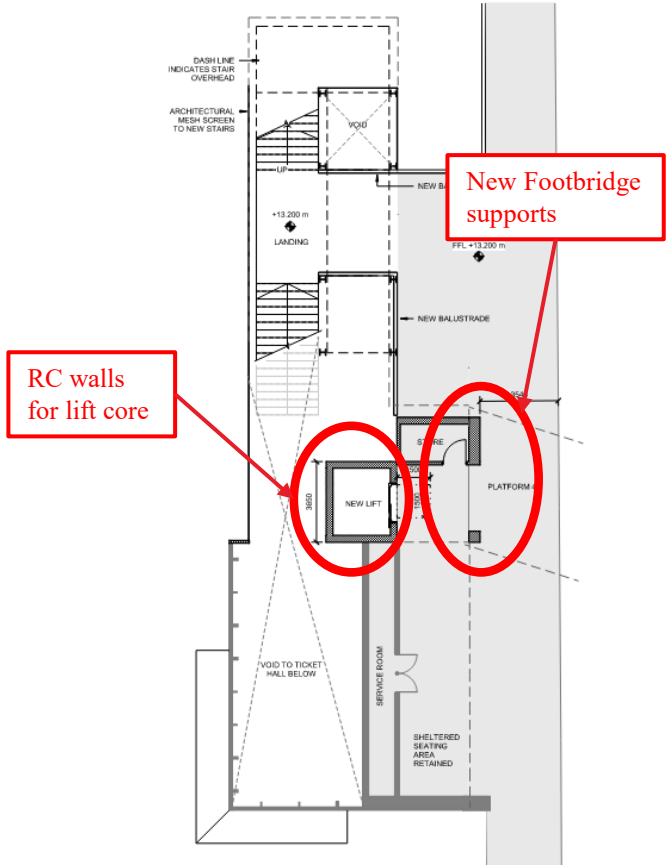
All steelwork is expected to arrive to site already corrosion protected, painted and ready to be connected to its final position. Connections are expected to be bolted with minimum site welding.



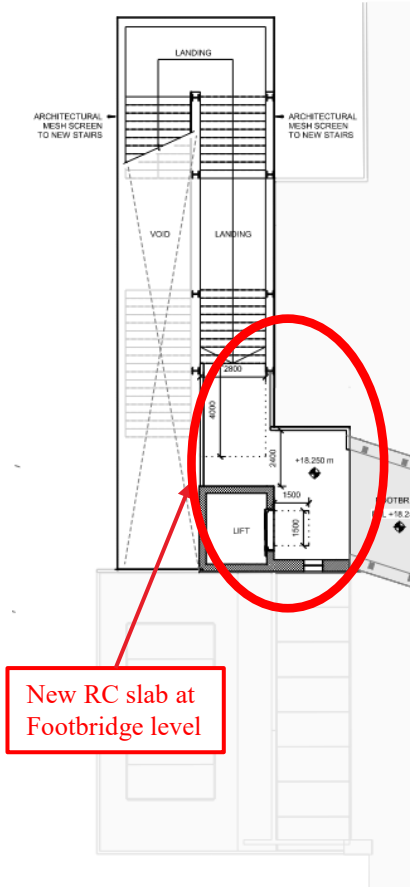
Ticket hall level - new foundations, columns, walls and slab

Station Entrances

Proposal - Donaghmede Option 2



Platform level - new foundations, columns and walls



Footbridge level - new slab

Station Entrances

Proposal - Kilbarrack Option 1

New staircase | lift retained

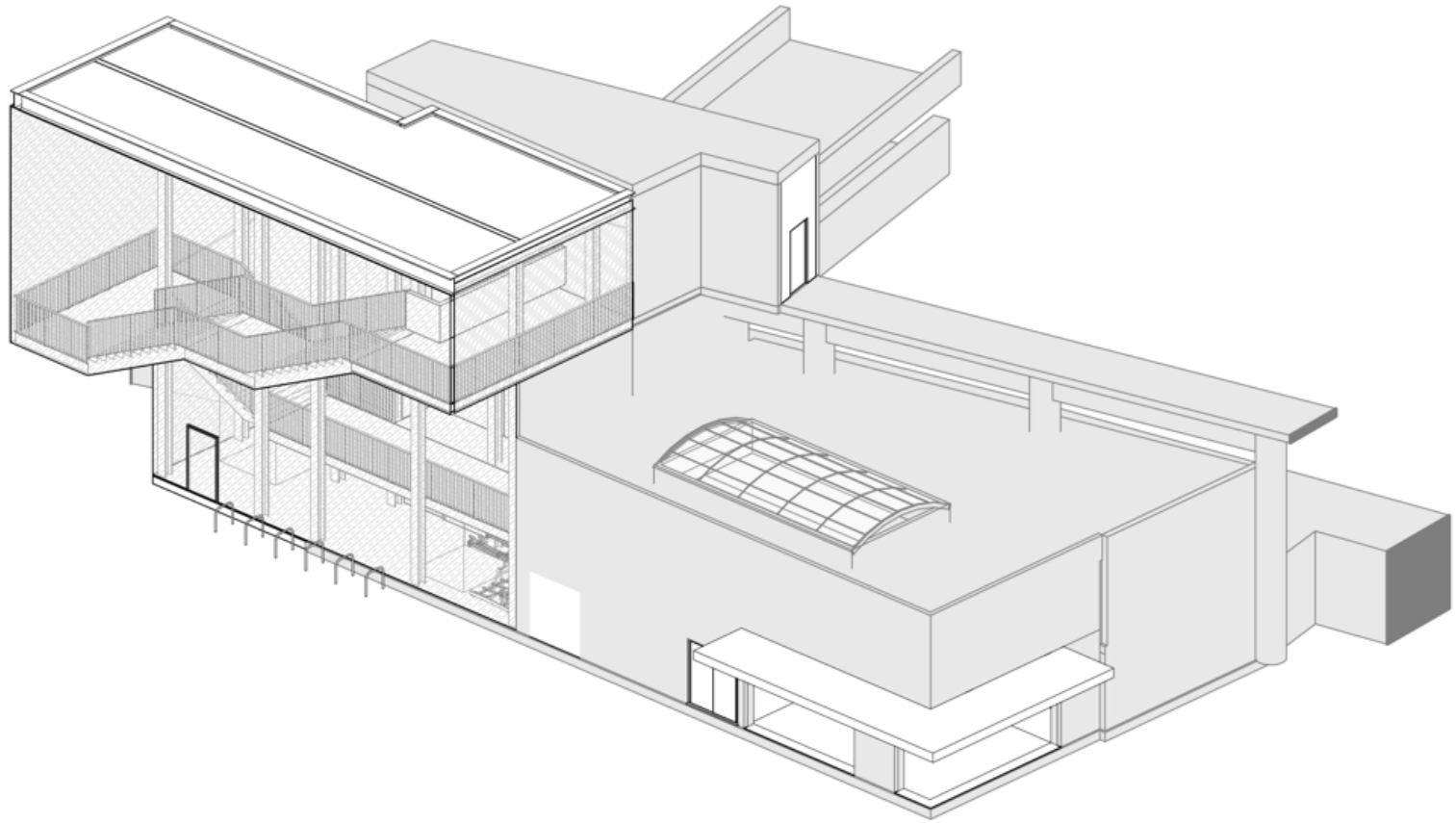
Option 1 for the Kilbarrack Entrance proposes to remove both sets of existing access stairs and replace them with a new single covered stair. The existing lift is to remain.

The new staircase provides a straight, single flight from Ticket Hall level up to platform level so that Platform 1 is visible when approaching the base of the stairs. The stairs then continue from the Platform up one flight to a landing where the stairs return and continue with two more equal flights to Footbridge level.

The staircase is designed to be open and inviting. Externally, the landing and top two flights are expressed so that the staircase is clearly visible to aid intuitive wayfinding. The staircase provides a 2.4m clear width (handrail to handrail) with 4m clear run-off at Ticket Hall, Platform and Footbridge level. Drainage channels will be included at all landings.

The retained lift provides sufficient waiting areas at all entrances. The structure that supports the existing public stair is retained as this supports the footbridge. The disused structure could provide a platform for art or advertising.

A secure bike store is located below half of the new staircase and a roof supported by central columns provides shelter. An architectural stainless steel mesh is hung from the edge of the roof and fixed to the base of the staircase to enclose the new structure and provide some further weather protection.

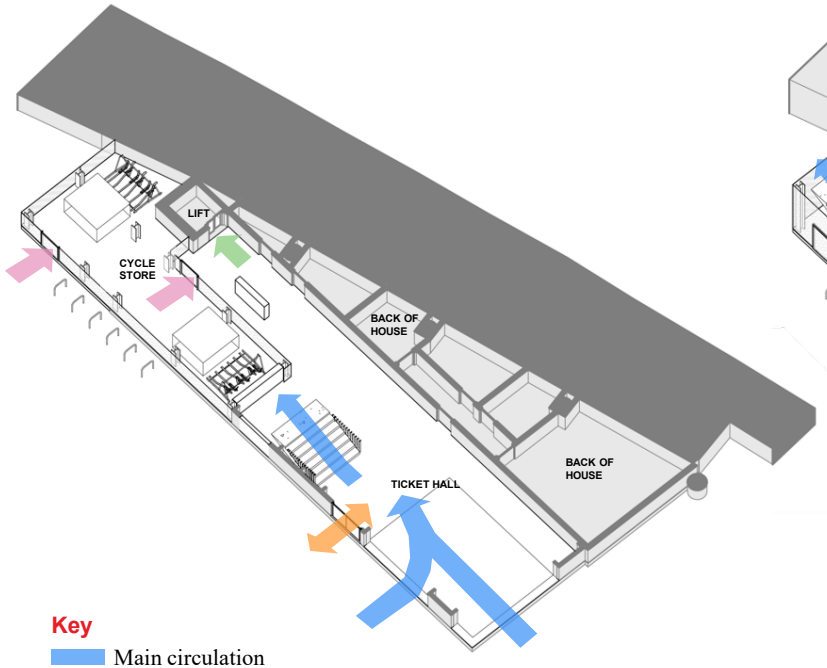


External entrance view of Kilbarrack Option 1

Station Entrances

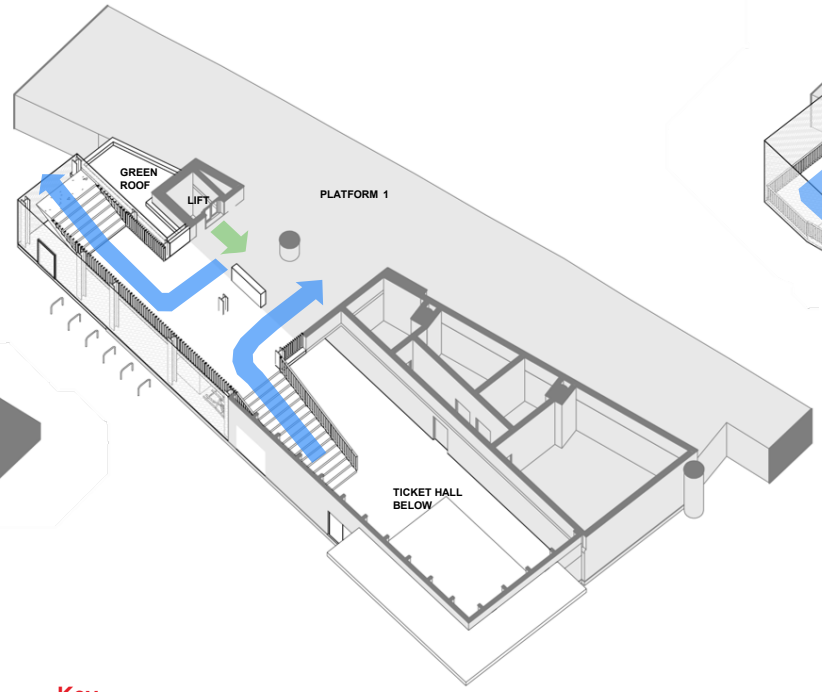
Proposal - Kilbarrack Option 1

Axonometric layouts



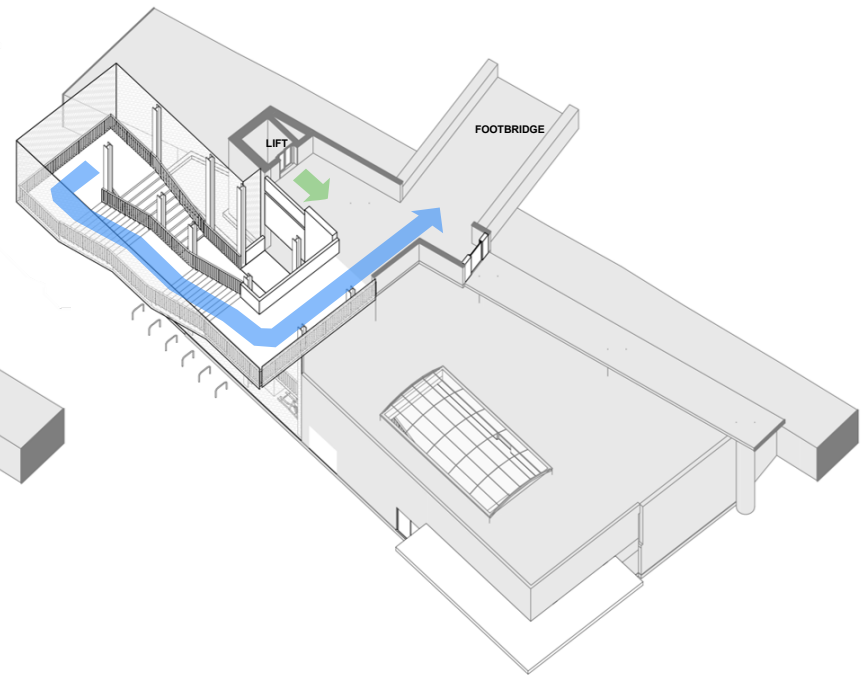
Key
- Main circulation
- Lift access
- Cycle access
- Out of hours access

Entrance level



Key
- Main circulation
- Lift access

Platform level



Key
- Main circulation
- Lift access

Footbridge level

Station Entrances

Proposal - Kilbarrack Option 1

Internal view of Proposed Kilbarrack Entrance Option 1

Station Entrances

Proposal - Kilbarrack Option 1

Structure - demolition

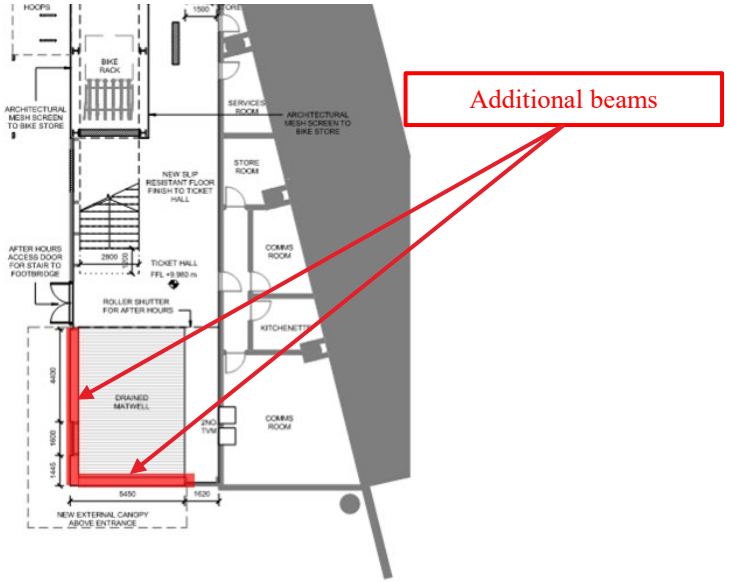
Kilbarrack Option 1 requires the removal of both existing stairs and replacing them with a new single stair. The existing lift is unaffected and remains in its current location.

The ticket hall extended entrances will require the removal of some of the existing steel columns. The Footbridge supporting system made from the four RC main columns, the lift core, the main spine beam, and the two corbels will not be affected and will remain in place.

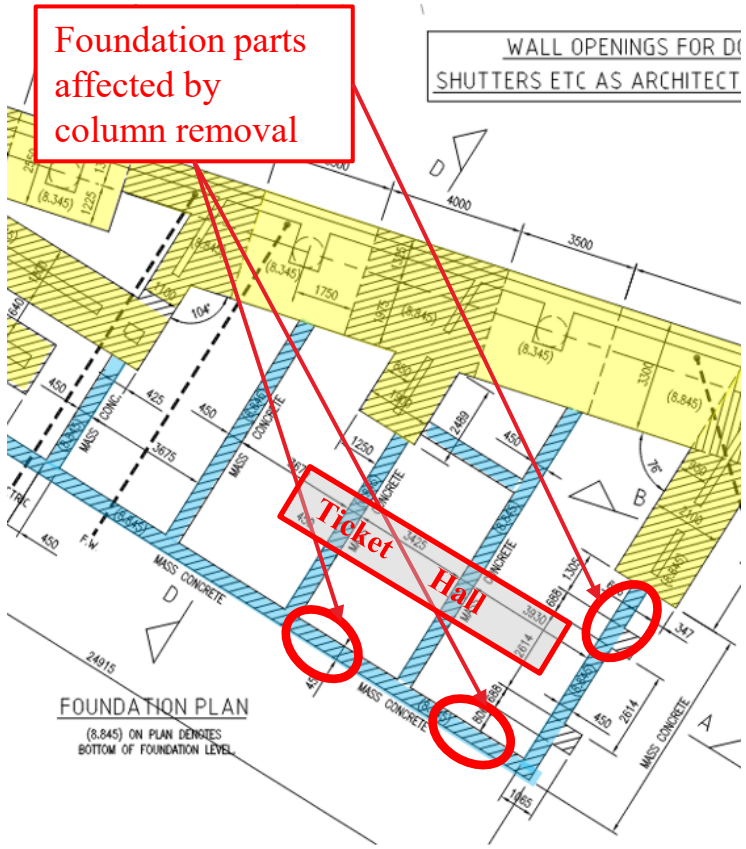
Similar to Donaghmede entrance, the removal of some steel columns from the entrance building is arranged such that the columns forming part of the vertical bracing system are kept in position. This will reduce the alternations required to the existing roof structure which will remain mostly the same.

The removal of some of the Ticket Hall columns will have the following consequences:

1. The foundation of the remaining columns will carry more load than they currently do. Strengthening measures are expected to be required to enhance the existing mass concrete foundation. Depending on the ground conditions, this strengthening might be in the form of new RC spread footings of piled foundations.
2. The remaining columns need to carry more load. Their ability to carry the new larger loads needs to be confirmed. Strengthening measures are made if required.
3. Spans between the remaining columns will be larger the current spans. Additional steel beams will be required to span over the removed columns.
4. The column removal and foundation strengthening will require the existing Ticket Hall structure to be temporarily supported until the strengthening and modifications works are completed.



Additional beams required to entrance of ticket hall



Foundation locations expected to require strengthening

Station Entrances

Proposal - Kilbarrack Option 1

Structure - demolition (continued)

The removal of the two existing stairs will require the removal of the stairs and their supporting walls. Such removal should not affect the Footbridge supporting system, and as such, the extent of structural changes are limited to the less significant parts of the building.

The roof on top of the existing internal stair and lift core needs to be revised to match the extent of the revised structure.

Structure - proposed

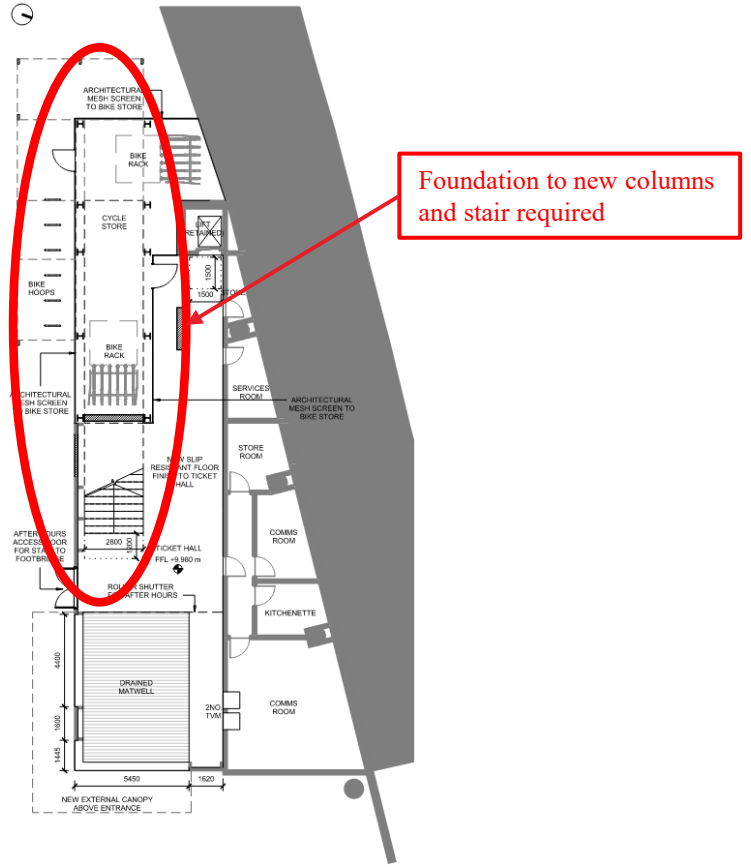
Following the removal of the two existing stairs, the new proposed stair can be added. This will require the addition of the new foundations to the new supports of the revised building. New steel columns are added to support the stair, landings, and new roof structure. Additional vertical bracing can be added to provide lateral stability to the new structure. Moment connections between the steel members can also be used to provide for the lateral stability.

It is envisaged that most of the new structure is made from steel in order to reduce the site construction time.

The structure is completed with a new roof over the new stair. The roof is envisaged to be made from a light steel structure covered by metal cladding.

All steelwork is expected to arrive to site already corrosion protected, painted and ready to be connected to its final position. Connections are expected to be bolted with minimum site welding.

Proposed loadings for the upgrade works are not yet available however it is envisaged that similar foundation solutions to those of the existing structures will be used. Where tension loads occur, small diameter piling may be required. The proposed foundation strategy will be reviewed at subsequent design stages based on the location, ground conditions and loadings associated with the proposed works. This applies to all options.



New foundations required

Station Entrances

Proposal - Kilbarrack Option 2

New stair & through lift

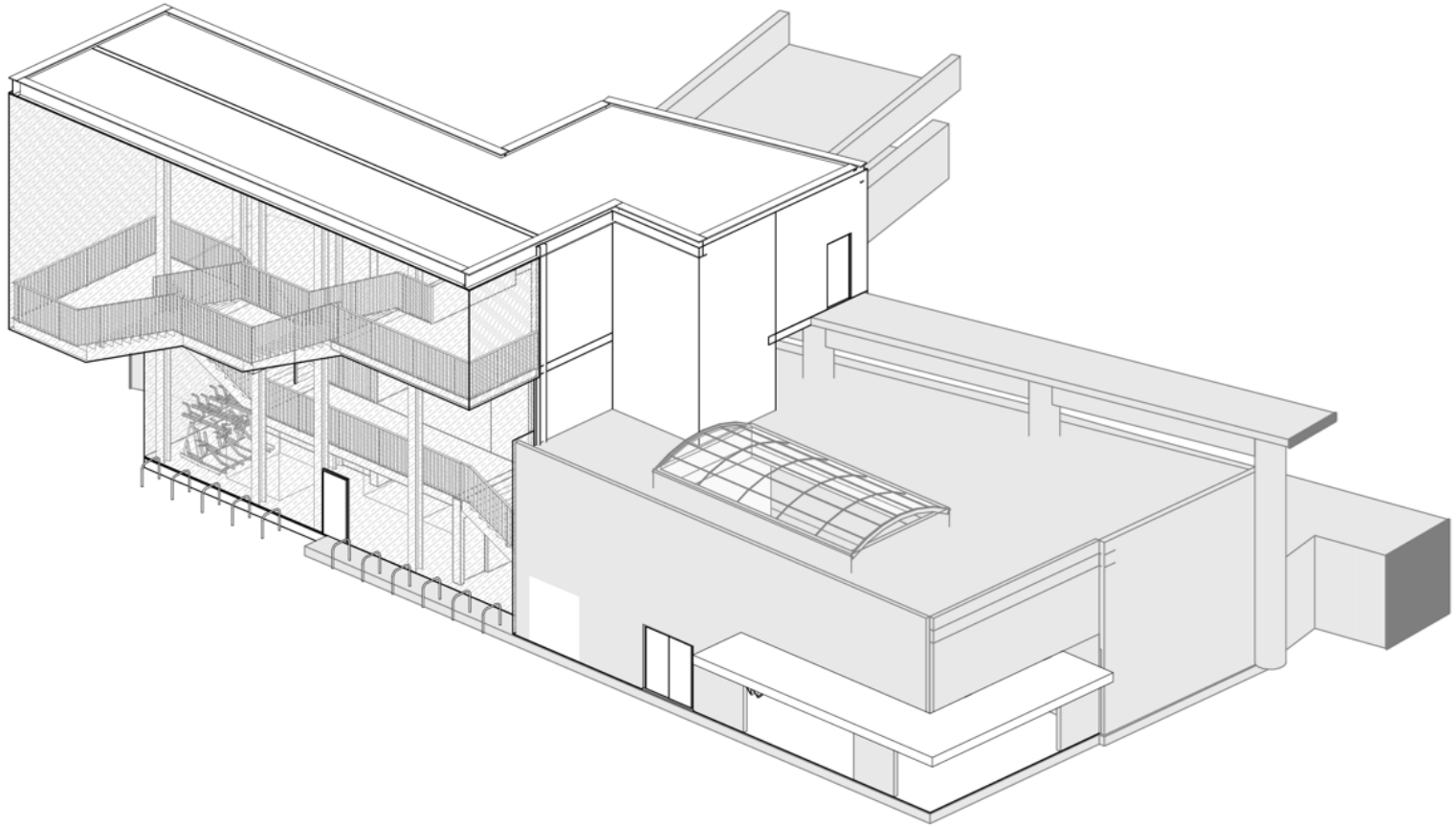
Option 2 for the Kilbarrack Entrance removes both sets of existing access stairs and replaces them with a new single covered stair. The existing lift is to be removed and replaced.

The new staircase provides a straight, single flight from Ticket Hall level up to platform level so that Platform 1 is visible when approaching the base of the stairs. The staircase then continues from the platform up one flight to a landing where the stairs return and continue with two more equal flights to Footbridge level.

The staircase is designed to be open and inviting. Externally, the landing and bottom two flights are expressed so that the staircase is clearly visible to aid intuitive wayfinding. The staircase provides a 2.4m clear width (handrail to handrail) with 4m clear run-off at Ticket Hall, Platform and Footbridge level. Drainage channels will be included to all landings.

The proposed lift is a through lift for improved accessibility. The shaft is located a lot closer to the Ticket Hall entrance door so that the door is adjacent to the base of the new stair. 1500mm square waiting areas are included to all lift doors.

A secure bike store is located below half of the new staircase and a roof supported by central columns provides shelter. An architectural stainless steel mesh is hung from the edge of the roof and fixed to the base of the stair to enclose the new structure and provide some further weather protection.

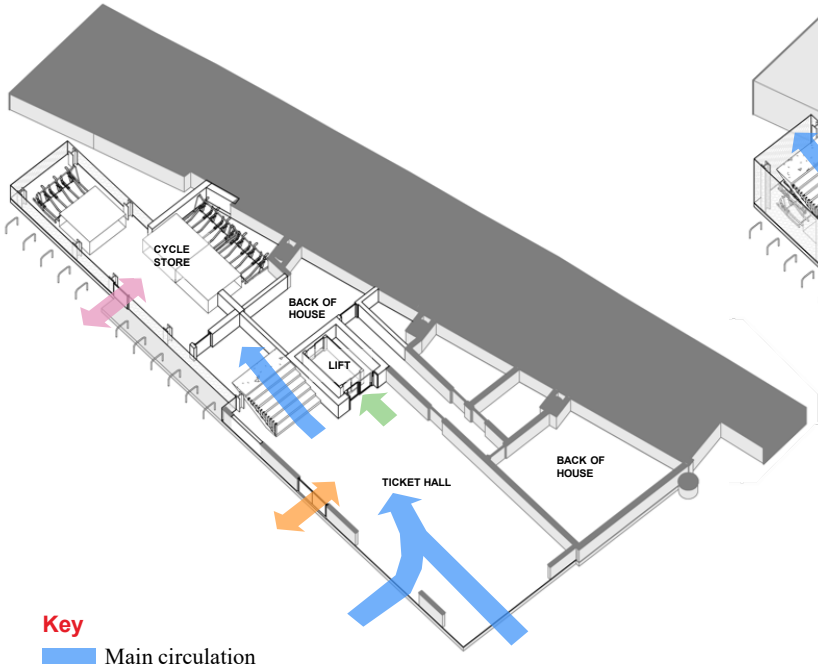


External entrance view of Kilbarrack Option 2

Station Entrances

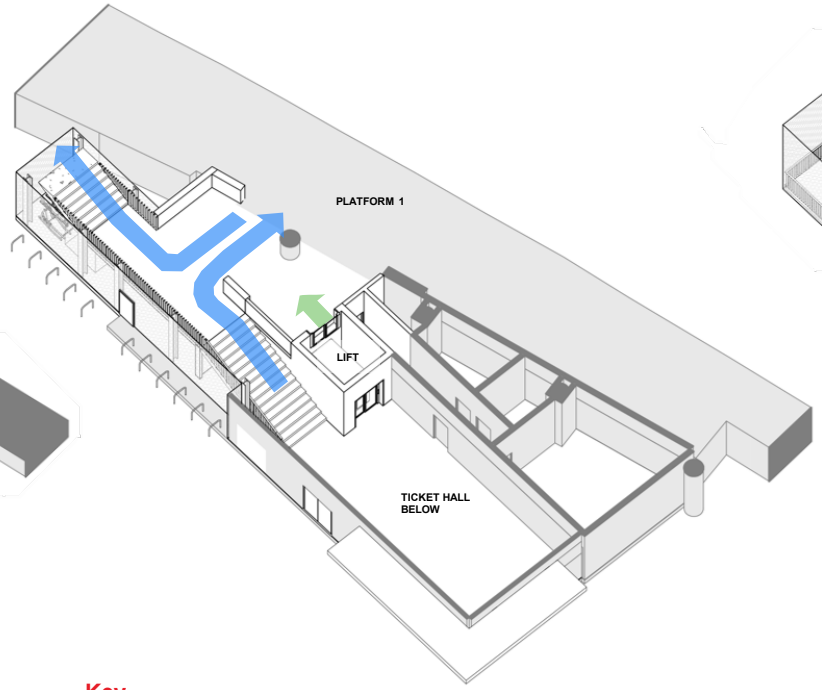
Proposal - Kilbarrack Option 2

Axonometric layouts



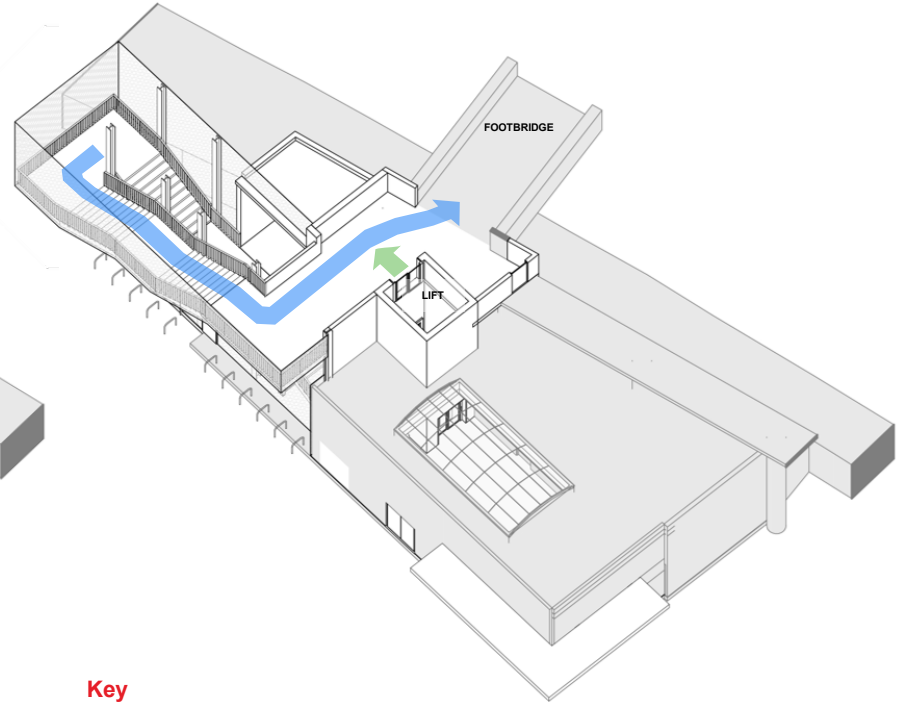
Key
- Main circulation
- Lift access
- Cycle access
- Out of hours access

Entrance level



Key
- Main circulation
- Lift access

Platform level



Key
- Main circulation
- Lift access

Footbridge level

Station Entrances

Proposal - Kilbarrack Option 2

Internal view of Proposed Kilbarrack Entrance Option 2

Station Entrances

Proposal - Kilbarrack Option 2

Structure - demolition

Kilbarrack Option 2 involves the removal of both existing stairs and replacing them with a new single stair. The existing lift is also moved to a new location.

The ticket hall is altered to by widening the existing entrance and adding another open entrance from the side.

The Footbridge supporting system made from the four RC main columns, the main spine beam, and the two corbels will not be affected and will remain in place.

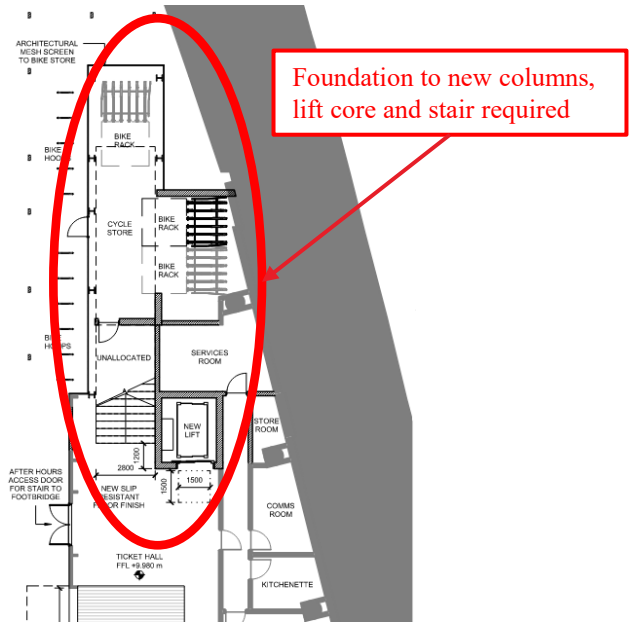
The lift core is to move from its current location and this change will require the removal of the RC lift core walls and rebuilding them at the new location. This change will have structural effects on the supporting system of the Footbridge as the main RC spine beam end is supported on the lift core walls in the existing arrangement.

The removal of the two existing stairs will require the removal of the stairs and their supporting walls. Such removal should not affect the Footbridge supporting system, and as such, the extent of structural changes are limited to the less significant parts of the building.

On the other hand, the relocation of the lift core will require more structural changes than those made for Option 1. The existing RC core walls need to be demolished.

This change will also have structural effects on the supporting system of the Footbridge as the main RC spine beam end is supported on the lift core walls in the existing arrangement.

The roof on top of the existing internal stair and lift core needs to be revised to match the extent of the revised structure.



New foundations required

Structure - proposed

Following the removal of the two existing stairs, the new proposed stair can be added. This will require the addition of the new foundations to the new supports of the revised building.

A new foundation is to be built at the new lift location, followed by construction of new RC lift core walls and slabs connecting the lift to different station levels.

New steel columns are added to support the stair, landings, and new roof structure. Additional vertical bracing can be added to provide lateral stability to the new structure. Moment connections between the steel members can also be used to provide for the lateral stability.

It is envisaged that most of the new structure is made from steel in order to reduce the site construction time.

The structure is completed with a new roof over the new stair. The roof is envisaged to be made from a light steel structure covered by metal cladding.

All steelwork is expected to arrive to site already corrosion protected, painted and ready to be connected to its final position. Connections are expected to be bolted with minimum site welding.

Summary

An Open, Light & Inviting Station

Overview

All proposed modifications to Howth Junction and Donaghmede Station will provide a significant benefit for passengers, the local population using the footbridge to cross between Donaghmede and Kilbarrack, and IÉ.

The removal of the central wall to the footbridge is the key modification that will significantly improve the interchange. The footbridge will become a light and open space with clear lines of sight to the entrances and on to the platforms.

There are three potential combinations of options in addition to the footbridge modifications:

1. Footbridge | CC Option 1 | Entrances Option 1
2. Footbridge | CC Option 2 | Entrances Option 1
3. Footbridge | CC Option 2 | Entrances Option 2

The adjacent table provides a high-level comparison between the potential combinations and the benefits that they provide.

The key comparison is whether the level of benefit provided by each option in terms of issues such as safety, usability and accessibility are worth the increase in time, cost and disruption that they would create.

	Footbridge Central Connection 1 Station Entrances 1	Footbridge Central Connection 2 Station Entrances 1	Footbridge Central Connection 2 Station Entrances 2
Safety & Security	🟡	🟡	🟢
Usability	🟡	🟢	🟢
Cost | Value for Money	🟢	🟢	🟡
Time	🟡	🟡	🔴
Risk	🟡	🟡	🔴
Disruption	🟡	🟡	🔴
Accessibility	🔴	🟡	🟢
Carbon Impact	🟢	🟢	🟡
Future Capacity	🔴	🟡	🟢
Health and Safety	🟢	🟢	🟡

Red, amber, green scoring to compare the combined options

Summary

An Open, Light & Inviting Station

Option assessment

The main difference between the Central Connection Option 1 and Option 2 is the second lift provided for redundancy and the additional work and expense of increasing the size of the central platform area to enable inclusion of the straight stair.

The second lift was requested by IÉ because currently if the existing Central Connection lift is out of service, passengers with reduced mobility alighting on Platforms 2 or 3 can only exit the station by using the stair (which may not be a possibility) or the long unlit footpath from the central island platforms that leads to the Baldoyle Industrial Estate, which has limited links to either Donaghmede or Kilbarrack.

A second lift was not requested to the station entrances because redundancy is provided from the footbridge by at least one of the entrances. For example, if the Donaghmede entrance lift is out of service, the Kilbarrack entrance lift can be used so passengers can at least exit via a lift. If exit or entry is required to Platform 1 and 4, the existing evacuation ramps that lead to the external areas of the station entrances can be used. Part of the works to all station entrance options is to make these ramps fully accessible with associated ticket machines and validator posts.

The primary benefit of the Central Connection Option 1 is the reduced footprint, risk, disruption and cost of only providing one lift. However, it is recommended that the added benefit of the second lift and the improved visibility and accessibility of the straight stair in Option 2 outweigh these benefits.

For the station entrances, the primary benefits of Option 2 over Option 1 are the increased visibility of the newly located lifts, and the improvement in accessibility and allowance for future capacity as these new lifts can be sized to meet expected future demand.

However, due to the complexity of the existing station building structure (see Appendix B), there is a lot of risk and additional cost in adding the new lift shafts and associated structures. Reference should also be made to the constructability assessment in Appendix E, that shows that the additional phasing required for Option 2 will potentially increase the programme by 50%. Therefore it is recommended that Option 1 for the station entrances is progressed.

Preferred Option

It is recommended that a combined option of the Central Connection Option 2 and the Station Entrances Option 1 is progressed to Phase 3 (Preliminary Design). Please refer to the figure on page 67 that provides a high-level illustration of this combination of options.

This will add significant improve the usability, safety and accessibility of the station whilst removing the additional time, cost and risk of Option 2 for the station entrances.

Summary

An Open, Light & Inviting Station

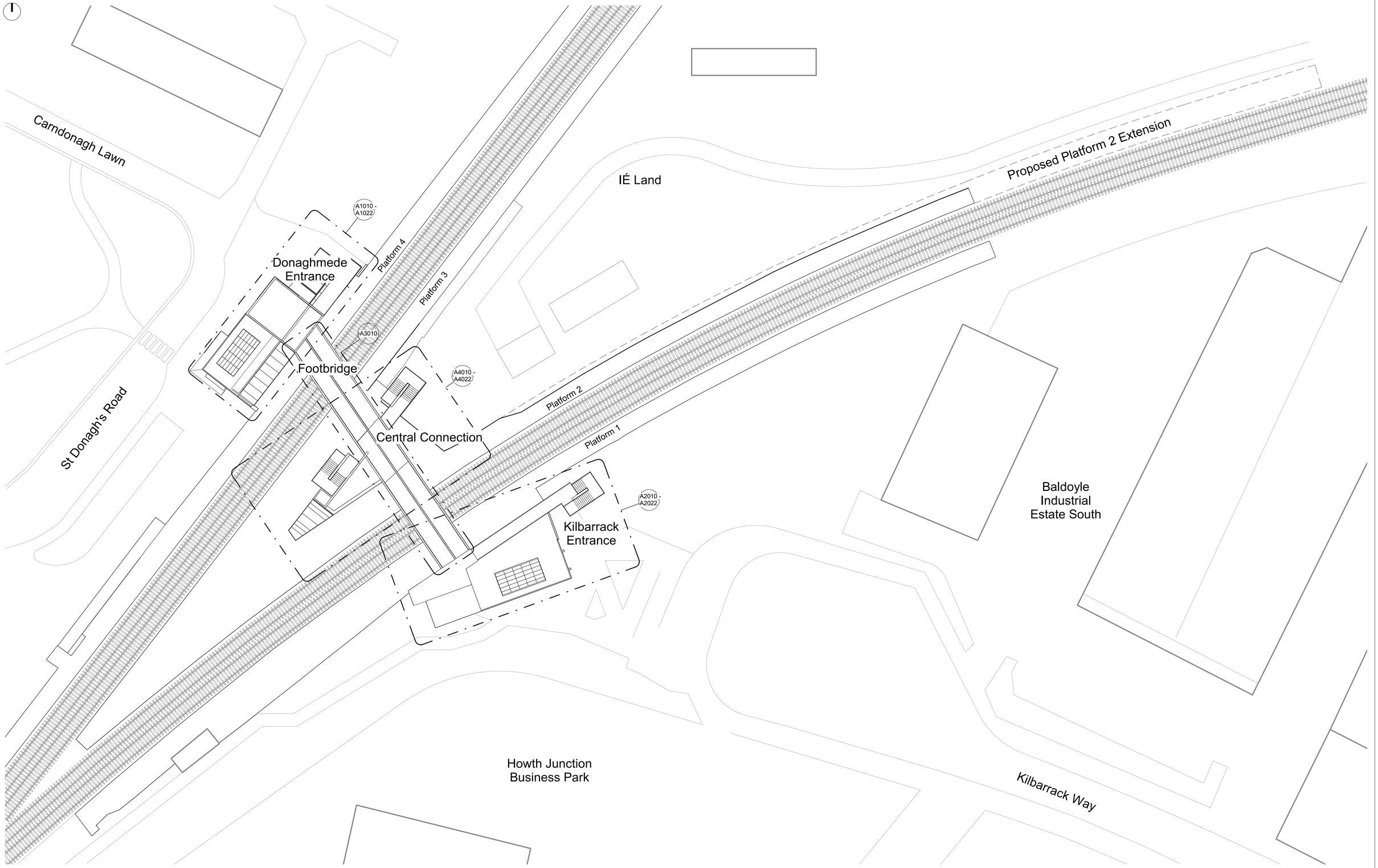
Combined option with Station Entrances Option 1 & Central Connection Option 2

Appendices

Appendix A - Architectural Drawings

Drawing List

A0010	Site Plan - Existing
A1010	Donaghmede Entrance | Option 1 | Existing Plans
A1012	Donaghmede Entrance | Option 1 | Proposed Plans
A1012	Donaghmede Entrance | Option 1 | 3D Views
A1020	Donaghmede Entrance | Option 2 | Existing Plans
A1021	Donaghmede Entrance | Option 2 | Proposed Plans
A1022	Donaghmede Entrance | Option 2 | 3D Views
A2010	Kilbarrack Entrance | Option 1 | Existing Plans
A2011	Kilbarrack Entrance | Option 1 | Proposed Plans
A2012	Kilbarrack Entrance | Option 1 | 3D Views
A2020	Kilbarrack Entrance | Option 2 | Existing Plans
A2021	Kilbarrack Entrance | Option 2 | Proposed Plans
A2022	Kilbarrack Entrance | Option 2 | 3D Views
A3010	Station Footbridge | Existing and Proposed | Plans and 3D Views
A4010	Central Connection | Option 1 | Existing Plans
A4011	Central Connection | Option 1 | Proposed Plans
A4012	Central Connection | Option 1 | 3D Views
A4020	Central Connection | Option 2 | Existing Plans
A4021	Central Connection | Option 2 | Proposed Plans
A4022	Central Connection | Option 2 | 3D Views



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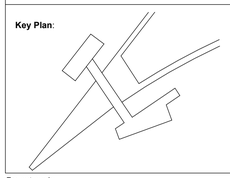

Notes:

1. Do not scale from drawing.
2. All dimensions are an approximate. Final setting out subject to further surveys and coordination with other workstreams.
3. All dimensions to be checked on site.
4. All dimensions are in millimetres unless otherwise stated.
5. Existing information based on drawings provided by Irish Rail within RFI 372.

Issue	Date	
1.0	03/03/2023	Phase 2 Concept Design

ARUP
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Tel +44 (0)20 7636 1531 Fax +44 (0)20 7580 3924
www.arup.com

Client: Iarnród Éireann Irish Rail

Project Title: Howth Junction & Donaghmede Station

Drawing Title: Site Plan - Existing

Scale at A1: 1:300

By / Chkd / Appd: AH/JW/RS

Role:

Status:

Arup Job No: **28505150**

Rev:

ID: **HOWTH JUNCTION-ARUP-A0010**

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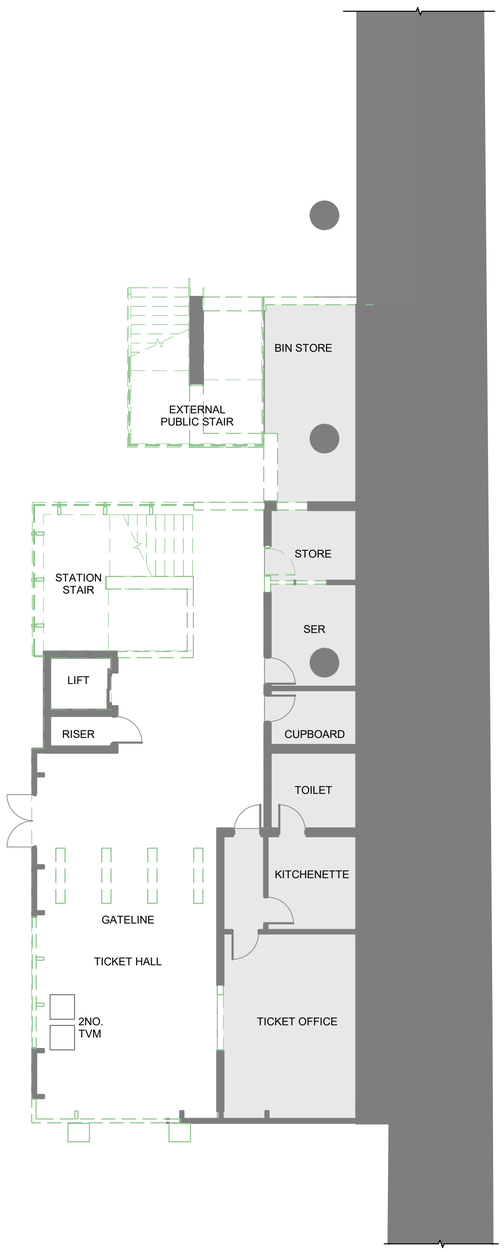
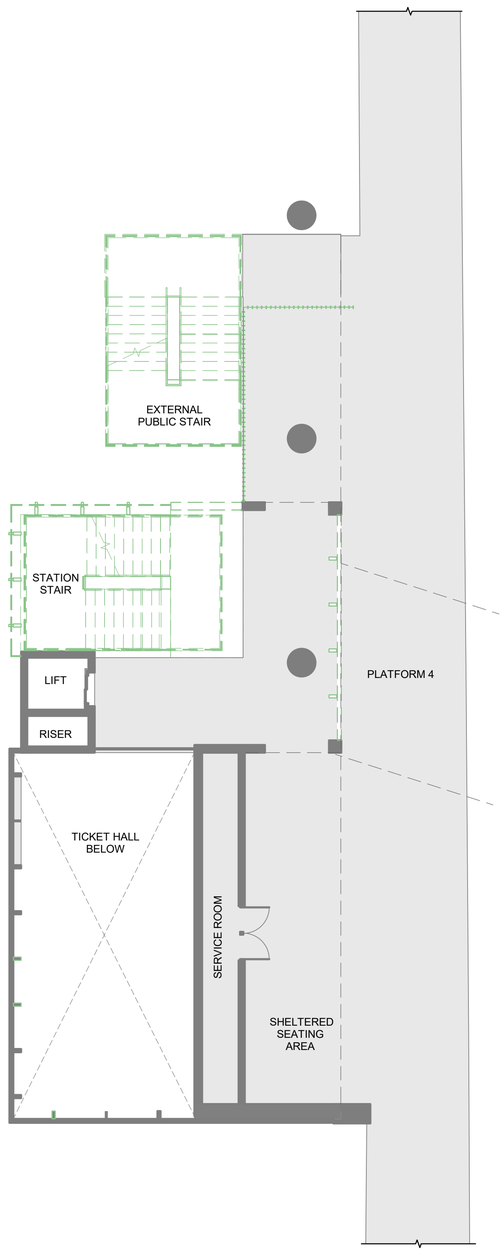


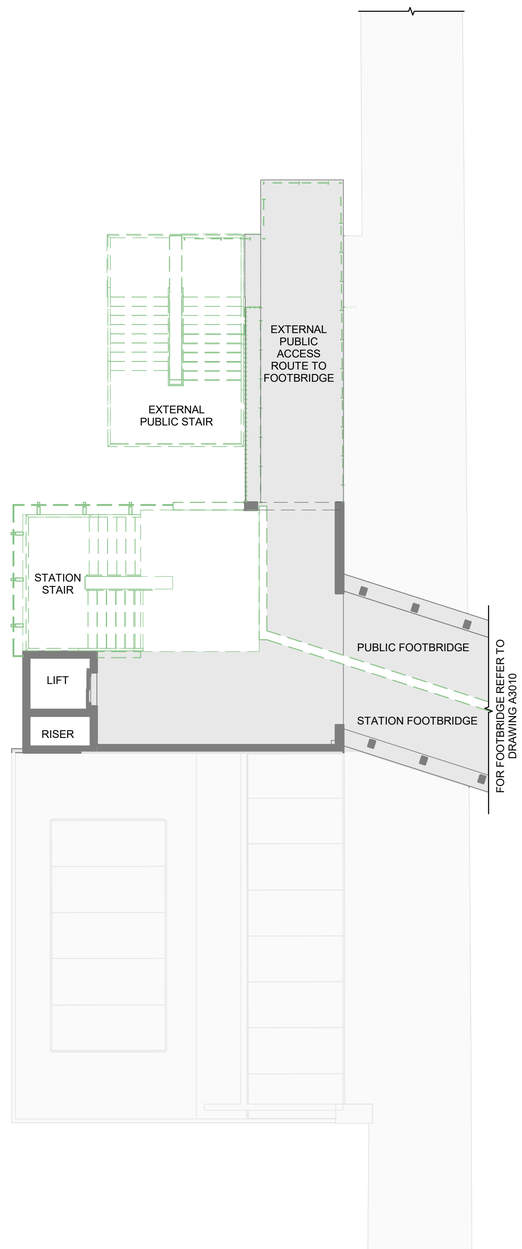
1 Ticket Hall Level - Existing with Demolition

1:100 @ A1
1:200 @ A3



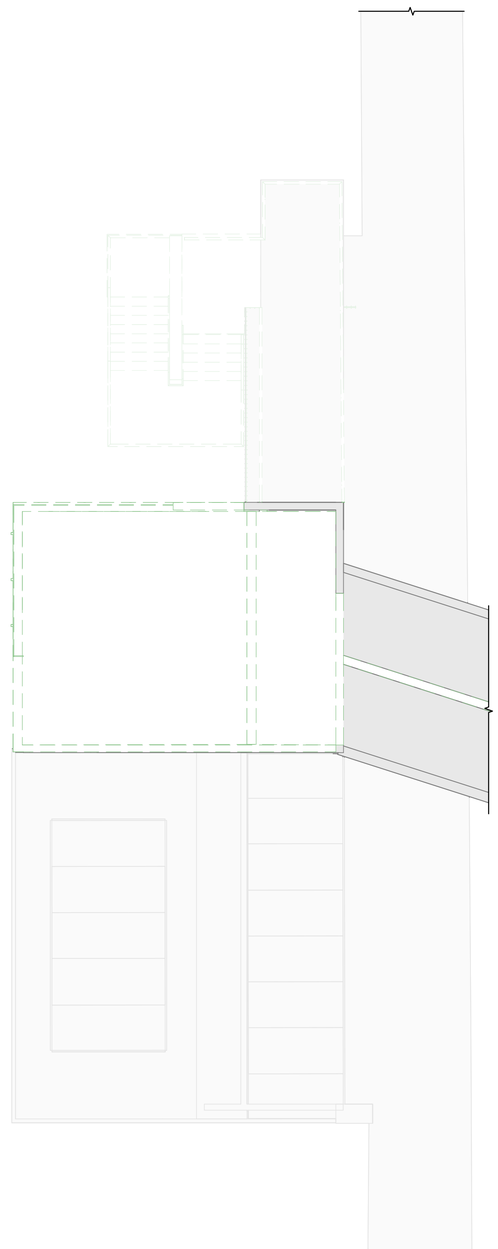
2 Platform Level - Existing with Demolition

1:100 @ A1
1:200 @ A3



3 Footbridge Level - Existing with Demolition

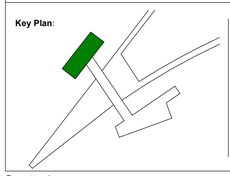
1:100 @ A1
1:200 @ A3



4 Roof Level - Existing with Demolition

1:100 @ A1
1:200 @ A3

Key Plan:



Key

- Existing - removed
- Existing - retained
- Existing - retained (cut)
- New
- New (cut)

Notes:

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Tel +44 (0)20 7636 1531 Fax +44 (0)20 7580 3924
www.arup.com

Client: Iarnród Éireann Irish Rail

Project Title: Howth Junction & Donaghmede Station

Drawing Title: Donaghmede Entrance Study
Option 1
Existing Plans

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By / Chkd / Appd: AH/JW/RS
Role:
Status:
Arup Job No: 28505150
Rev:
ID: HOWTH JUNCTION-ARUP-A1010

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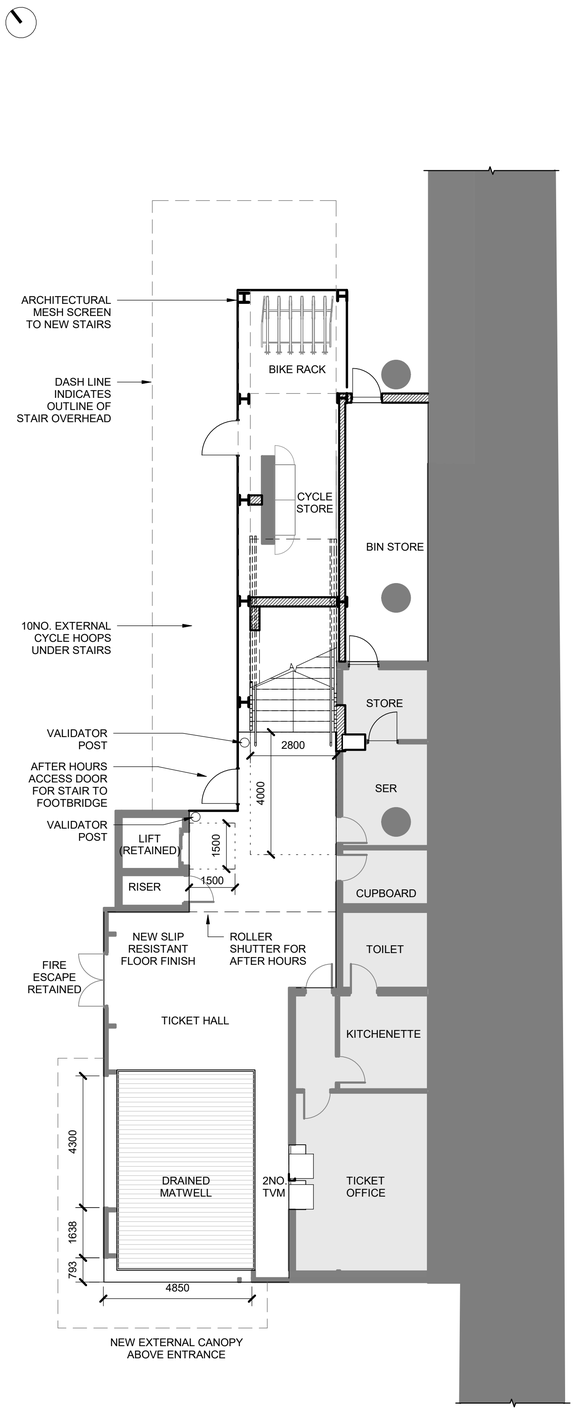
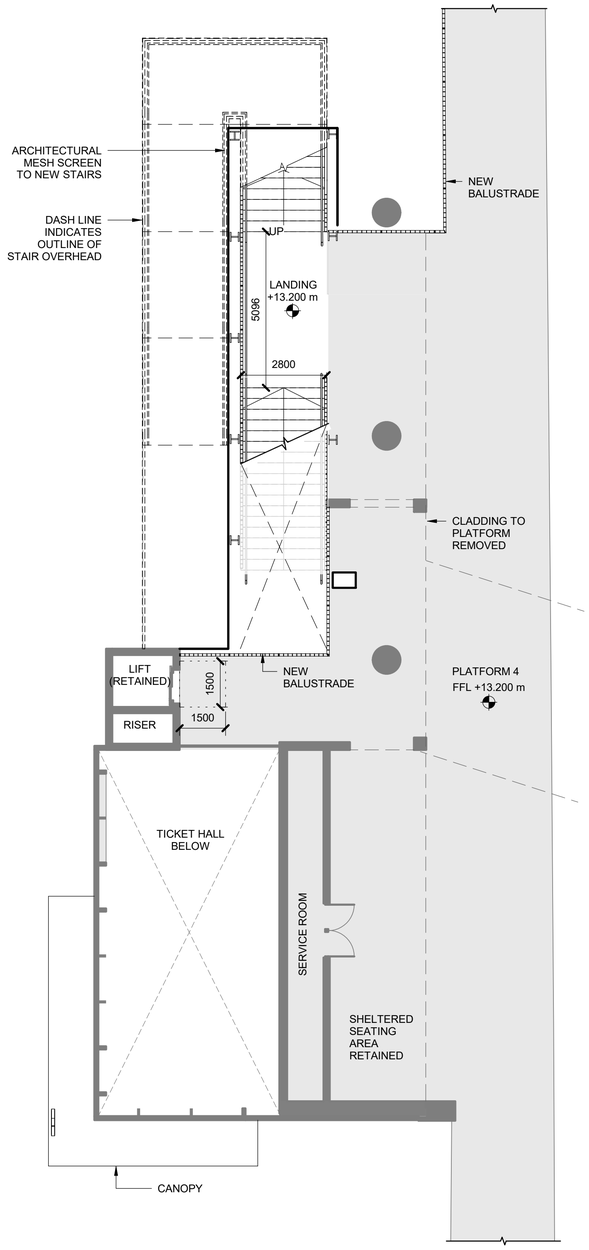


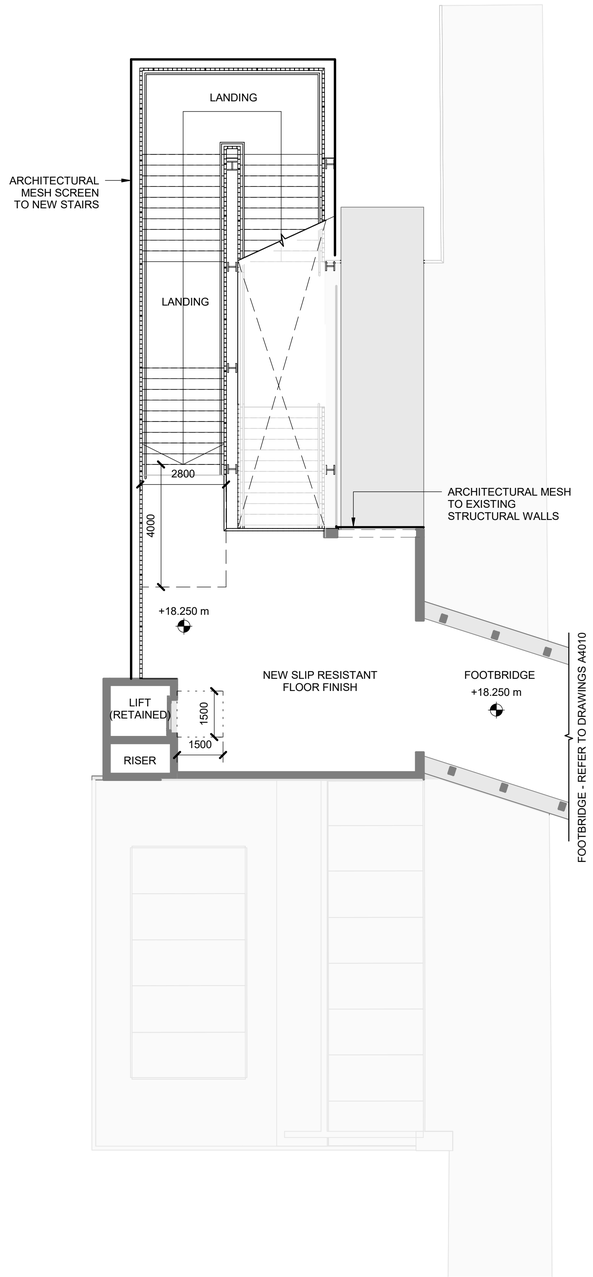
1 Ticket Hall Level - Proposed

1:100 @ A1
1:200 @ A3



2 Platform Level - Proposed

1:100 @ A1
1:200 @ A3



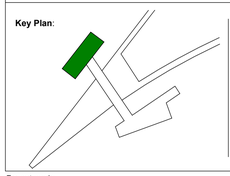
3 Footbridge Level - Proposed

1:100 @ A1
1:200 @ A3

4 Roof Level - Proposed

1:100 @ A1
1:200 @ A3

Key Plan:



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- New (cut)

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Client: Iarnród Éireann Irish Rail

Project Title: Howth Junction & Donaghmede Station

Drawing Title: Donaghmede Entrance Study
Option 1
Proposed Plans

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By / Chkd / Appd: AH/JW/RS
Role: A
Status:
Arup Job No: 28505150
Rev:
ID: HOWTH JUNCTION-ARUP-A1011

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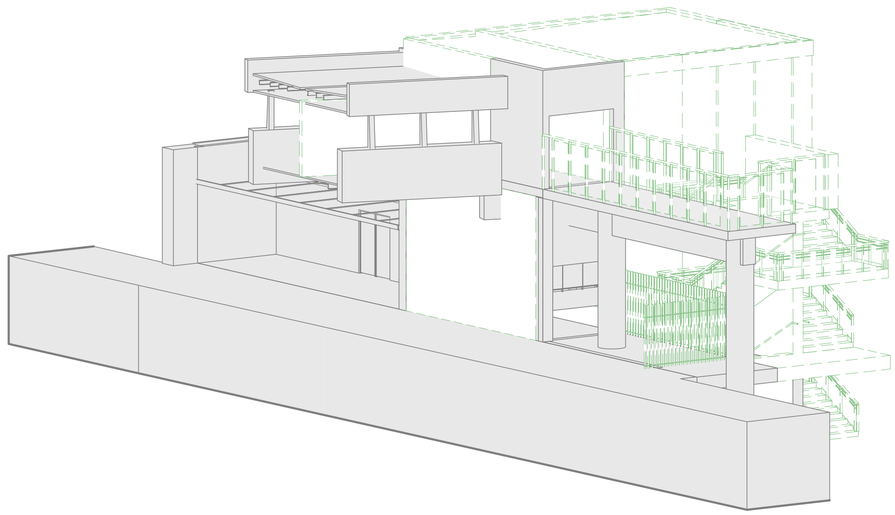
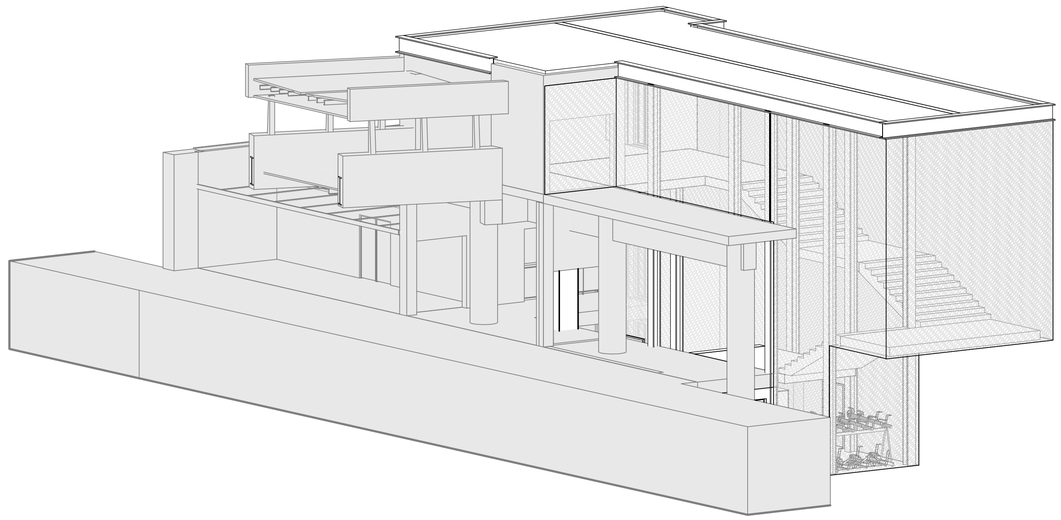


1 View from Platform Side - Existing with Demolition
NTS

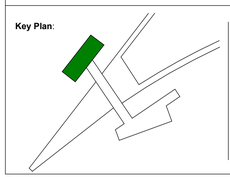


2 View from Platform Side - Proposed
NTS

3 View from External Side - Existing with Demolition
NTS

4 View from External Side - Proposed
NTS

Key Plan:



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- New
- New (cut)

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Client: Iarnród Éireann Irish Rail

Project Title: Howth Junction & Donaghmede Station

Drawing Title: Donaghmede Entrance Study
Option 1
3D Views

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By / Chkd / Appd: AH/
Role:
Status:
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Rev:
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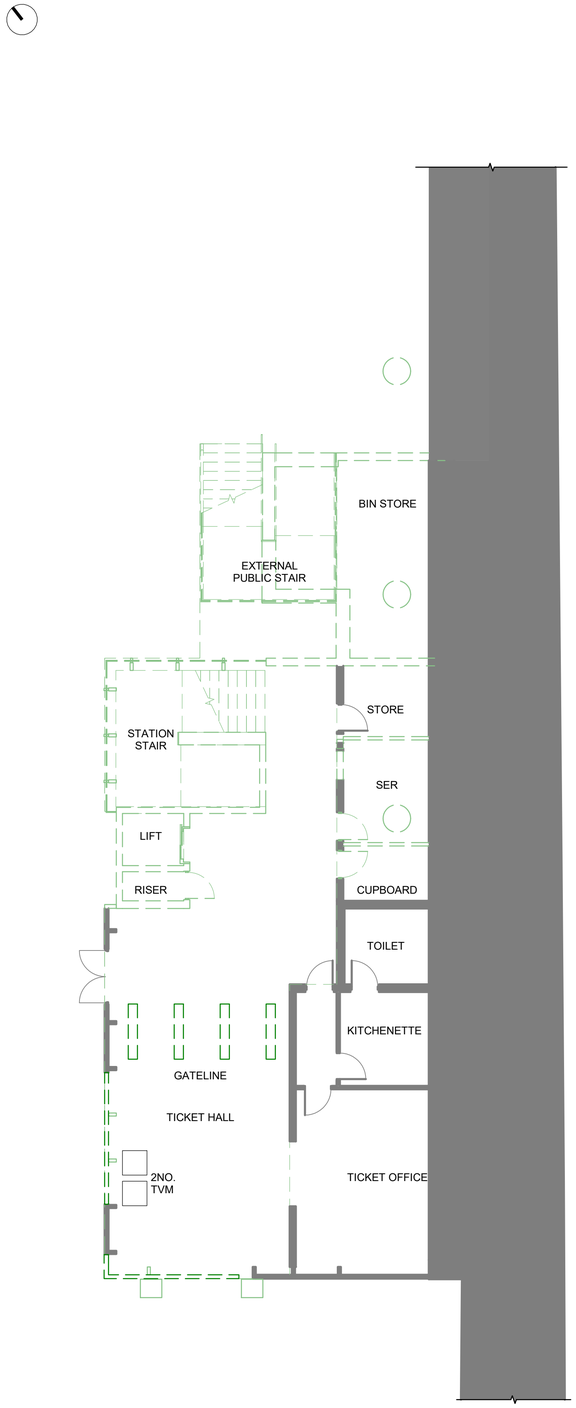

1 Entrance Level - Existing with Demolition

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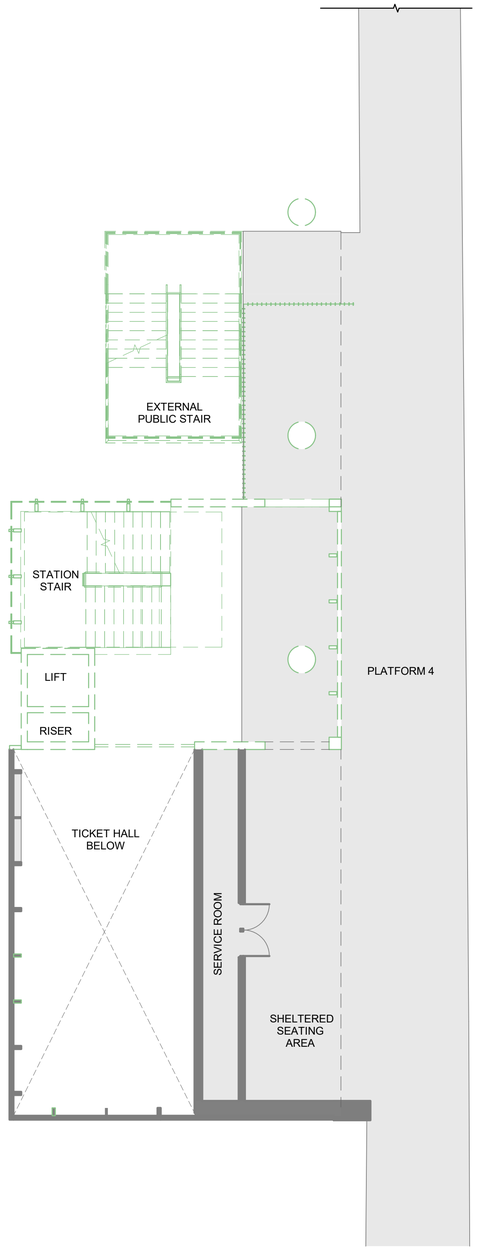

2 Platform Level - Existing with Demolition

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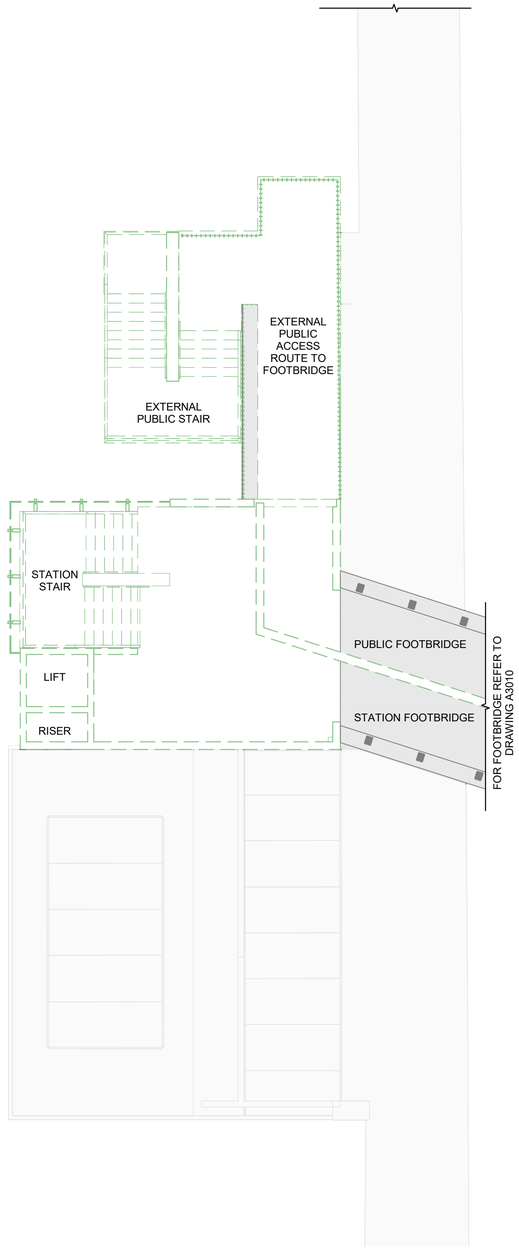
1:200 @ A3



3 Footbridge Level - Existing with Demolition

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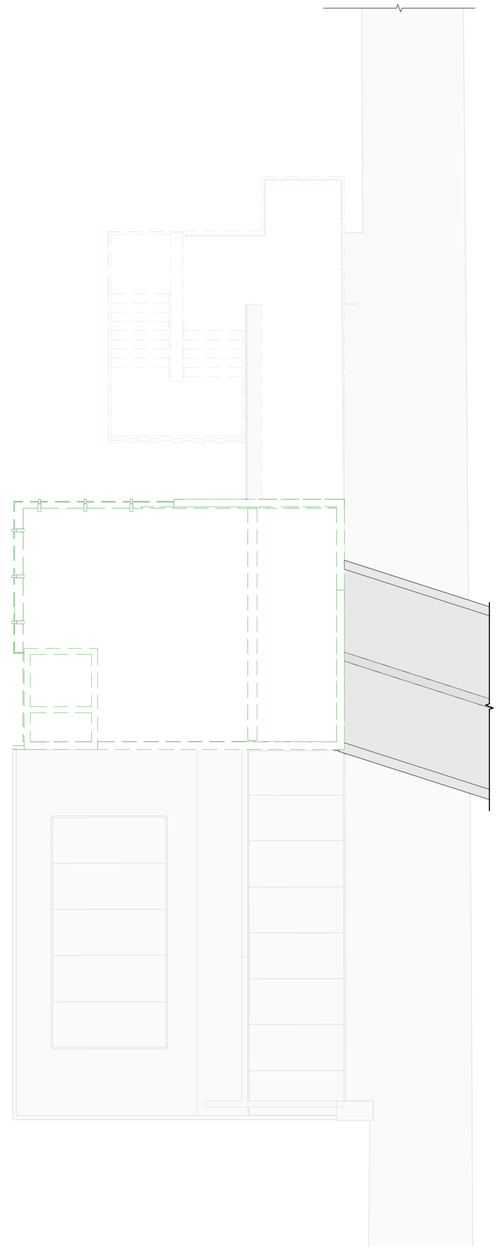
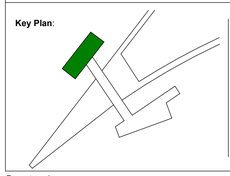


4 Roof Level - Existing with Demolition

1:100 @ A1
1:200 @ A3

Key Plan:



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- New (cut)

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www.arup.com

Client: Iarnród Éireann Irish Rail

Project Title: Howth Junction & Donaghmede Station

Drawing Title: Donaghmede Entrance Study
Option 2
Existing Plans

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By / Chkd / Appd: AH/JW/RS
Role:
Status:
Arup Job No: 28505150
Rev:
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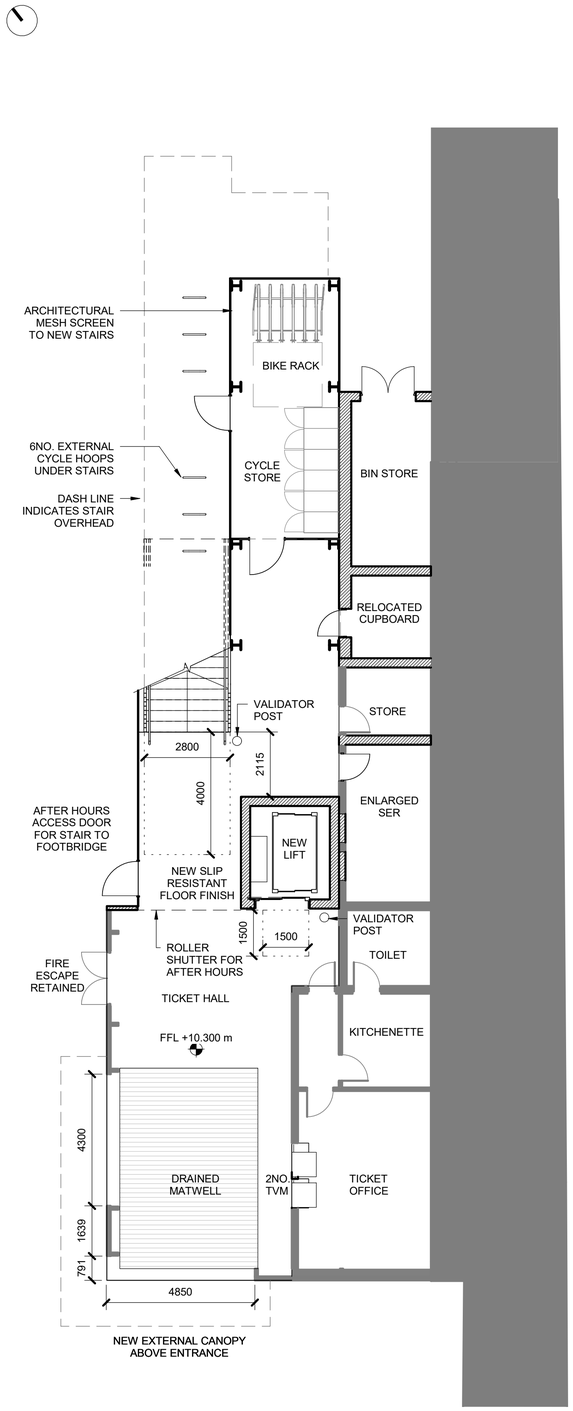
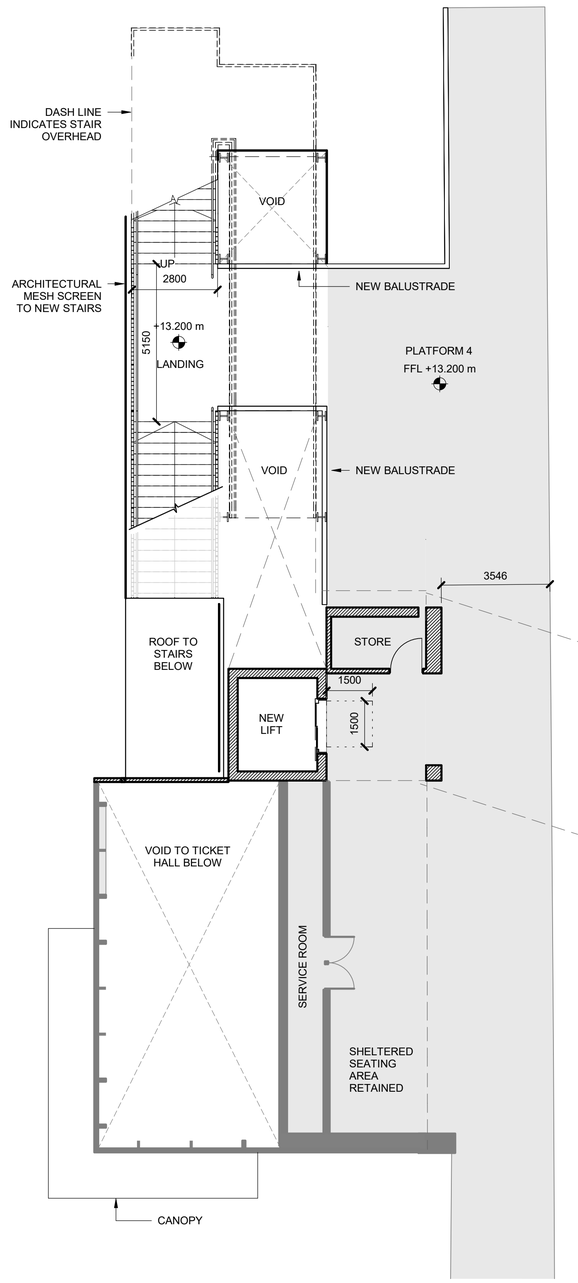


1 Ticket Hall Level - Proposed

1:100 @ A1
1:200 @ A3



2 Platform Level - Proposed

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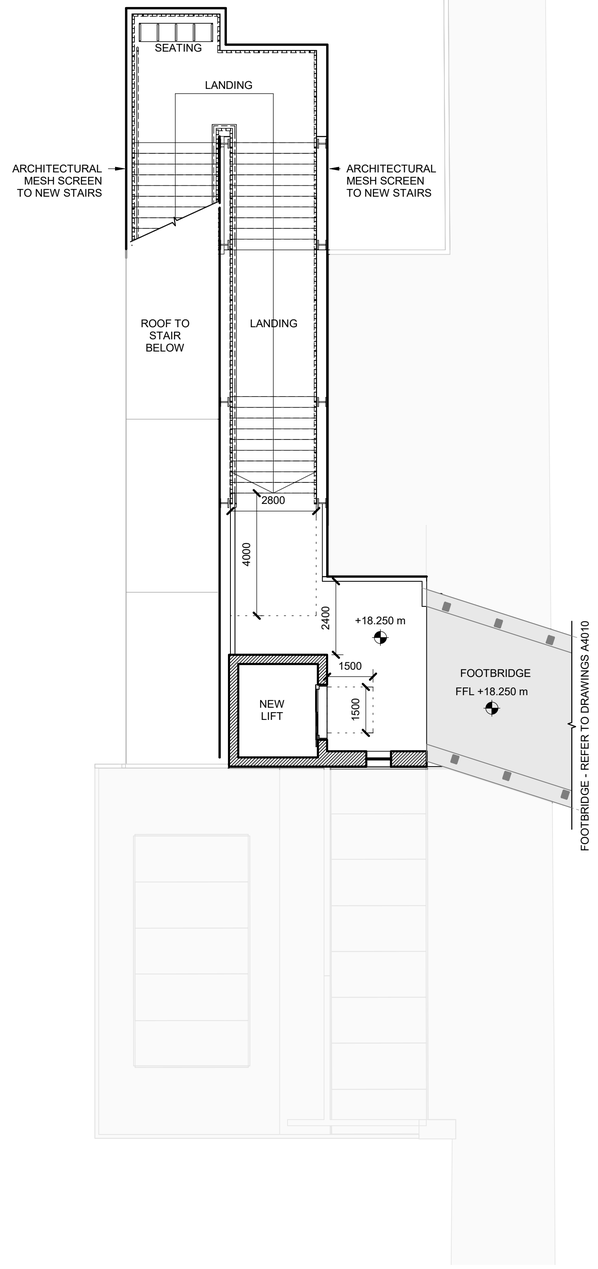

3 Footbridge Level - Proposed

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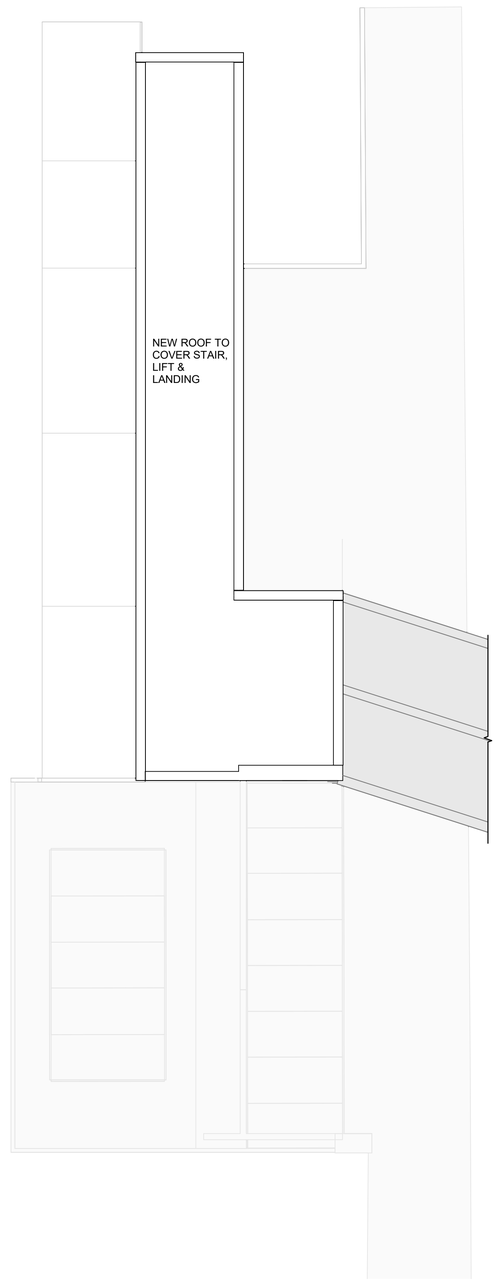
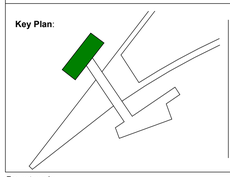
1:200 @ A3



4 Roof Level - Proposed

1:100 @ A1
1:200 @ A3

Key Plan:



Key

- Existing - removed
- Existing - retained
- Existing - retained (cut)
- New
- New (cut)

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www.arup.com

Client: Iarnród Éireann Irish Rail

Project Title: Howth Junction & Donaghmede Station

Drawing Title: Donaghmede Entrance Study
Option 2
Proposed Plans

Scale at A1: 1 : 100
By / Chkd / Appd: AH/JW/RS
Role:
Status:
Arup Job No: **28505150**
Rev:
ID: **HOWTH JUNCTION-ARUP-A1021**

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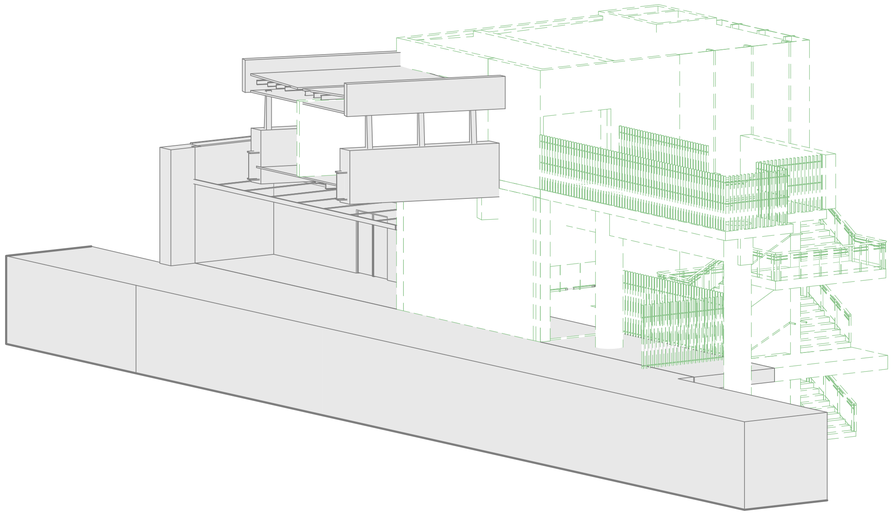
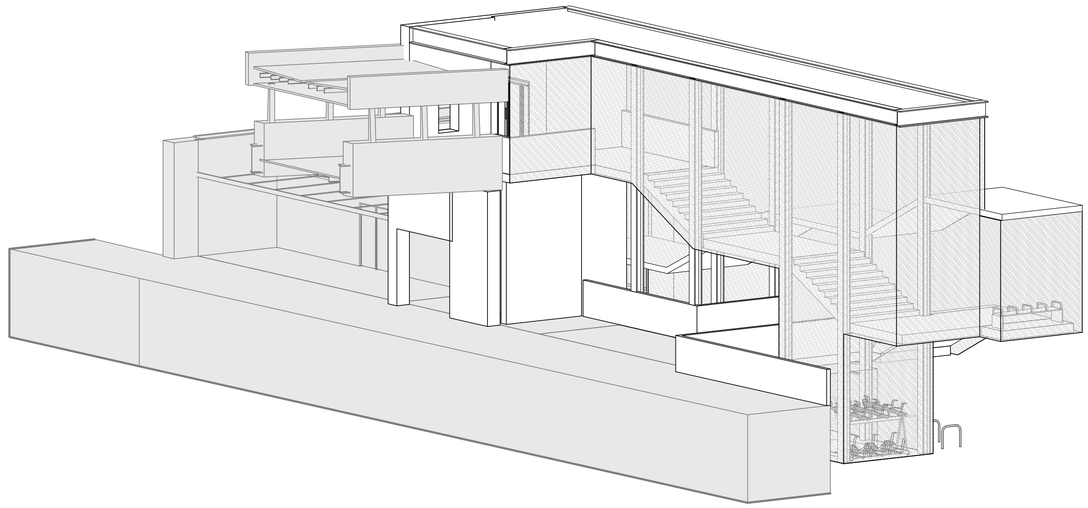
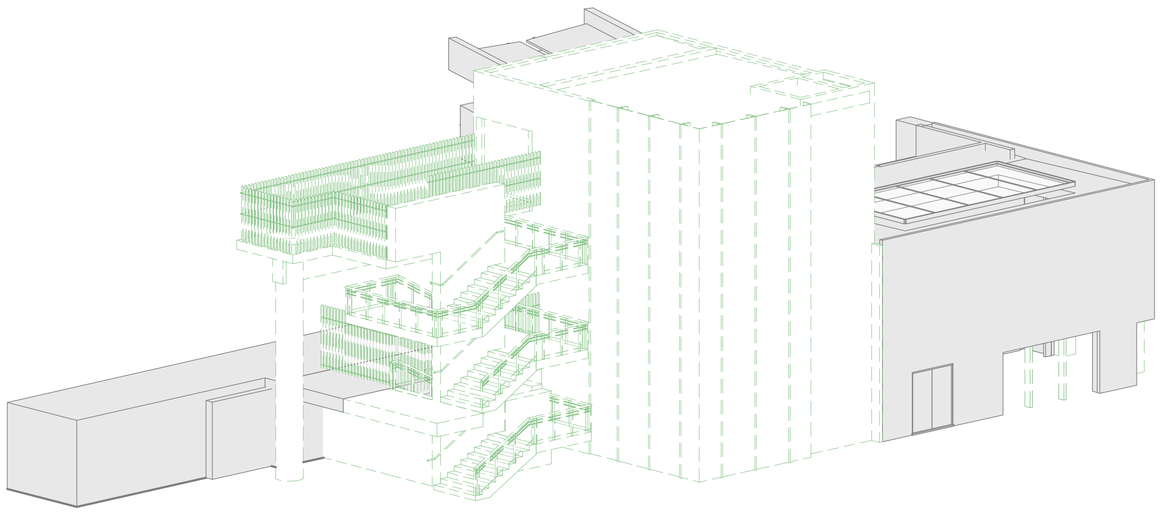
02/03/2023 15:21:01



1 View from Platform Side - Existing with Demolition
NTS



2 View from Platform Side - Proposed
NTS



3 View from External Side - Existing with Demolition
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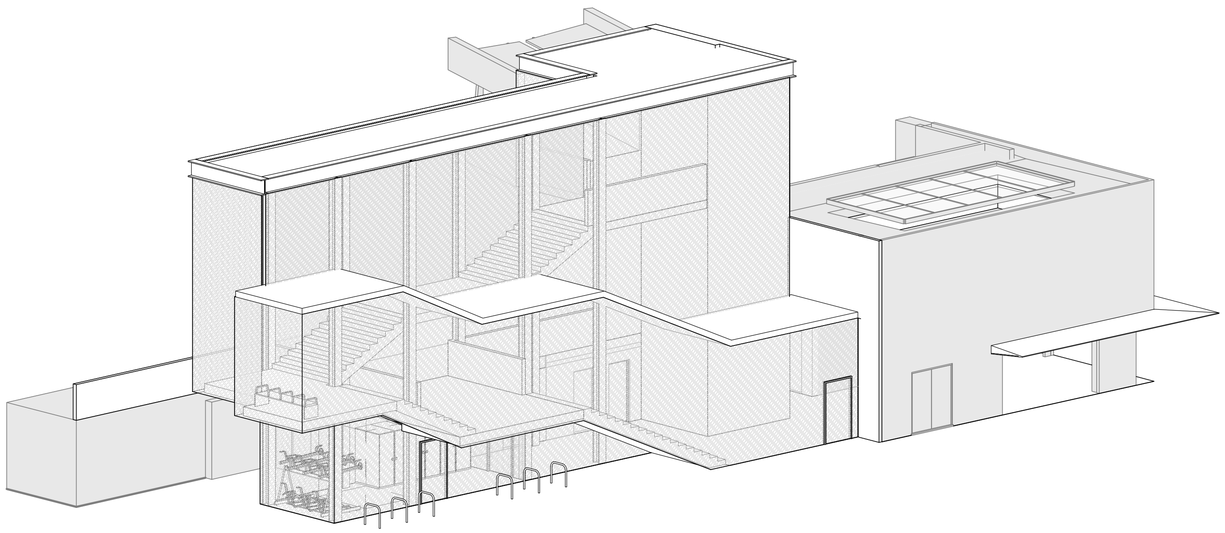
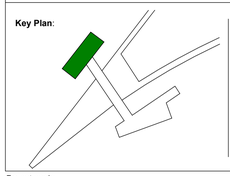


4 View from External Side - Proposed
NTS

Key Plan:



Key

- Existing - removed
- Existing - retained
- Existing - retained (cut)
- New
- New (cut)

Notes:

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2. All dimensions are an approximate. Final setting out subject to further surveys and coordination with other workstreams.
3. All dimensions to be checked on site.
4. All dimensions are in millimetres unless otherwise stated.
5. Existing information based on drawings provided by Irish Rail within RFI 372.

Issue	Date	
1.0	03/03/2023	Phase 2 Concept Design

ARUP
8 Fitzroy Street
London W1T 4BJ
Tel +44 (0)20 7636 1531 Fax +44 (0)20 7580 3924
www.arup.com

Client
Iarnród Éireann
Irish Rail

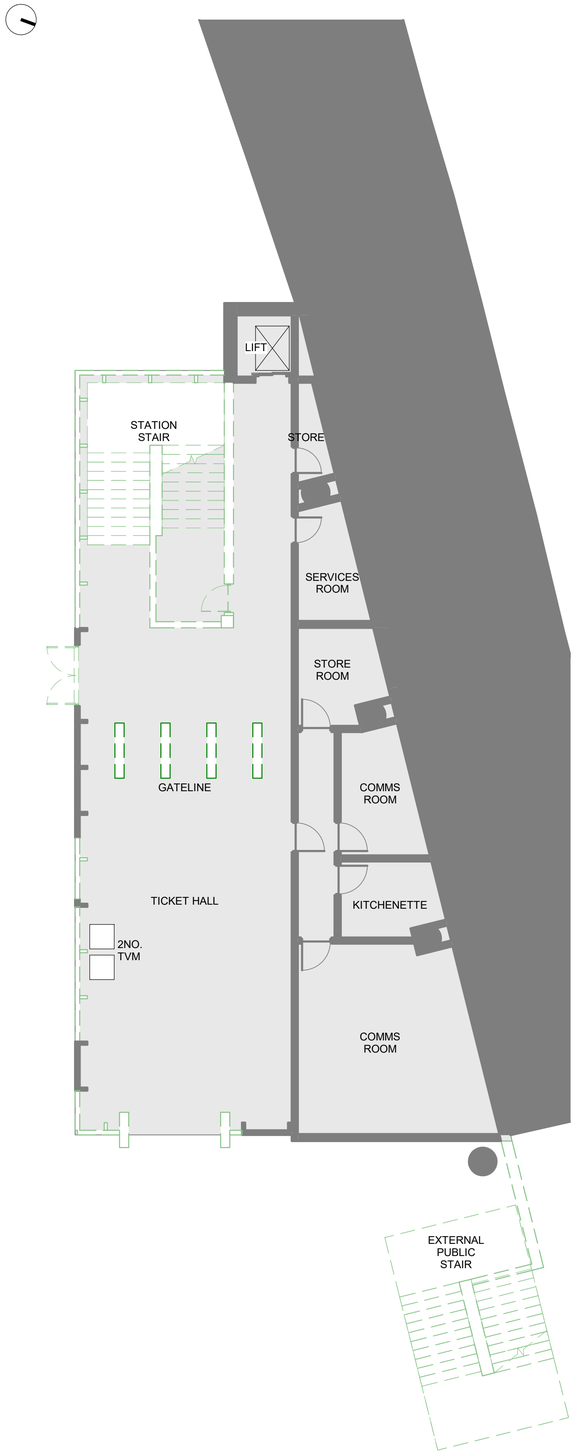
Project Title
Howth Junction & Donaghmede Station

Drawing Title
Donaghmede Entrance Study
Option 2
3D Views

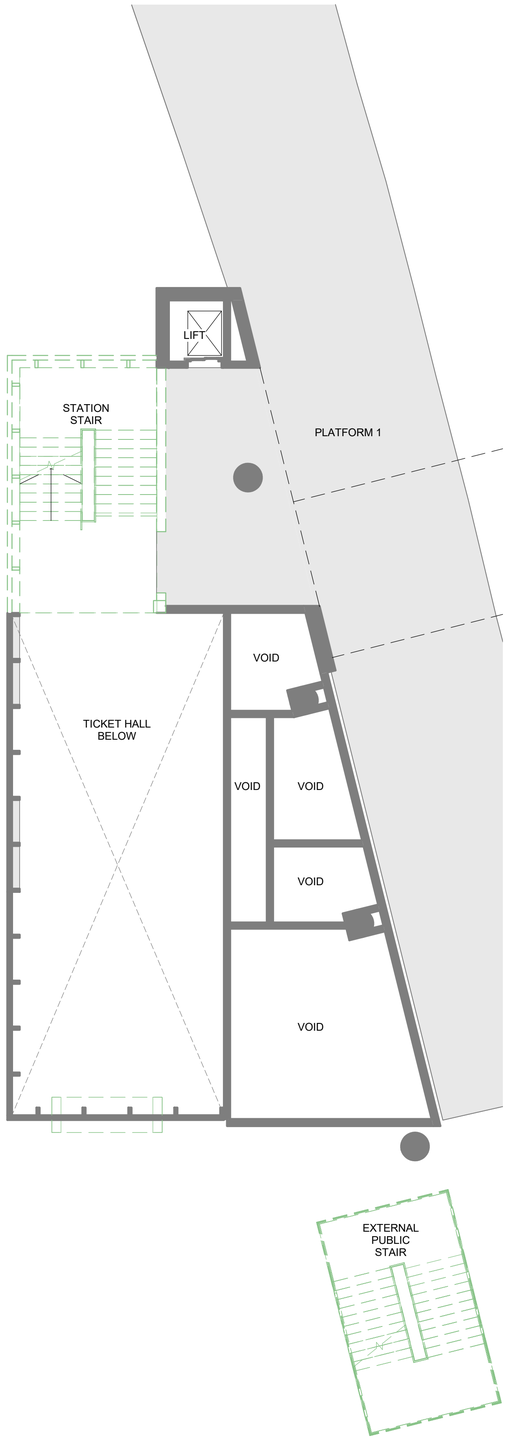
Scale at A1 NTS
By / Chkd / Appd AH/
Role
Status
Arup Job No **28505150**
Rev
ID **HOWTH JUNCTION-ARUP-A1022**

Do not scale

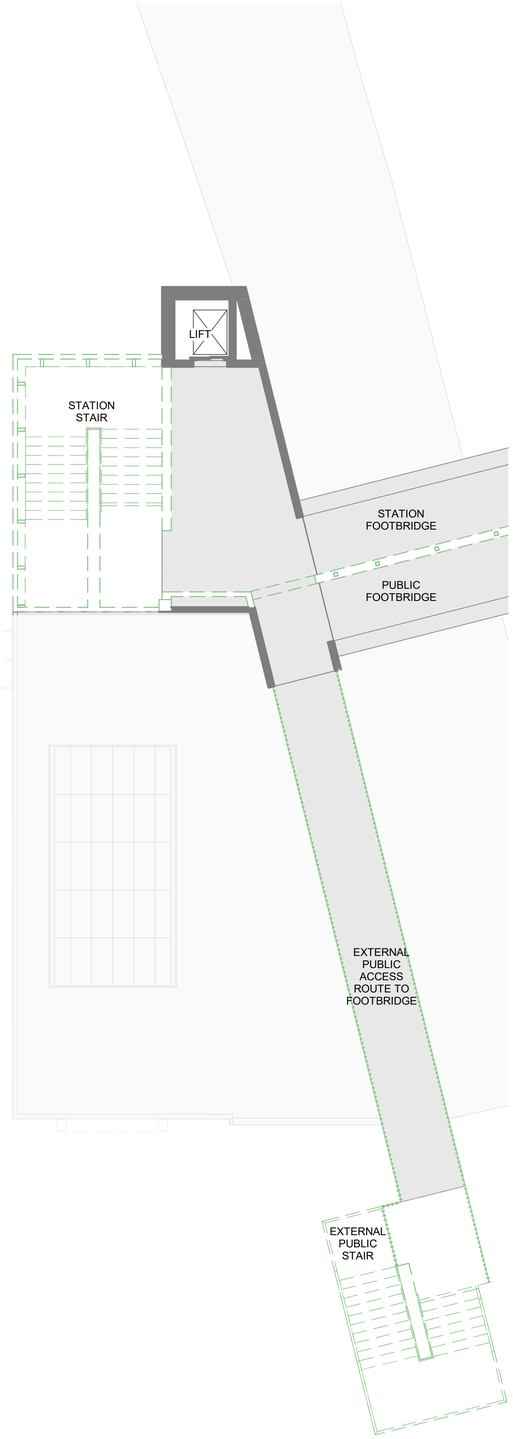
02/03/2023 15:51:46



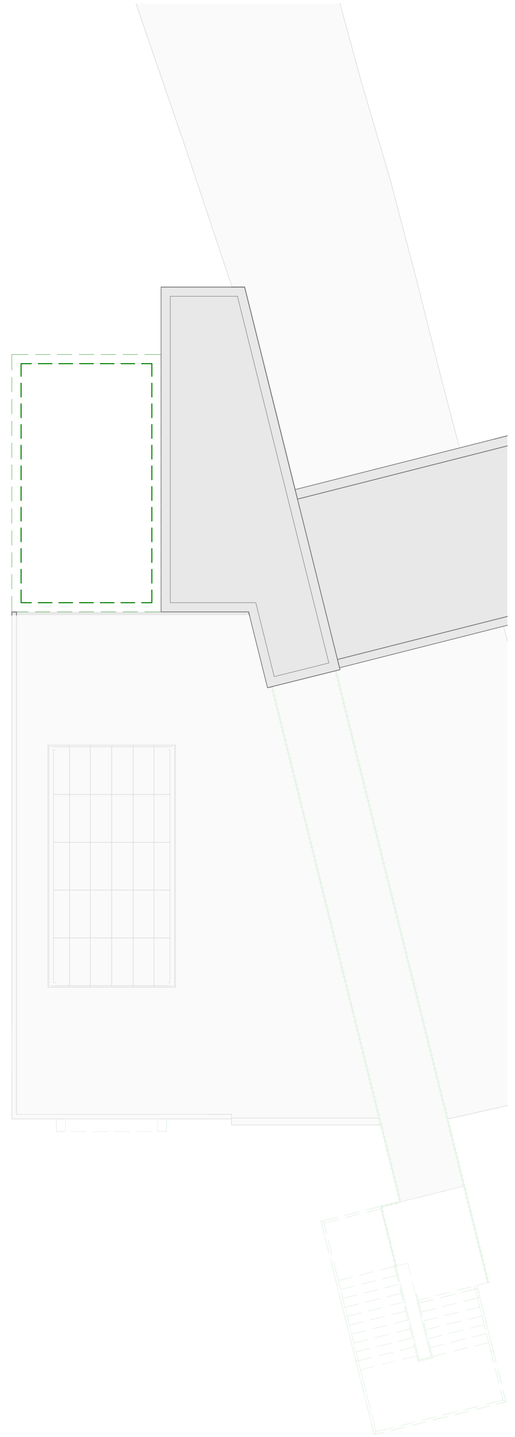
1 Ticket Hall Level - Existing with Demolition
1:100 @ A1
1:200 @ A3



2 Platform Level - Existing with Demolition
1:100 @ A1
1:200 @ A3

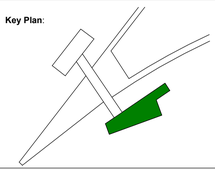


3 Footbridge Level - Existing with Demolition
1:100 @ A1
1:200 @ A3



4 Roof Level - Existing with Demolition
1:100 @ A1
1:200 @ A3

Key Plan:



Key

- Existing - removed
- Existing - retained
- Existing - retained (cut)
- New
- New (cut)

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Issue	Date	
1.0	03/03/2023	Phase 2 Concept Design

ARUP
8 Fitzroy Street
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Tel +44 (0)20 7636 1531 Fax +44 (0)20 7580 3924
www.arup.com

Client: Iarnród Éireann Irish Rail

Project Title: Howth Junction & Donaghmede Station

Drawing Title: Kilbarrack Entrance Study
Option 1
Existing Plans

Scale at A1: 1 : 100
By / Chkd / Appd: MN/JW/RS
Role:
Status:
Arup Job No: **28505150**
Rev:
ID: **HOWTH JUNCTION-ARUP-A2010**

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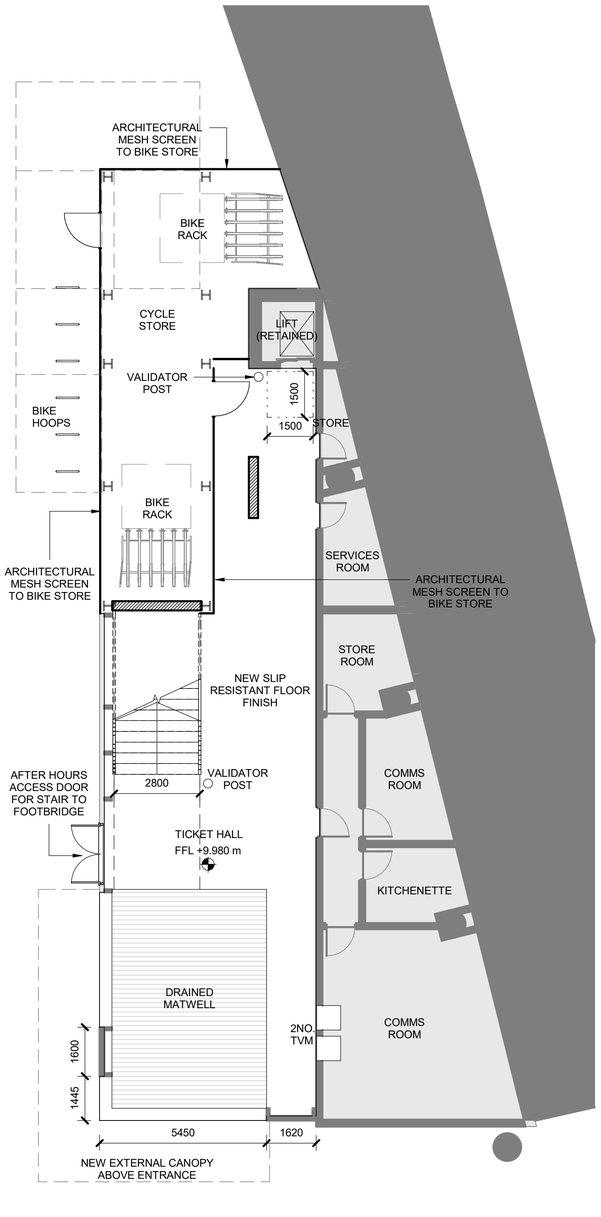
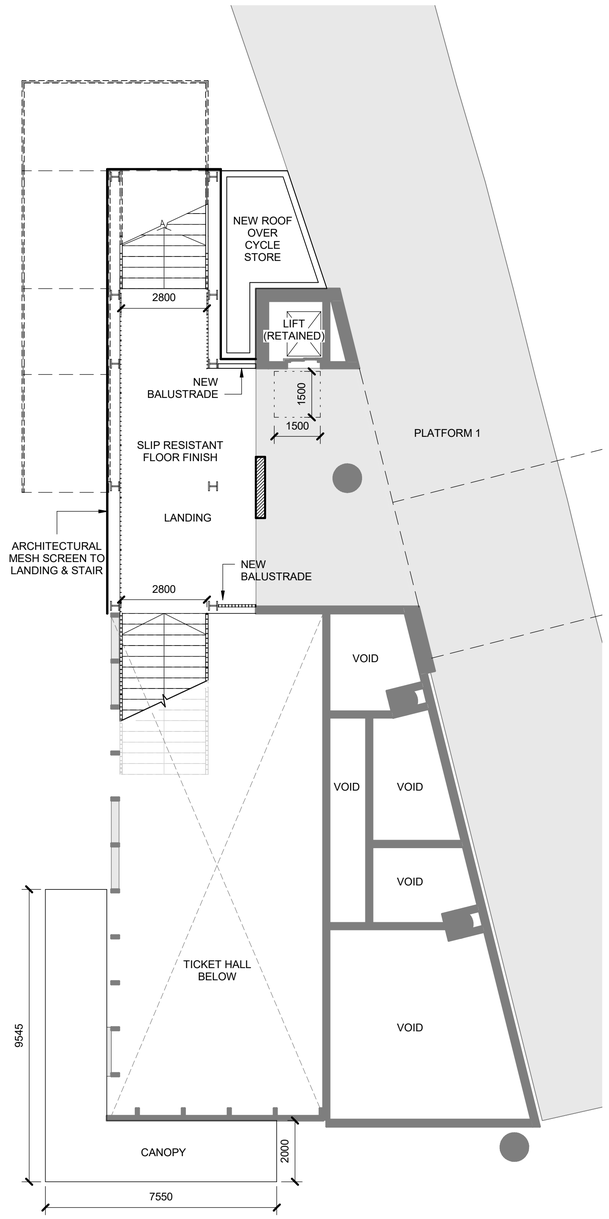
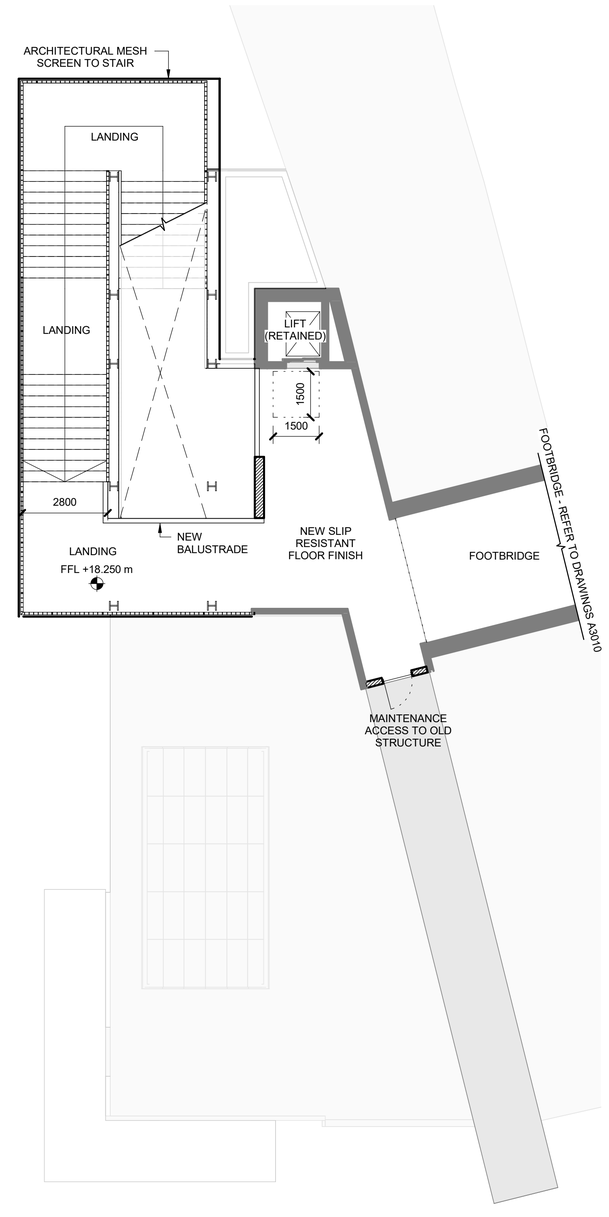
20/04/2023 10:59:36



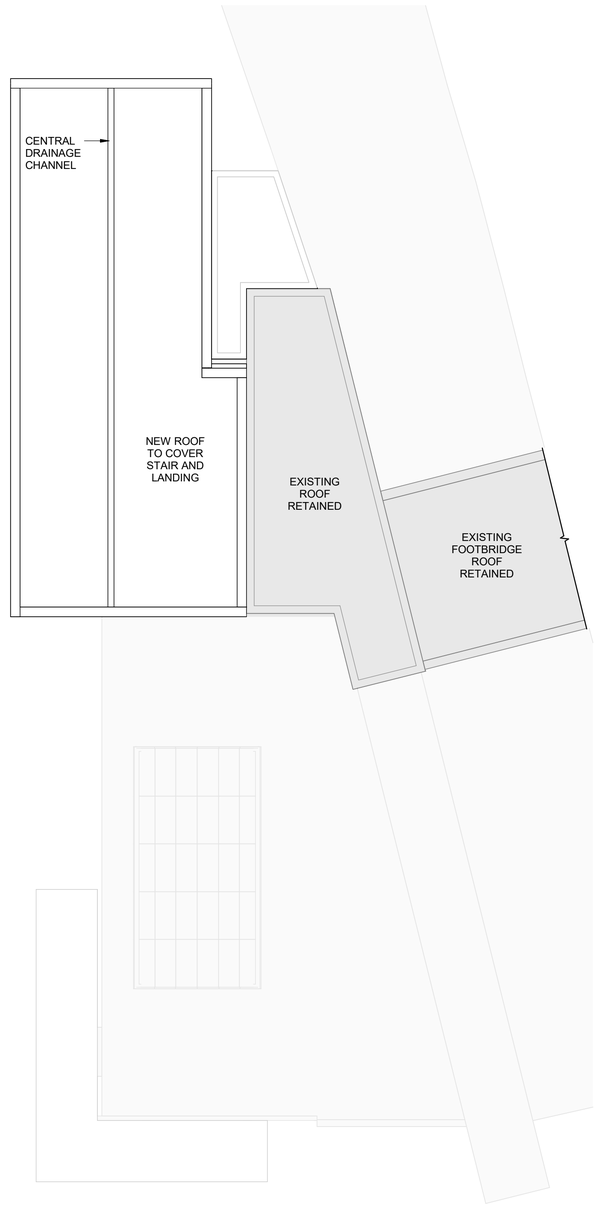
1 Ticket Hall Level - Proposed
1:100 @ A1
1:200 @ A3



2 Platform Level - Proposed
1:100 @ A1
1:200 @ A3

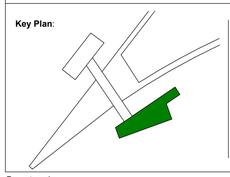


3 Footbridge Level - Proposed
1:100 @ A1
1:200 @ A3



4 Roof Level - Proposed
1:100 @ A1
1:200 @ A3

Key Plan:



Key

- Existing - removed
- Existing - retained
- Existing - retained (cut)
- New
- New (cut)

Notes:

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Issue	Date	
1.0	03/03/2023	Phase 2 Concept Design
2.0	20/04/2023	Rpt IE Comments

ARUP
8 Fitzroy Street
London W1T 4BJ
Tel +44 (0)20 7636 1531 Fax +44 (0)20 7580 3924
www.arup.com

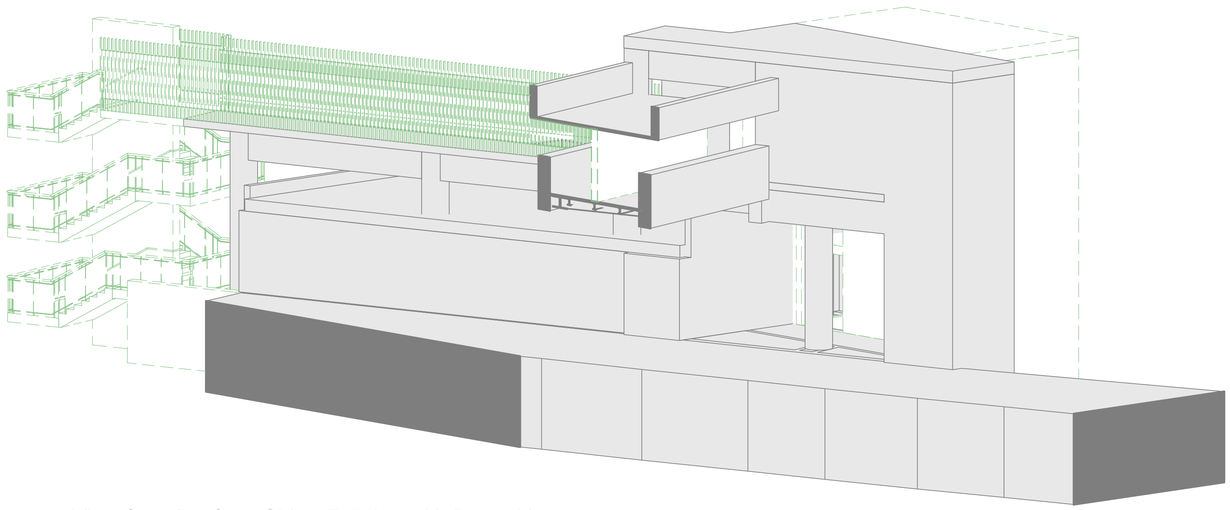
Client: Iarnród Éireann Irish Rail

Project Title: Howth Junction & Donaghmede Station

Drawing Title: Kilbarrack Entrance Study
Option 1
Proposed Plans

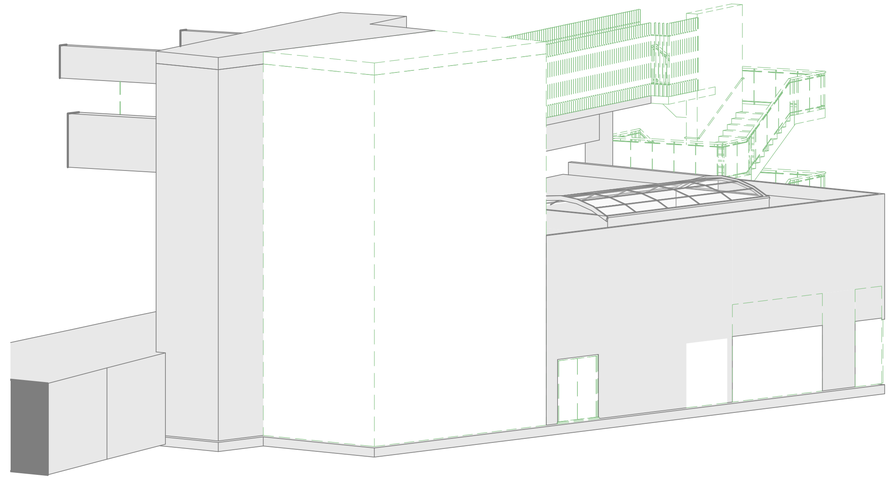
Scale at A1: 1 : 100
By / Chkd / Appd: MN/JW/RS
Role:
Status:
Arup Job No: 28505150
Rev: 2
ID: HOWTH JUNCTION-ARUP-A2011

Do not scale



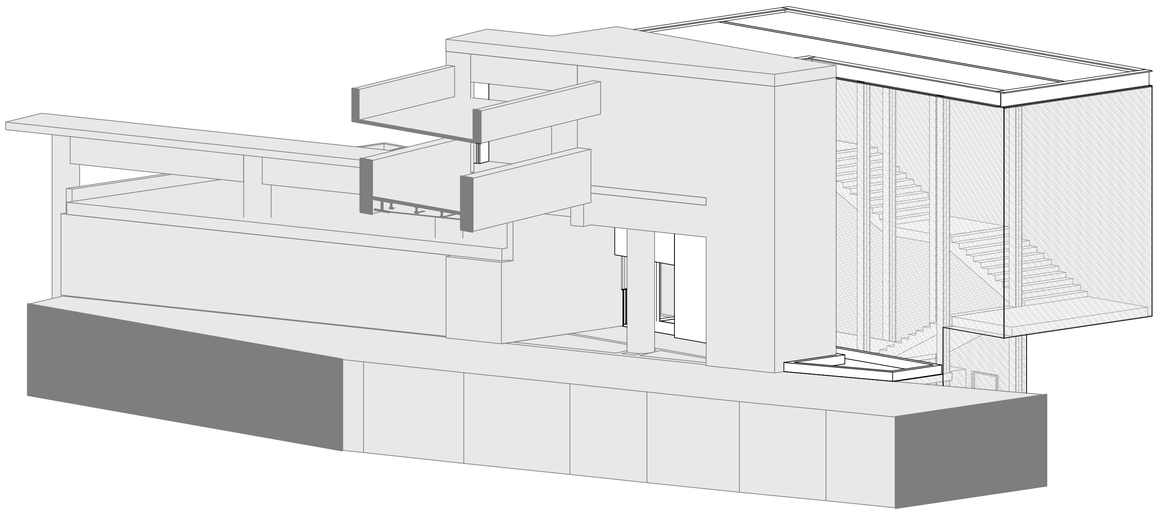
1 View from Platform Side - Existing with Demolition

NTS



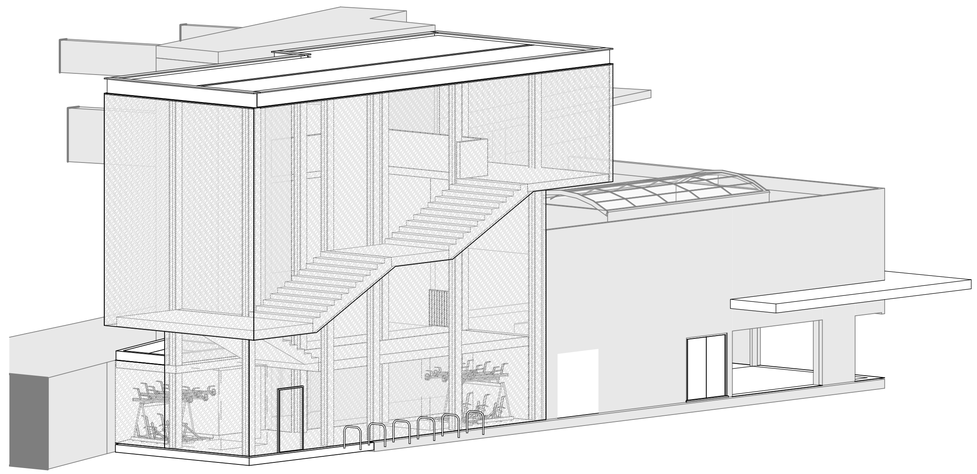
2 View From External Side - Existing with Demolition

NTS



3 View from Platform Side - Proposed

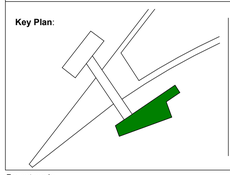
NTS



4 View from External Side - Proposed

NTS

Key Plan:



Key

- Existing - removed
- Existing - retained
- Existing - retained (cut)
- New
- New (cut)

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Issue	Date	
1.0	03/03/2023	Phase 2 Concept Design

ARUP
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Tel +44 (0)20 7636 1531 Fax +44 (0)20 7580 3924
www.arup.com

Client: Iarnród Éireann Irish Rail

Project Title: Howth Junction & Donaghmede Station

Drawing Title: Kilbarrack Entrance Study Option 1 3D Views

Scale at A1: NTS

By / Chkd / Appd: MN/JW/RS

Role:

Status:

Arup Job No: **28505150**

Rev:

ID: **HOWTH JUNCTION-ARUP-A2012**

02/03/2023 15:51:59

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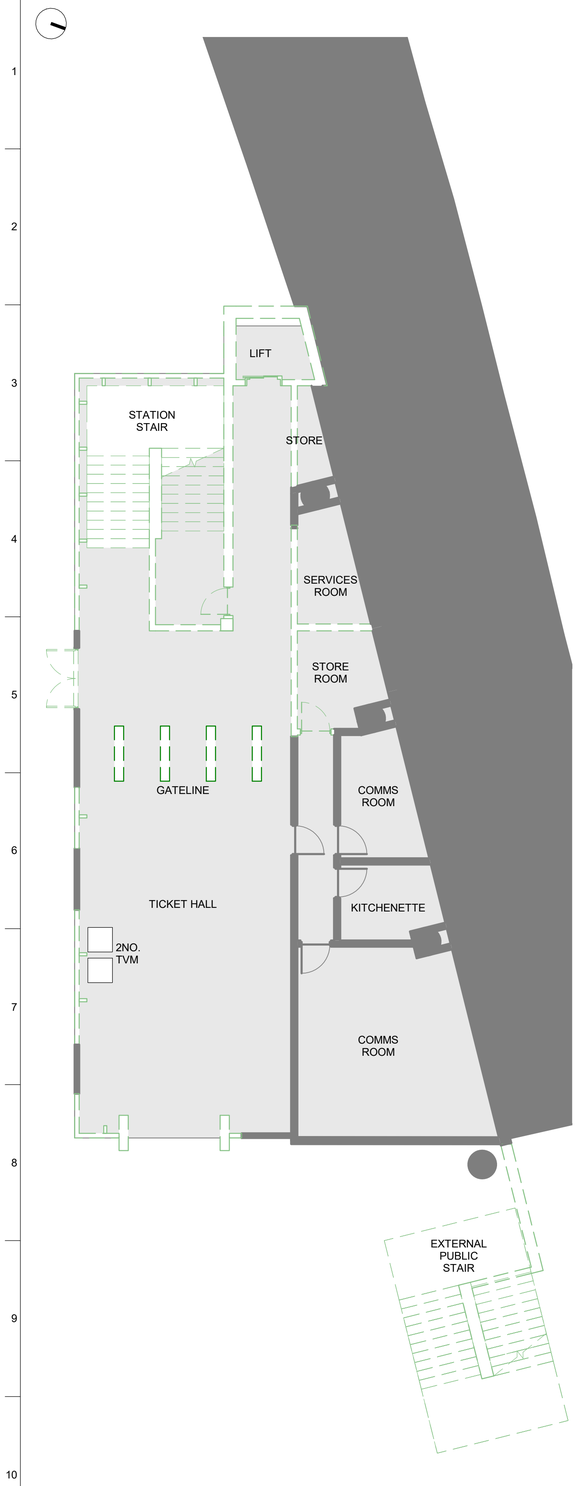
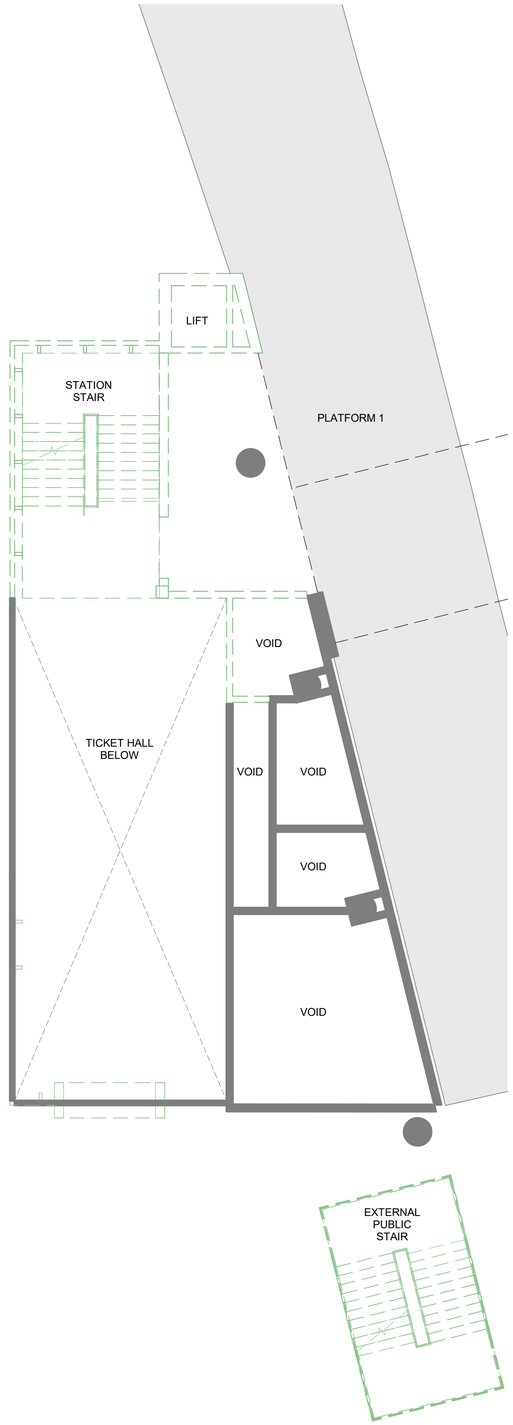
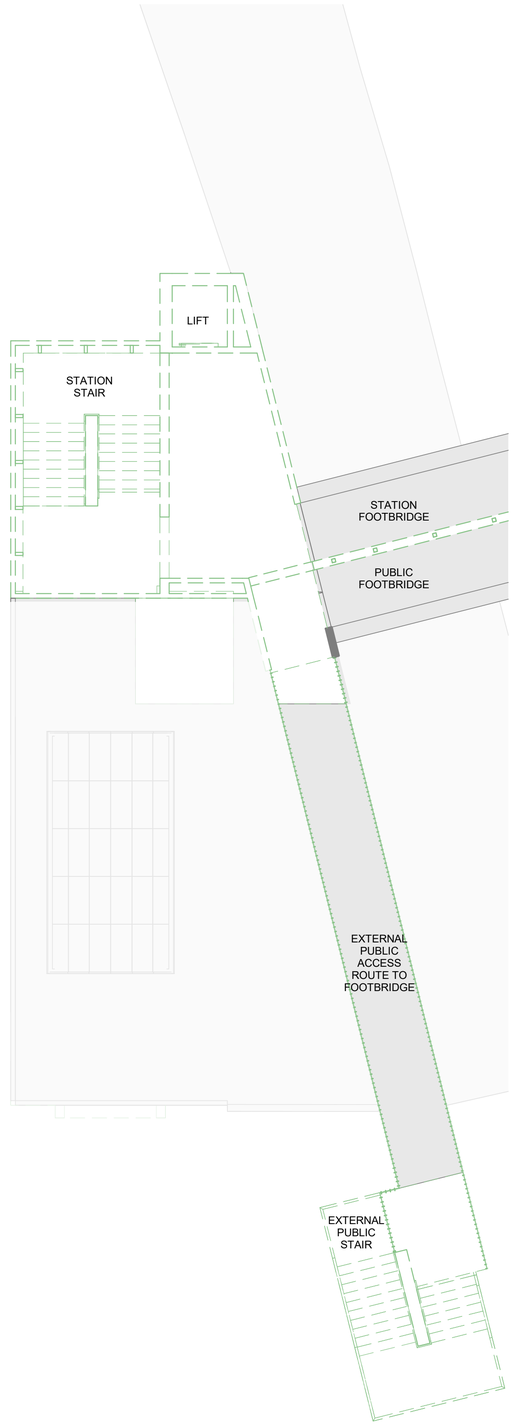


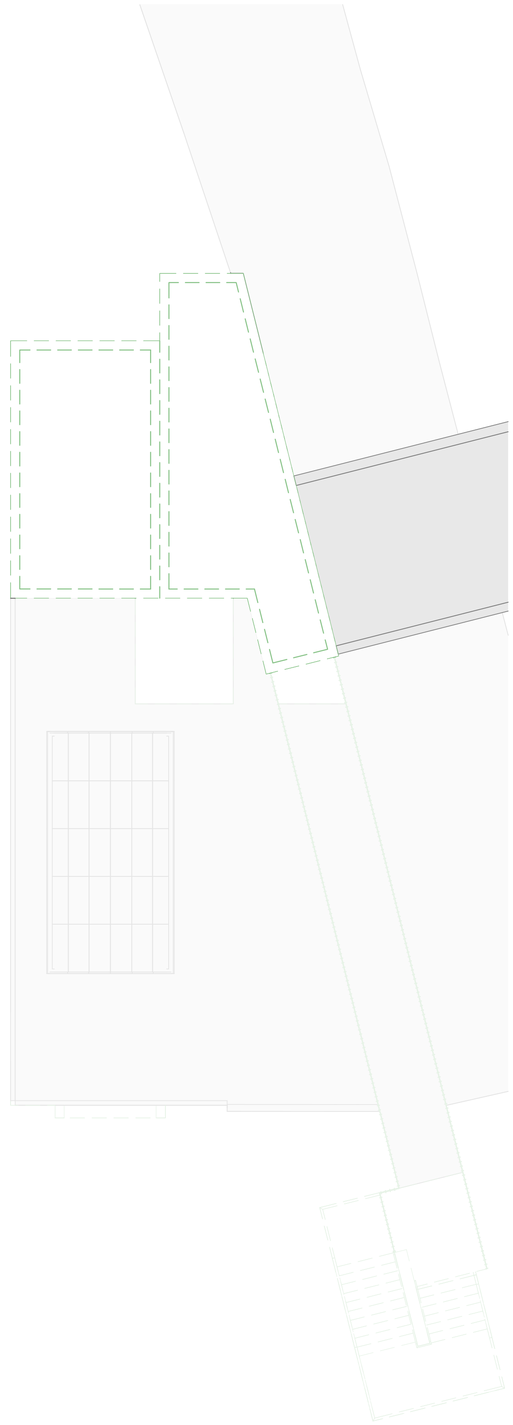
1 Ticket Hall Level - Existing with Demolition
1:100 @ A1
1:200 @ A3



2 Platform Level - Existing with Demolition
1:100 @ A1
1:200 @ A3

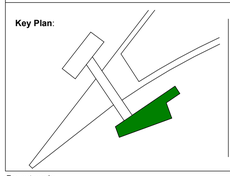


3 Footbridge Level - Existing with Demolition
1:100 @ A1
1:200 @ A3



4 Roof Level - Existing with Demolition
1:100 @ A1
1:200 @ A3

Key Plan:



Key

- Existing - removed
- Existing - retained
- Existing - retained (cut)
- New
- New (cut)

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Issue	Date	
1.0	03/03/2023	Phase 2 Concept Design

ARUP
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www.arup.com

Client: Iarnród Éireann Irish Rail

Project Title: Howth Junction & Donaghmede Station

Drawing Title: Kilbarrack Entrance Study
Option 2
Existing Plans

Scale at A1: 1 : 100
By / Chkd / Appd: MN/JW/RS
Role:
Status:
Arup Job No: 28505150
Rev:
ID: HOWTH JUNCTION-ARUP-A2020

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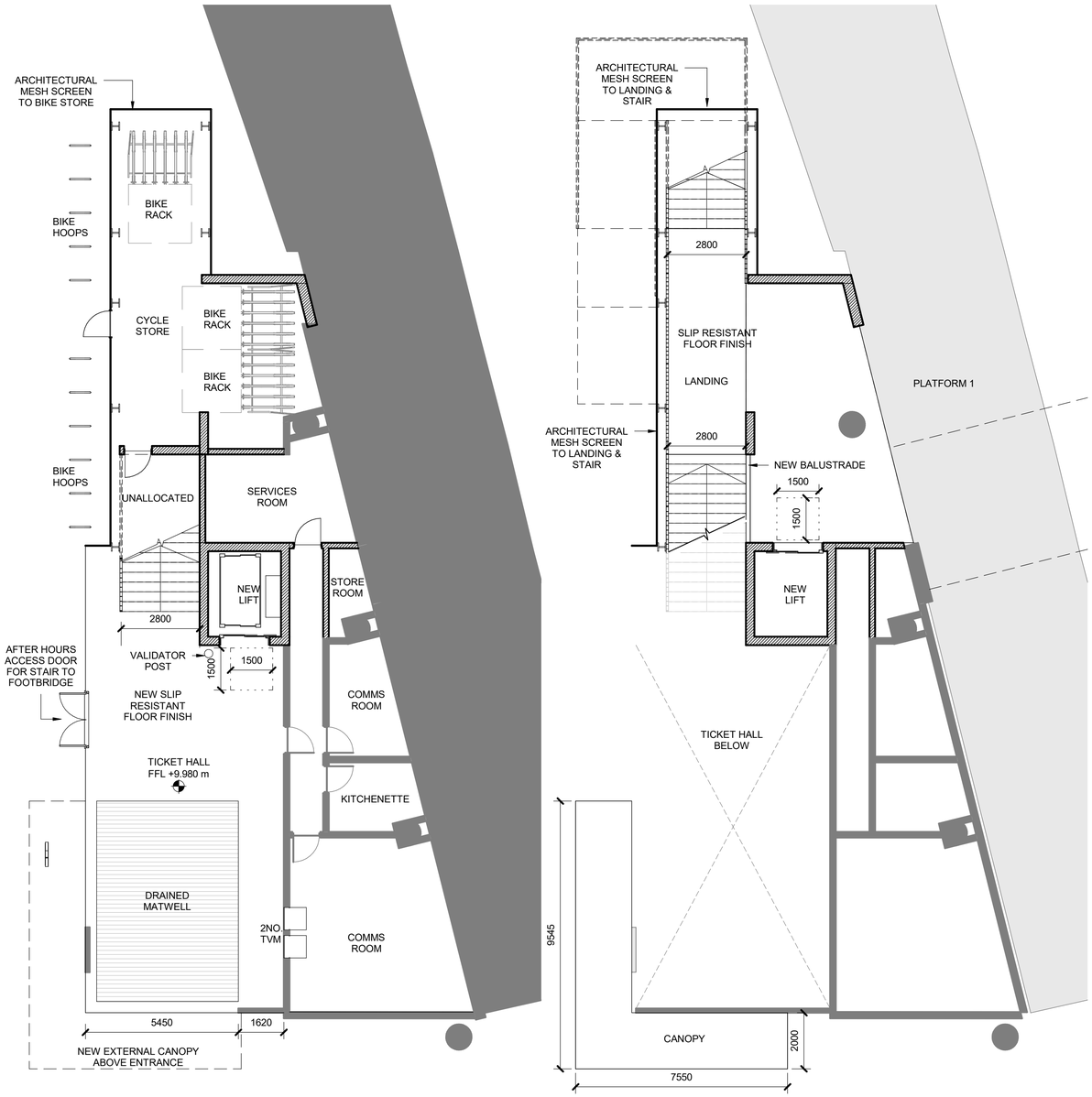
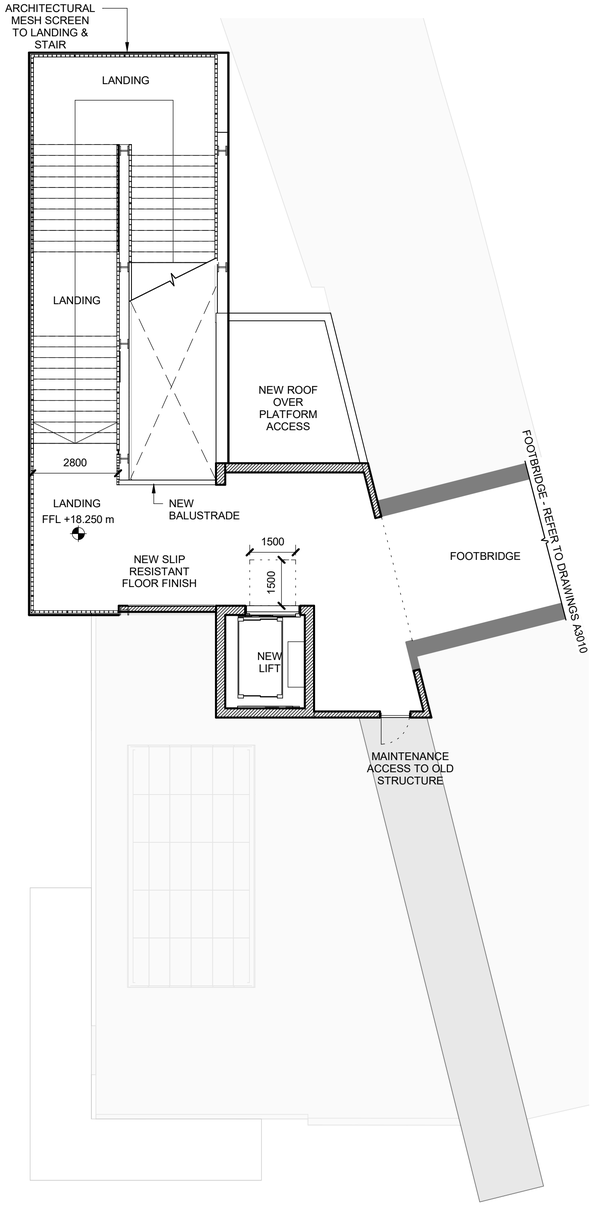
02/03/2023 15:52:02

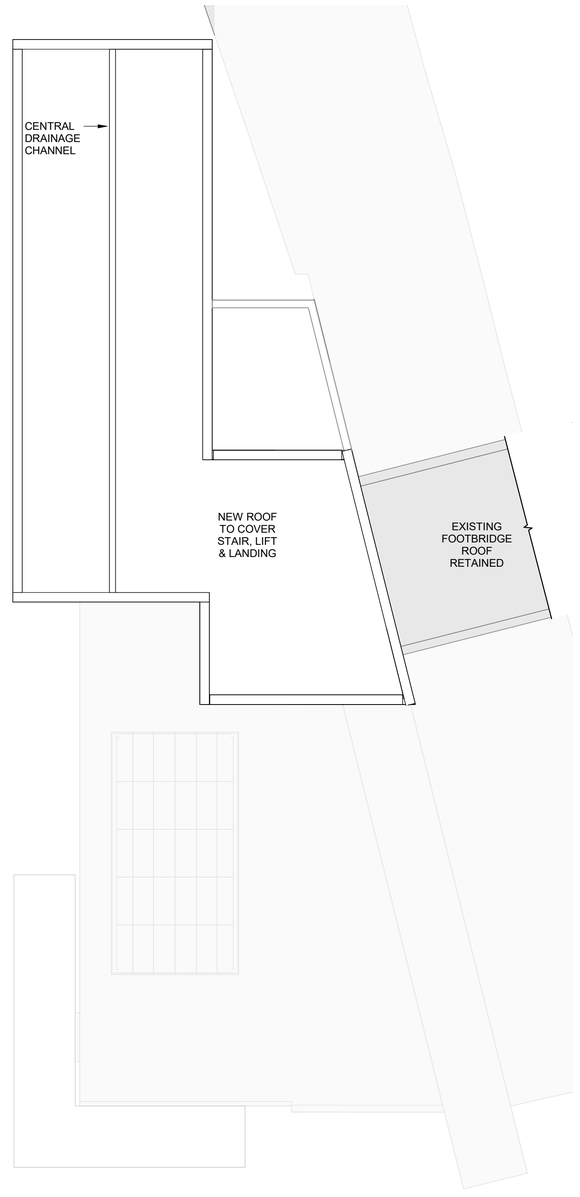


1 Ticket Hall Level - Proposed
1:100 @ A1
1:200 @ A3

2 Platform Level - Proposed
1:100 @ A1
1:200 @ A3

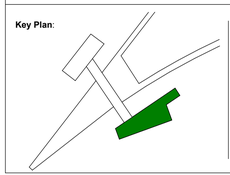


3 Footbridge Level - Proposed
1:100 @ A1
1:200 @ A3



4 Roof Level - Proposed
1:100 @ A1
1:200 @ A3

Key Plan:



Key

- Existing - removed
- Existing - retained
- Existing - retained (cut)
- New
- New (cut)

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Issue	Date	
1.0	03/03/2023	Phase 2 Concept Design
2.0	20/04/2023	Rpt IE Comments

ARUP
8 Fitzroy Street
London W1T 4BJ
Tel +44 (0)20 7636 1531 Fax +44 (0)20 7580 3924
www.arup.com

Client: Iarnród Éireann Irish Rail

Project Title: Howth Junction & Donaghmede Station

Drawing Title: Kilbarrack Entrance Study
Option 2
Proposed Plans

Scale at A1: 1 : 100
By / Chkd / Appd: MN/JW/RS
Role:
Status:
Arup Job No: **28505150**
Rev: **2.0**
ID: **HOWTH JUNCTION-ARUP-A2021**

20/04/2023 10:59:40

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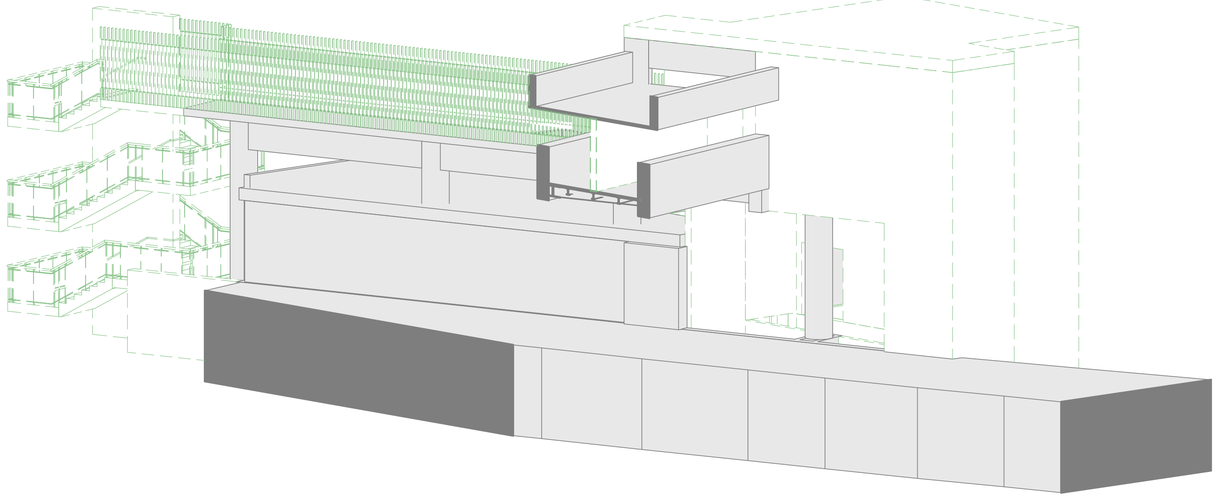
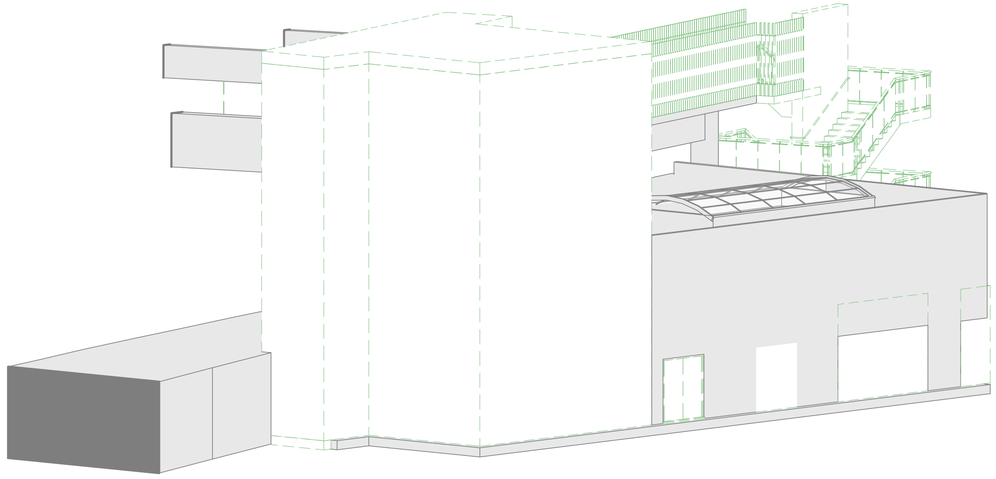


1 View from Platform Side - Existing with Demolition
NTS

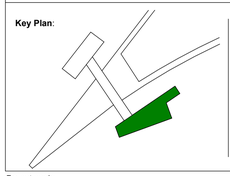


2 View From External Side - Existing with Demolition
NTS

3 View from Platform Side - Proposed
NTS

4 View from External Side - Proposed
NTS

Key Plan:



Key

- Existing - removed
- Existing - retained
- Existing - retained (cut)
- New
- New (cut)

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Issue	Date	
1.0	03/03/2023	Phase 2 Concept Design

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8 Fitzroy Street
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Tel +44 (0)20 7636 1531 Fax +44 (0)20 7580 3924
www.arup.com

Client: Iarnród Éireann Irish Rail

Project Title: Howth Junction & Donaghmede Station

Drawing Title: Kilbarrack Entrance Study Option 2 3D Views

Scale at A1: NTS
By / Chkd / Appd: MN/JW/RS
Role:
Status:
Arup Job No: **28505150**
Rev:
ID: **HOWTH JUNCTION-ARUP-A2022**

02/03/2023 15:52:15

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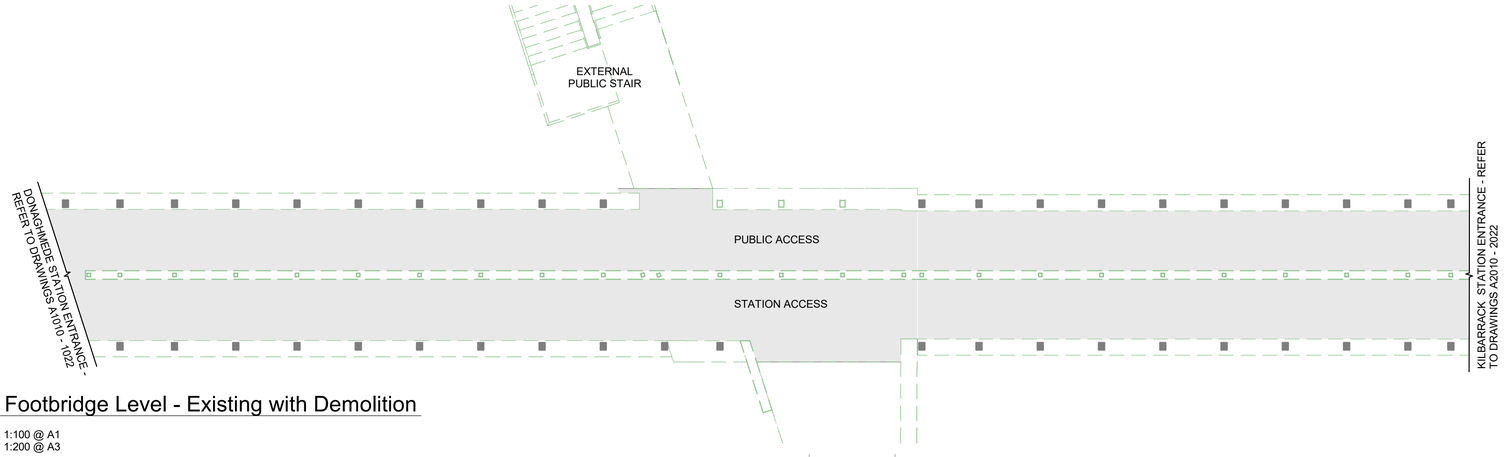
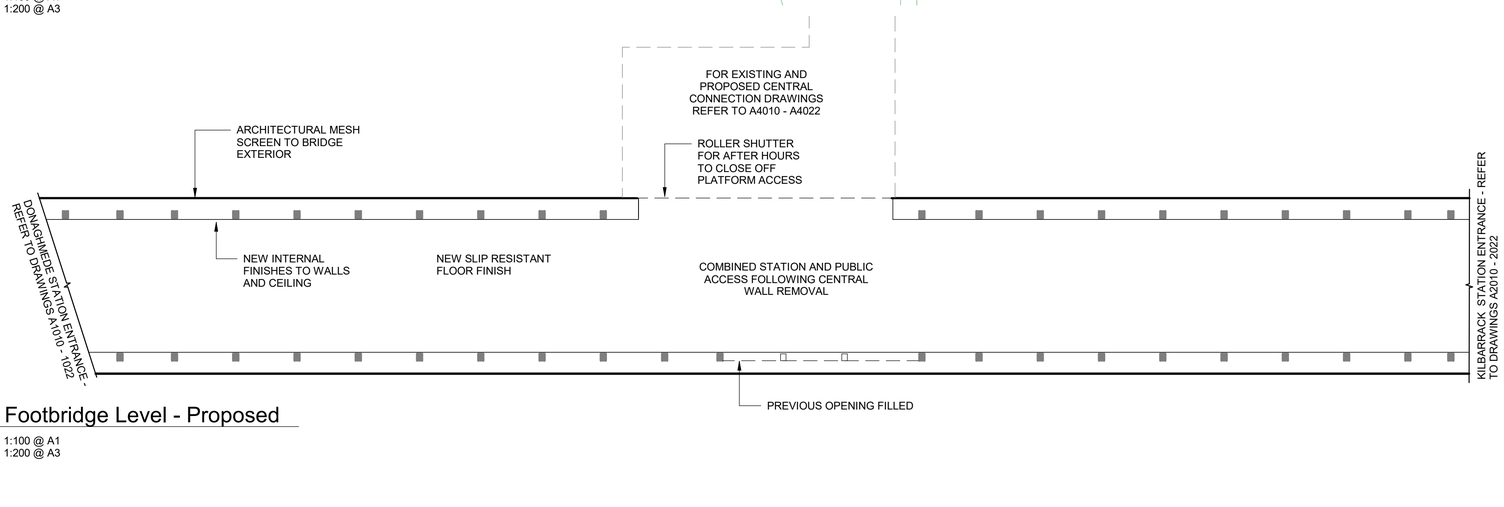
20/04/2023 11:06:07



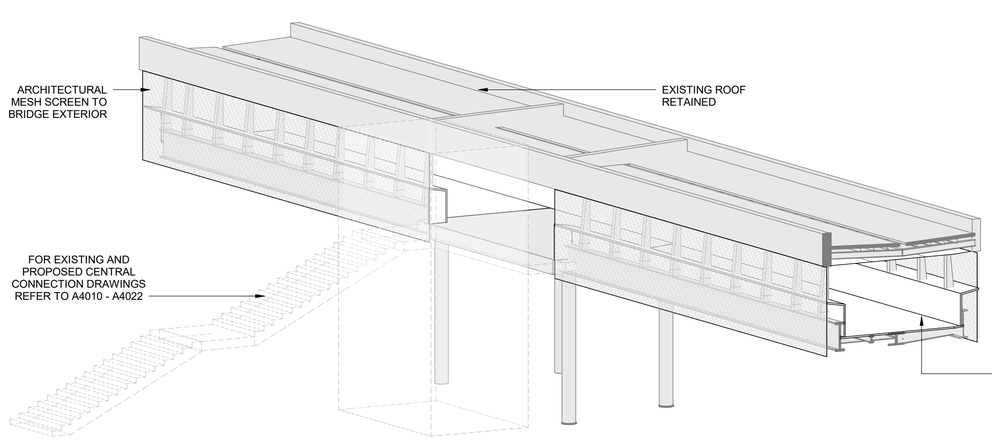
1 Footbridge Level - Existing with Demolition

1:100 @ A1
1:200 @ A3



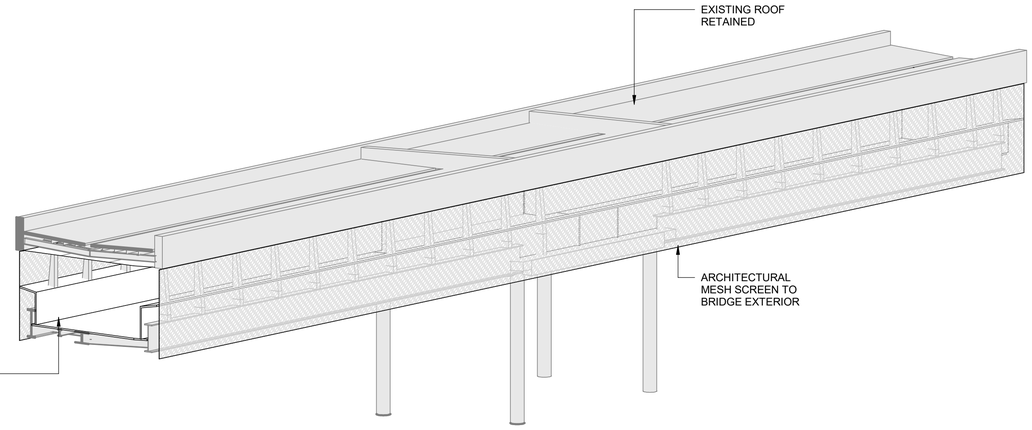
2 Footbridge Level - Proposed

1:100 @ A1
1:200 @ A3



3 View from North West - Proposed

NTS



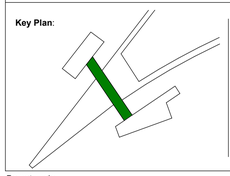
4 View from South East - Proposed

NTS

STATION ENTRANCE BUILDINGS ON EITHER SIDE NOT SHOWN FOR CLARITY - REFER TO DRAWING SERIES A1000 FOR DONAGHMEDE ENTRANCE; A2000 FOR KILBARRACK ENTRANCE .

CENTRAL PLATFORM ACCESS OPTION 2 INDICATED HERE. REFER TO DRAWING SERIES A4000 FOR FULL OPTIONEERING

Key Plan:



Key

- Existing - removed
- Existing - retained
- Existing - retained (cut)
- New
- New (cut)

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Issue	Date	
1.0	03/03/2023	Phase 2 Concept Design
2.0	20/04/2023	Rpt IE Comments

ARUP
8 Fitzroy Street
London W1T 4BJ
Tel +44 (0)20 7636 1531 Fax +44 (0)20 7580 3924
www.arup.com

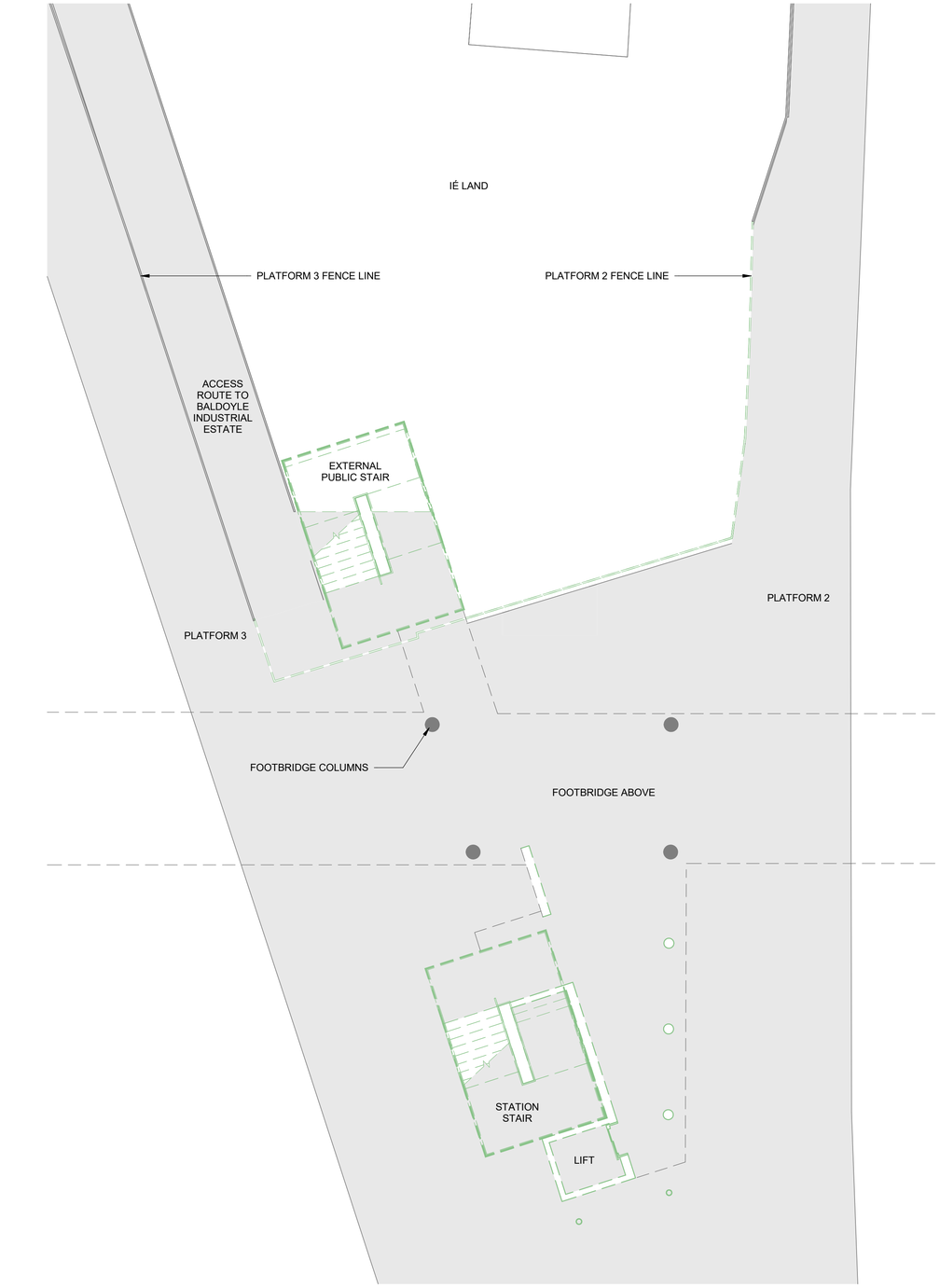
Client: Iarnród Éireann Irish Rail

Project Title: Howth Junction & Donaghmede Station

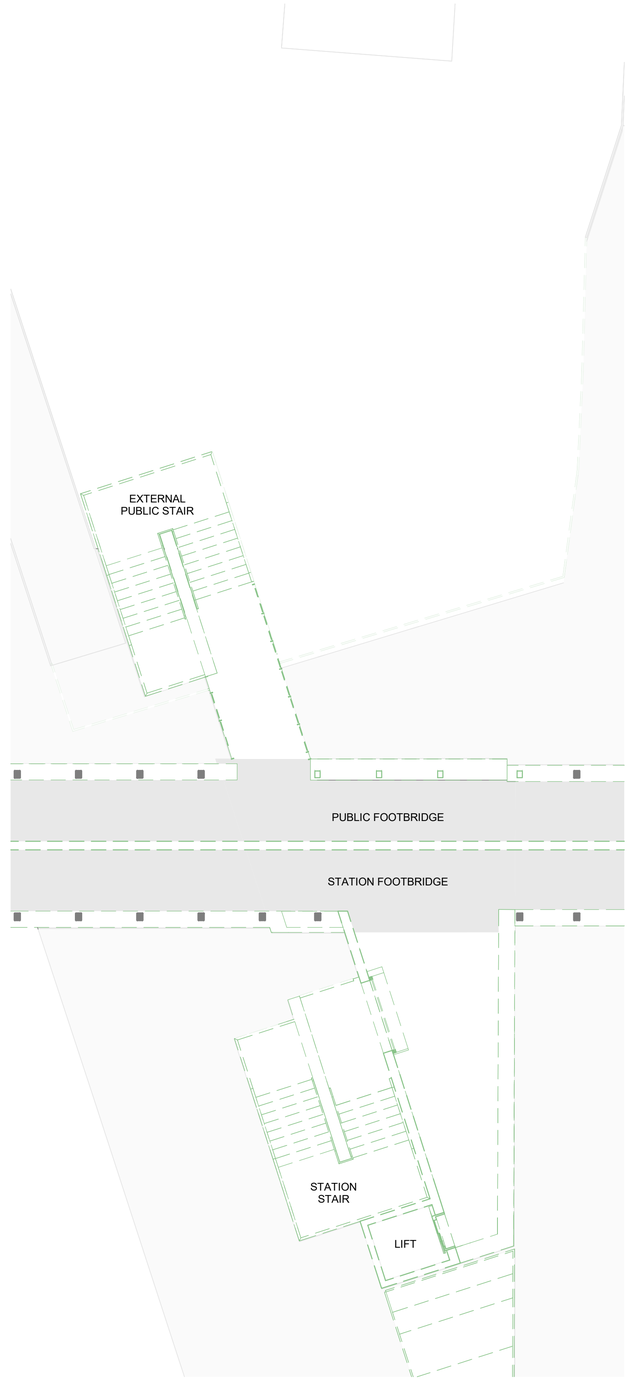
Drawing Title: Station Footbridge Existing and Proposed Plans and 3D Views

Scale at A1: 1 : 100
By / Chkd / Appd: AH/JW/RS
Role:
Status:
Arup Job No: 28505150
Rev: 2
ID: HOWTH JUNCTION-ARUP-A3010

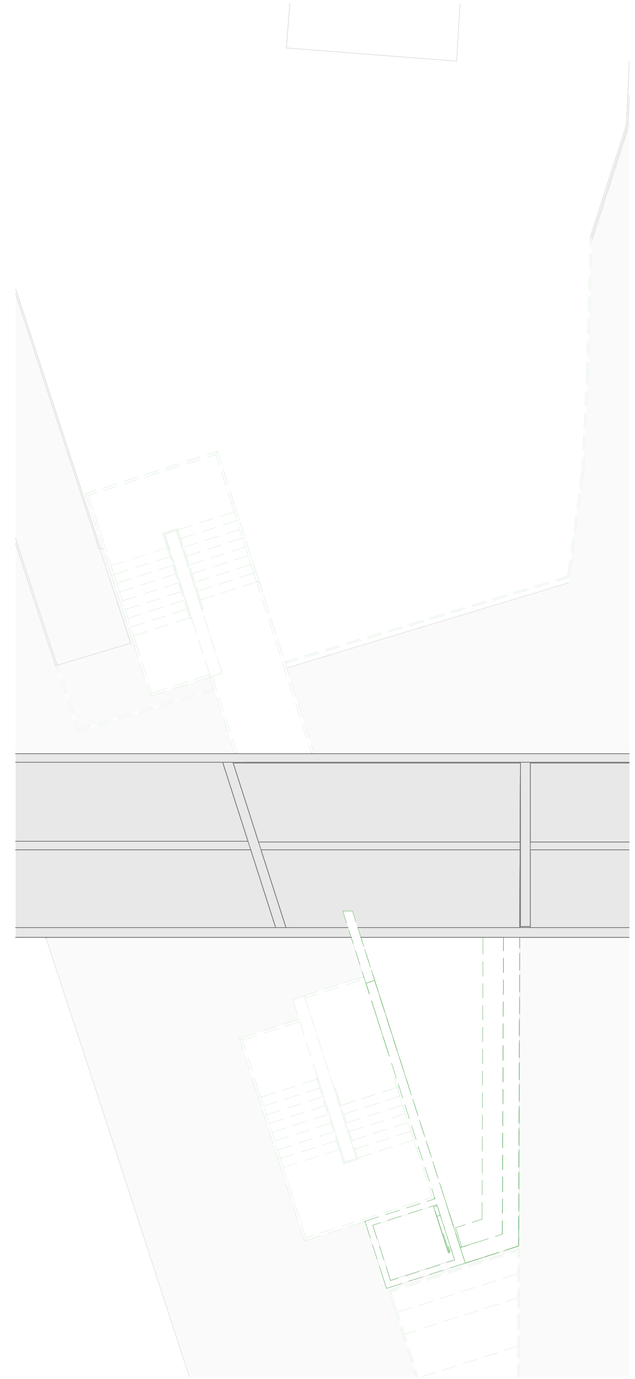
Do not scale



1 Platform Level - Existing with Demolition
1:100 @ A1
1:200 @ A3

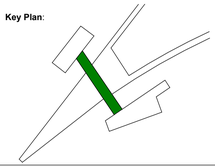


2 Footbridge Level - Existing with Demolition
1:100 @ A1
1:200 @ A3



3 Roof Level - Existing with Demolition
1:100 @ A1
1:200 @ A3

Key Plan:



Key

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- New
- New (cut)

Notes:

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Issue	Date	
1.0	03/03/2023	Phase 2 Concept Design

ARUP
8 Fitzroy Street
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www.arup.com

Client: Iarnród Éireann Irish Rail

Project Title: Howth Junction & Donaghmede Station

Drawing Title: Central Connection Option 1 Existing Plans

Scale at A1: 1 : 100
By / Chkd / Appd: AG/JW/RS
Role:
Status:
Arup Job No: **28505150**
Rev:
ID: **HOWTH JUNCTION-ARUP-A4010**

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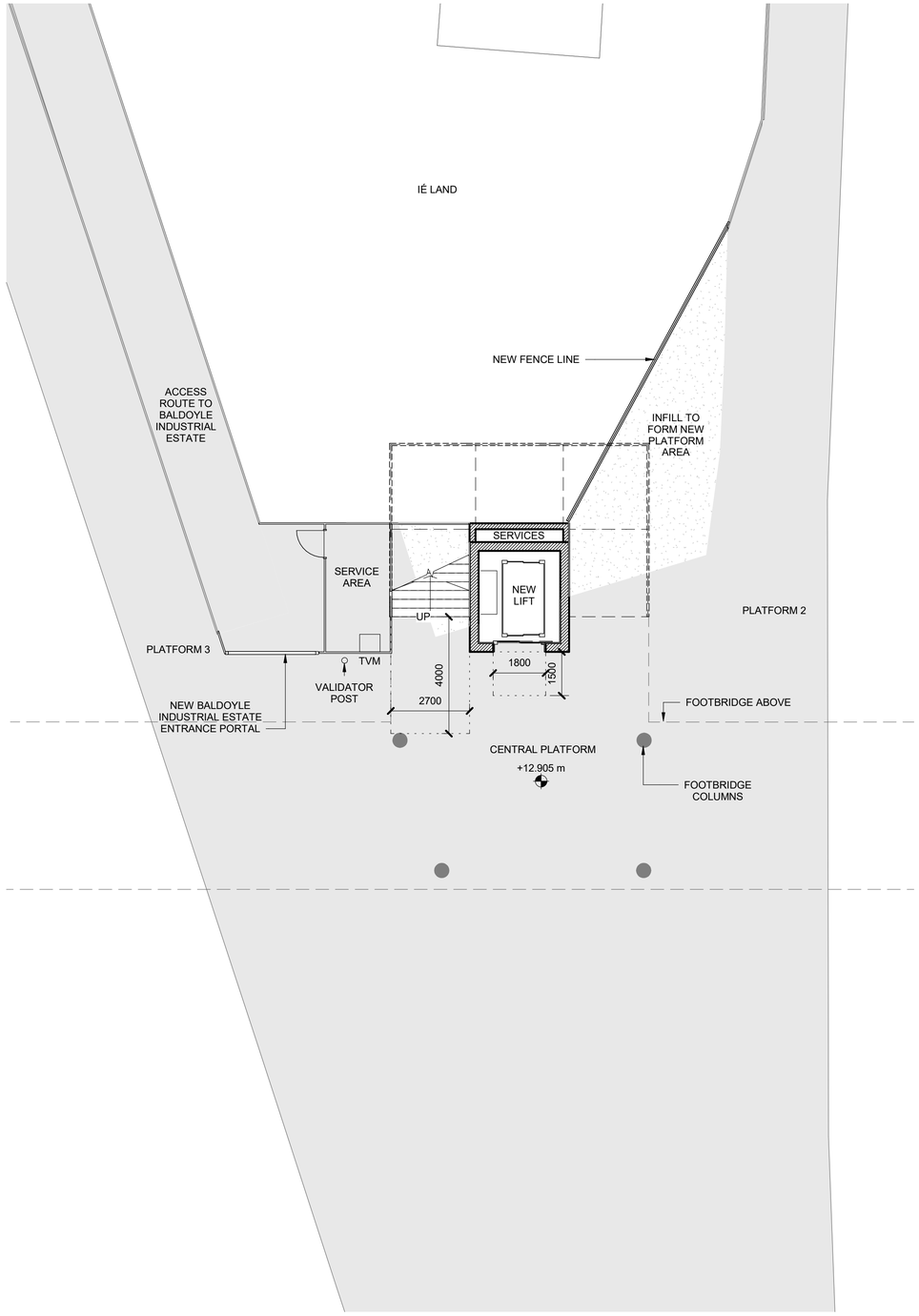
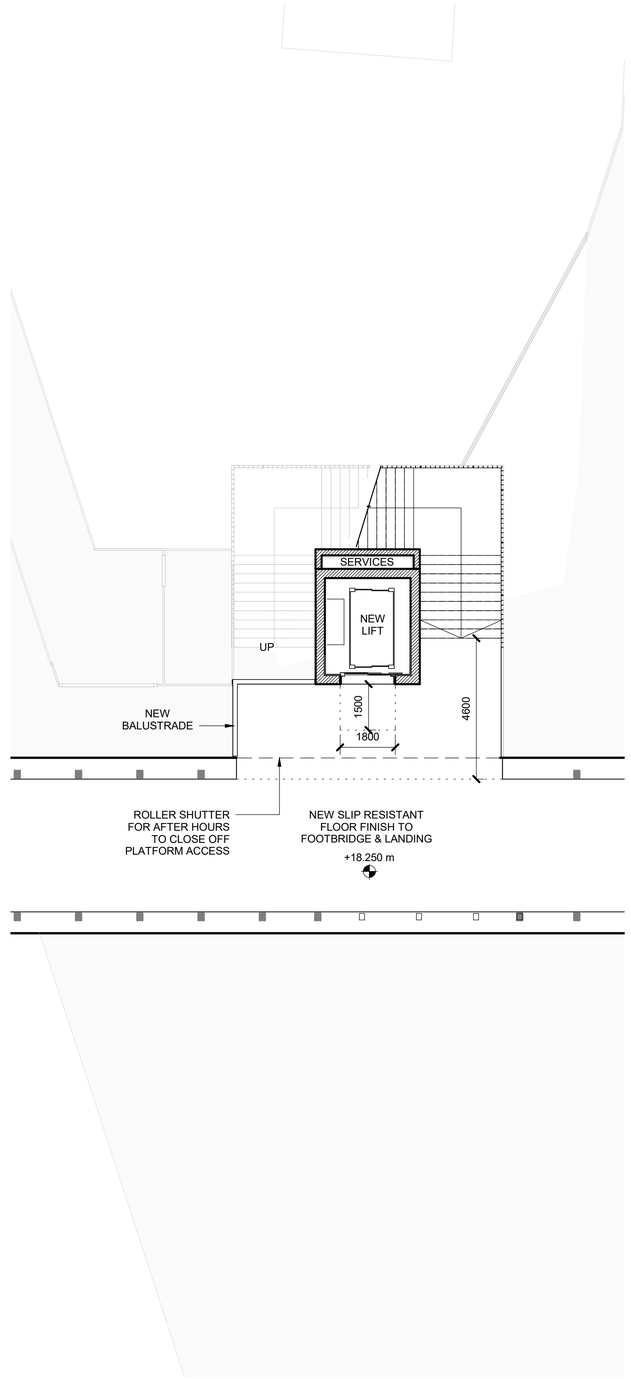
20/04/2023 10:59:42



1 Platform Level - Proposed

1:100 @ A1
1:200 @ A3



2 Footbridge Level - Proposed

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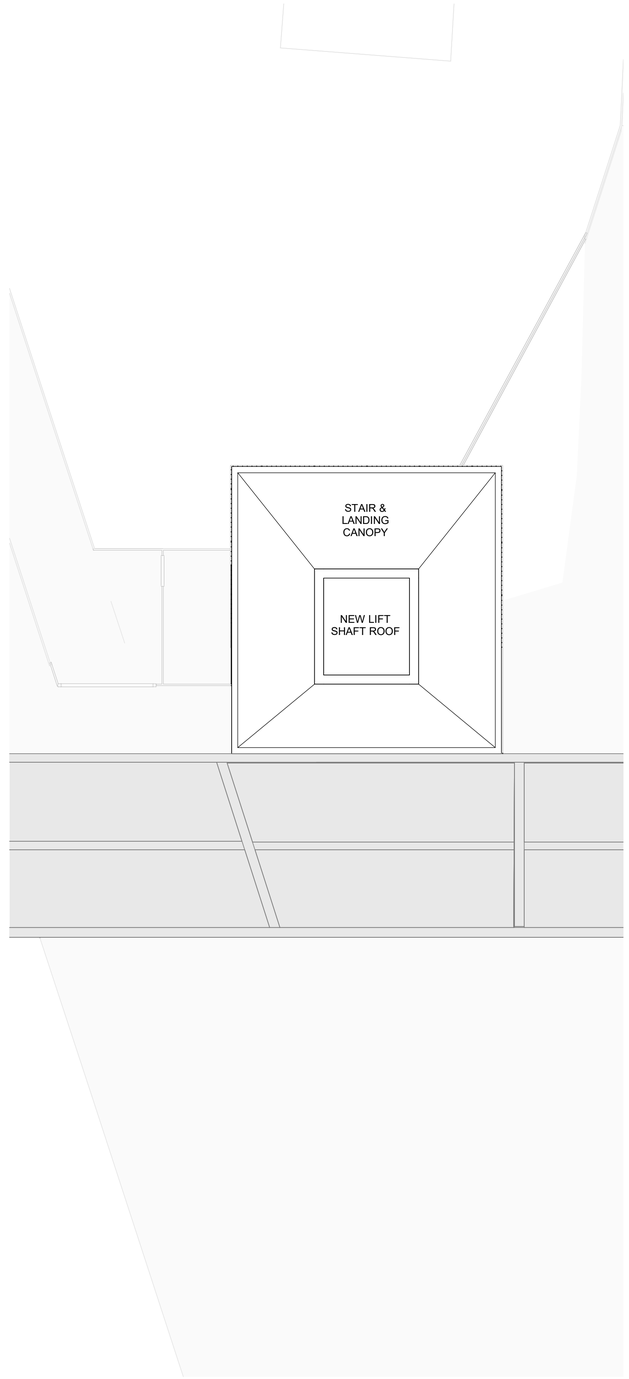
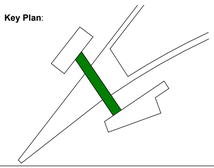
1:200 @ A3



3 Roof Level - Proposed

1:100 @ A1
1:200 @ A3

Key Plan:



Key

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- Existing - retained (cut)
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- New (cut)

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2.0	20/04/2023	Rpt IE Comments

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Client: Iarnród Éireann Irish Rail

Project Title: Howth Junction & Donaghmede Station

Drawing Title: Central Connection Option 1 Proposed Plans

Scale at A1: 1 : 100
By / Chkd / Appd: AG/JW/RS
Role:
Status:
Arup Job No: **28505150**
Rev: **2**
ID: **HOWTH JUNCTION-ARUP-A4011**

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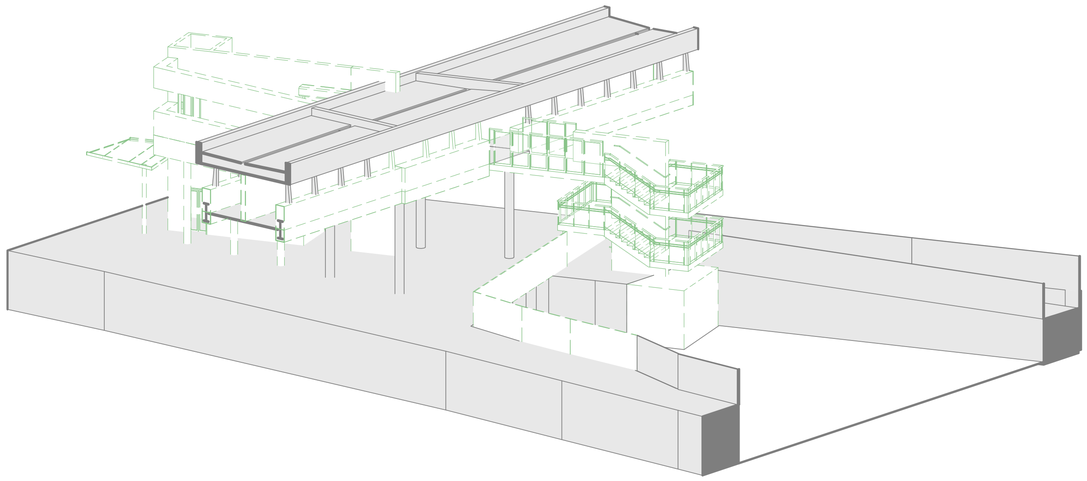
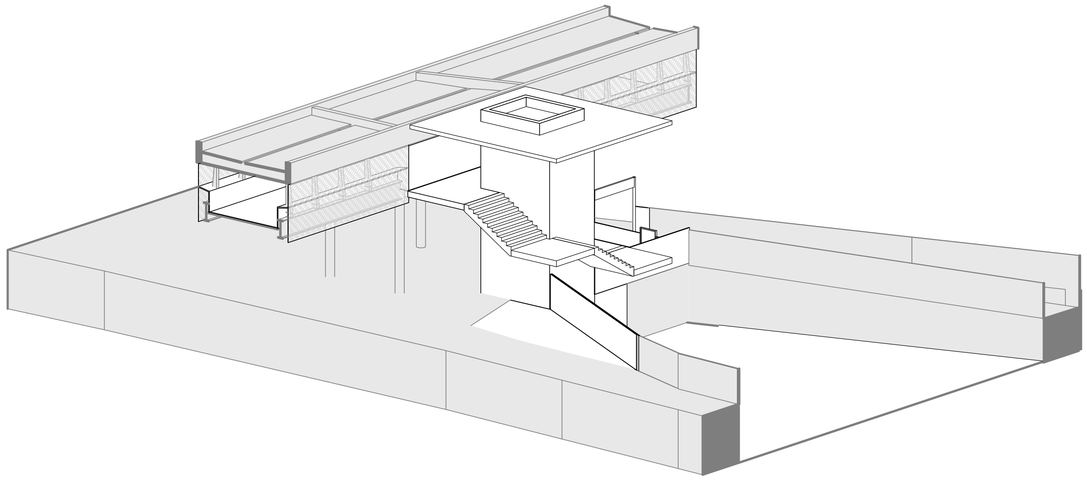


1 View From East - Existing with Demolition
NTS



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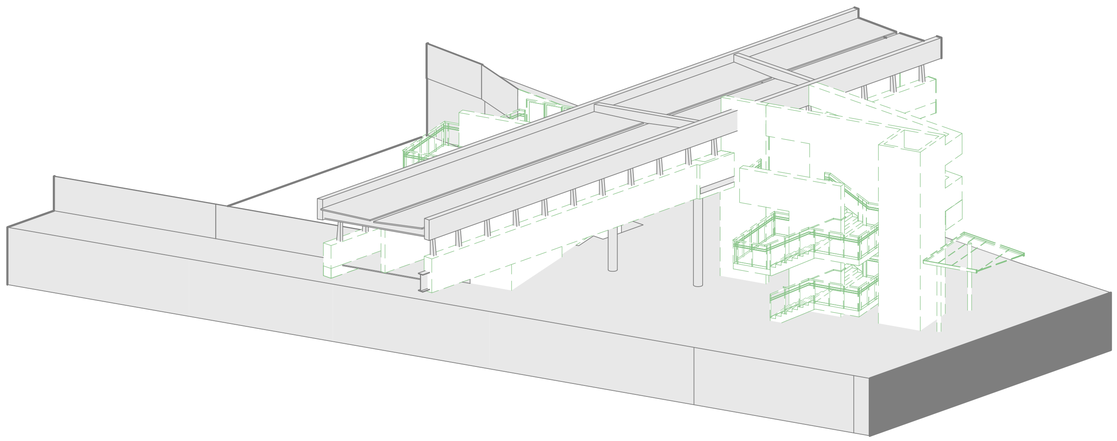

3 View From West - Existing with Demolition
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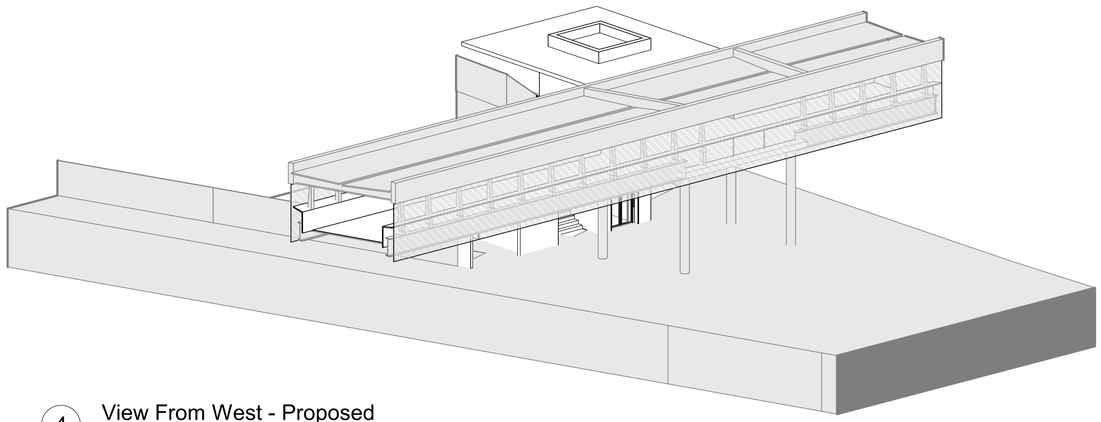
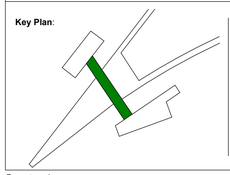


4 View From West - Proposed
NTS

Key Plan:



Key

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- Existing - retained (cut)
- New
- New (cut)

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Issue	Date	
1.0	03/03/2023	Phase 2 Concept Design

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Client: Iarnród Éireann Irish Rail

Project Title: Howth Junction & Donaghmede Station

Drawing Title: Central Connection Option 1 3D Views

Scale at A1: NTS	By / Chkd / Appd: AG/JW/RS
Role:	
Status:	
Arup Job No: 28505150	Rev:
ID: HOWTH JUNCTION-ARUP-A4012	

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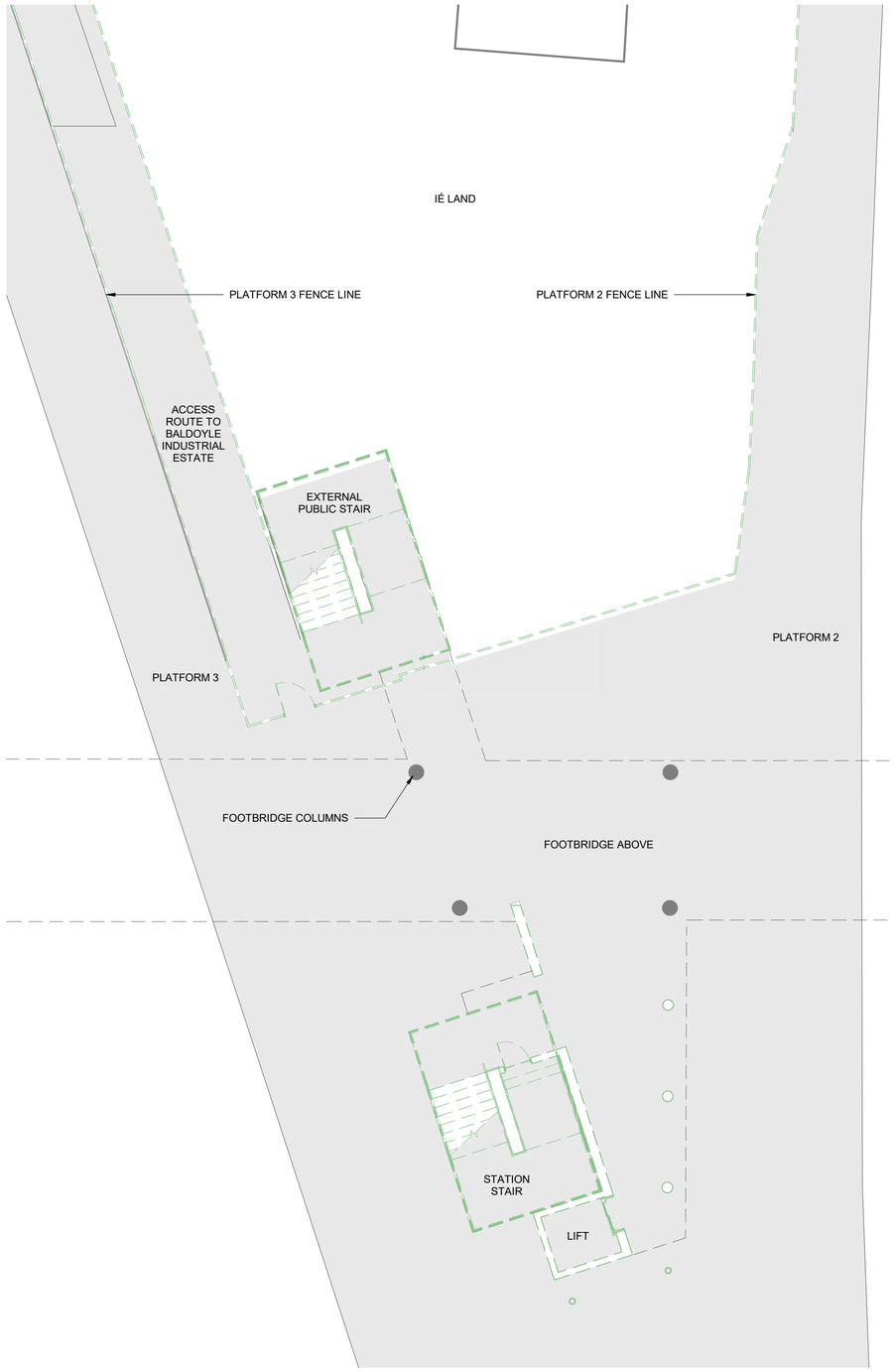
A1



1 Platform Level - Existing with Demolition
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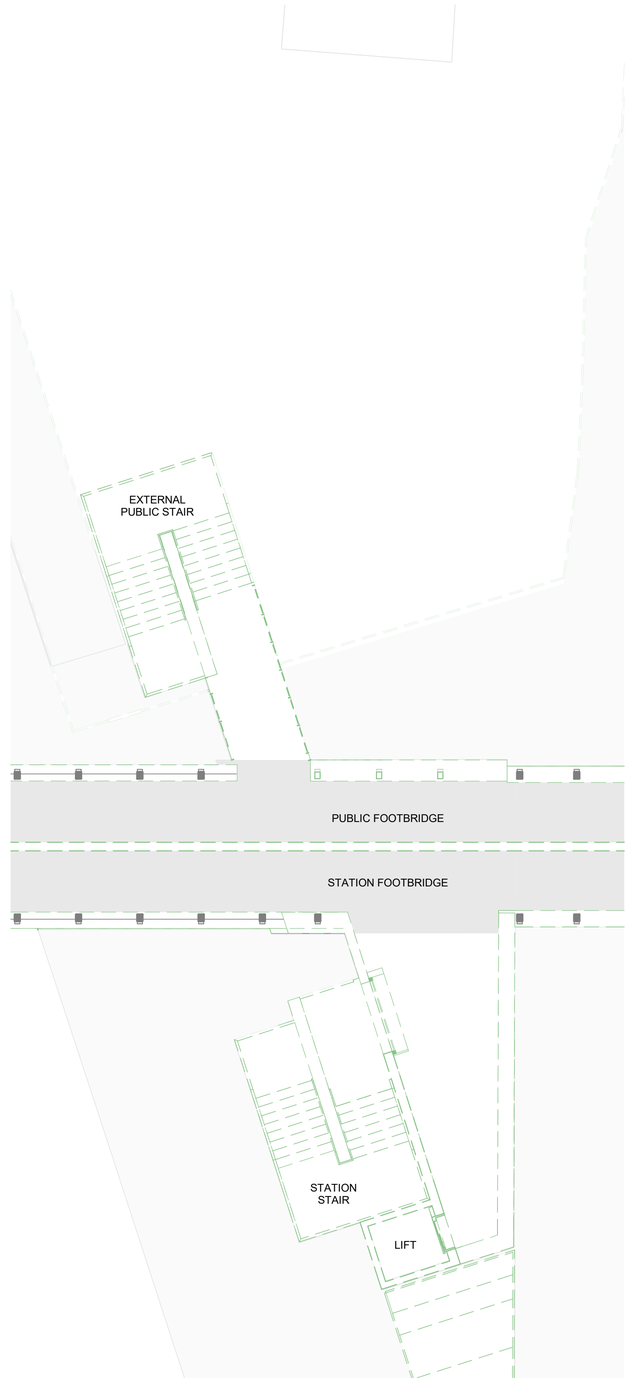

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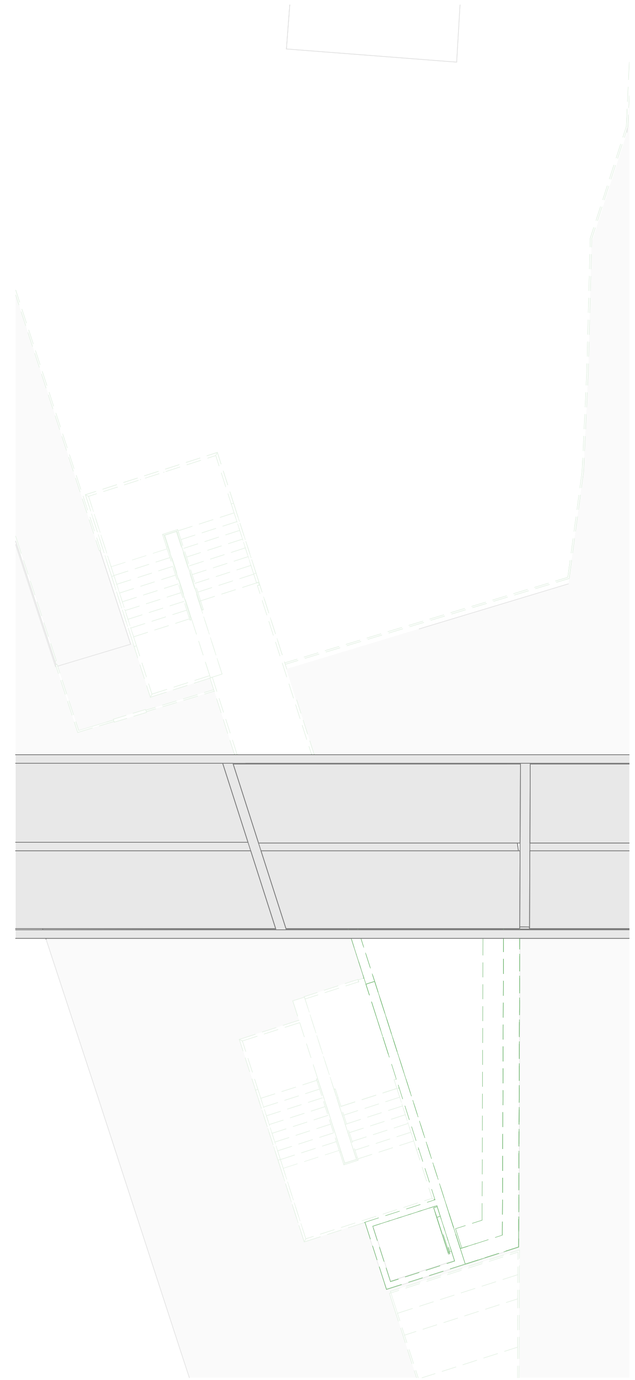
1:200 @ A3



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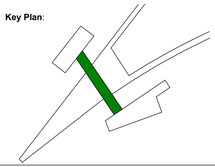
1:200 @ A3

Key Plan:



Key

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- New
- New (cut)

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Client: Iarnród Éireann Irish Rail

Project Title: Howth Junction & Donaghmede Station

Drawing Title: Central Connection Option 2 Existing Plans

Scale at A1: 1 : 100
By / Chkd / Appd: AG/JW/RS
Role:
Status:
Arup Job No: **28505150**
Rev:
ID: **HOWTH JUNCTION-ARUP-A4020**

03/03/2023 12:43:51

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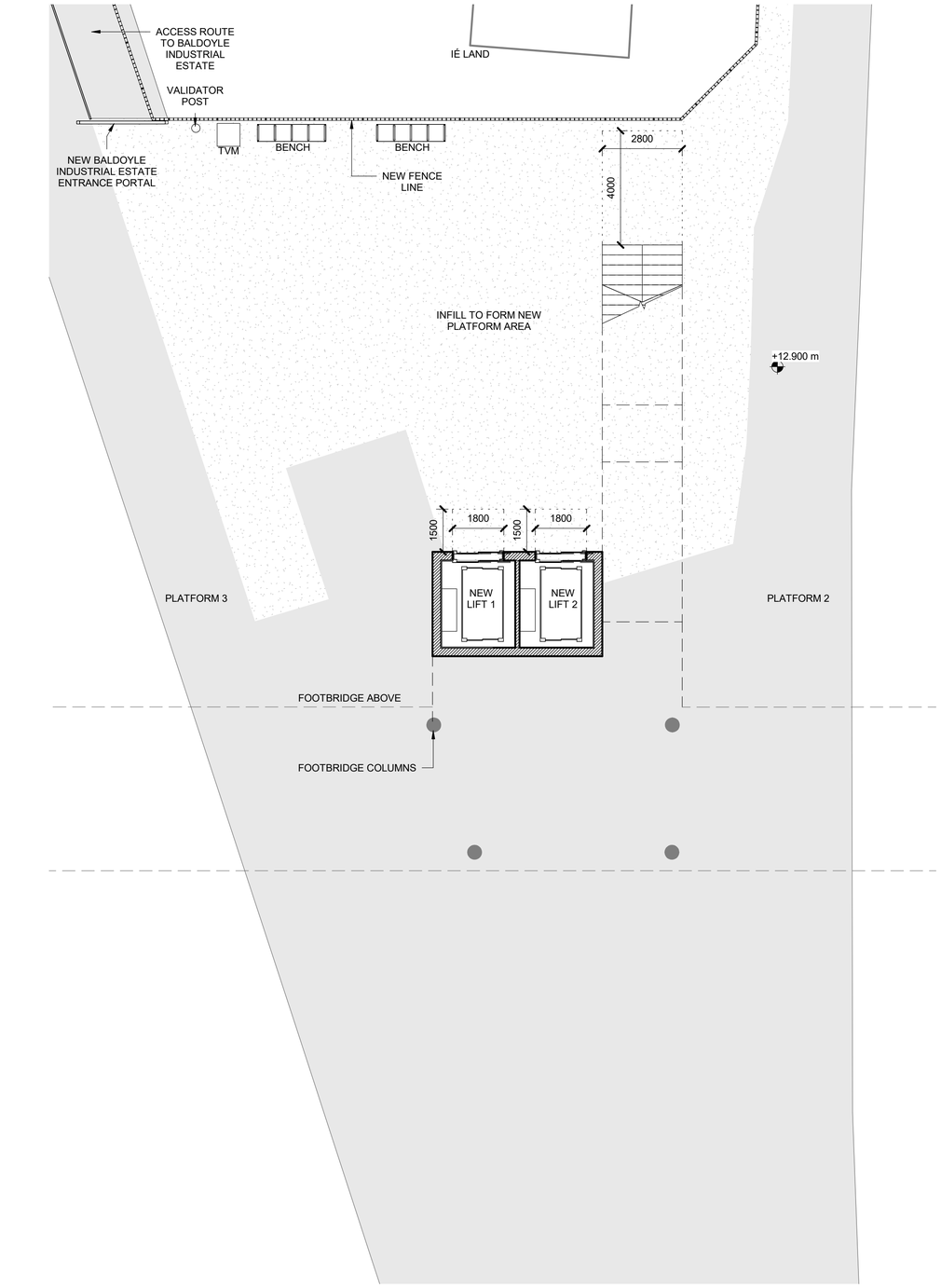

1 Platform Level - Proposed
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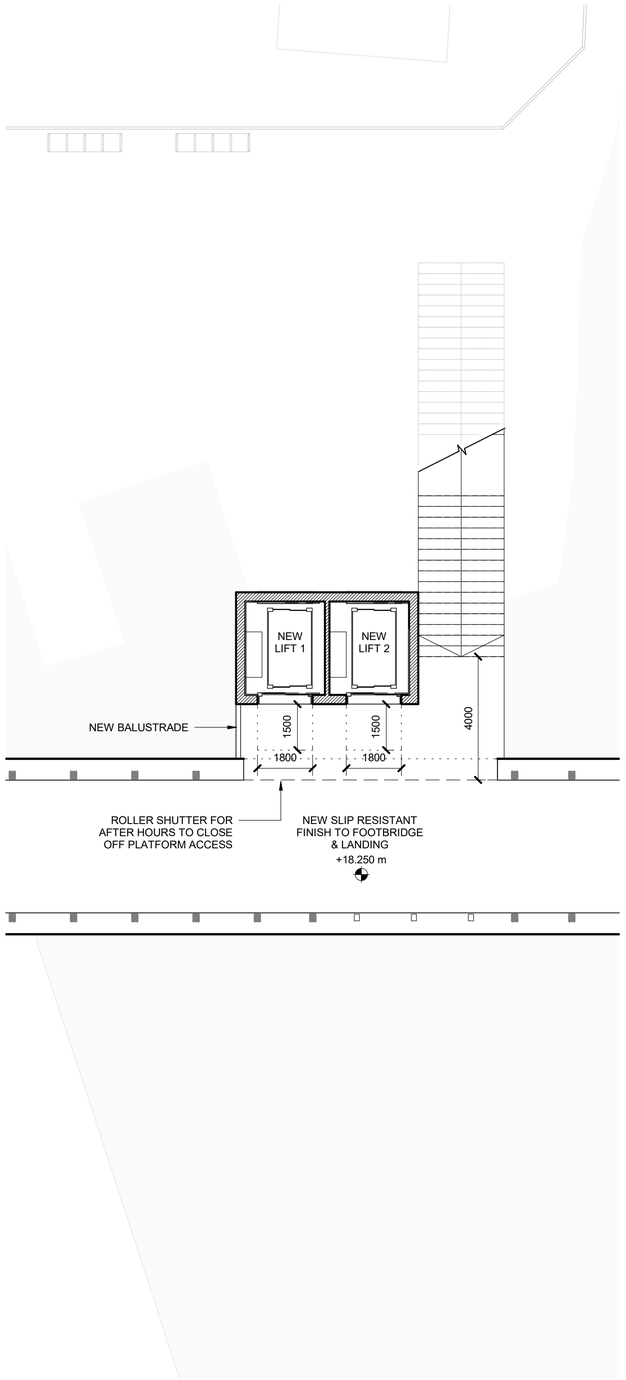

2 Footbridge Level - Proposed
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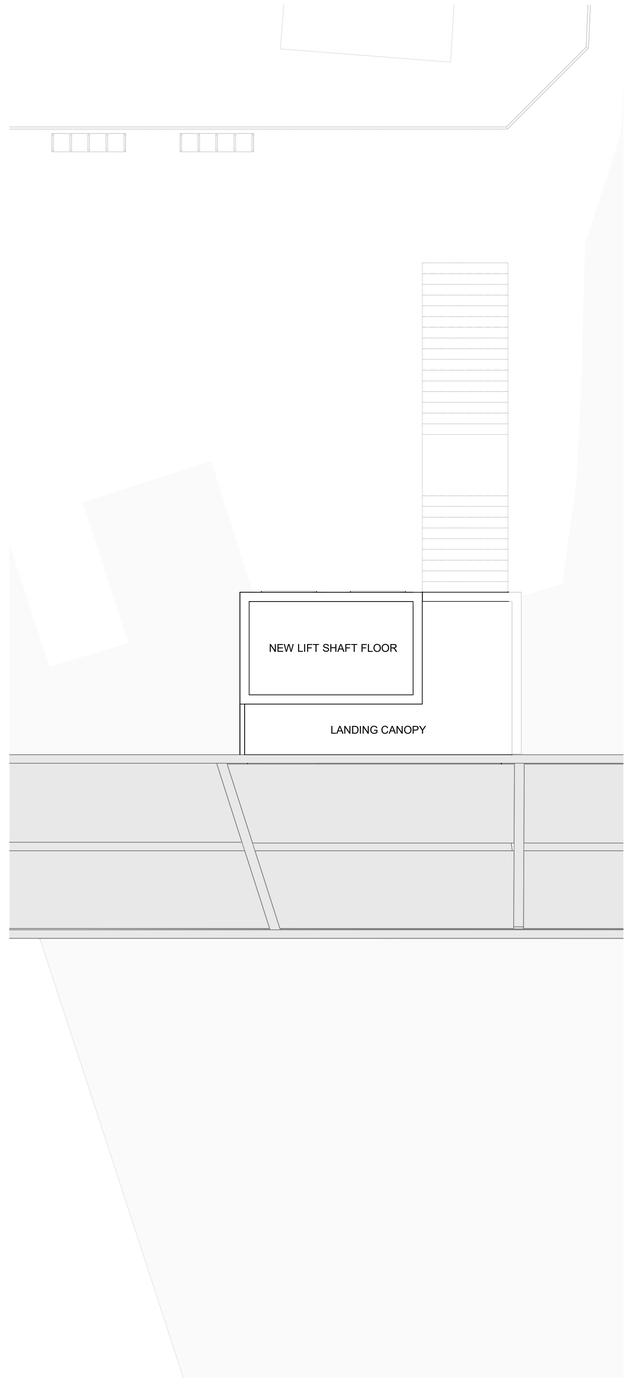

3 Roof Level - Proposed
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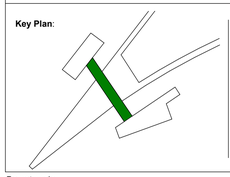
1:200 @ A3

Key Plan:



Key

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Issue	Date	
1.0	03/03/2023	Phase 2 Concept Design
2.0	20/04/2023	Rpt IE Comments

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Client: Iarnród Éireann Irish Rail

Project Title: Howth Junction & Donaghmede Station

Drawing Title: Central Connection Option 2 Proposed Plans

Scale at A1: 1 : 100
By / Chkd / Appd: AG/JW/RS
Role:
Status:
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Rev: 2
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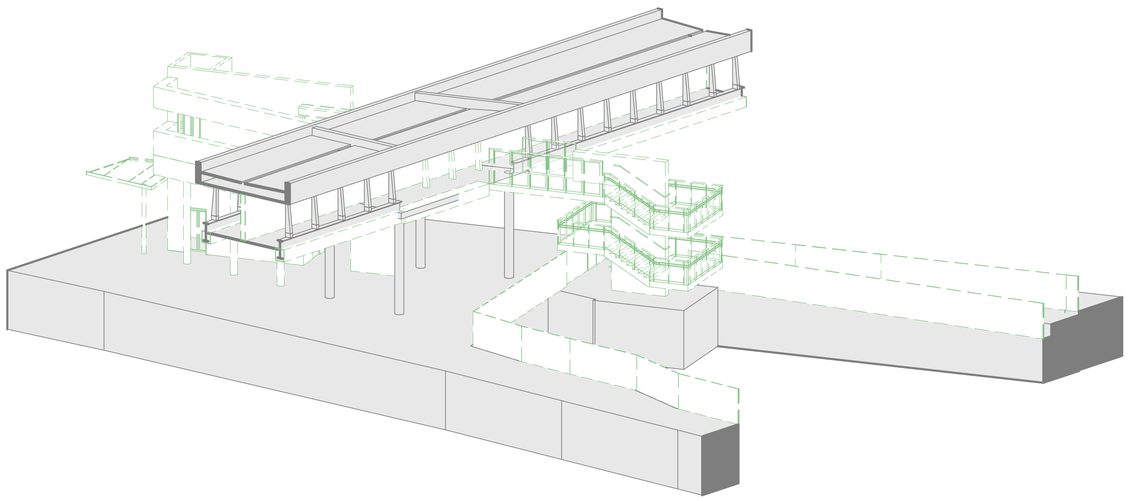

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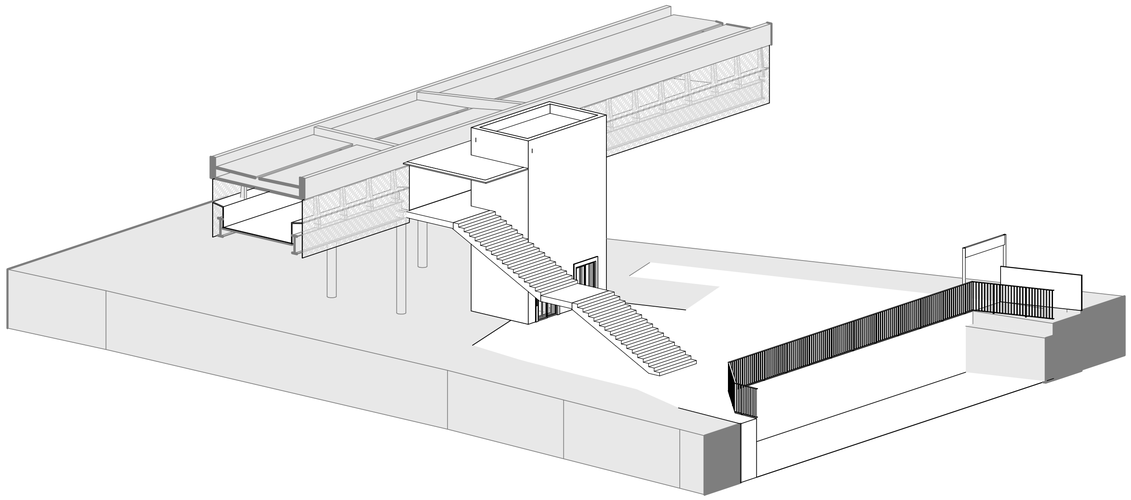

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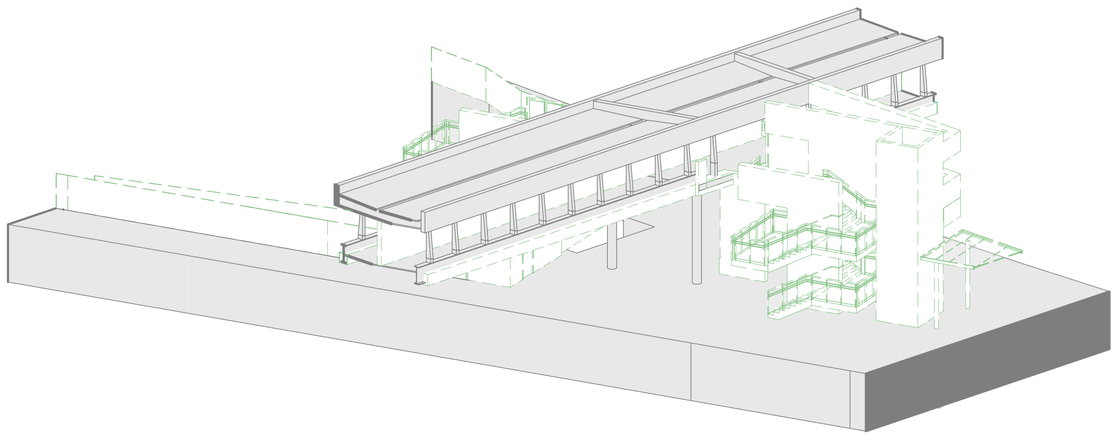

3 View From West - Existing with Demolition
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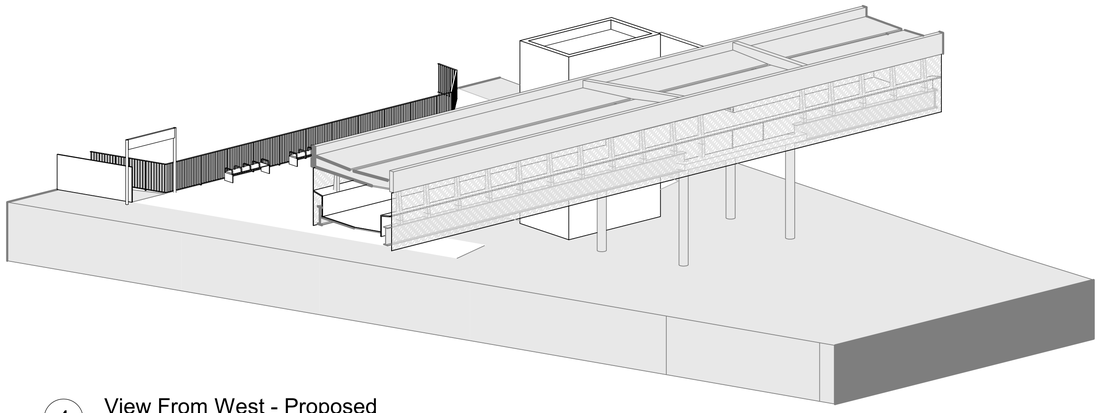
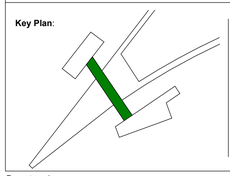


4 View From West - Proposed
NTS

Key Plan:



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- New (cut)

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Project Title
Howth Junction & Donaghmede Station

Drawing Title
Central Connection
Option 2
3D Views

Scale at A1 NTS
By / Chkd / Appd AH/JW/RS
Role
Status
Arup Job No **28505150**
Rev
ID **HOWTH JUNCTION-ARUP-A4022**

Do not scale

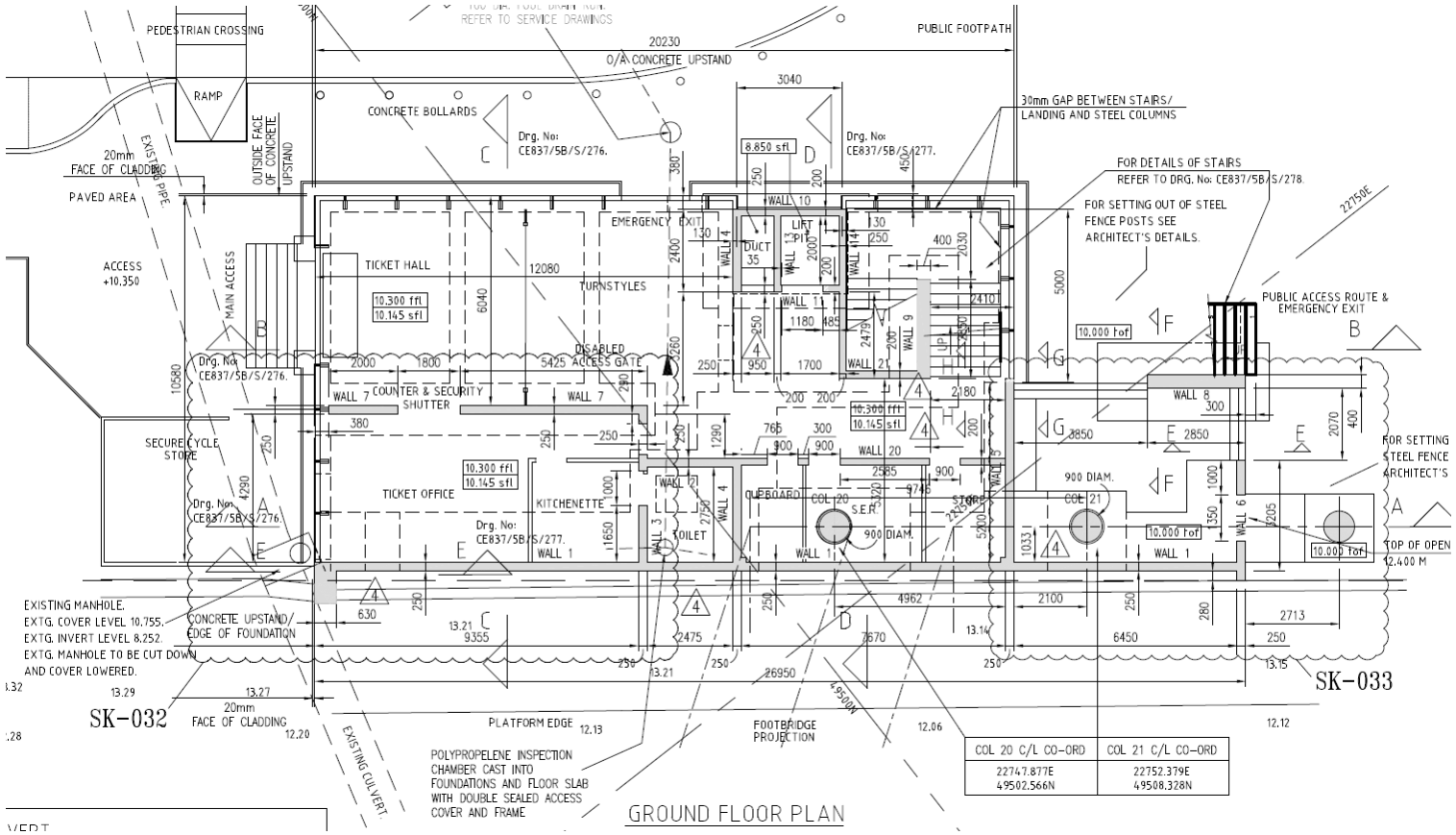
Appendices

Appendix B - Station Entrances Existing Structural System

Donaghmede Entrance - General

The Donaghmede Entrance building provides direct access to Platform 4 and to other platforms by means of the footbridge. The building comprises an entrance to the station with ticket office and other service rooms. An internal stair and lift provide access to Platform 4 level and to the footbridge level. An external stair provides access to the platform and footbridge also.

The building structure is made from steel columns and roof for the Ticket Hall and reinforced concrete (RC) for the walls, beams and slabs elsewhere. All of the structure is supported on RC pad foundations.



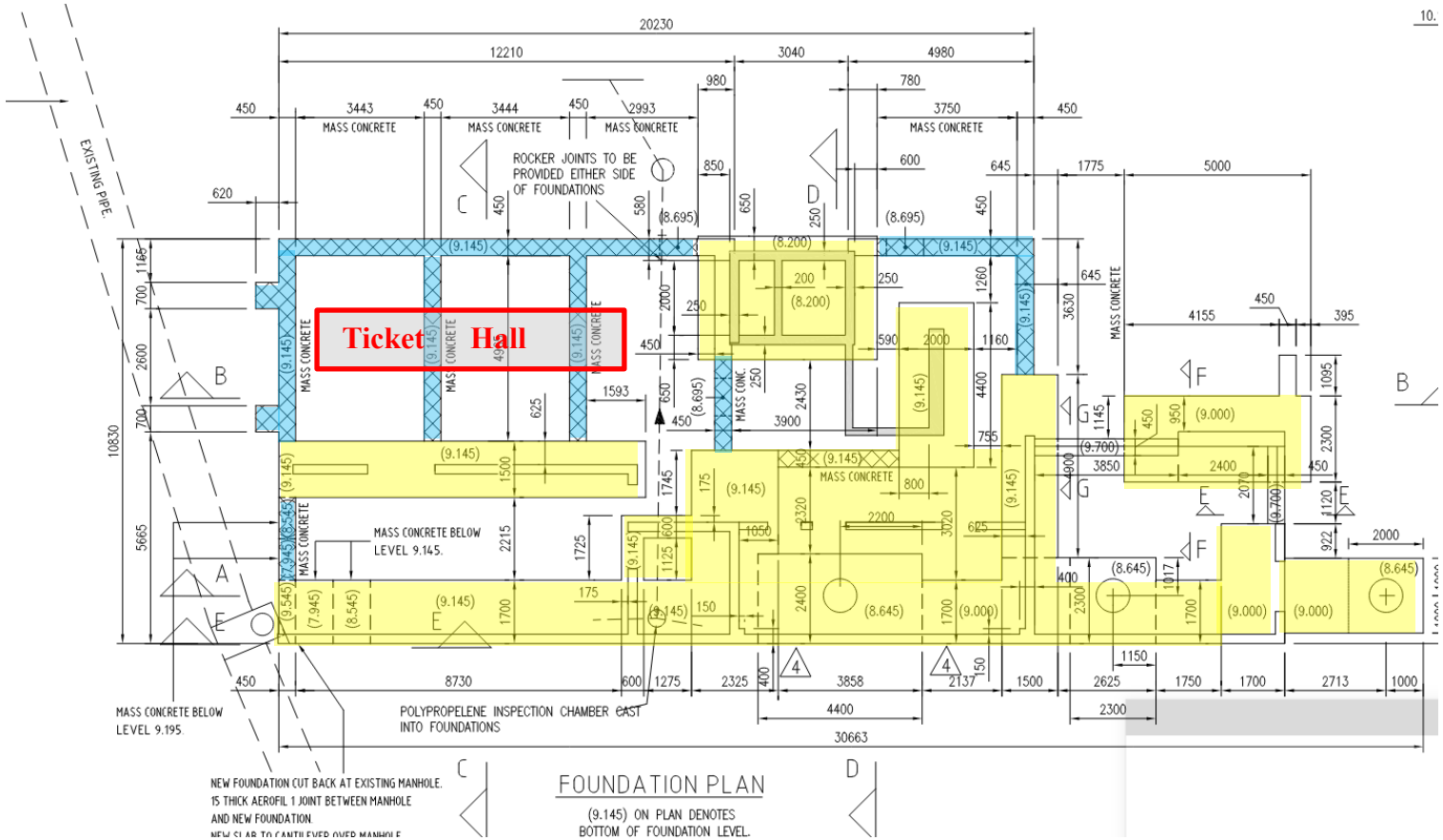
Structural GA of the Donaghmede Entrance

Appendices

Appendix B - Station Entrances Existing Structural System

Donaghmede Entrance - Foundation

The building structure is made from steel columns and roof for the ticket hall at the building entrance and reinforced concrete for the walls, beams and slabs. The structure is supported on RC pad foundations, highlighted in yellow in the foundation layout figure. However, the steel columns supporting the glazes roof over the ticket hall is made from mass concrete, highlighted in blue in the foundation layout figure.



Existing foundation of the Donaghmede Entrance

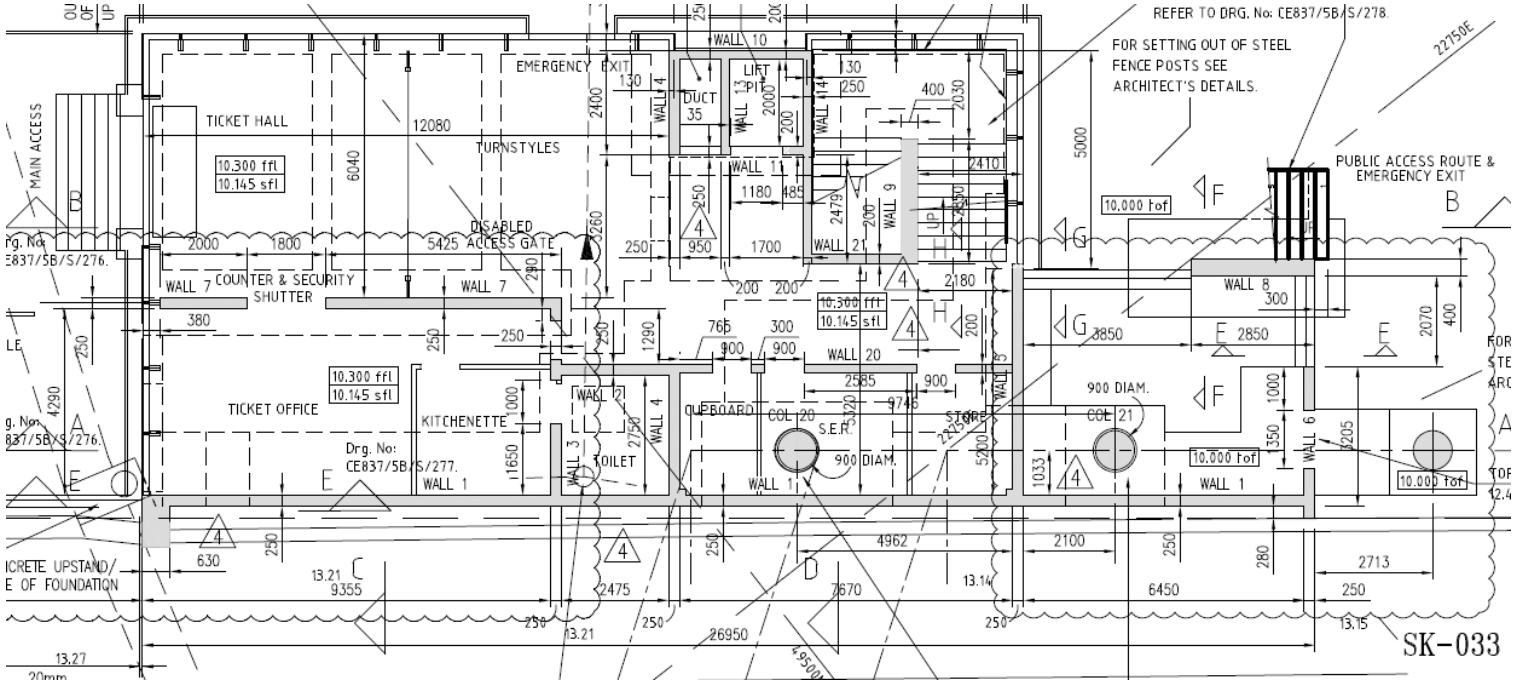
Appendices

Appendix B - Station Entrances Existing Structural System

Donaghmede Entrance - RC walls, slabs and stairs - Ground level

The general arrangement of the RC walls at the ground floor (level +10.300 m) is shown in the figure. RC wall thicknesses vary from a minimum of 200 mm for minor internal walls to 400 mm for main walls. However, most of the major walls are 250 mm thick.

The two stairs are supported on 400 mm thick RC walls which are supported by RC pad foundations.



RC walls at ground level to the Donaghmede Entrance

Appendices

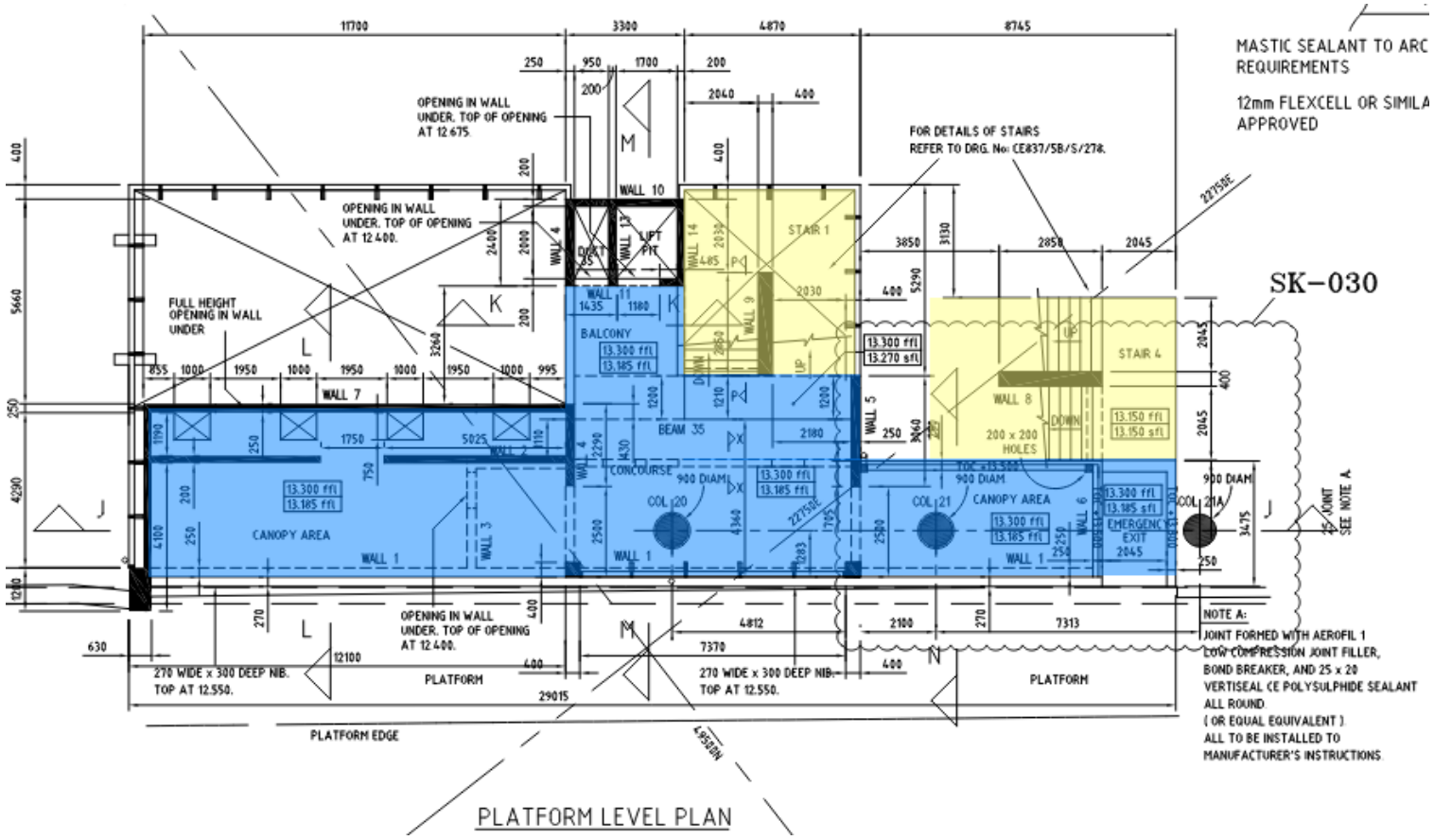
Appendix B - Station Entrances Existing Structural System

Donaghmede Entrance - RC walls, slabs and stairs - Platform level

At the platform level, only some of the walls at ground level continue above the platform level (+13.300 m). These are the ticket hall walls, the lift shaft walls, the walls supporting the two stairs, and one wall at the back of the building.

The RC slabs at the platform level is typically 250 mm thick and extends over the area highlighted in blue. The slab is supported by the walls and columns below.

The two stairs, one internal and another external are highlighted in yellow and are supported by 400 mm thick RC walls.



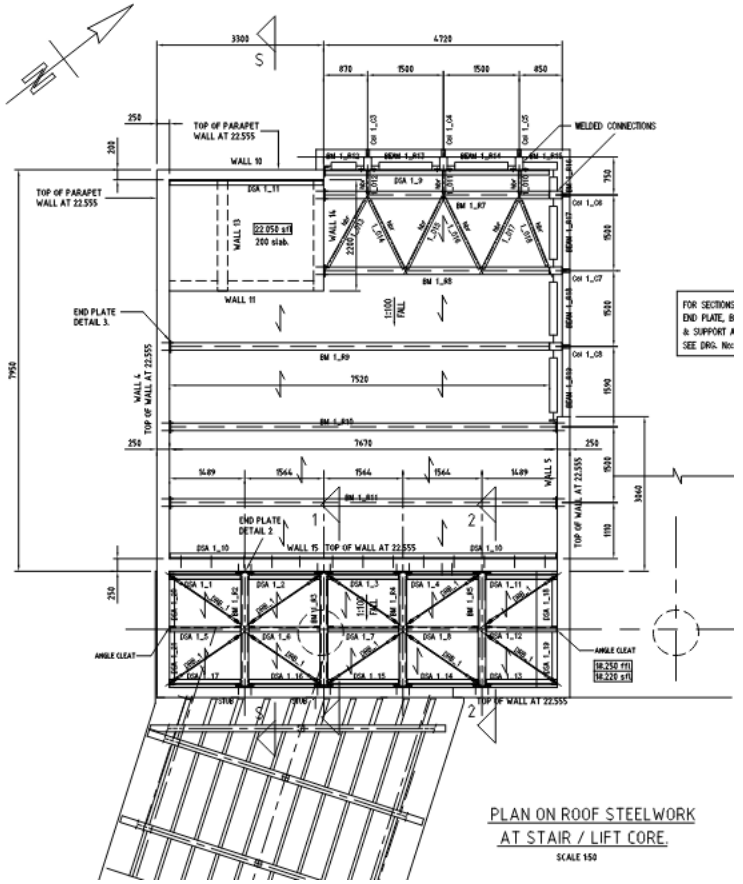
RC walls at platform level to the Donaghmede Entrance

Appendices

Appendix B - Station Entrances Existing Structural System

Donaghmede Entrance - RC walls, slabs and stairs - - Roof to stair and lift core

At roof level of the stair and lift core, a light weight roof metal decking is supported by an arrangement of steel beams which are supported on RC walls and steel columns. Horizontal bracing is added to provide in-plane stability to the roof.



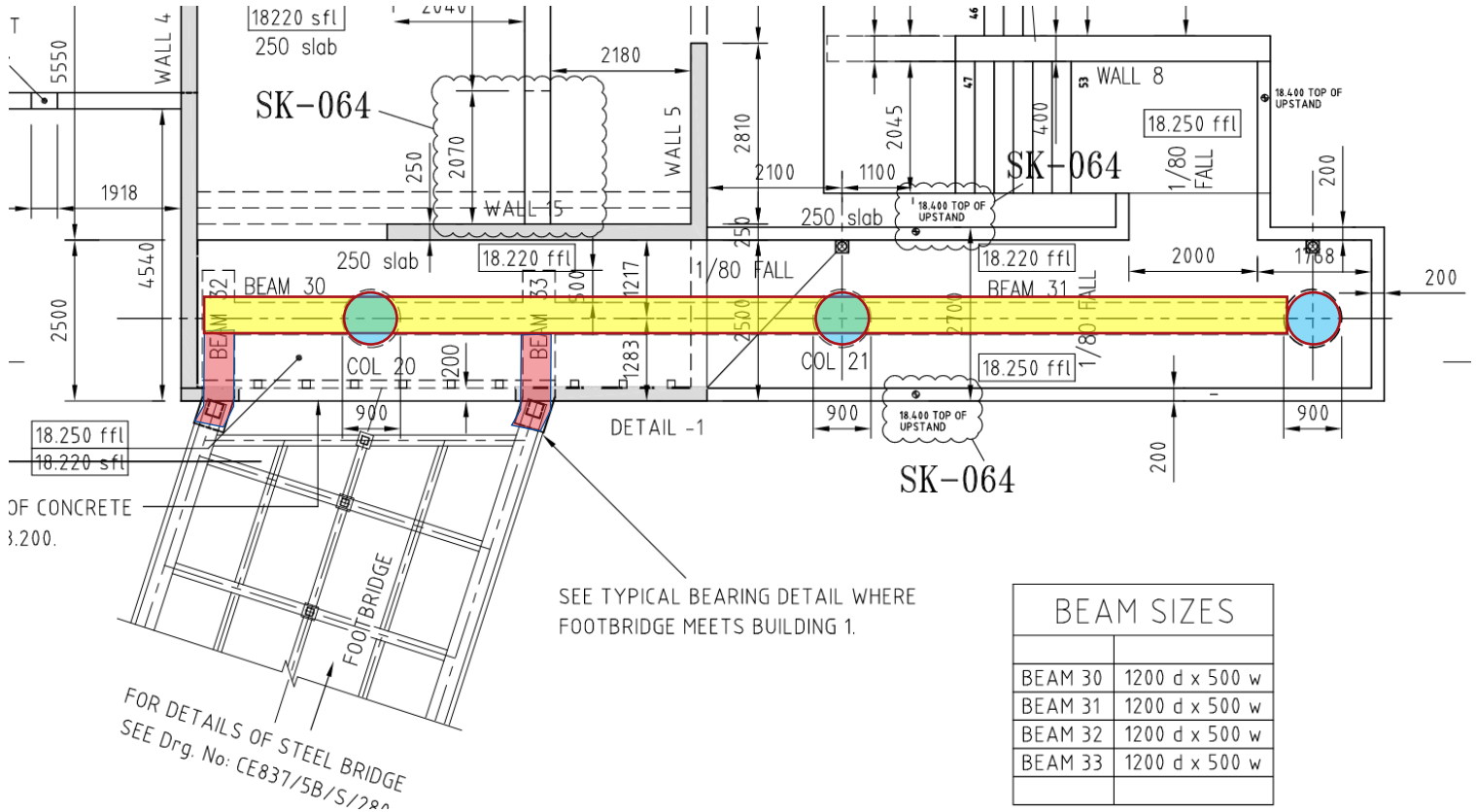
Steelwork roof to stair and lift core to the Donaghmede Entrance

Appendices

Appendix B - Station Entrances Existing Structural System

Donaghmede Entrance - Footbridge Support

The footbridge is supported by two RC cantilevering 1200 mm deep and 500 mm wide corbels (highlighted in red) extending from a main RC spine beam (highlighted in yellow), also 1200 mm deep and 500 mm wide. This beam is supported by three 900 mm diameter RC columns.



BEAM SIZES	
BEAM 30	1200 d x 500 w
BEAM 31	1200 d x 500 w
BEAM 32	1200 d x 500 w
BEAM 33	1200 d x 500 w

Donaghmede Entrance Footbridge Support

Appendices

Appendix B - Station Entrances Existing Structural System

Donaghmede Entrance - Footbridge Support

The main spine beam is connected to the 250 mm thick RC slab with no joints between the two. The slab and main spine beam are isolated with joints from some, but not all walls.

The corbels supporting the footbridge are isolated from the RC wall around them with a joint.

It is noted that this system of the footbridge support has many unusual features:

1. System relies on torsional resistance of a RC beam which is unusual in structural design as torsional stiffness can significantly change due to cracking
2. Structural separation by joints is not complete and can result is unpredictable load transfer and load paths
3. The RC slab is 250 mm thick and is flexible relative to the 1200 mm deep main beam. Hence slab ability to transfer beam torsion to the slab supporting columns and walls is low
4. As a result all three large columns are necessary to resist the torsional beam effects

Donaghmede Entrance - Joints of footbridge support

Donaghmede Entrance - Joint around corbel supporting footbridge

Appendices

Appendix B - Station Entrances Existing Structural System

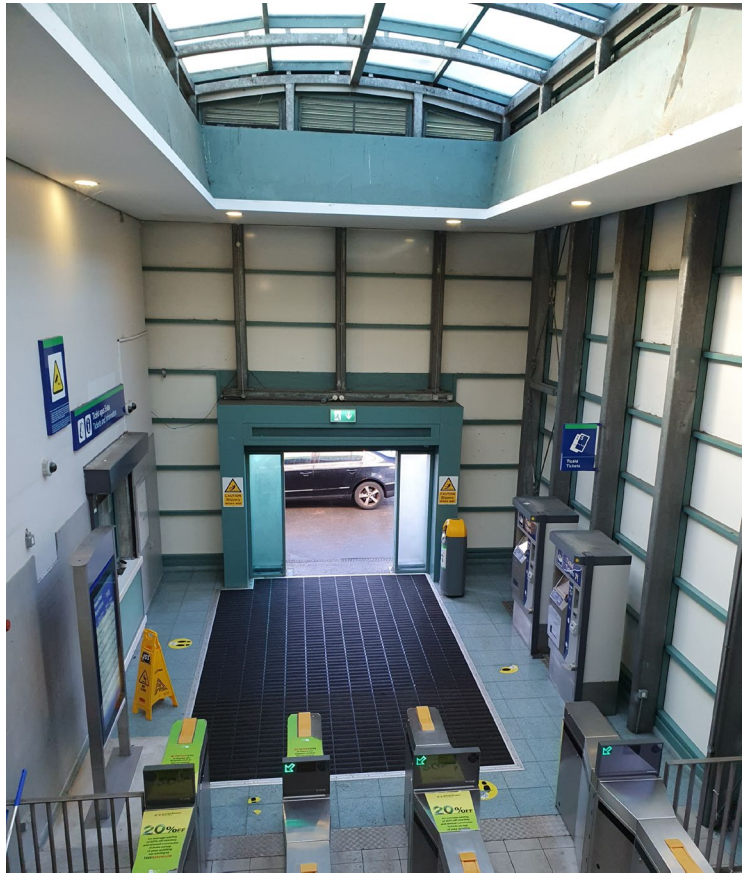
Donaghmede Entrance - Ticket hall

The ticket hall structure is made from steel columns and roof. The steel columns extend over the two external sides of the ticket hall and are made from 250x150x10 RHS sections and spaced at typical 1500 mm spacing. These seem to be supported on the mass concrete foundation. The internal walls are made from RC and are supported on RC pad foundations.

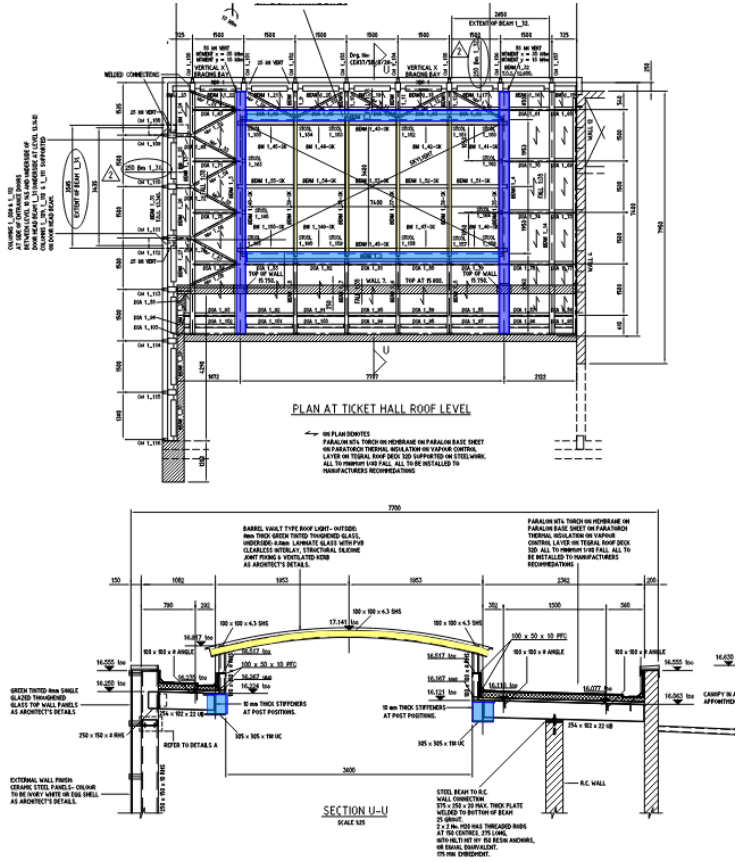
The roof is partly glazed to form a sky light. This is made from curved steel 100x100x6.3 SHS beams, highlighted in yellow, spanning the short width of 3600 mm. These beams are supported on vertical 100x100x8 SHS short columns which in turn are supported on 7500 mm long secondary beams made from 305x305x118 UC sections, highlighted in light blue.

The secondary beams are supported on primary beams, made from similar section and spanning in the other direction, highlighted in dark blue.

The two primary beams are supported on the steel columns from one side and on a RC wall on the other side.



Donaghmede Entrance - Ticket Hall



Donaghmede Entrance - Steel roof of Ticket Hall

Appendices

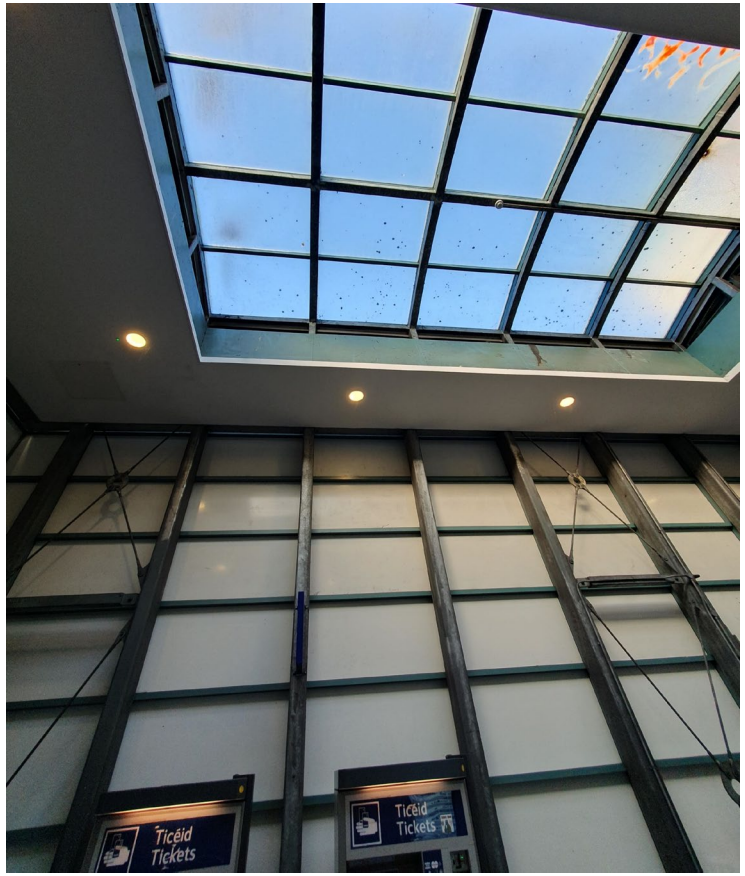
Appendix B - Station Entrances Existing Structural System

Donaghmede Entrance - Ticket hall

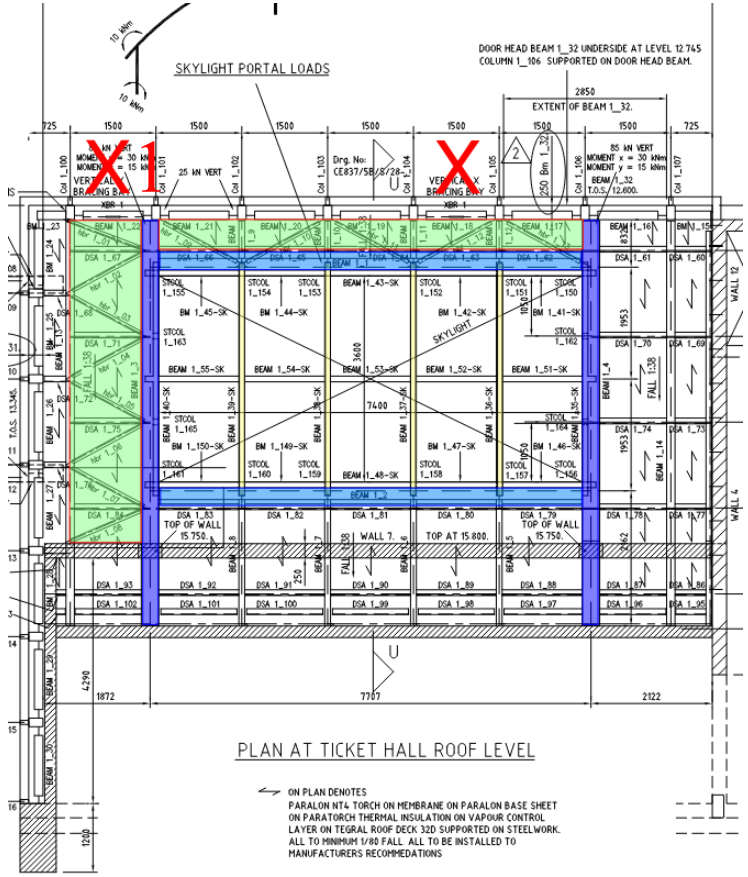
The lateral stability of the steel roof and columns is provided by two horizontal trusses at the flat part of the roof, highlighted in green.

The lateral stability of the external columns is provided by vertical cross braced bays, marked by red X.

The location of one of the roof horizontal trusses is aligned with the vertical cross braced bay X1. This continuity of the bracing system provides a direct load path of the roof bracing down to the foundations.



Donaghmede Entrance - Vertical bracing of ticket hall



Donaghmede Entrance - Roof horizontal bracing of ticket hall

Appendices

Appendix B - Station Entrances Existing Structural System

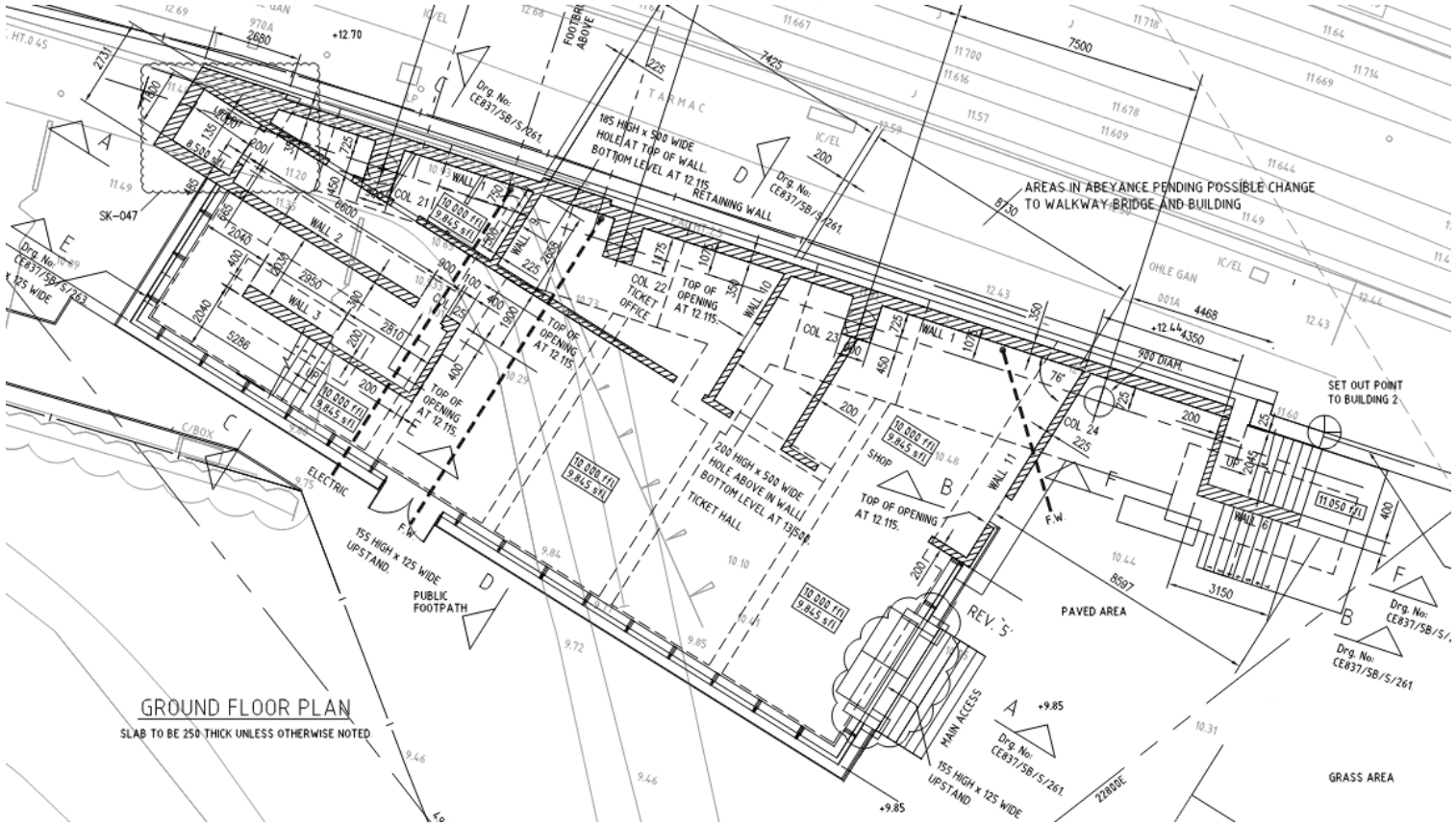
Kilbarrack Entrance - General Arrangement

To a large extent, the overall general arrangement of Kilbarrack entrance building is similar to that at the Donaghmede entrance.

The building provides direct access to Platform 1 and to other platforms by means of the footbridge. The building comprised an entrance to the station with ticket office and other service rooms. An internal stair and lift provide access to Platform 1 level and to the footbridge level. An external stair provides access to the platform and footbridge also.

The building structure is made from steel columns and roof for the Ticket Hall and RC walls, beams and slabs elsewhere. All of the structure is supported on RC pad foundations.

General arrangement of Kilbarrack entrance building



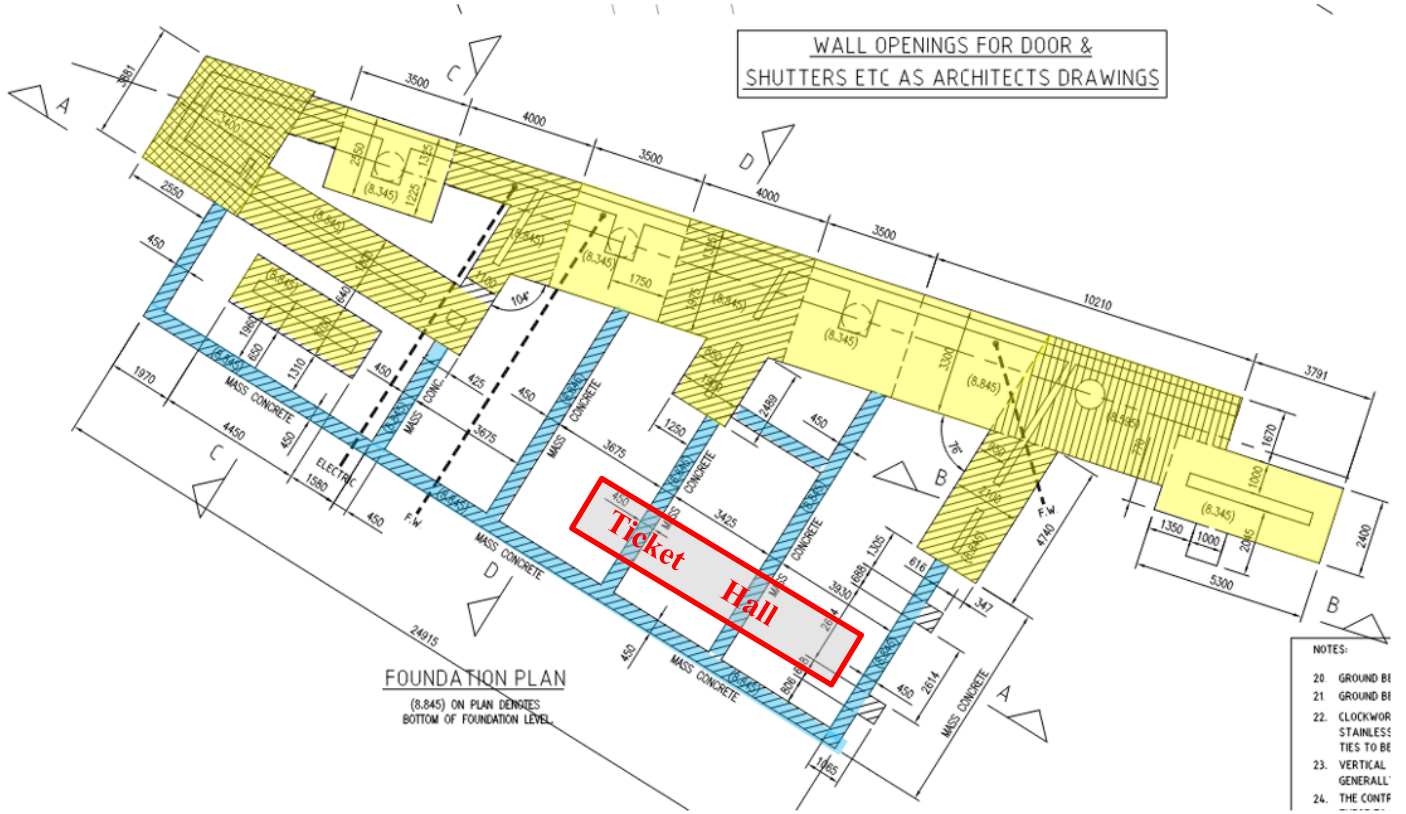
Appendices

Appendix B - Station Entrances Existing Structural System

Kilbarrack Entrance - Foundation

The building structure is made from steel columns and roof for the ticket hall at the building entrance and reinforced concrete for the walls, beams and slabs. The structure is supported on RC pad foundations. Similar to the Donaghmede entrance building, the steel columns supporting the glazes roof over the ticket hall and other minor foundations are made from mass concrete, highlighted in blue in the foundation layout figure. All other major foundations, highlighted in yellow, are made from RC.

Existing foundation of Kilbarrack Entrance building



Appendices

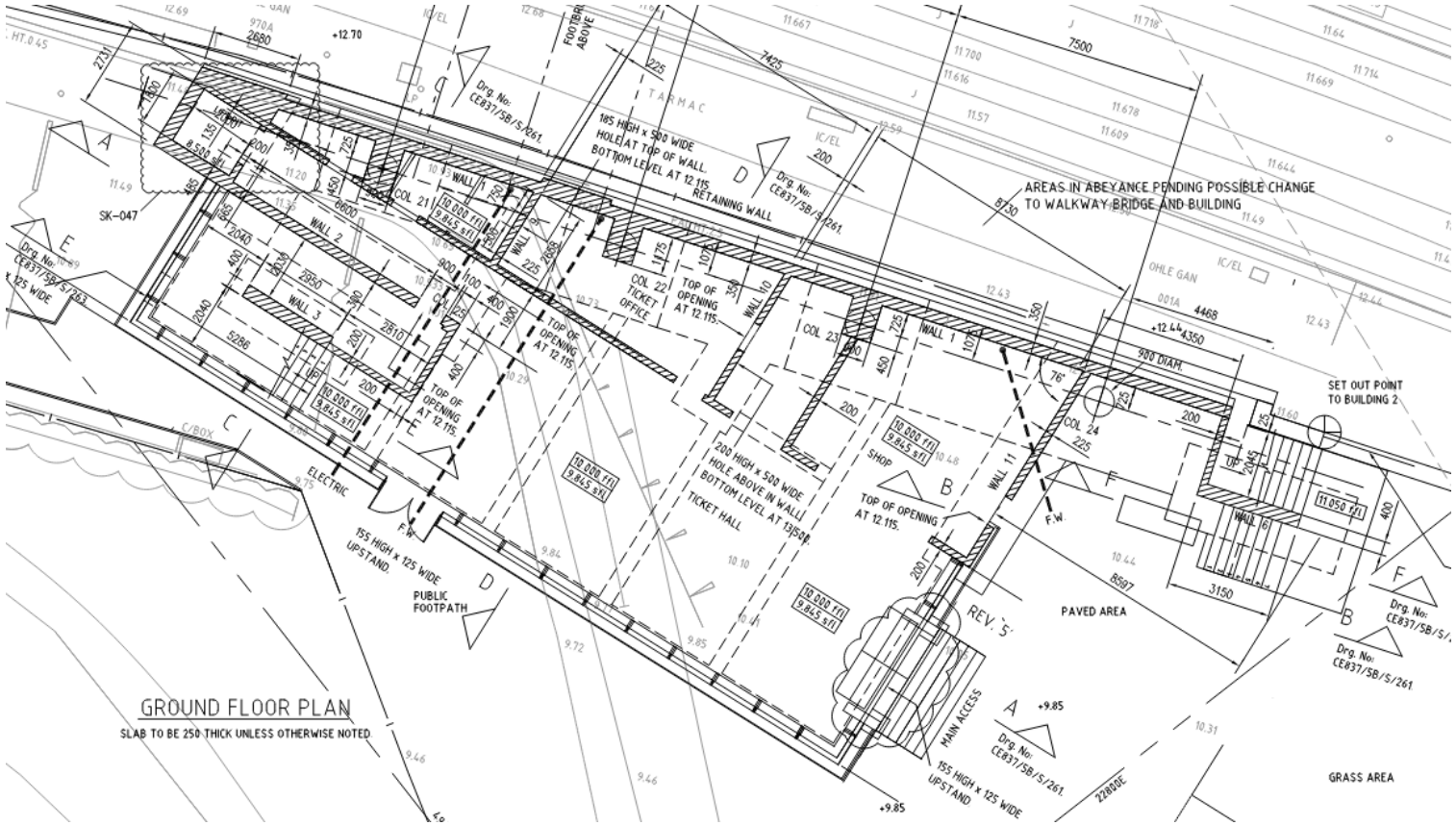
Appendix B - Station Entrances Existing Structural System

Kilbarrack Entrance - RC walls, slabs and stairs-Ground level

The general arrangement of the RC walls at the ground floor (level +10.000 m) is shown in the figure. RC wall thicknesses vary from a minimum of 200 mm for minor internal walls to 400 mm for main walls. However, most of the major walls are 225 mm thick.

The two stairs are supported on 400 mm thick RC walls which are supported by RC pad foundations.

RC walls at ground level



Appendices

Appendix B - Station Entrances Existing Structural System

Kilbarrack Entrance - RC walls, slabs and stairs-Platform level

At the platform level, most of the walls at ground level continue above the platform structural level (+12.740 m).

The RC slabs at the platform level is typically 250 mm thick and extends over the area highlighted in blue. The slab is supported by the walls and columns below.

The two stairs, one internal and another external are highlighted in yellow and are supported by 400 mm thick RC walls.

RC walls and slabs at platform level

Appendices

Appendix B - Station Entrances Existing Structural System

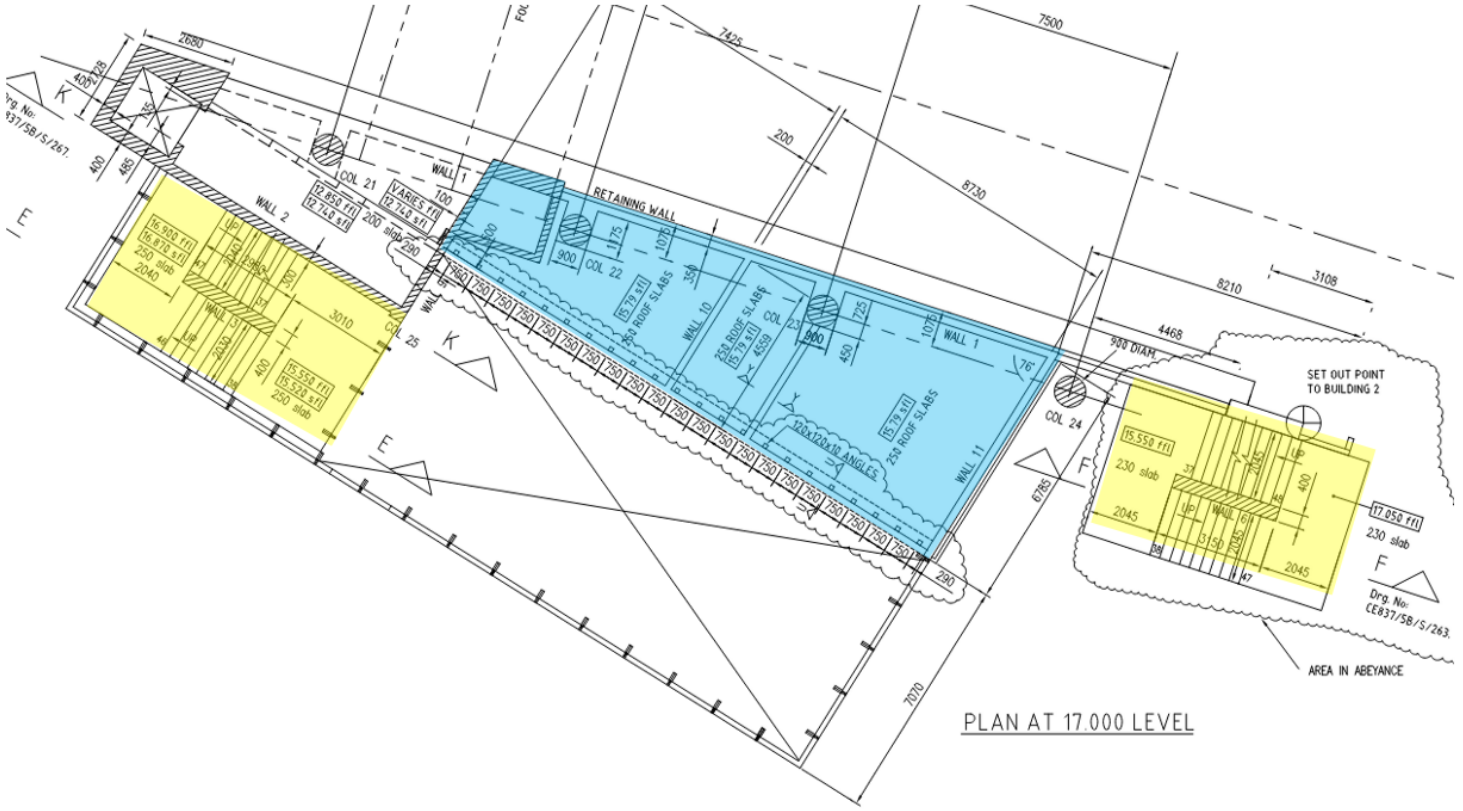
Kilbarrack Entrance - RC walls, slabs and stairs-Level +17.000 m

At the platform level, most of the walls at ground level continue above the platform structural level (+12.740 m).

The RC slabs at the platform level is typically 250 mm thick and extends over the area highlighted in blue. The slab is supported by the walls and columns below.

The two stairs, one internal and another external are highlighted in yellow and are supported by 400 mm thick RC walls.

RC walls and slabs at level +17.000 m



Appendices

Appendix B - Station Entrances Existing Structural System

Kilbarrack Entrance - RC walls, slabs and stairs- Footbridge level

At the footbridge level, mostly at +18.250 m, less number of walls extend above the footbridge level. The walls maintain their thickness as they extend upwards.

The RC slabs at the footbridge level is typically 250 mm thick and extends over the area highlighted in blue. The slab is supported by the walls, beams and columns below.

The two stairs, one internal and another external are highlighted in yellow and are supported by 400 mm thick RC walls.

RC walls and slabs at Footbridge level

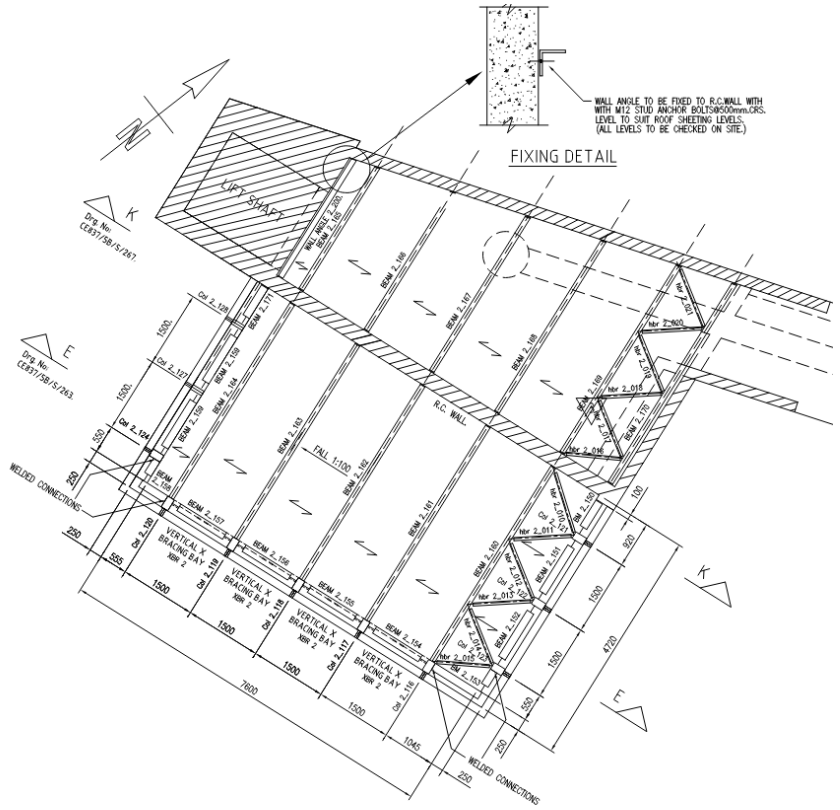
Appendices

Appendix B - Station Entrances Existing Structural System

Kilbarrack Entrance - RC walls, slabs and stairs-Roof to stair and lift core

At roof level of the stair and lift core, a light weight roof metal decking is supported by an arrangement of steel beams which are supported on RC walls and steel columns. Horizontal bracing is added to provide in-plane stability to the roof.

Steelwork roof to stair and lift core



PLAN AT STAIRCASE 3 ROOF LEVEL
(ROOF SHEETING TO ARCHITECTS REQUIREMENTS.)

Appendices

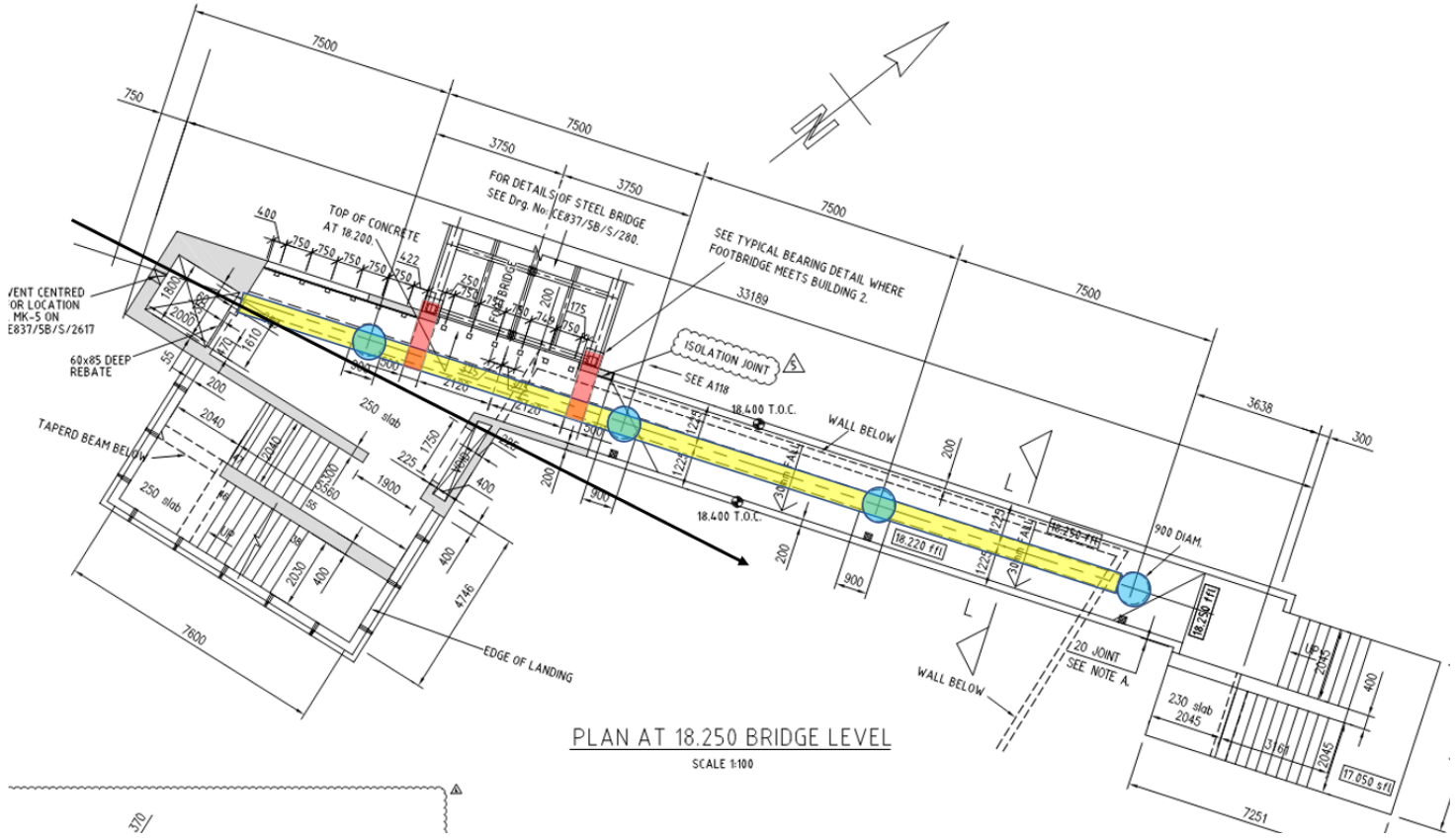
Appendix B - Station Entrances Existing Structural System

Kilbarrack Entrance - Footbridge support

The footbridge is supported by two RC cantilevering 1200 mm deep and 500 mm wide corbels (highlighted in red) extending from a main RC spine beam (highlighted in yellow), also 1200 mm deep and 500 mm wide. This beam is supported by four 900 mm diameter RC columns and the lift core.

It is noted that the same comments previously stated on the Footbridge support system at Donaghmede Entrance building are also applicable to this building.

Footbridge support



Appendices

Appendix B - Station Entrances Existing Structural System

Kilbarrack Entrance - Ticket hall

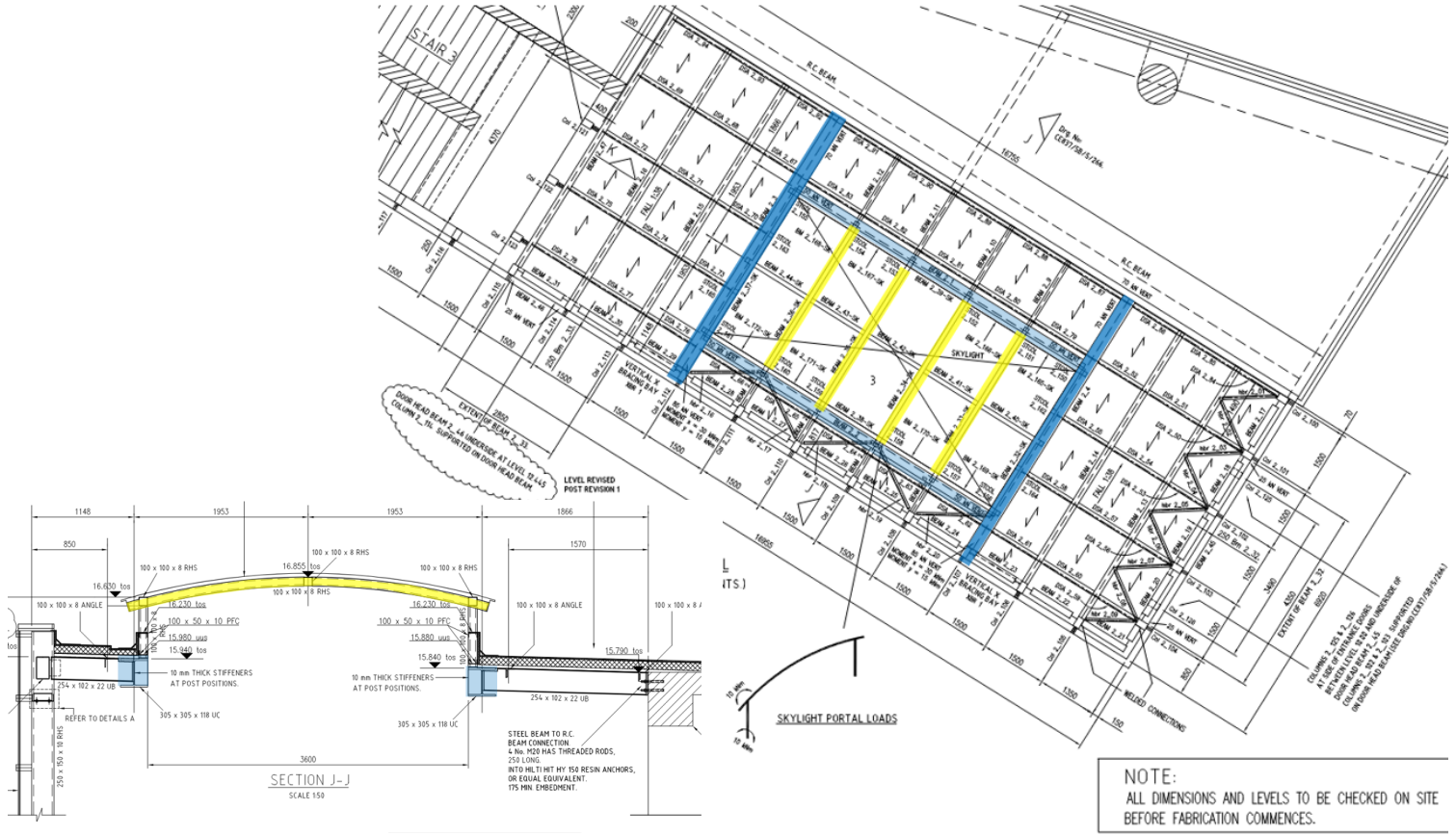
The ticket hall structure is made from steel columns and roof. The steel columns extend over the two external sides of the ticket hall and are made from 250x150x10 RHS sections and spaced at typical 1500 mm spacing. These seem to be supported on the mass concrete foundation. The internal walls are made from RC and are supported on RC pad foundations.

The roof is partly glazed to form a sky light. This is made from curved steel 100x100x8 SHS beams, highlighted in yellow, spanning the short width of 3600 mm. These beams are supported on vertical 100x100x8 SHS short columns which in turn are supported on 7500 mm long secondary beams made from 305x305x118 UC sections, highlighted in light blue.

The secondary beams are supported on primary beams, made from similar section and spanning in the other direction, highlighted in dark blue.

The two primary beams are supported on the steel columns from one side and on a RC wall on the other side.

Ticket Hall steel roof



Appendices

Appendix B - Station Entrances Existing Structural System

Kilbarrack Entrance - Ticket hall

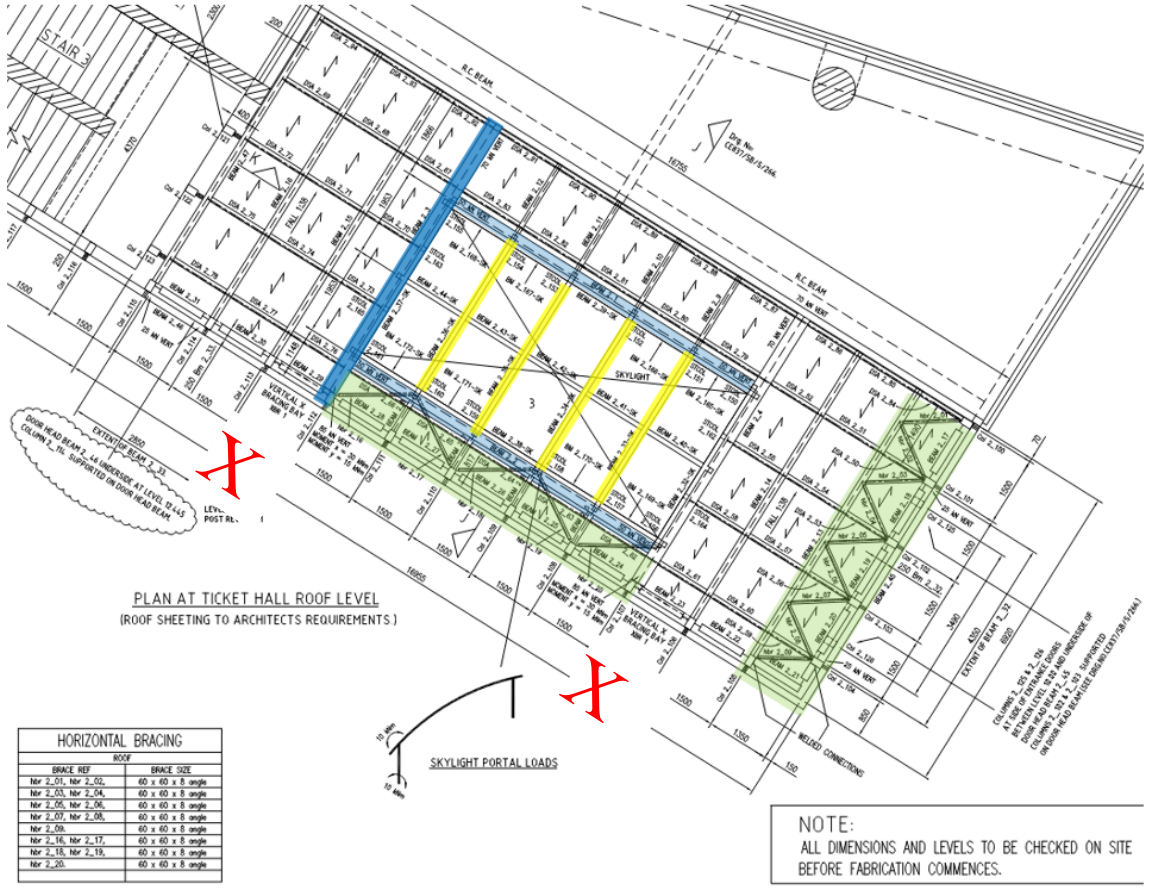
The lateral stability of the steel roof and columns is provided by two horizontal trusses at the flat part of the roof, highlighted in green.

The lateral stability of the external columns is provided by vertical cross braced bays, marked by red X.

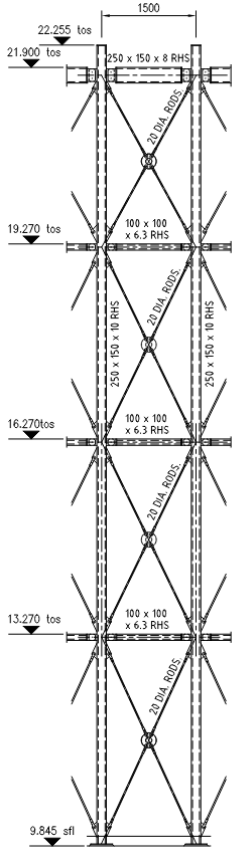
The combined horizontal and vertical bracing system, provides the required stability to the steel roof structure.

The vertical bracing is made by adding cross-bracing diagonal members made from 20 mm diameter rods. These run between two 250x150x10 RHS columns and 100x100x6.3 horizontal members.

Roof horizontal bracing of Ticket Hall



Vertical bracing of Ticket Hall



Appendices

Appendix C - Summary of Ground Conditions

Geology:

The EPA National Soil and the GSI Quaternary sediment mapping indicates the widespread presence of Made Ground, and Till derived from Limestones (potentially underlying the made Ground). Gravels derived from Limestones are noted to the north-east and recent sediments such as alluvial deposits were noted including an alluvium channel running west-east through the station.

Additionally, the GSI Quaternary geomorphology mapping shows a landform classified as a mega scale glacial lineation was identified to the north. The historic British Geological Society (BGS) geological map series (Wilson *et al*., 1859, 1901 & 1902) show that the site sits on boulder clay containing much limestone over lower Limestone formation.

GSI bedrock mapping shows that the site overlays the boundary of the Tober Colleen formation (calcareous shale, limestone conglomerate) and of the Lucan Formation (dark limestone and shale (calp)). GSI GeoUrban depth to bedrock (Dublin County) mapping shows that the bedrock depth is in the range 5m – 10m below ground level.

Dart Enhancement Howth Junction GI (IGSL, Report 9412, 2004):

At the existing Howth Junction Station, an historic ground investigation (GI) was completed by IGSL in 2004, see Figure B-1. This comprised three cable percussion boreholes, a GPR survey of existing culvert (not available at the time of writing) and laboratory testing.

The investigation identified the presence of up to 1.5m of Made Ground overlying firm to hard fine grained glacial Clay deposits. One borehole, located at the existing central bridge pier between the Dundalk line and the Howth lines, identified Made Ground to a depth of 5.5m BGL. The depths of the glacial deposits have not been proven, with boreholes terminating at 6.0 to 10.5m BGL. No rotary drilling was completed to confirm bedrock levels and no groundwater monitoring information is available.

Table C-1 (see next page) provides a preliminary ground model for the station area.

DART+ Coastal North Stage A GI

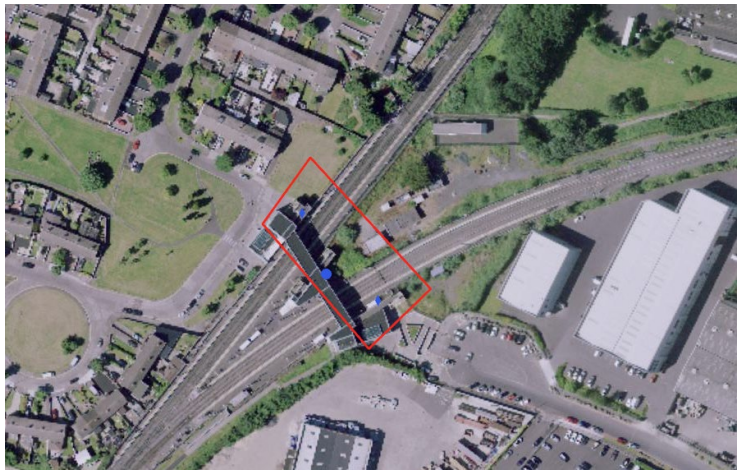
As part of the DART+ Coastal North Stage A GI (NA GI) contract, GI works were specified for the proposed platform extension 90-280m to the east of the existing platform.

No works were specified as part of the NA GI in the vicinity of the existing station structures or bridge.

Future GI

Based on the proposed works, a review of the available historic GI is required to assess any potential gaps in information required and additional ground investigation may be required to inform future design stages. Any additional ground investigation required will be completed as part of future stages of GI for the Northern Line.

Figure C-1: Historic IGSL (2004) GI locations



Appendices

Appendix C - Summary of Ground Conditions

Strata	Depth to Top of Strata (mGBL)	Thickness (m)
Donaghmede and Kilbarrack areas		
Topsoil	0.0	0.2
Made ground consisting of sand, clay, plastic and red brick	0.2	0.8-1.3
Firm to stiff sandy gravelly Clay	1.0-1.5	1.0-2.0
Very stiff/Hard sandy gravelly Clay with cobbles and boulders	2.0-3.5	3.3-3.9, thickness not proven
Central Platform area		
Made ground consisting of sand, clay concrete, ash, timber and red brick	0.0	5.5
Hard sandy gravelly Clay with cobbles and boulders	5.5	10.5, thickness no t proven

Table C-1: Preliminary design ground model (based on IGSL 2004)

Appendices

Appendix D - Howth Junction & Donaghmede Station | Fire Strategy Note

Contents

Tables

Figures

1. Introduction

This document sets out the Fire Safety Principles for the modification works to Howth Junction. The intent of this document is to provide an overview of the Fire Strategy principles for design development purposes. The level of detail is considered commensurate with the stage of preliminary design outlining key fire safety principles and mitigation measures. The purpose of the report is to:

- Define the fire safety goals,
- Outline the fire strategy design basis (local and client requirements), and
- Outline the fire strategy principles at this stage of design.

This report should be read in conjunction with the preliminary design report covering the platform works required at the station - see D+WP56-ARP-P3-NL-RP-CX-000030 Howth Junction and Donaghmede Station Platform and the fire strategy design report covering at the platform 2 of Howth Junction – see D+WP56-ARP-P3-NL-RP-FI-000003.

The requirements of the Fire Services Act 1981 & 2003 and Safety, Health & Welfare at Work Act 2005 apply.

The recommendations contained within the following sections of this report, are therefore considered as a reasonable interpretation of the above Acts with respect to demonstrating how compliance can be achieved. To establish a benchmark, we have adopted relevant recommendations from the guidance documents outlined below:

- Technical Guidance Document Part B (TGD B)
- Guidance for Fire Precautions on Existing British Rail Surface Stations, 1993 (GFP – EBRSS)

In addition to the above guidance document, the following previously approved report by Iarnrod Eireann was considered:

- Fire Risk Assessment - Howth Junction Train Station issued on 23/12/2016 (mentioned within this document as FRA).

The findings in this note solely focus on the new concourse area and station building design as described in Section 1.1.2. A separate fire safety strategy design report will cover the platform of Howth Junction. The design principles for Emergency Lighting, Portable Fire Extinguishers, Emergency Escape Signs, and Wayfinding are set out in the previous fire risk assessment report noted above and are unchanged for the purpose of this overview of principle provisions. It is noted that the previous FRA outlined two intolerable risk items which are management items as opposed to design items (i.e., fire safety management panel and faulty fire alarm panel) that needed to be addressed. IR to confirm that these risks are addressed as they are not part of this assessment on layout provisions of new renovation design.

In the next design phases, once the proposed changes have been identified in full, a revised fire safety certificate application (FSC) will be required for the new proposed station buildings (Donaghmede and Kilbarrack entrances) due to the change in floor area/material changes.

Once the station improvements work has reached preliminary design stage, the platform report will be updated to holistically address both the station building and platform fire safety design requirements.

1.1 Building Overview

1.1.1 Proposed Additional Work

The proposed additional work for the Howth Junction station includes the modification of the existing railway station as shown Figure 1. Different renovation options have been outlined for the central platform connection staircase, Donaghemede and Kilbarrack Entrance and footbridge connecting both entrances. The

principles outlined in this note are not impacted by the different stair geometries proposed. As a result, the recommendations outlined in this note apply to all potential options.

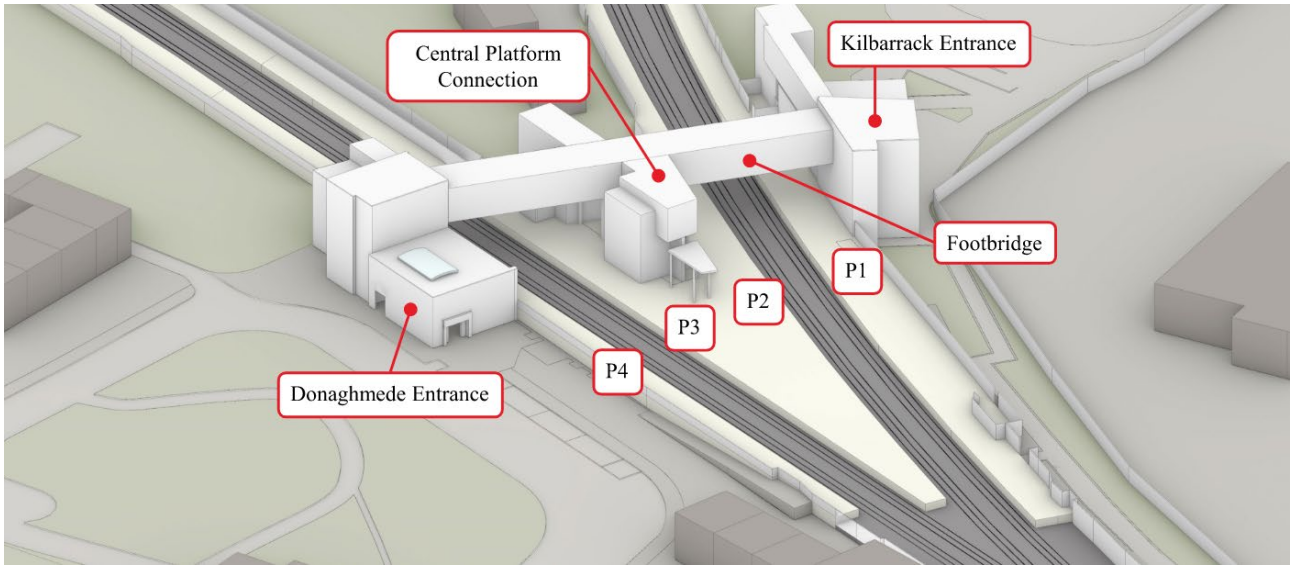


Figure 1 Howth Junction Proposed Work

1.1.2 Station description

The points are summarising key station items which are pertinent to this report.

1. **Concourse area** considered as following areas:
    - Footbridge above platforms which is connecting both the entrances.
    - Staircase from Donaghmede connecting to the footbridge.
    - Staircase from Kilbarrack connecting to the footbridge.
    - Staircase connecting the central platform to the footbridge.
2. **Station building**- Both the Donaghmede and Kilbarrack Entrances have a separate building with a small ticket office and ancillary accommodation.

2. Egress Strategy

Provisions for means of escape will be designed in accordance with Table A Guidance for Fire Precautions on Existing British Rail Stations (GFP – EBRSS) for the concourse. Internal accommodation which forms part of the station building will be assessed in accordance with the relevant recommendations in TGD B.

2.1 Concourse Egress

The escape assessment has been carried out on the basis of flow rates attained from the relevant guidance documents and exit component widths measured.

The flow rates are based on the following:

- Recommendations within London Underground Station Planning Standard (ref 1-371) has been applied (50 person/min) for evacuation flow through ticket gates.
- 60 person/min/unit width flow rates for flat surfaces as recommended in GFP – EBRSS. Each unit width is 0.55m.

- 40 person/min/unit width flow rates for stairs and sloped surfaces as recommended in GFP – EBRSS. Each unit width is 0.55m.

As per previous FRA report, Irish Rail advised the crush load per train the worst-case crush loaded train has capacity for 1600 persons (8 carriage train at 200 persons / carriage). For the purposes of this assessment, an approximate estimated occupancy has been considered based on a crush loaded train entering the platform as well as passengers equating to 50% of a crush loaded train waiting on the other platforms (a total number of 2400 people). This is considered to be a conservative assumption.

There are two worst-case credible scenarios that have been analysed for the scope of this note.

1. Fire at the Donaghmede entrance - there will only be one staircase available from the Kilbarrack entrance to evacuate the occupants, as the staircase at the Donaghmede entrance will be assumed to be discounted due to the fire.
2. Fire at the Kilbarrack entrance - Similarly, fire breaks out in Kilbarrack Entrance, the staircase in Donaghmede will be available for evacuation while the staircase in Kilbarrack Entrance will not be accessible due to the fire.

The calculated evacuation time for both scenarios, as shown in Table 1, is expected to be 13 minutes and 45 second which exceeds the maximum recommended time of 8-12 minutes.

Table 1 Evacuation time calculation for fire scenarios

Fire Scenarios	Exit components Available	Occupants (no. of people)	Available Exit Width (m)	Discounted exit	Evacuation time
1) Fire at the Donaghmede Entrance	Staircase in Kilbarrack Entrance	2400	2.4	Staircase (2.4 m width) in Donaghmede Entrance	13 minutes 45 seconds
2) Fire at the Kilbarrack Entrance	Staircase in Donaghmede Entrance	2400	2.4	Staircase (2.4 m width) in Kilbarrack Entrance	13 minutes 45 seconds

Although this exceeds the maximum evacuation time of 8-12 minutes recommended by GFP – EBRSS, it is considered reasonable as in any potential fire scenario there will be an available escape remote from the fire. Additionally, it is considered highly unlikely that the entirety of the 2400 occupants will escape via this route when considering that there is an alternative means of escape from the platform, which will result in a shorter evacuation time. These alternative exit routes from the platform are one ramp at the one end of platform 2 and an exit gate off platform 3. These alternative routes lead to locations off the platforms, outside the station. Please refer to Howth Platform fire safety strategy design report for further clarifications with regards to egress routes off the platform 2.

It is noted that current effective stair width is indicatively cited as 2.4m. Under the recommendation of TGD B a central handrail should be provided This will be reviewed in further details at next design stage when stair width is finalized.

2.2 Station building Egress

The station building and associated accommodation (e.g., ticket office, shops, toilets, stores, building services rooms etc.) shall be designed in line with TGD B, 2006. In line with TGD B, the following recommendations for travel distances have been met:

- Single travel distance – 18m
- Alternative distance – 45m

For Donaghemede entrance building, the longest alternative travel distance is ~23.4m in line with TGD B. For Kilbarrack, the longest alternative travel distance is ~17.6m in line with TGD B.

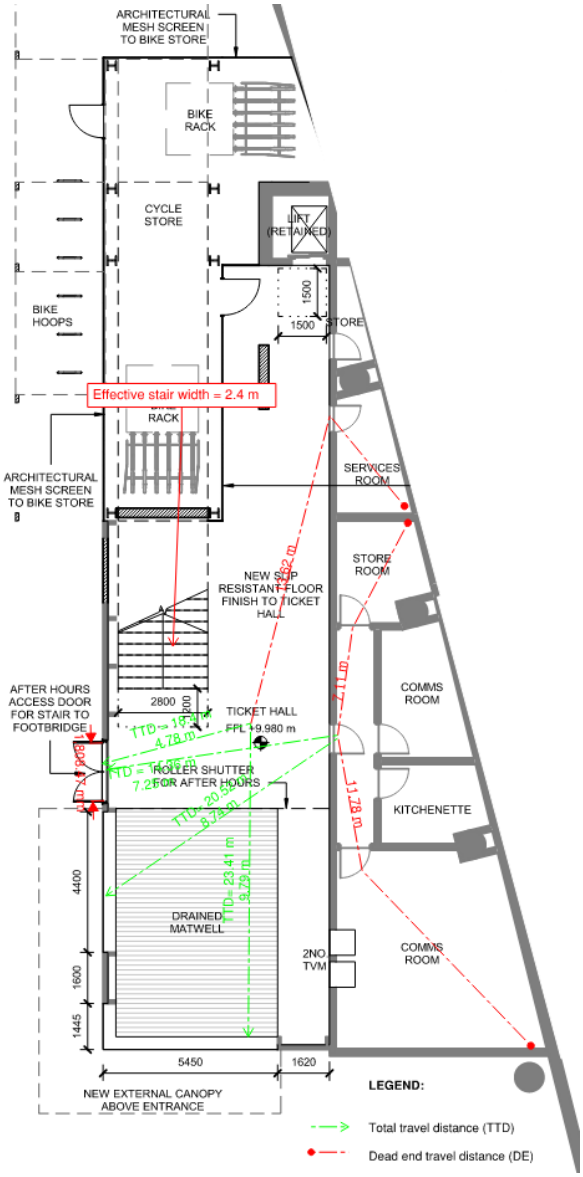


Figure 2 Kilbarrack Station Building

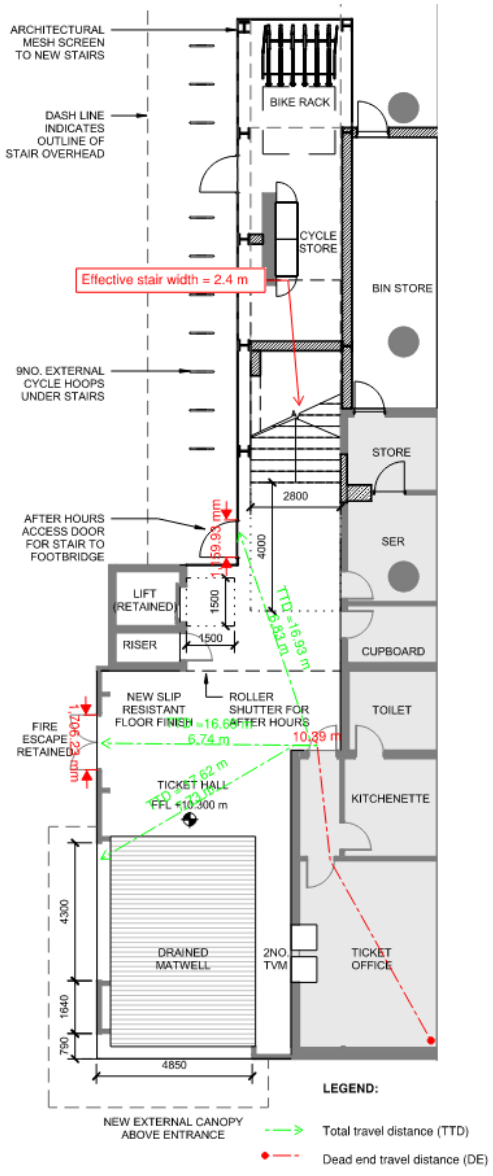


Figure 3 Donaghmede Station Building

2.3 Escape Capacity from other Accommodation

The occupancy numbers for ticket office and associated accommodation are relatively low i.e., less than 50. In accordance with TGD B, 2006 a door width of 750 mm from these rooms.

2.4 Concourse Area Exit Widths

When considering the egress route from the platform to the final exit via the concourse area, the proposed new route does not provide egress bottleneck/pinch points as there is no decrease of flow rate along the egress route as shown in Table 2. For this reason, the proposed egress routes are considered reasonable.

Table 2 Concourse area exit widths

Egress Element	Width (m)	Flow Rate (Person / min)
Central Platform Staircase	2.4	174.5
Footbridge	4.3	469
Staircase connecting Footbridge and entrances buildings	Kilbarrack Entrance - 2.4	174.5
	Donaghmede Entrance - 2.4	174.5
Final Exits (see Figure 2 and Figure 3)	Kilbarrack Entrance – 13	1418.2
	Donaghmede Entrance – 12.8	1396.3

2.5 General Exit Provisions

The following are key recommendations adopted from GFP – EBRSS and TGD B, 2006.

- Exits should open in the direction of escape and should be easily openable without the use of a key.
- Doors located on escape routes should be readily openable without the use of a key and should not be obstructed by security barriers or shutters. Gates or shutters are acceptable on escape routes provided that these are secured in the open position while the station is open to the public. These should be provided with appropriate signage. Additionally, gates and turnstile are to be size in accordance with the relevant standards and peak occupancy assessment.
- Any electrical operating ticket gates should be provided with fail safe opening systems to ensure that they open in an emergency and on power failure.

3. Internal Fire Spread (Structure)

3.1 Fire Resistance of Elements of Structure

The station comprises of two separate buildings at opposite sides of the station, connected to each other and the island platform by a footbridge over the tracks. All elements of structure supporting the footbridge above the tracks platforms and station buildings should achieve a minimum of 60 minutes fire resistance on account of this forming part of the building and escape route form the platform. This is in line with the original requirements outlined within the FRA report.

3.2 Openings in Vertical Bridge elevation

The existing bridge link is provided with a solid vertical elevation where openings are provided along one of the elevations for natural lighting. In the event of a carriage fire beneath the bridge, occupants are provided alternative exits off the island platform independent of the bridge.

In addition, with regards to potential smoke ingress, it is considered reasonable that occupants who are in transit on the bridge, will make their way off the bridge in a relatively short time frame in the event an incident occurs under the bridge (while pedestrians are in bridge transit). On this basis it is not proposed to alter the vertical elevation of the existing bridge walkway. This will be discussed in further detail with the AHJ on submission of the FSC application for the buildings changes.

3.3 Compartmentation and Fire-Resistant Construction

Compartmentation is used to prevent rapid fire spread which could trap occupants of the building and to prevent fire becoming too large and therefore more dangerous to attending fire fighters. The information in Table 3 Fire Resistant Construction below provides indicative recommendations on the compartmentation/

fire resistance requirements for different room usage in accordance with TGD B. A more detailed assessment of fire rating requirement will be carried out in next design stage.

Table 3 Fire Resistant Construction

Area	Typical Period of Fire Resistance	Fire Doors
Special fire risk rooms e.g. switch rooms, transformer rooms, etc	60 minutes	FD60s
Stores	30 minutes	FD30s

4. Emergency Lighting

In accordance with the Fire Service Act, the station building and external escape routes leading to place of safety should be provided with emergency lighting. This system, for the buildings/bridge area, should be designed, installed, and commissioned in accordance with IS 3217 as cited in TGD B. Furthermore, GFP – EBRSS recommends that all parts of the station premises used for means of escape and any fire safety exit signage or notices shall be provided with emergency lighting.

It should be noted that the platform is considered to be a place of relative safety (in line with GFP-EBRSS) in the event of a fire on train, on a platform or within the station building, albeit passengers should be able to escape from the platforms to outside the station premises. A more detailed review should be conducted to determine what additional external escape lighting is needed in the areas adjacent the final exit from the platforms or stations concourse where hazards are present i.e., traffic, trip and fall hazards etc. This recommendation is also in line with the requirements outlined within the FRA report.

5. Emergency Escape Signs and Wayfindings

In accordance with the requirements of IS 3217, GFP – EBRS and TGD B, Emergency exit signs should be provided to adequately indicated escape routes within station building/footbridge area (including escape route from external platforms). This is in line with the requirements outlined within the FRA report.

6. Portable Fire Extinguishers

It is recommended that portable fire extinguishers be installed and maintained in accordance with IS 291 2002 to comply with the Fire Services Act 1981 & 2003 and The Safety, Health, and Welfare at Work Act 2005.

In accordance with GFP – EBRS and the FRA report, it is recommended that portable fire extinguishers be installed and maintained in accordance with IS 291 2002 to comply with the Fire Services Act 1981 & 2003 and The Safety, Health, and Welfare at Work Act 2005. It is also recommended that they are not located in positions they can be easily tampered with due to anti-social behaviour.

7. Access and Facilities for the Fire Service

An emergency response pack should be available for the fire service on arrival. This should include plans of the building indicating all relevant information including escape routes, places of special fire risks, fire safety systems controls and communication systems, firefighting equipment, shut off devices. In unmanned stations this information should be displayed in a conspicuous position which will be accessible to the fire service. This is in line with the requirements outlined within the FRA report. Please also see D+WP56-ARP-P3-NL-RP-FI-000003 for other relevant commentary for the platforms.

Appendices

Appendix E - Constructability

Option 1

This assessment is based on progressing Option 1 for the Central Connection and both of the Station Entrances.

The fact that the existing lifts are not touched in Option 1 is the major difference between Option 1 and Option 2 for both the Donaghmede and Kilbarrack entrances.

Option 1 allows for continuity of access for people of reduced mobility between all platforms. In Option 2 the existing lifts must be demolished and built in a new location. This means that no matter how construction is phased lift access to the footbridge is lost during construction of the associated entrance stair and lift. Additionally,

there may be a need to provide a taxi service to people of reduced mobility who need to move between platforms 1 and 4.

If continuity of access to the footbridge is required Option 1 could be constructed in four main phases as follows:

1. Construct temporary stairs to footbridge at Donaghmede.

2. Demolish the existing:

a) Donaghmede internal and external stairs,

b) Central Access external stairs, and

c) Kilbarrack internal stairs.

3. Construct the:

a) new Donaghmede stairs,

b) new Central Access lift and stairs, and

c) new Kilbarrack stairs.

4. Demolish the existing:

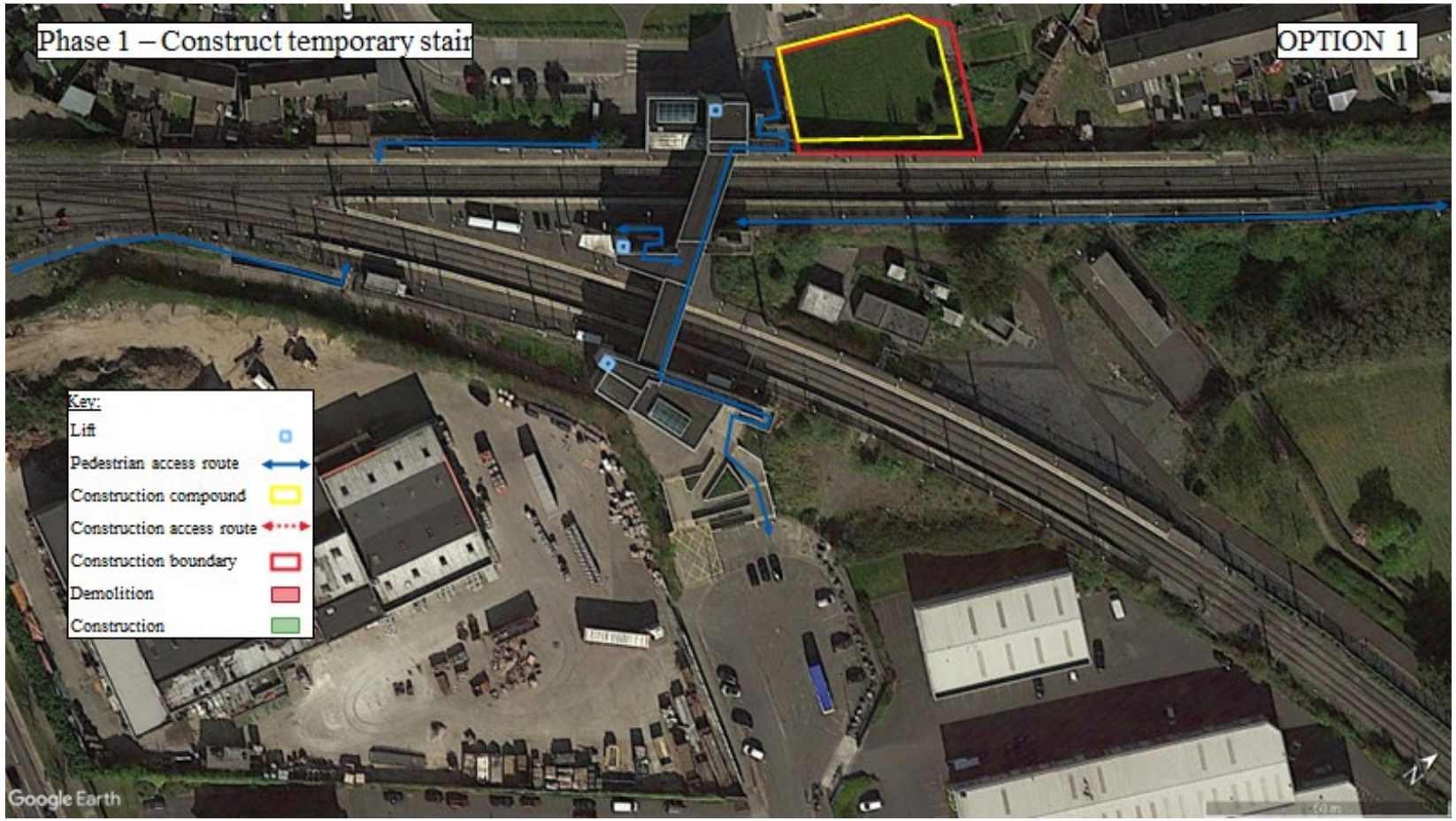
a) Central Access lift and internal stairs and

b) Kilbarrack external stairs.

These phases and the likely areas required for the works are depicted in the following figures. It would be preferable to carry out the proposed modifications to the footbridge following these phases to minimise damage to the new finishes from construction.

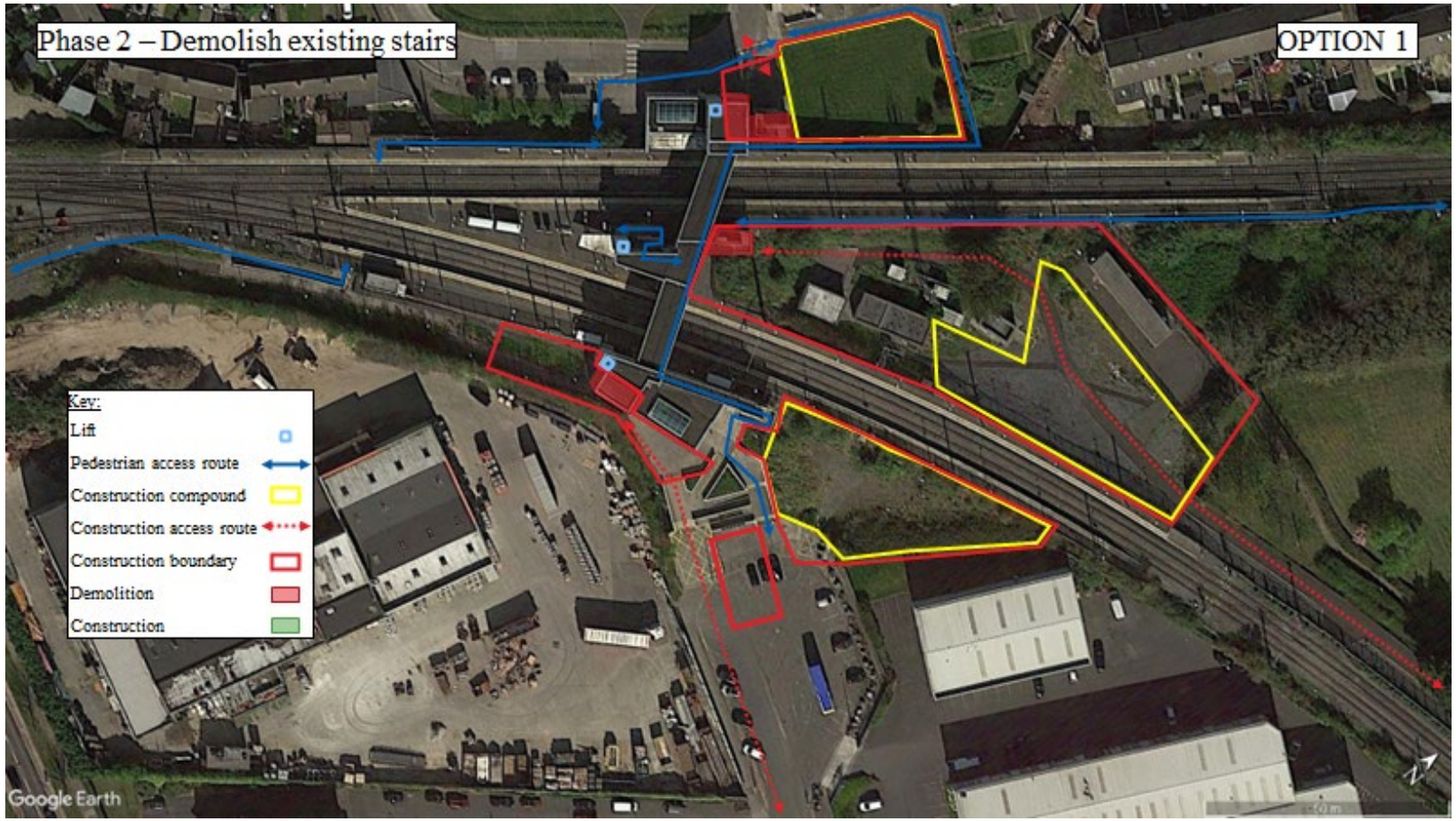
Appendices

Appendix E - Constructability



Appendices

Appendix E - Constructability

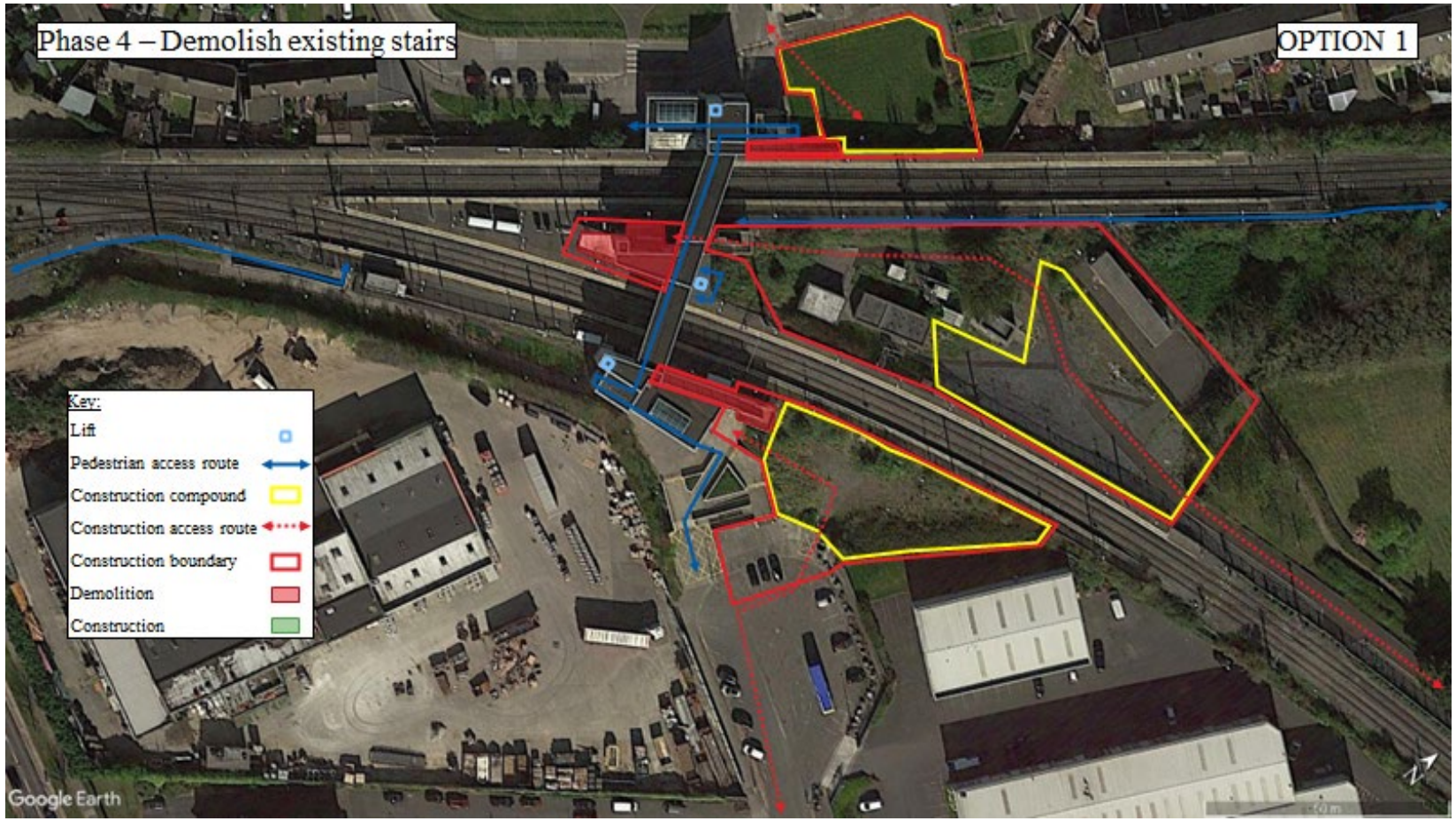


Appendices

Appendix E - Constructability

Appendices

Appendix E - Constructability



Appendices

Appendix E - Constructability

Option 2

If a route to Platforms 2&3 via the footbridge must be maintained for people of reduced mobility whilst constructing Option 2 six phases are likely to be required. These are as follows:

1. Construct temporary stairs footbridge on Platform 1.

2. Demolish the existing:

a) Donaghmede lift, internal and external stairs and

b) Central Access external stairs

3. Construct the:

a) new Donaghmede lifts and stairs,

b) new Central Access lift and stairs, and

c) a temporary access ramp to Platform 4 by the Kilbarrack entrance.

4. Demolish the existing:

a) Central Access lift and internal stairs and

b) Kilbarrack lift and intenal stairs.

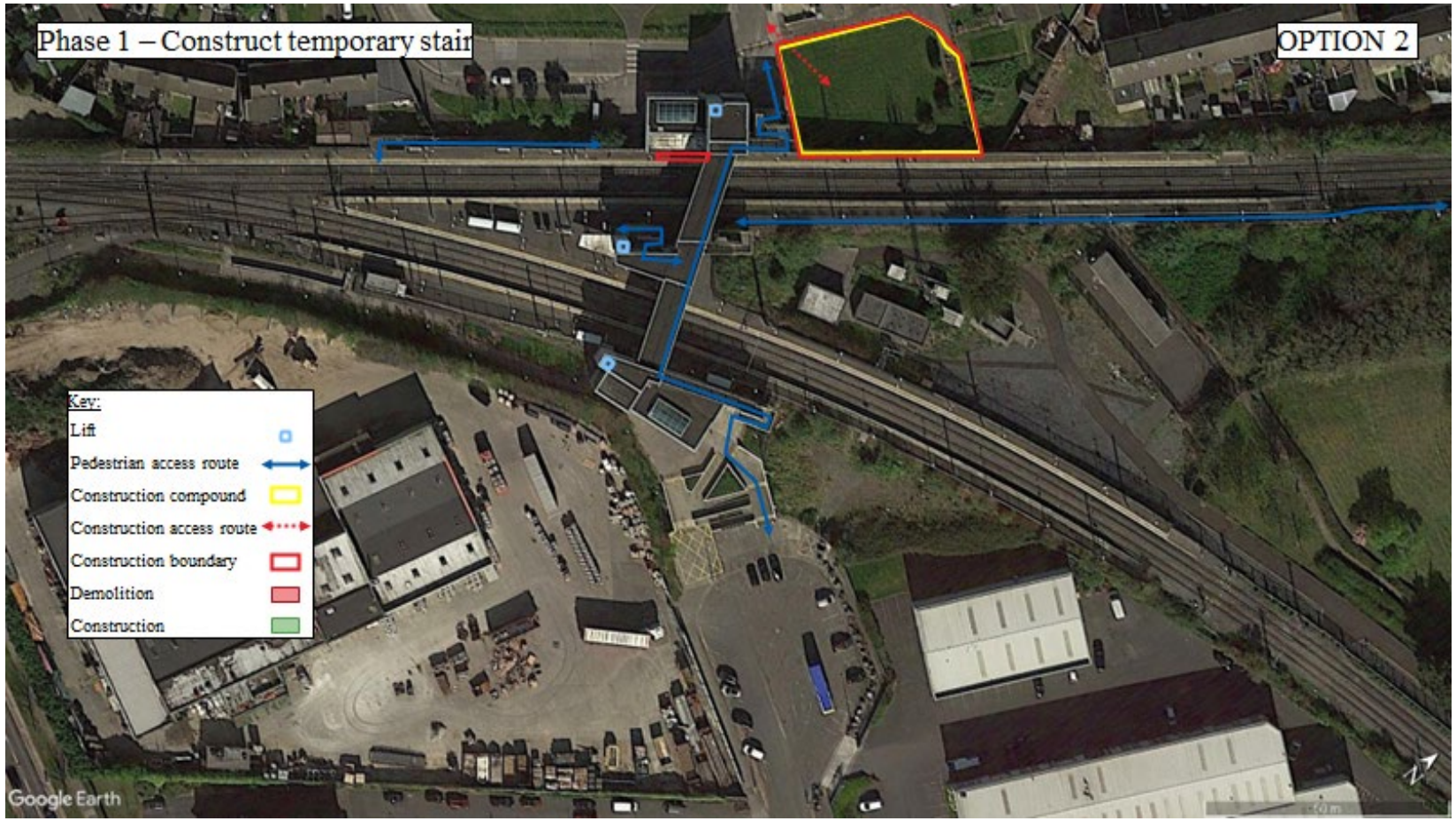
5. Construct the new Kilbarrack lift and stairs.

6. Demolish the existing Kilbarrack external stairs.

The additional phasing will likely extend the programme by 50%. The above phases and the areas that could be required for the works are depicted in the following figures. As with Option 1 it would be preferable to carry out the proposed modifications to the footbridge following these phases to minimise damage to the new finishes from construction. Work could be supported by any of the proposed compounds.

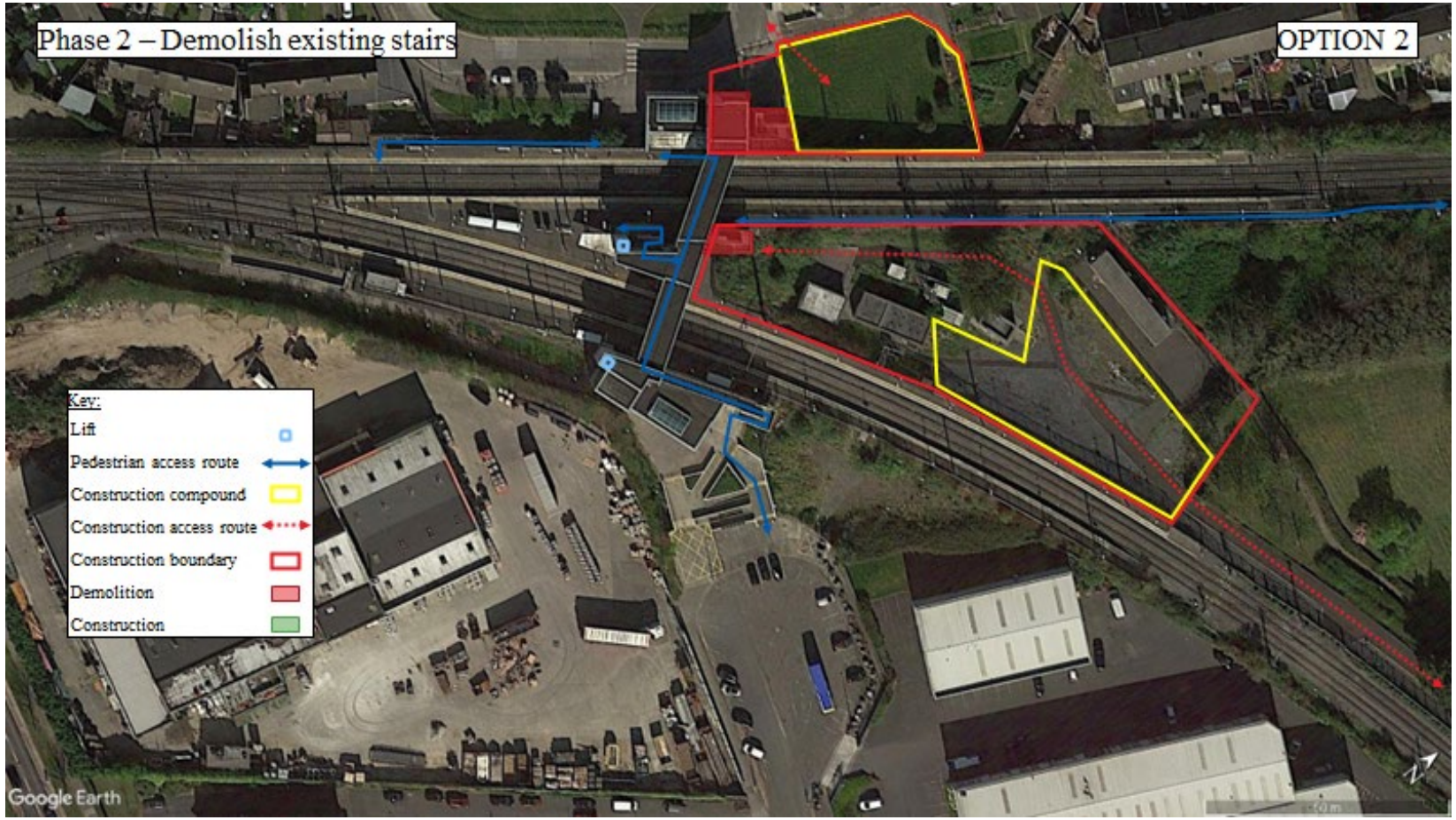
Appendices

Appendix E - Constructability



Appendices

Appendix E - Constructability



Appendices

Appendix E - Constructability

Appendices

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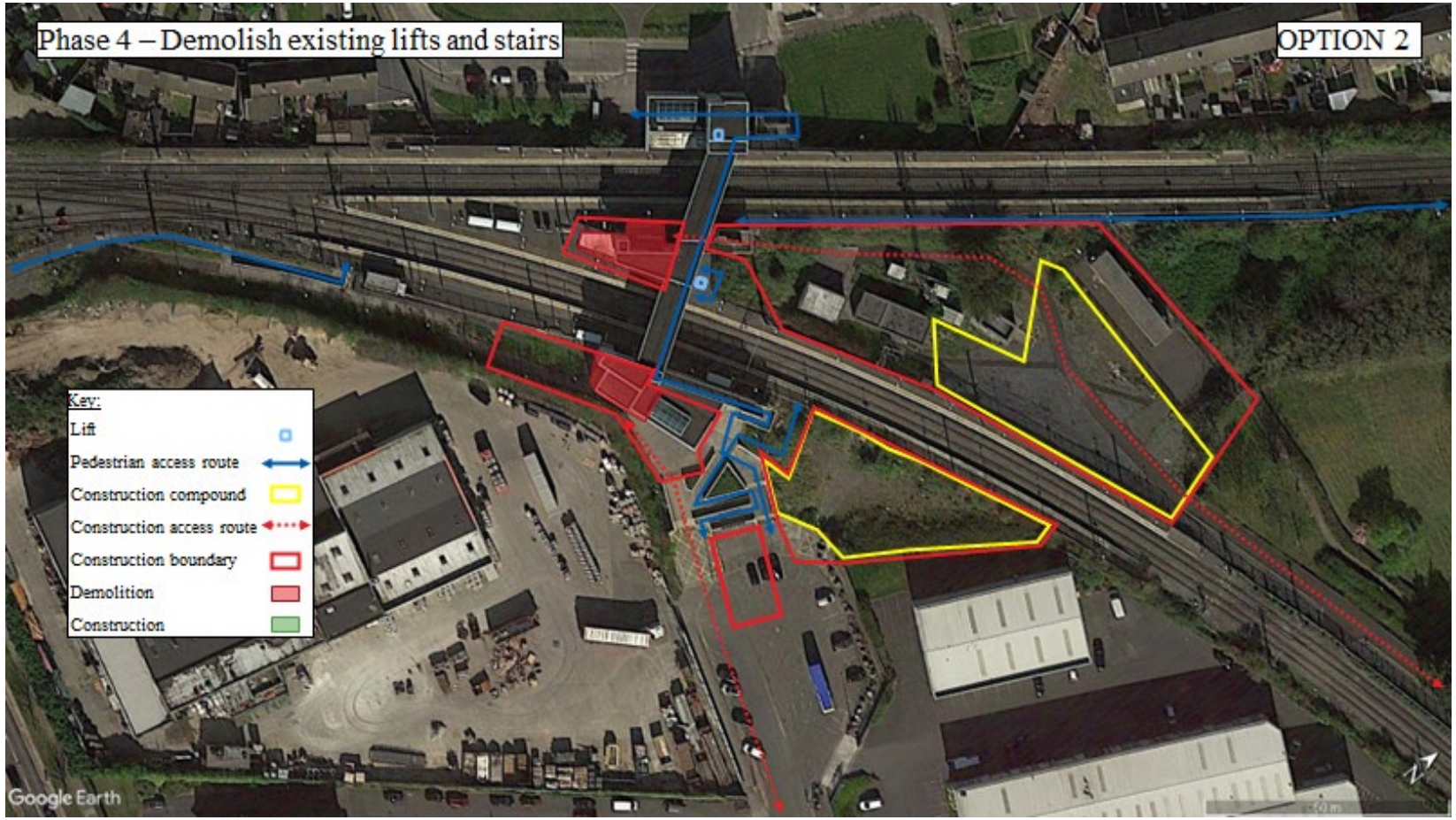
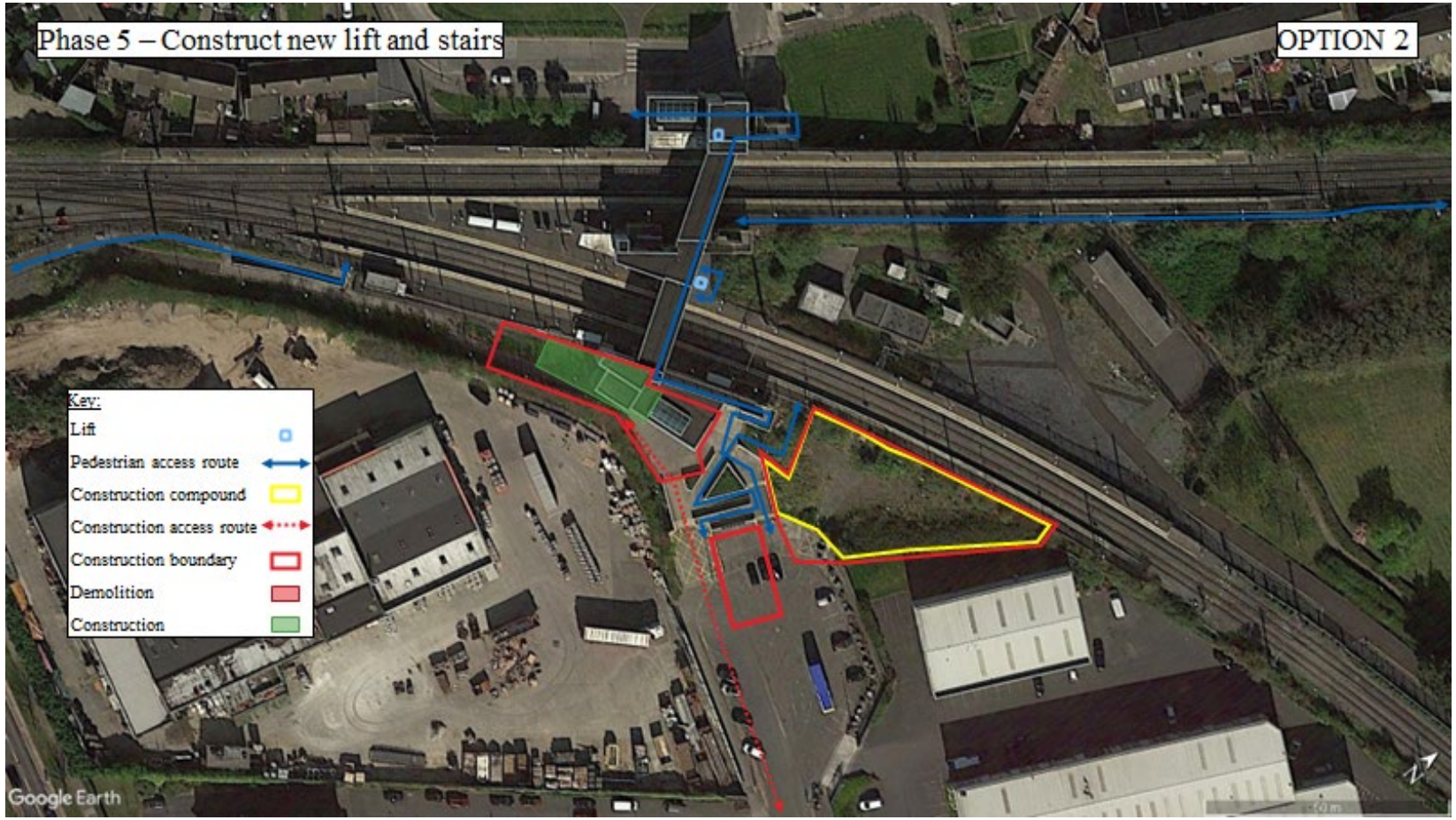


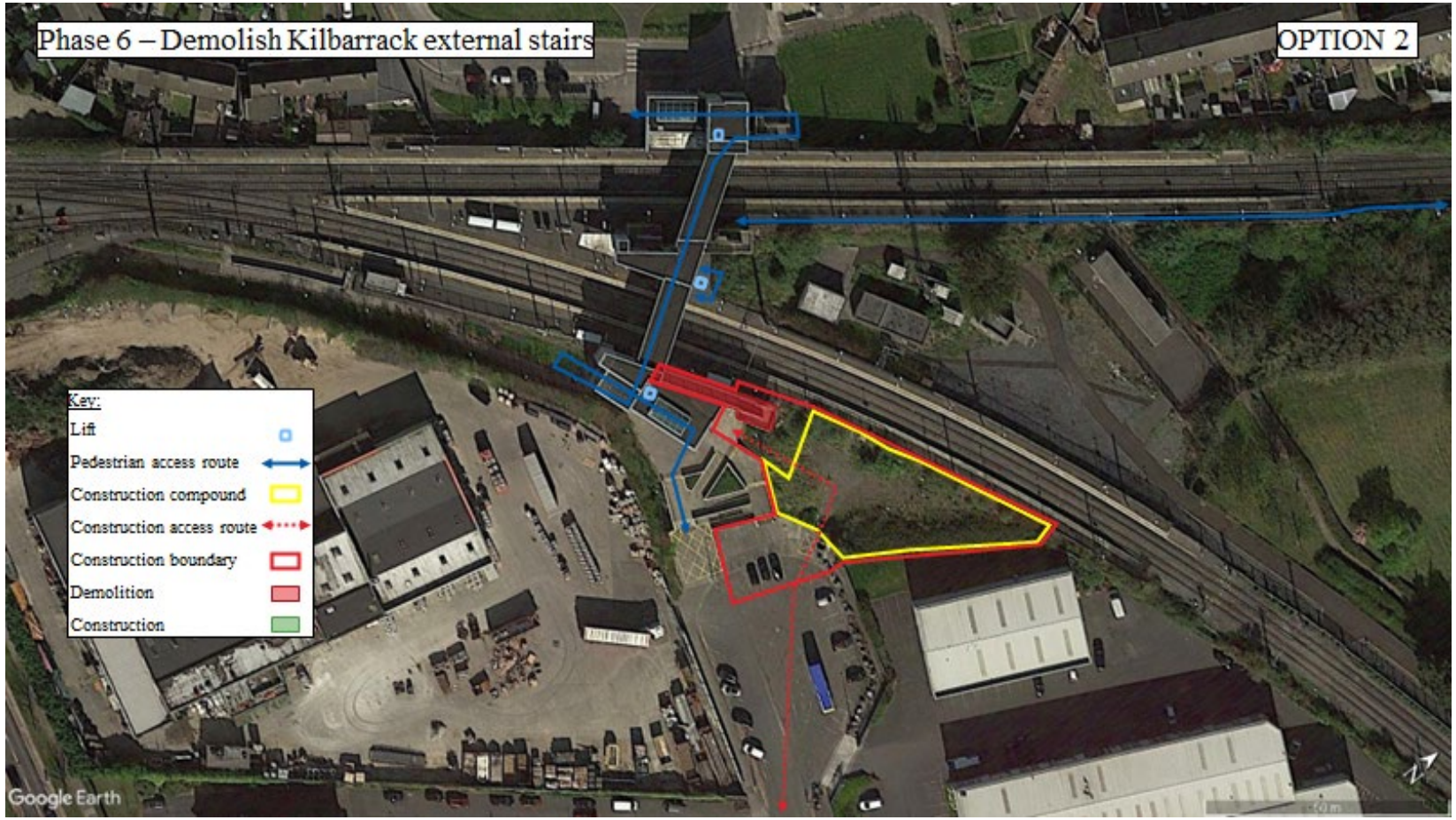
Appendices

Appendix E - Constructability



Appendices

Appendix E - Constructability



Appendices

Appendix E - Constructability

Craneage

A review of craneage options was also undertaken to assist in understanding the temporary land take required to construct the new station facilities. The figure on this page indicates several possible locations for cranes.

As can be seen the distance from the compound for the Central Access area modifications is right on the limit of a typical mobile crane. It may be better to use the crane adjacent to the Donaghmede entrance to support this work. This would limit when lifts could be undertaken however, as lifting over the platforms and tracks would not be possible during operational hours.