Appendix 13-1. Pier 3 Architectural Design Statement

Pier 3 Fixed Links and Nodes

Architectural Design Statement

Dublin Airport Authority

19 August 2022

5196988-ATK-DT1-ZZ-ZZZ-RP-Z-XXX-1100

Notice

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This document has 52 pages including the cover.

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Client signoff

Client	Dublin Airport Authority
Project	Pier 3 Fixed Links and Nodes
Job number	5196988
Client signature/date	

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1. Introduction

This project proposes the construction of a vehicle underpass below runway 16/34 linking Pier 3 to the Western Campus and providing new fixed links and nodes to reconfigured stands to the north west of the Pier 3 decagon. This Architectural Design Statement provides detail of the emerging design proposals for the new Pier 3 Fixed Links, Nodes and alterations to the Pier 3 decagon.

1.1. Purpose of this Project Element

The proposed Project Element includes the provision of new fixed links and nodes serving reconfigured stands to the northwest of Pier 3. Subsequent reconfiguration to the existing Pier 3 decagon building to accommodate the new fixed links will also be required.

This Project Element is necessitated by the proposed new western apron underpass and supporting infrastructure changes. These changes include the new underpass ramp road, a new head-of-stand (HoS) road and reconfigured aircraft stands to the north-west of the Pier 3 decagon. These changes make redundant the existing fixed links, nodes and airbridges serving the current north western stands, which will have to be replaced with appropriate infrastructure, responding to the context and site constraints.

1.2. Project Element Background

The West Apron area contains existing remote stands. The central area in question consists of Pier 3, Apron Taxiway 4, the Taxiway F-2, the 16/34 crosswind runway, and Taxiway W1 and W2.

Currently the West Apron area is accessed either by crossing the 16/34 Runway or by circulating the north of the 16/34 Runway when it is in operation (Dual OPS & Crosswind). Crossing the apron safely at surface will become increasingly less safe and impractical as passenger numbers increase.

Circulating to the north involves a considerable increase in journey time and therefore increased fuel consumption/vehicle emissions.

In order to connect the West Apron to the main terminal buildings, a vehicle underpass is proposed between Pier 3 and the West Apron, see Figure 1-2.

The underpass will permit a fast, reliable and safe access that is critical for both the continued use, commercial use and future expansion of the Airport.

The underpass will unlock the ability of the Airport to use existing stands on the West Apron, future stands to be developed on Apron 7 and subsequent developments of airfield and terminal/pier infrastructure in the west.

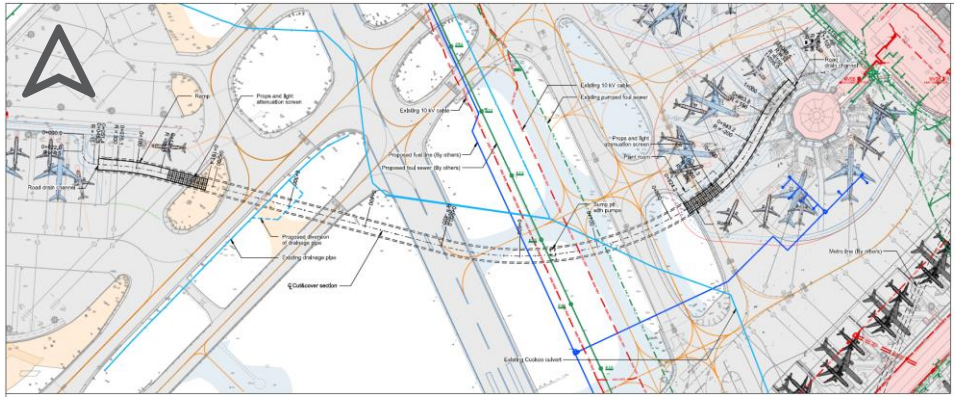


Figure 1-1 – Geometric design and alignment of the West Apron Vehicles Underpass in the CIP.

1.3. Site Location

Pier 3 is located to the southwest of Terminal 1 with the apron and aircraft stands wrapping around it. The new underpass will have a similar southwest / northeast alignment as the existing Pier. The new underpass and Head of Stand (HoS) roads will divide the apron to the north and south of Pier 3.

Figure 1-2 – Existing Site Location Plan (5196988-ATK-DP3-ZZ-XXX-DR-A-300-1001).

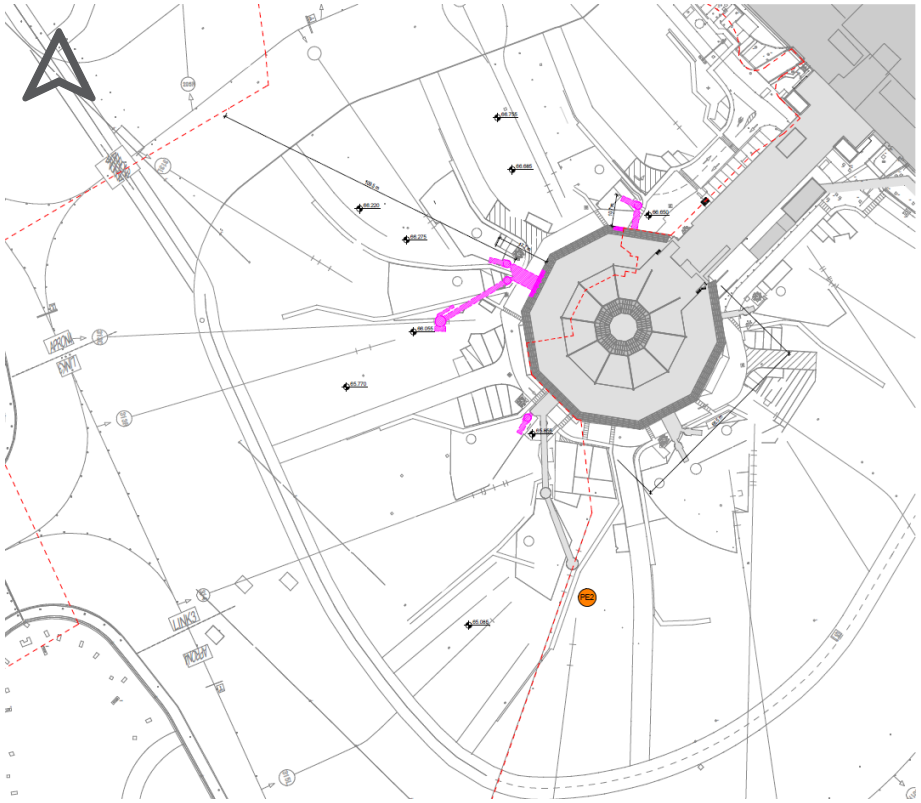
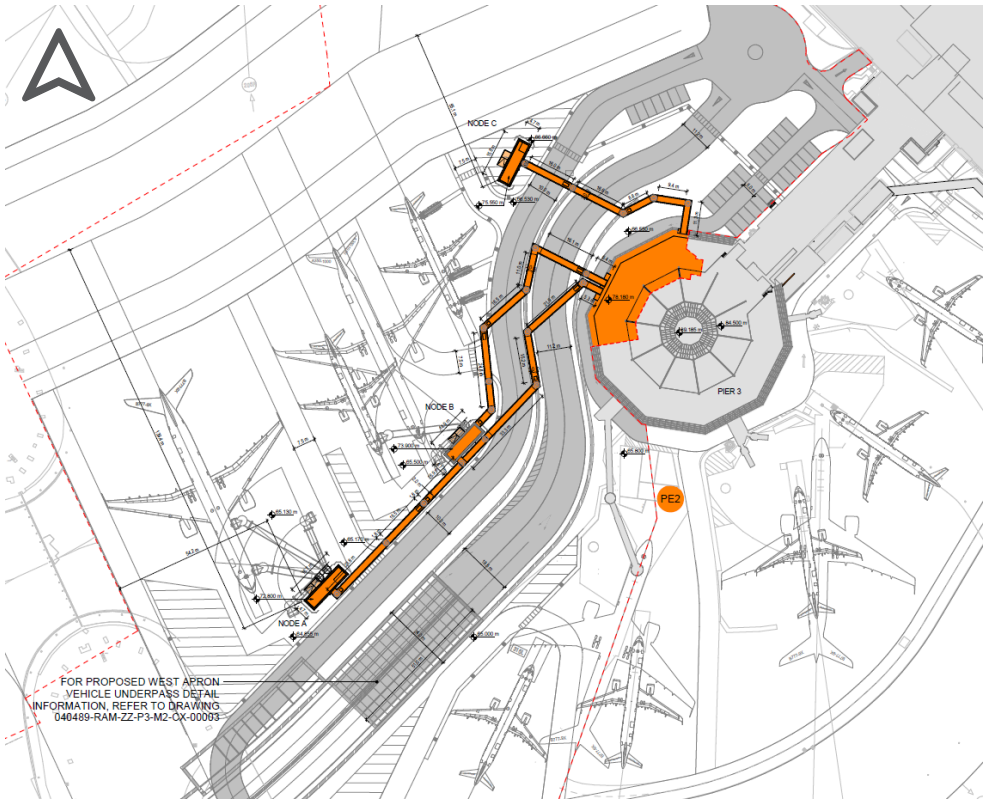


Figure 1-3 – Proposed Site Location Plan (5196988-ATK-DP3-ZZ-XXX-DR-A-300-1002).



1.4. Site Analysis: Context and Constraints

1.4.1. Existing Pier 3 decagon

The original decagon building at the end of Pier 3 was constructed around 1970 at the same time as the Terminal 1 8-Bay structure. It was originally a two-storey building with a small plant room in the central core above the main roof level. Since then an additional storey has been added on the roof level and several internal reconfigurations have been made.

The structure is of steel framed construction forming a decagon shape on plan and is 64m across, between facets at Departures level.

The decagon comprises four levels including Level 30 office accommodation, Level 20 departure gates, Level 15 mezzanine providing access to the fixed links and nodes and Level 10 arrivals immigration hall.

Level 20 Departures is approximately 7.1m above the varying external apron level. This original floor typically comprised pre-cast concrete double-Tee planks spanning onto the steel beams that are oriented in a radial arrangement projecting from the central core of columns.

The existing fixed links connect to the decagon building at Level 15 Mezzanine leaving approximately 3.8m clear below the fixed links and limiting the head of stand clearance on the airside road.

Figure 1-4 - Photograph of the original Pier 3 decagon circa 1975

Figure 1-5 - Existing Pier 3 decagon and surrounding aircraft stands

Level 30 Office Accommodation

Level 30 does not accommodate any passenger areas at present. A single staircase and lift provide access to this level. Emergency egress is by means of the staircase. A secondary means of egress is onto the roof structure.

Level 20 Departures Gate Seating

The main departures processes are located at Level 20. The floorplate contains eight seating areas arranged in an open lounge configuration around the periphery of the decagon with washrooms, minor retail and a Food & Beverage (F&B) outlet and two airline boarding desks per gate.

Departing domestic and international passengers departing from Pier 3 are called to gate from the International Departures Lounge at set times prior to departure and dwell at the Gates for a short time prior to boarding card / ID verification before proceeding downstairs or a lift to the Mezzanine level.

Level 15 Mezzanine providing access to fixed links and nodes

The limited floor plate at the Mezzanine level provides an access platform to the fixed links and nodes leading to passenger boarding bridges. Departing passengers descend via the lifts and stairs and are directed to the appropriate fixed link. Arriving passengers are directed to the same lifts and stairs and directed to the Arrivals level below.

Level 10 – Arrivals Immigration Hall

The lowest level of the Pier is some 1.9m above apron level, and accommodates the following:

- Immigration controls for passengers arriving into Terminal 1;
- A series of manually controlled corridors to separate T2 arrivals and arriving passengers to the dedicated T2 link bridge.
- A Vertical Circulation Core leading to the T2 link bypassing the T1 Immigration booths; and
- A coaching gate holding area.

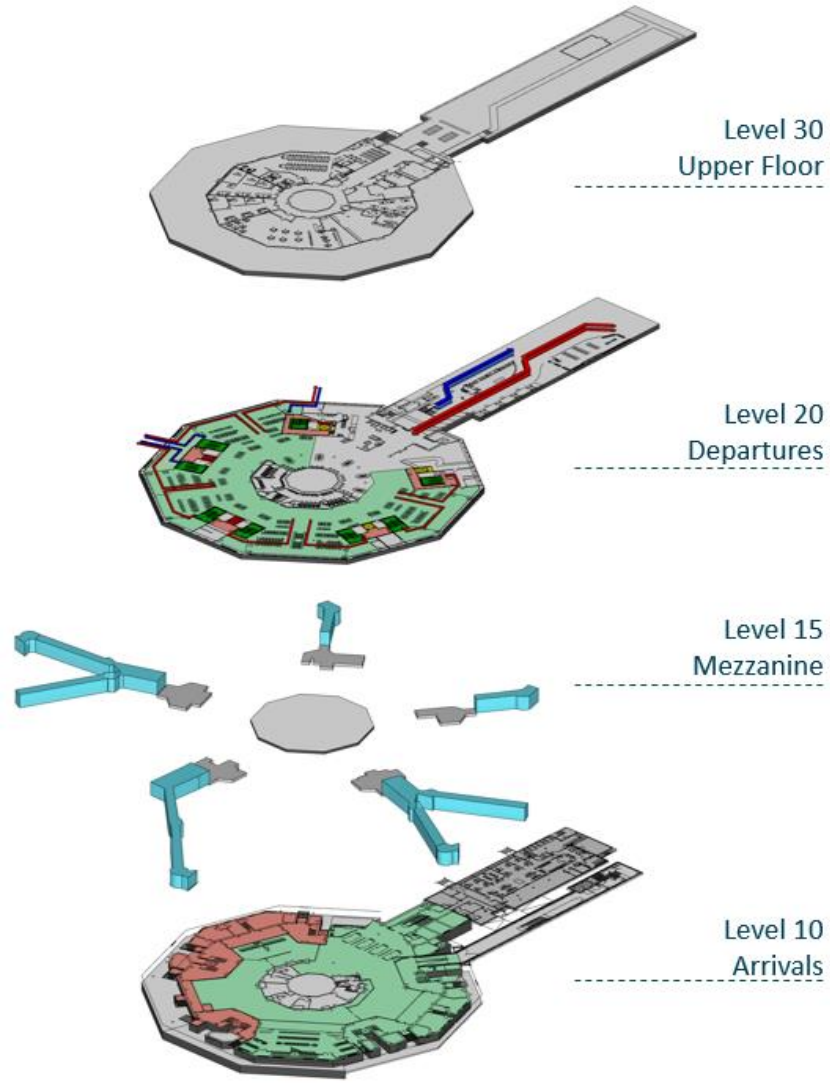


Figure 1-6 - Existing Pier 3 decagon internal accommodation

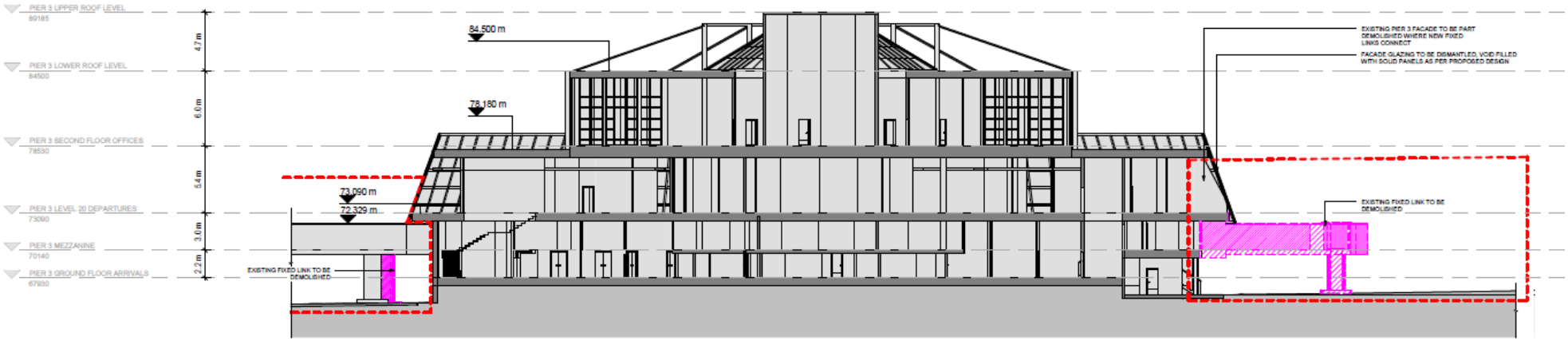


Figure 1-7 - Existing section including demolition works, through the Pier 3 decagon (Drawing reference: 5196988-ATK-DP3-ZZ-XXX-DR-A-300-2000).

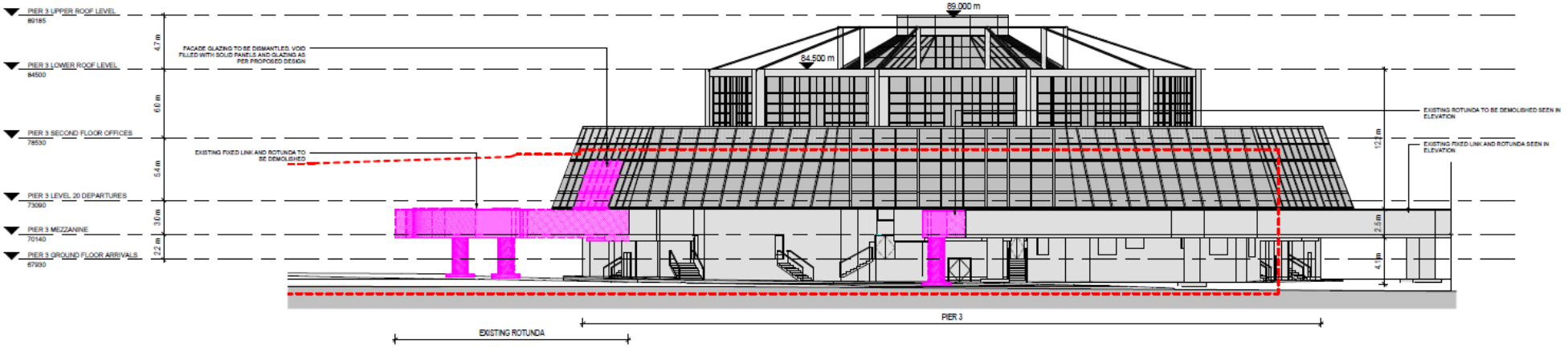


Figure 1-8 - Existing South Western elevation including demolition works (Drawing reference: 5196988-ATK-DP3-ZZ-XXX-DR-A-300-2000).

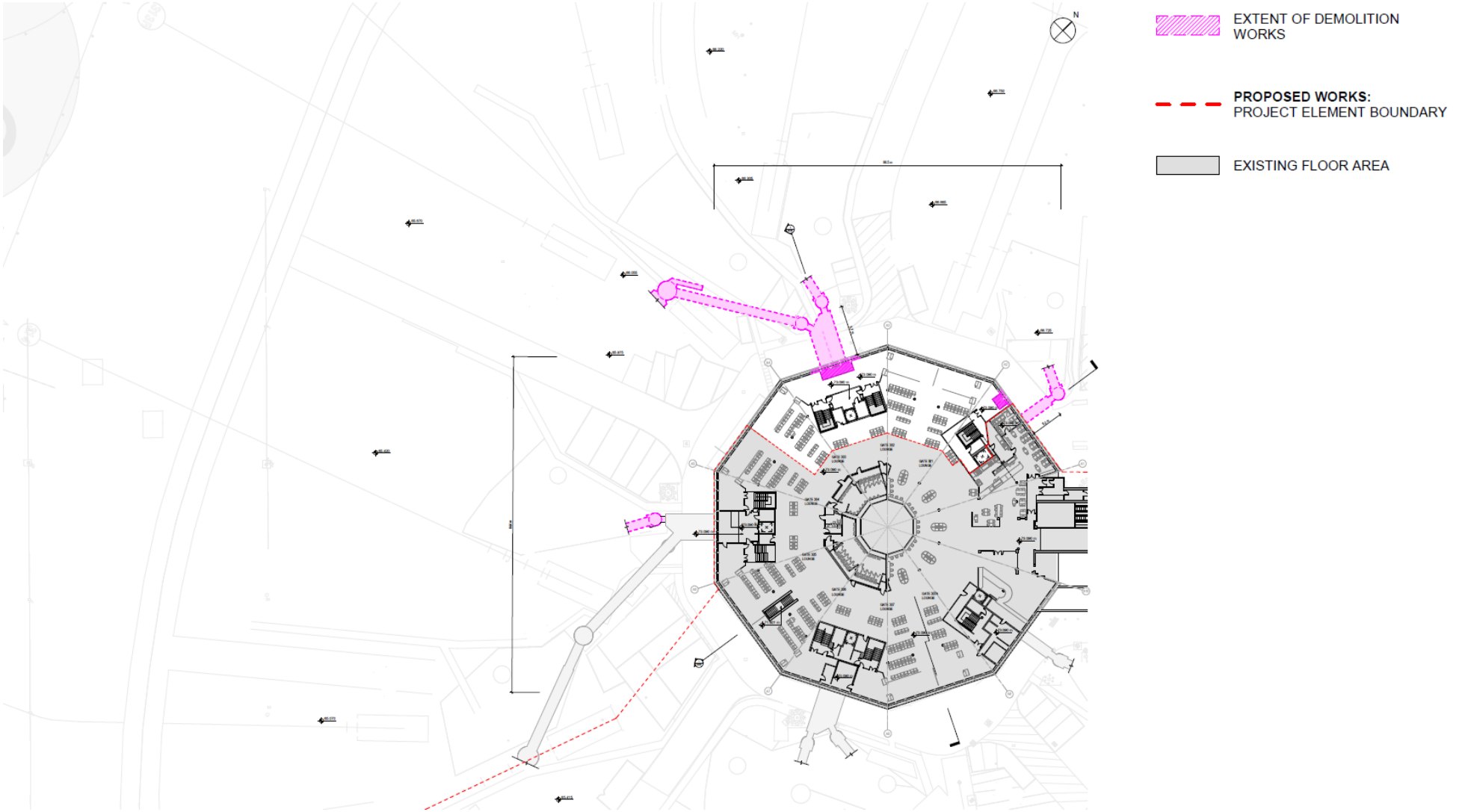


Figure 1-9 - Existing Pier 3 Level 20 Departures showing gate lounges and VCCs (Drawing reference: 5196988-ATK-DP3-ZZ-L15-DR-A-300-1011).

1.4.2. Surrounding airfield and infrastructure

Located on the East Apron adjacent to Terminal 1, Pier 3 serves passengers within Terminal 1 and Terminal 2.

The current configuration of the Pier requires a considerable amount of manual intervention to ensure passenger safety (for example in crossing of roads) and security (segregating of arriving and departing passengers as well as segregation of Terminal 1 and Terminal 2 arriving passengers) is maintained.

The aprons around Pier 3 contain multiple centrelines which can accommodate different combinations of aircraft depending on the size of aircraft.

The topographical information for this area shows that the apron falls away to the South West increasing the level difference between the Pier 3 decagon and the cill height of aircraft located west of Pier 3, and therefore the length of fixed links.

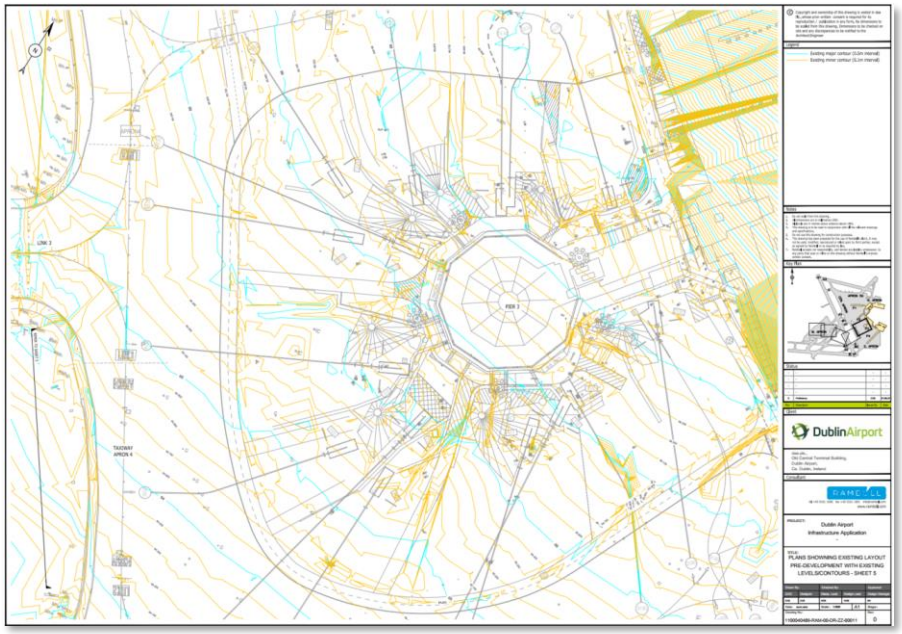


Figure 1-10 - Topography drawing: 1100040489-RAM-00-DR-ZZ-00011

Currently up to 11 Code C aircraft can be parked around the Pier, eight of which can be airbridge served. Alternatively, up to five Code E aircraft can be parked around the Pier, all of which can be airbridge served.

The configuration imposes a number of restrictions on the maximum aircraft size on most of the centrelines. i.e.

- Not all Code C / E aircraft can be accommodated on the respective stands; and
- The use of adjacent gates for simultaneous arrivals or departures is constrained due to shared facilities such as stairs and lifts.

Stand No	Max A/C Size	Apron Condition *Source: AIP*	PLB No	Boarding Gate
311L	C*: 320	311C Vacant	-	301
311C	D: 75W	311L, 311R Vacant	08	
311R	C: 32Q	311C Vacant		
312	D: 75W		07	302
313L	C: 73H	313C Vacant	-	
313C	E: 77W	313L,313R Vacant	06	303
313R	C*: 321	313C Vacant	-	
314	E: 359	Max 47.6 when 315L in use	05	304
315L	C*: 320	315C Vacant, 314 downgraded	-	305
315C	E: 77W	315L,315R Vacant	04	
315R	C*:320	315C Vacant	-	305A
316	E: 77W	317, 318C Vacant	03	306/307
317	E: 333	318L, 318R Vacant	03	306
318L	D: 75W	316, 318C Vacant	02	307
318C	E: 359	318L, 318R Vacant	01	307A
318R	C: 32Q	318C Vacant		

* Code C restricted

Figure 1-11 - Operational restrictions and shared facilities by Stand

Lift

Stair core

305 Gate Lounge Number

311 WIWO/ Coached Stand

311 Airbridge Served Stand

02 Airbridge Number

White dashed line indicates pedestrian footpath

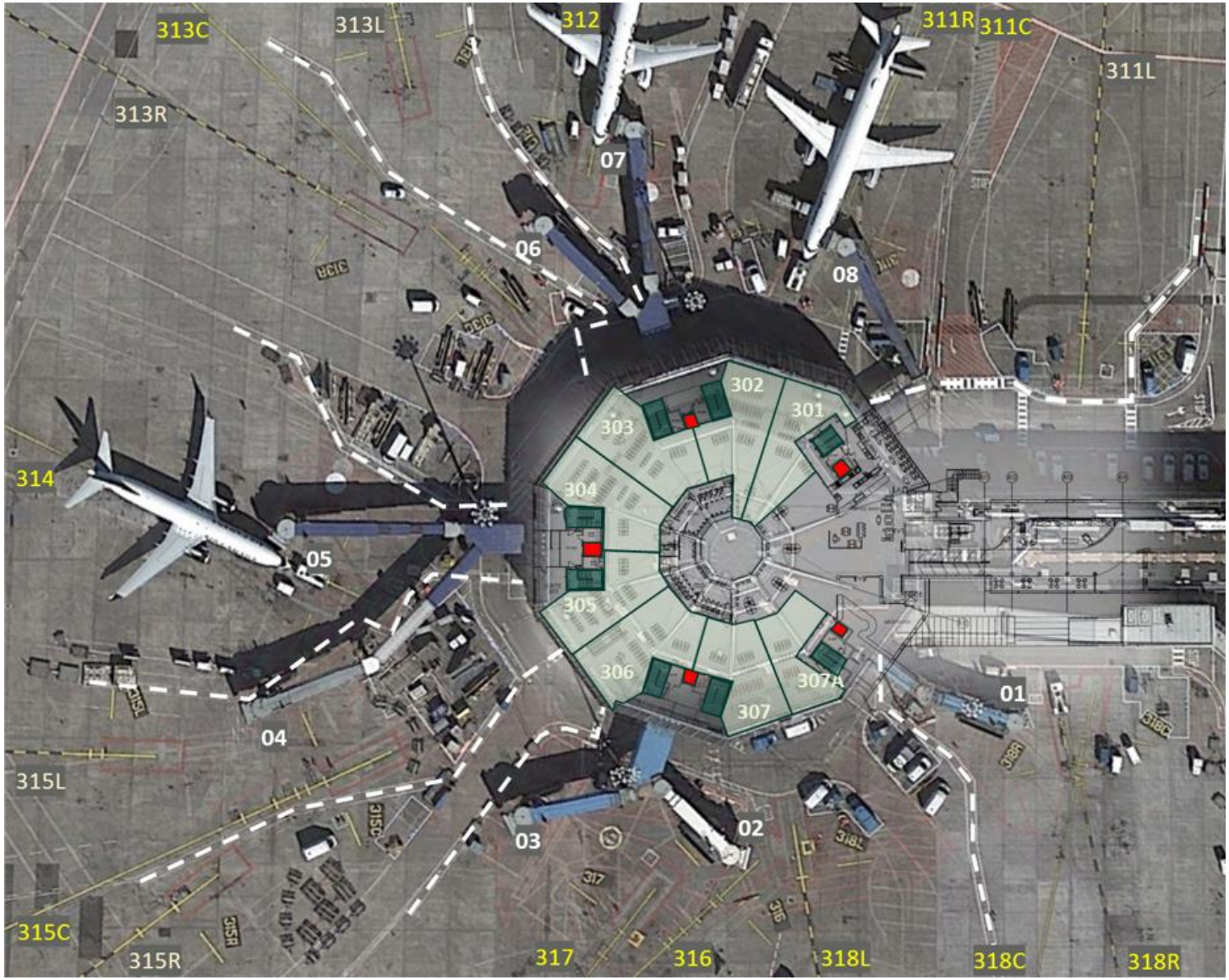


Figure 1-12 - Existing Pier 3 gate lounges serving the surrounding stands.

1.5. Planning Policy and Guidance

The western apron underpass and associated works that are required to Pier 3 are an important part of daa 's Capital Investment Programme to enhance the passenger experience and increase capacity at Dublin Airport over the coming years.

The continued growth of Dublin Airport is supported by planning policy at National, Regional and Local level, with the need for 'quality terminal facilities' highlighted within the County Development Plan (CDP) as critical if the airport is to realise its full potential. Objective DA04 of the CDP confirms that it is adopted policy *to "Facilitate the ongoing augmentation and improvement of terminal facilities at Dublin Airport"*, with Objective DA21 emphasising the importance of high quality design in doing so: *"All development within the Dublin Airport…lands will be of a high standard of design, to reflect the prestigious nature of an international gateway airport, and its location adjacent to Dublin City"*. In a general sense the CDP aims to *"facilitate the operation and future development of Dublin Airport"*, safeguarding *"current and future operational, safety, technical and developmental requirements"* and providing *for "its ongoing development within a sustainable development framework"*[1].

A Local Area Plan for the Airport was adopted in December 2019 which further emphasises the importance of high-quality design at the Airport, to *"create a high-quality environment which enriches visitor experiences"*. The need for development of the existing Pier facilities is recognised within the LAP, with Objective SBG01 stating that the LAP will *"facilitate the development of new stands, piers and boarding gates in line with the expansion of associated runway and terminal capacity across the Airport".*

The Local Area Plan has established a set of 'Key Design Principles' which must be reflected in development at the Airport:

Figure 1-13 - Key Design Principles (Dublin Airport Local Area Plan 2020)

[1] CDP, Objective DA01, DA03

Architectural Design Framework

To coincide with the introduction of the LAP daa has, in partnership with relevant stakeholders, prepared a Dublin Airport 'Architectural Design Framework' to guide the design process for projects at the Airport. The Framework, building upon the LAP, highlights a number of 'Key Design Principles' for new development at the Airport, including:

A Sense of Place

The airport is identifiable as an international transport hub and global gateway. The airport's diverse functions must work together to harness this vibrant environment as a great place to work, shop and dine, with comfortable waiting areas or places to rest on a break, creating an interesting and enjoyable place to be.

Accessibility

When designing built environments at Dublin Airport a key design principle is to allow them to be easy to navigate from a visual and physical perspective.

Sustainability

Designers at the Airport must be aware of the daa's Sustainability Strategy. All new and refurbishment works at the airport must consider the key priority areas and commitments of Airport's Sustainability Strategy and the industry-wide sustainable standards and regulations.

All new developments at the airport should contribute positively towards a reduced energy consumption and the associated carbon footprint.

Benchmarking

Designers should review comparable airports at the earliest stage of design when designing built environments at the airport.

An Uplifting Travel Experience

Airports can often be stressful places, particularly for those who do not travel regularly or are under particular time pressure. Designers must be aware that the daa aims to create calm spaces for passengers that are easy to navigate and do not act as additional sources of stress.

Figure 1-14 - Draft daa Architectural Design Framework

Detailed design guidance is provided across a series of ‘character areas’ within the Framework. The Pier 3 works are within ‘Character Area 1 (Piers and Terminals)’.

The Framework notes that, when designing buildings within this area consideration should be given to how they link externally to the existing buildings and that a common pallet of materials is used. It also notes that the more recent developments within this character area are contemporary in nature using contemporary materials such as steel and glass. A series of ‘Key Design Guidelines’ are presented in the Framework including, of particular note for the Pier 3 works:

- Overall forms and volumes should be simple, elegant, rectilinear, well proportioned, basic, geometric shapes with an economical use of structure.
- The use of materials at the airport should be of a contemporary nature that seeks to complement each other along with compatibility of use. Consider the whole of life costs that may be involved in the specification of material finishes.
- Colour should be used a major unifying element for the Airport property, not only the colours themselves but through their use and application.
- A proactive approach to the passenger experience is necessary to influence the early stage design of the physical space, to complement the passenger’s perspective and create that effortless journey. A passenger focused design that is cohesive and integrated will be superior and more cost-effective than any later retro fit.
- Designers should consider what materials and finishes can offer ease and comfort to the passenger’s journey through the airport from the arrivals to the departures area.
- When designing at Dublin Airport designers need to consider the latest trends that are changing the airports landscape such as Programming and Behaviour. Four design elements that should also be considered are Ambiance, Materiality and Scale, Consistent Design Approach.
- Airports are transport hubs that also function as meeting places for business, shopping, dining as well as venues to welcome and part for friends and family. It is also a working environment for considerable numbers, so the correct amenities are very important elements of future development at Dublin Airport.
- Designers should consider accessibility to all services: mechanical, electrical and plumbing systems that support terminal operations in the building design in relation to designing for maintenance.
- All designers must adhere to the current building standards and regulations however designers working at the airport must be aware of all the design constraints some of which are specific to Dublin Airport others which are more general to working within an airport environment.
- Within an airport environment departure and arrivals, transient spaces, set down, and pick up areas form part of the passenger journey an understanding of passenger flow and behaviour must be to the fore when designing these spaces.
- The treatment of movement spaces at all times should be clear and legible this is critical to integrating the new with the existing.

2. Design Solution

The Pier 3 Fixed Links and Nodes Project has been developed in line with the Dublin Airport Architectural Design Framework (to be updated post review by Final County Council), taking account of daa Architectural Vision and Key Design Principles which includes:

- A Sense of Place
- A Strong Urban Framework
- Accessibility
- Flexibility
- Sustainability
- Benchmarking
- A Positive Travel Experience
- A Gateway to Ireland
- Connecting Ireland with the World

The airport's campus is comprised of a variety of building types which vary in terms of structural typologies and building form. The Pier 3 Fixed Links and Nodes falls within the Piers and Terminals Character Area which are predominantly public areas. In these areas, priority is given to passenger experience and passenger interface.

2.1. Design Development

Prior to the development of the preferred design option for planning, a five-week feasibility study was conducted to investigate options and recommend a solution to minimise the impact of the Western Apron Vehicle Underpass (WAU) on Pier 3. Following the Feasibility Study investigation and a review with the airfield design team, Option 1C was identified as the recommended option. This option connects the existing structure in locations that utilise existing structural support, and vertical circulation infrastructure within the building. The recommended option minimises disruption, both during construction and in operation, maintaining existing passenger, goods delivery, waste and engineering access points.

2.2. Description of the Proposal

The proposed Pier 3 Fixed Links and Nodes have been developed through engagement with daa stakeholders. Particular attention has been given to creating an environment that will allow a positive passenger experience through intuitive wayfinding, maximising of natural daylight and creating interesting views out onto the airfield. The design has been developed through benchmarking and reviewing comparable projects and drawing on the design team's experience of best practice and knowledge of current trends at other world class airports.

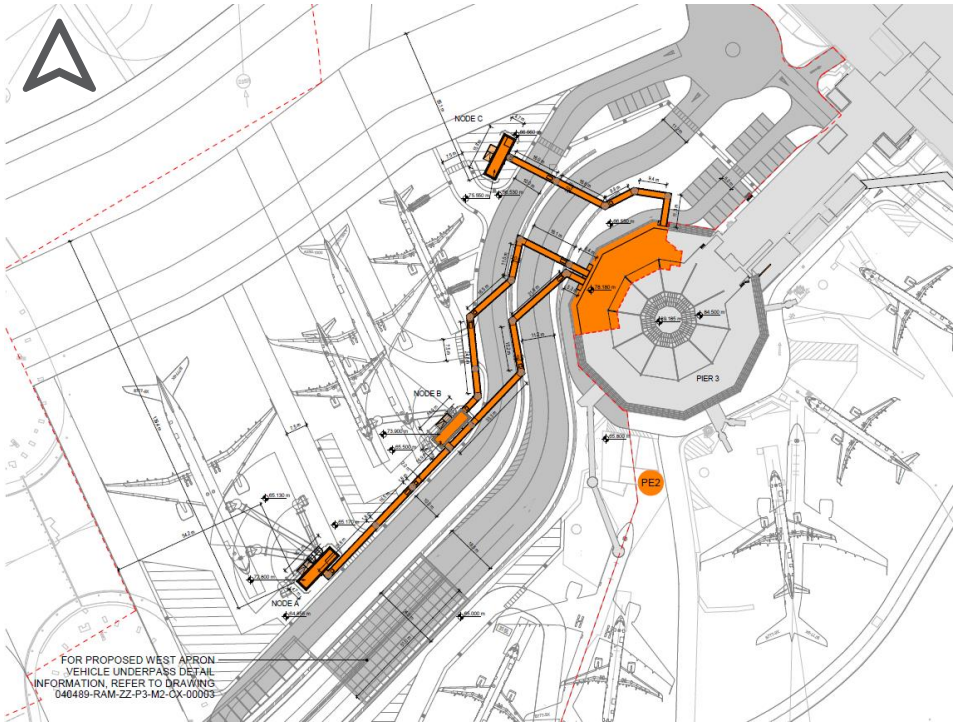


Figure 2-1 - Proposed Site Plan (5196988-ATK-DP3-ZZ-XXX-DR-A-300-1002).

2.2.1. Site and building layout

The introduction of the new WAU resulted in a new underpass road curving around the Pier 3 decagon to the north, connecting with the existing airside road network adjacent to Terminal 1. This road requires a height clearance of 4.7m for high vehicles passing through the underpass. Further impact on the apron includes a new re-aligned HoS (head of stand) road to the north of Pier 3, also requiring a height clearance of 4.7m for high vehicles.

The stands to the north of the Pier have been reconfigured to include two Code E stands, one of which is reconfigured as a Multi-Aircraft Ramp System (MARS) stand. The new inter-stand clearway roads between these centrelines require a height clearance of 4.4m. The existing stand arrangement to the South is retained with a realigned centreline for Stand 315L. The maximum number of aircraft that can be accommodated at any time is reduced from 11 to 8.

The revised stand arrangement drove the need for new fixed links and nodes to connect the proposed stands to the Pier 3 decagon. The nodes are positioned in the most optimal location on the stand to serve the connecting airbridges and have the least impact on the operational stand activity. Space on the stands were highly constrained and therefore limited the size and location of the nodes.

Node A, serving two airbridges and parallel with the HoS road, is the further away from the Pier 3 decagon and produces the longest fixed link. Node B, serving one airbridge, is the middle node positioned parallel with the HoS road. Node C, located nearest to the Pier, does not provide jetty-service due to site constraints.

The fixed links span from the Pier 3 departures level, approximately 7.1m above the surrounding apron, and gradually slope down and connect with the nodes. The fixed links connect with the existing Pier along the same façade facets where the existing demolished fixed links were connected, making use of the existing structural support. The fixed link support columns are positioned on either side of the tunnel and HoS road, no more than 25m apart to allow for the maximum structural span between columns.

Consideration have been given to the positioning of safety barriers and segregated pedestrian walkways adjacent to the nodes.

2.2.2. Pier 3 decagon

Internal Layout

The decagon comprises four levels including Level 30 office accommodation, Level 20 departure gates with open lounges, Level 15 mezzanine providing access to the fixed links and nodes and Level 10 arrivals immigration hall.

The new fixed links will connect and span from Level 20 where the departure gates are located. Fixed Link A will serve passengers from gate lounge 303, Fixed Link B will serve passengers from gate lounge 302 and Fixed Link C will serve passengers from gate lounge 301.

A new partition creating an airlock will be required between the entrance/ exits of Fixed Links A and B to ensure full segregation of departing and arriving passengers. The lift lobby in the existing VCC will have to be access controlled, allowing access to Arriving passengers going down to the Immigration Hall.

Fixed Link C have been positioned to join the departures level where it has the least impact on the existing food and beverage concession.

The decagon building is currently provided with fan coil units around the internal perimeter of the departures level. Where the new fixed link connections are to be made, the fan coil units are to be removed and the heating and chilled water pipework serving them reconfigured.

A new cladded portal with new doors and access control are to be provided and integrated at each new fixed link location.

Due to the retained stand arrangement to the South, no changes are required to the fixed links and gate lounges serving these stands.

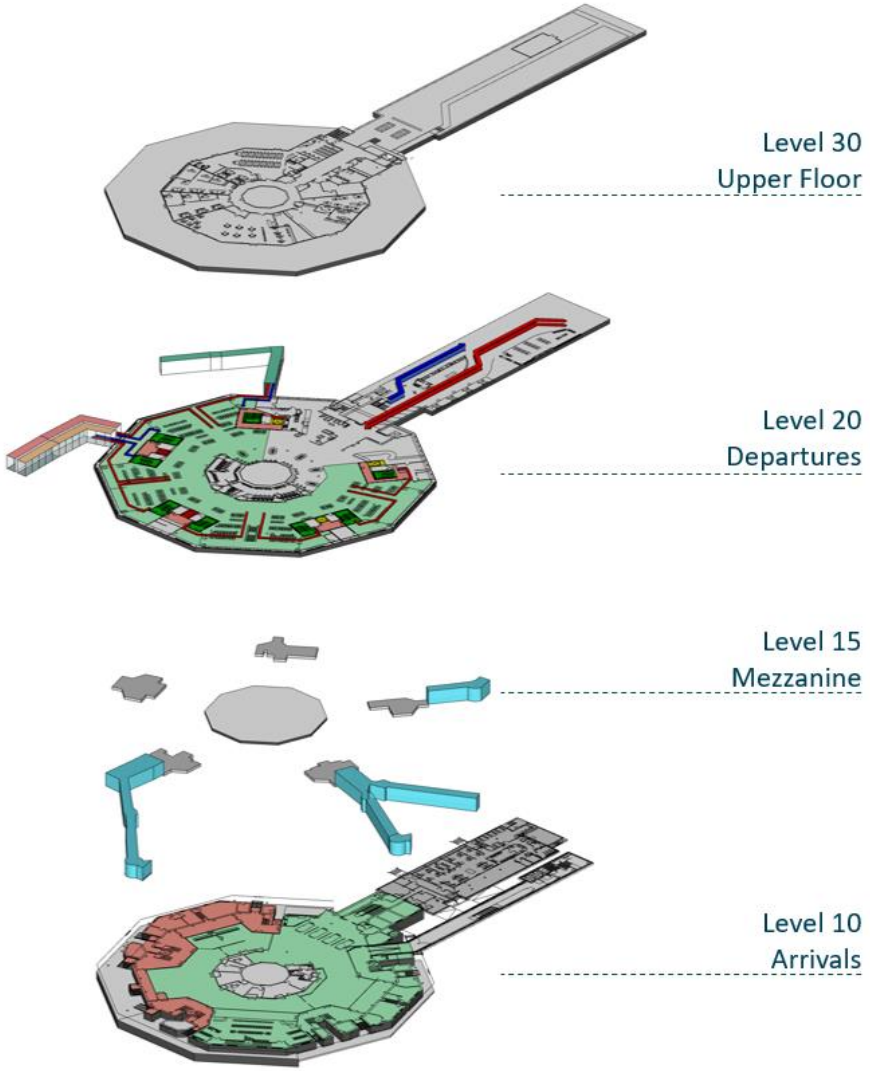


Figure 2-2 - Proposed Pier 3 levels showing existing and new fixed links

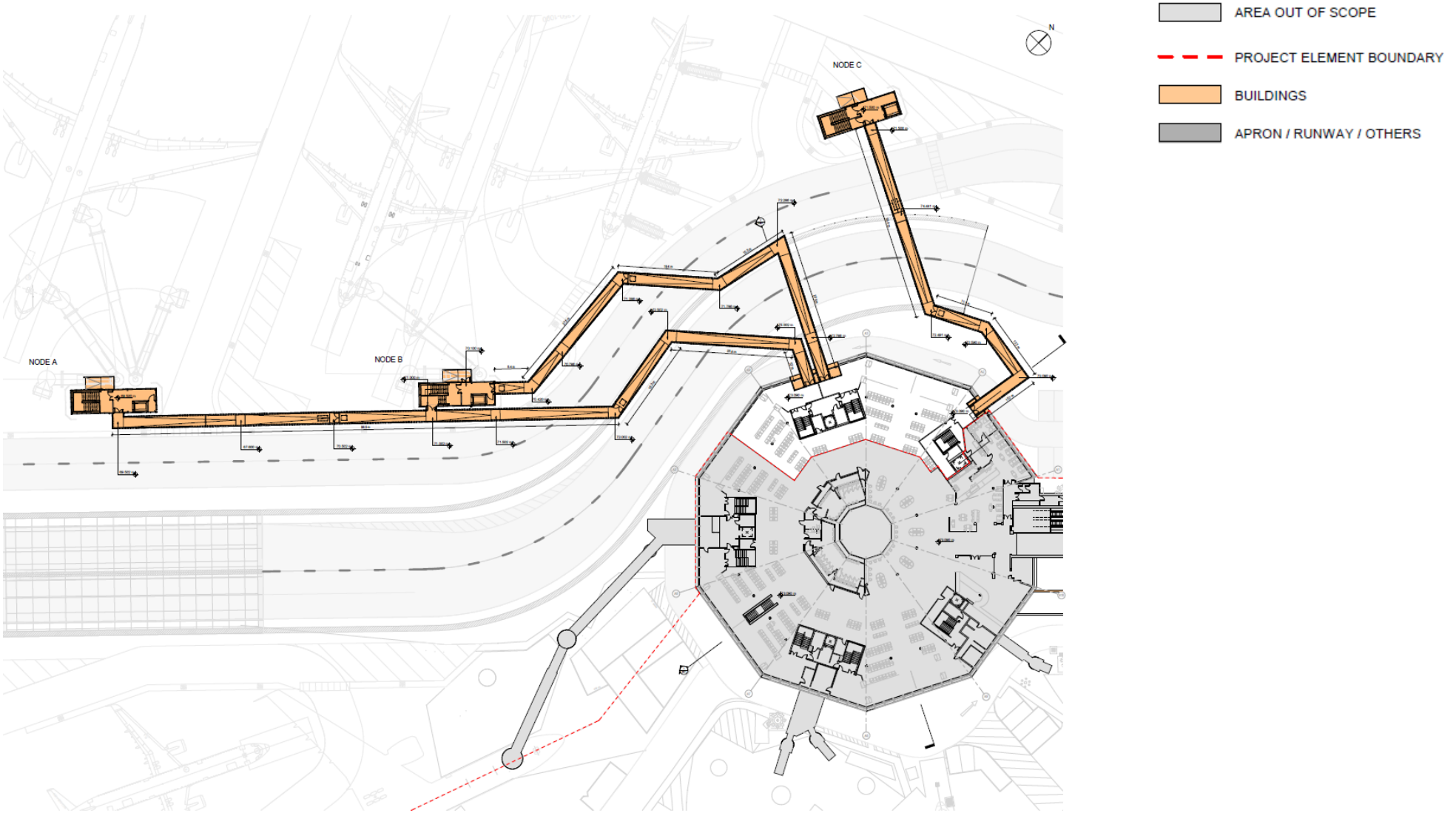


Figure 2-3 - Proposed Level 20 Departures Layout (Drawing reference: 5196988-ATK-DP3-ZZ-L30-DR-A-300-1023).

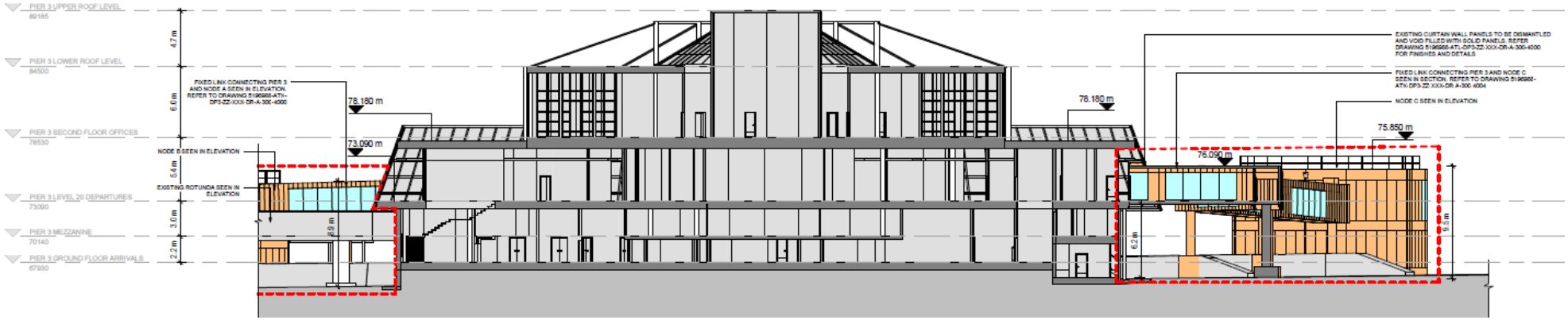


Figure 2-4 - Proposed section through Pier 3 and Fixed Link C (Drawing reference: 5196988-ATK-DP3-ZZ-XXX-DR-A-300-2001)

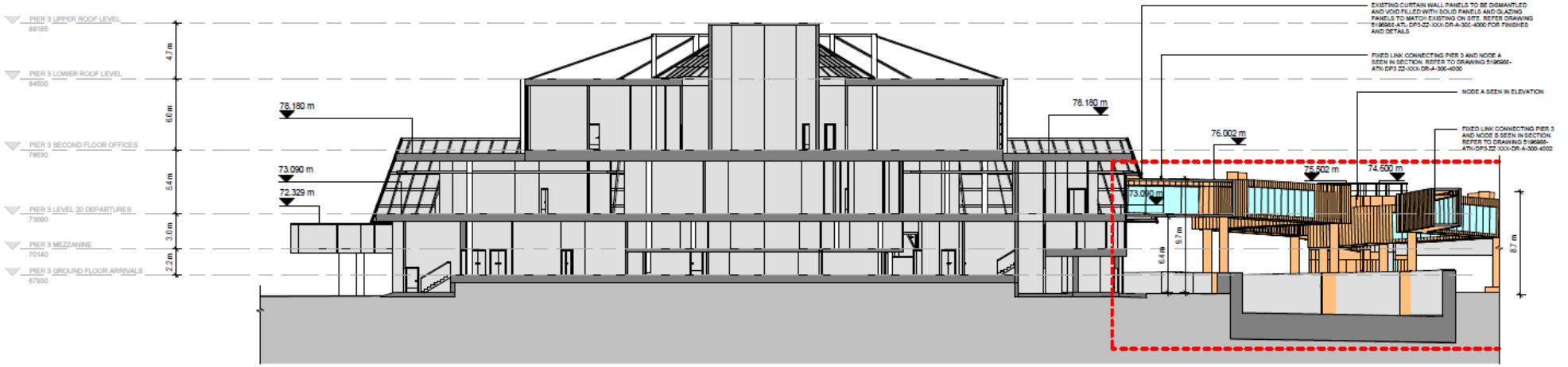


Figure 2-5 - Proposed section through Pier 3 and Fixed Links A and B (Drawing reference: 5196988-ATK-DP3-ZZ-XXX-DR-A-300-2001)

Facades

The existing Pier 3 decagon is characterised by the slanted and faceted glazed curtain wall system to the main middle level 20 departures. The curtain wall façade comprises prominent transoms and mullions with dark tinted glass panels spanning the full height from the floor to above the suspended ceiling, allowing plenty of natural light into the departures lounge.

All the existing fixed links are currently located below the level 20 glazed façade, connecting the level 15 mezzanine below. As part of the development, the existing fixed links between gridlines A1 and A2 and also between A3 and A4 will be removed and replaced with new fixed links spanning directly from level 20 departures. Please refer to Figure 2.4 Proposed Level 20 Departures Layout for gridline clarification.

In these areas where the new fixed links will connect with the existing Pier building, the glass panels and framing will have to be carefully removed. A structural frame supporting the remaining glazing system will be installed. Once the new fixed links are in position, the gap between the fixed link and the glazing system will be sealed using a movement joint detail to allow for minor movement between the fixed link and the façade. The façade area surrounding the fixed link will be closed using solid cladding panels, extending inwards to create a solid clad portal around the fixed link entrance.

Figure 2-6 - Proposed new portal to the fixed link entrance

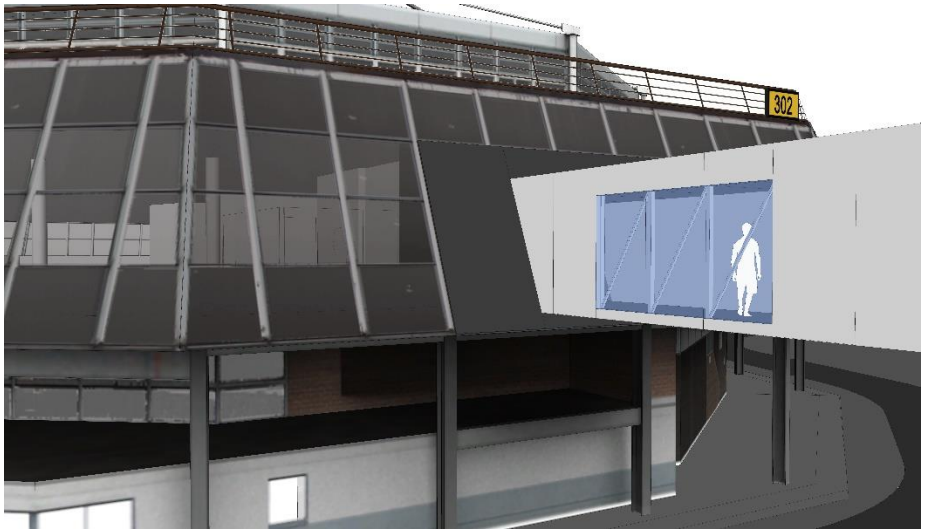


Figure 2-7 - New fixed link connection to the existing Pier 3 facade

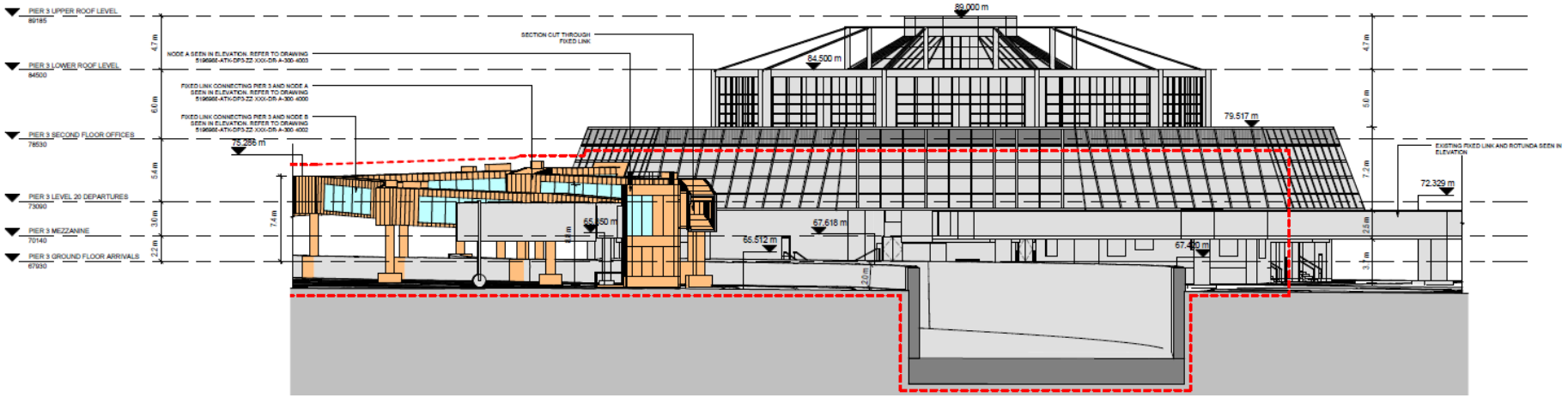


Figure 2-8 - Proposed Western Elevation

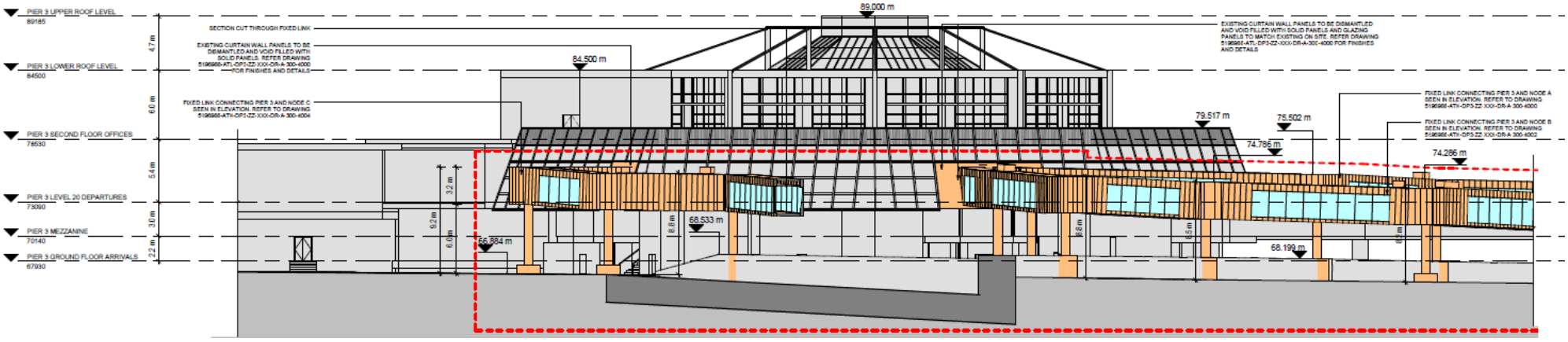


Figure 2-9 - Proposed Northern Elevation

2.2.3. Fixed links and nodes

Scale, massing and form

Fixed links are access bridges, often connecting terminals or piers to the aircraft stands and providing a safe and accessible passenger route with minimal level changes.

It is proposed that the fixed links are to be modular prefabricated structures. The advantage of a prefabricated modular solution is minimizing cost and time on site while reducing impact on airfield operations. In addition, delivery and assembly of prefabricated units improves the final product quality and safety performance.

The fixed links will consist of a steel truss structure clad with steel and intermittent glazing (no more than 50%) to allow for natural light and views out on to the airfield. The fixed links will be approximately 2.2m wide and 3.2m tall. Sufficient height has been allowed for in the fixed link to run services including electrical cables, sprinkler system and lighting above a suspended ceiling.

The fixed link segments have a maximum span of approximately 25m between column supports. The column supports are anticipated to be a circular mono-post design with a diameter ranging from 0.5m – 1m. The columns will be surrounded by vehicle impact protection which could either be a barrier system or a raised reinforced concrete plinth.

The nodes are two storey rectangular buildings based on a modular planning grid of 1.8m and a structural grid of 5.4m. The node building structural frames are anticipated to be economically constructed using traditional braced steel frames with a concrete upper floor and light-weight roof.

Node A is located furthest away from the Pier 3 decagon with a fixed link that is approximately 150m long. It is 16.7m long, 4.7m wide, 8.4m tall and has a GEA of 157m². Node A services two airbridges and has a rotunda height of 4.4m high. Node B is located in the middle of the three nodes and has a fixed link that is approximately 95m long. It is 14.9m long, 4.7m wide, 8.9m tall and has a GIA of 154m². Node B serves one airbridge and has a rotunda height of 4.4m high. Node C is located nearest to the Pier 3 decagon and has a fixed link that is approximately 70m long. It is 15.8m long, 4.7m wide, 9.2m tall and has a GIA of 148m².

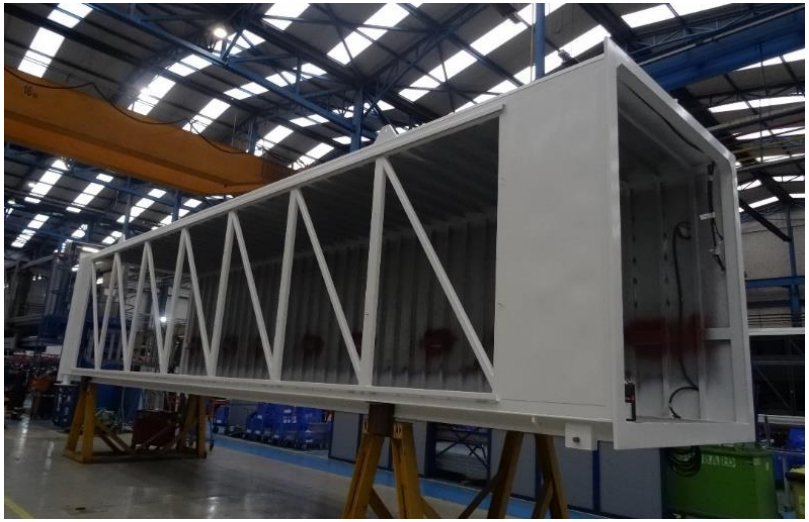


Figure 2-10 - Prefabricated modular Fixed Links

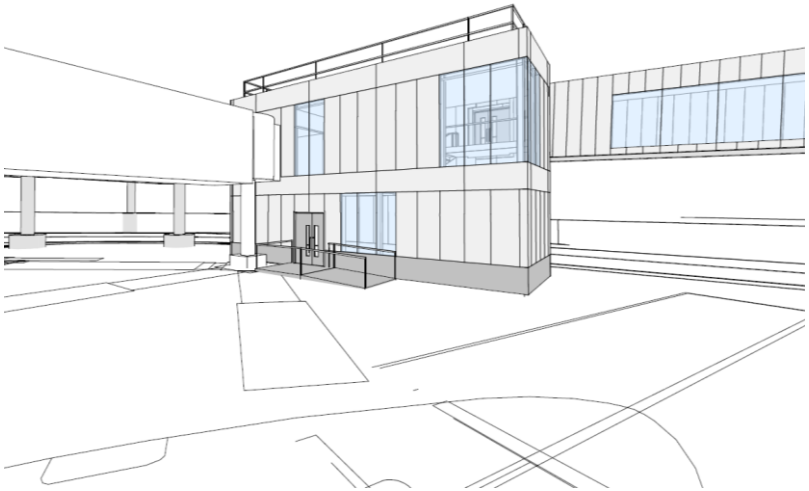


Figure 2-11 - Proposed Node B Perspective View

Internal Layout

The design aims to provide a clean and clear internal layout for the fixed links and nodes which will enhance the passenger experience and aid intuitive wayfinding.

Although the Fixed Links are relatively long corridors, careful consideration has been given to internal spacing, layout and accessibility to improve the passenger experience. A combination of ramps (1:20 gradient) and gentle slopes (between 1:21 and 1:50 gradient) with landings at every 500mm rise takes passengers down to the node level. A clear width of 1800mm between handrails is proposed to allow two wheelchair users to pass one another.

The nodes generally consist of one escape staircase, one lift, refuge and orientation area, electrical and comms cupboard and a service riser. A minimum space allowance of 1.8m x 1.8m has been allowed for in front of the lift on the upper and lower floors for passenger waiting. The central orientation area is useful for passenger to orientate themselves before proceeding to the airbridge, lift or stair. It is also classified as a refuge area in case of an emergency escape.

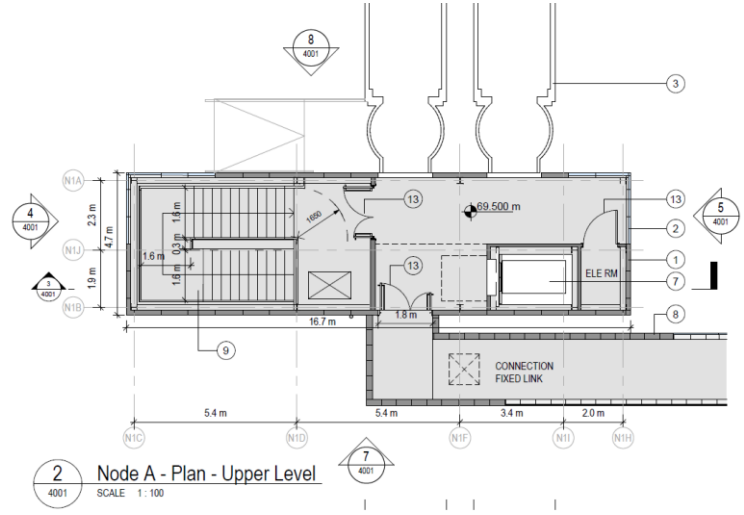


Figure 2-12 - Proposed Node A Upper Level

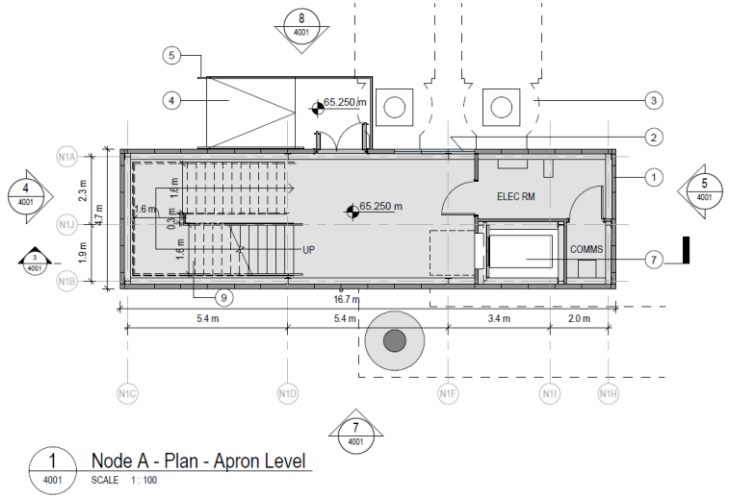


Figure 2-13 - Proposed Node A Lower Level

Facades

The new proposed Node facades will be attractive and in keeping with the surrounding context. The design will comply with Part L 2020 requirements for energy performance and greenhouse gas emissions. The new development will be designed and constructed to limit heat loss and where appropriate, limit heat gains through the fabric of the building. In order to limit the heat loss through the building fabric the thermal insulation for each of the elements of the development will meet or exceed the area weighted average elemental U-Values as specified in Part L.

Key features of the energy efficient design of the proposed building will include enhanced building fabric performance, efficient heating, ventilation and lighting with occupancy and daylight control where applicable.

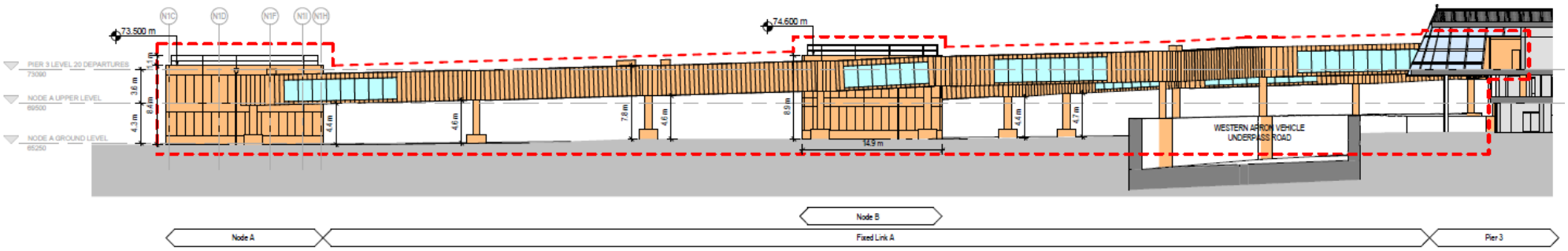
The energy strategy shall be in accordance with Fingal Development Plan 2017-2023, Policy Objectives PM29 - Promote energy efficiency and conservation above Building Regulations standards in the design and development of all new buildings and residential schemes in particular and require designers to demonstrate that they have taken maximising energy efficiency and the use of renewable energy into account in their planning application.

The nodes will be clad using modular composite cladding panels fixed to the structural frame with a secondary steel system. The panels will be light grey aluminium and the appearance and arrangement will be similar to that of Terminal 1 and Pier 4 nodes.

Careful consideration has been given to the placement of windows to allow sufficient natural daylight and views out onto the airfield but avoid unnecessary solar gain.

The nodes will have mono-pitch flat roofs with parapet upstands and metal edge protection rails. A single rainwater downpipe and hopper will be located near the centre of the roof fall on the southern façade.

Figure 2-14 - Node and Fixed Link A Elevation



Interior Materials and Details

The design proposal sets out to satisfy a Key Design Principle which aims to achieve “a sense of place” by means of the following:

- Material quality and subtle use of colour, natural textures and light.
- Clear visibility and lines of sight which aids intuitive wayfinding and creates a sense of calm.
- Accessibility through space planning and ordered layouts which is easy to navigate and welcoming.

Within the Pier 3 decagon, minor changes are required to the interior finishes. New partition walls at the fixed link entrances will be covered with high pressure laminate panels to protect them from bypassing damage. The entrance portals to the fixed links will be clad in rigid and durable cladding panels of a high material quality suitable for passenger areas.

Figure 2-15 – The internal environment is designed around the use of quality materials, subtle use of colour and natural light

The prefabricated fixed links will have non-slip flooring, high pressure laminate panels on the walls with handrails and removable suspended ceiling panels with integrated lighting. The floor to ceiling height in the fixed links will be 2.4m.

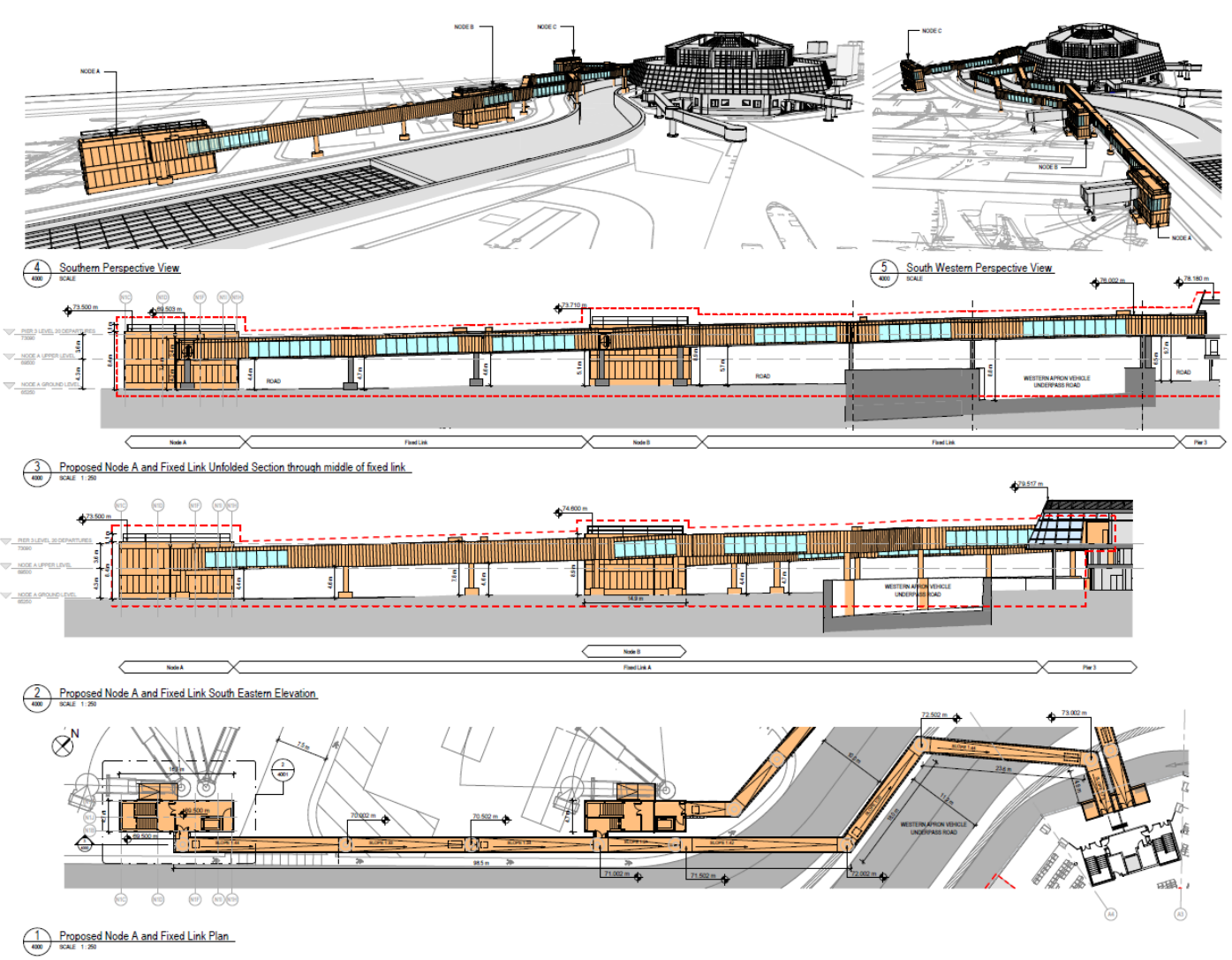
Figure 2-16 - The fixed links will be modular prefabricated structures with exposed steel on the inside and durable finishes to the floors and walls.

Within the nodes the internal white powder coated finish of the composite cladding panel will be visible. The stairs will be steel framed with non-slip flooring and contrasting nosing on the treads.

Figure 2-17 - Steel framed stairs with non-slip flooring and contrasting nosing

The internal partitions will be covered with full-height white laminate panels which is durable and easy to clean. It will have a suspended ceiling with modular removeable panels, integrated lighting and services and a floor to floor height that ranges from 2.4m to 3.85m.

Figure 2-18 - Proposed suspended ceiling system with integrated lighting



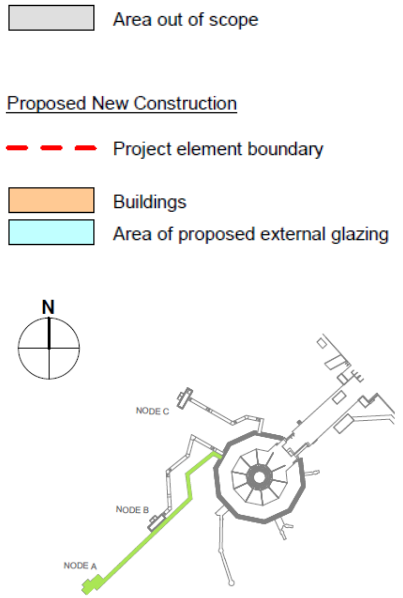


Figure 2-19 - Proposed Node A Layout, Section and Elevation

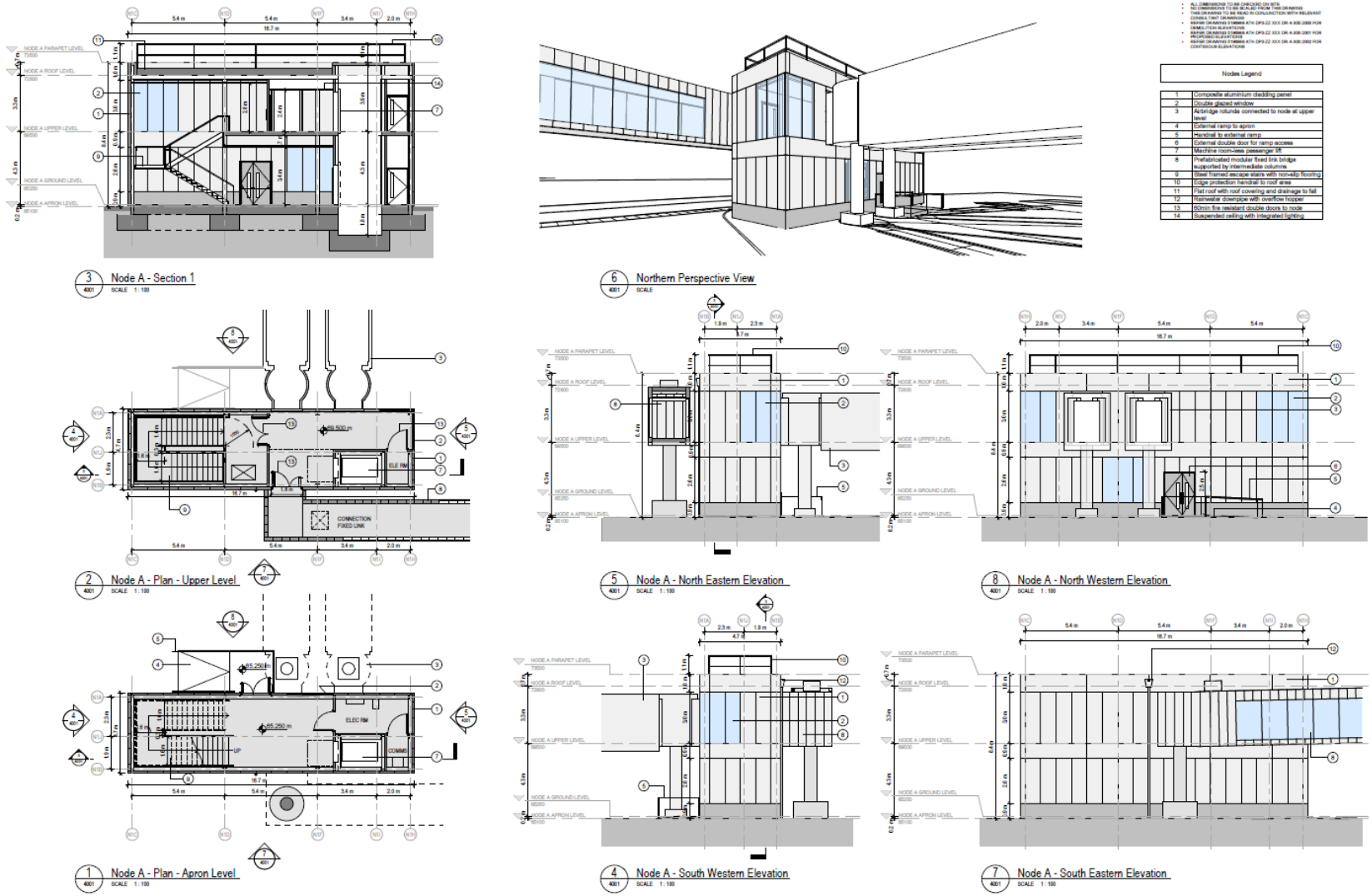


Figure 2-20 - Proposed Node A General Arrangement Plans, Section and Elevations

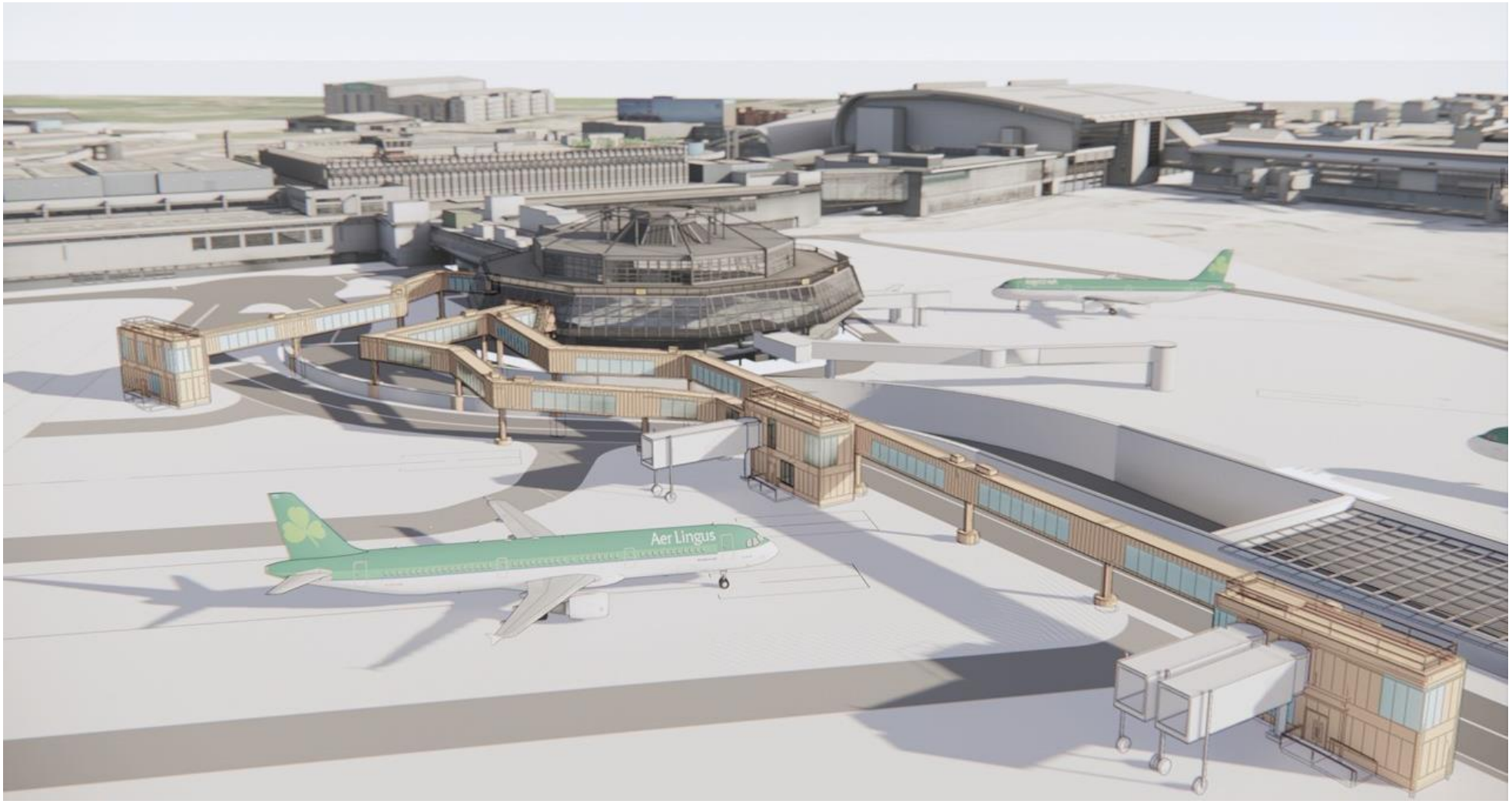


Figure 2-21 - Proposed New Pier 3 Fixed Links and Nodes

2.3. Area Schedules

The following floor space schedules have been generated from the existing and proposed general arrangement plans. It shows the existing gross areas affected by the proposed works in the Pier 3 decagon and fixed links. It also shows the proposed gross and net areas affected by the works in the Pier 3 decagon, fixed links and nodes.

Existing Gross Area Schedule	
Pier 3 Level 20 Departures	**3,500**
Pier 3 Level 20 Gates 301, 302, 303 and VCCs only	**876**
Existing fixed links to be demolished	**97**

Figure 2-22 – Existing Gross Area Schedule in sqm

Proposed Gross Area affected by the Works	
Pier 3 Level 20 Gates 301, 302, 303 and VCCs only	876
Fixed Link A	356
Fixed Link B	227
Fixed Link C	170
Node A (Upper and Lower Floor)	157
Node B (Upper and Lower Floor	154
Node C (Upper and Lower Floor)	148
Total	**2,088**

Figure 2-23 - Proposed Gross Area affected by the works in sqm

Proposed Net Area affected by the Works	
Pier 3 Level 20 Gates 301, 302, 303 and VCCs only	667
Fixed Link A	297
Fixed Link B	189
Fixed Link C	142
Node A (Upper and Lower Floor)	52
Node B (Upper and Lower Floor	36
Node C (Upper and Lower Floor)	43
Total	**1,426**

Figure 2-24 - Proposed Net Areas affected by the Works

2.5. Public Realm

Due to the proposed new fixed links, nodes and Pier 3 reconfigurations being airside, there is no impact on the external public realm and landscaping surrounding the terminal buildings.

2.6. Access and Permeability

2.6.1. Vehicular and transport links

The proposed reconfigurations and extensions within this project do not include any changes to the existing vehicular and transport links to the airport.

2.6.2. Inclusive access

Terminal 1 already has dedicated passenger drop-off and pick-up zones at the Terminal Forecourt, in-between the two main entrance doors, as well as suitable car parking provision in the nearby multi-storey carparks. The proposed development does not impact the existing Terminal 1 entrances or PRM routes.

Within the existing Pier 3 decagon where the new fixed links are positioned to come off Level 20 Departures, the departing passenger route is improved by removing the requirement for level change via Level 15 Mezzanine. The remaining fixed link routes will still require passengers to go down via Level 15 Mezzanine using the stairs and lifts. All Arriving Passengers will be required to go down to Level 10 Immigration Hall via the various VCC stairs and lifts.

Within the fixed links, level change will be in compliance with Irish Building Regulations Part M, using a combination of ramps (1:20 gradient) and gentle slopes (between 1:21 and 1:50 gradient) with landings at every 500mm rise. A clear width of 1800mm between handrails is proposed to allow two wheelchair users to pass one another.

Within the nodes, assuming a maximum occupancy of 400 persons (Code E aircraft load) a clear width of 1650mm between stair handrails are proposed in accordance with BS9999.

Node A and Node B will each contain a 13 person lift with a 1,100mm x 2,100mm internal car size. Due to these nodes serving airbridges, it is not anticipated that these lifts will be used by passengers on a daily basis, but rather in case of emergency escape, when the airbridge is not working or by the aircraft handlers when they take down large items like buggies or luggage.

Within Node C a 21-person lift with a 1,400mm x 2,400mm internal car size is proposed to accommodate a stretcher on wheels and two people beside it. This lift will also get used by passengers on a daily basis as it does not provide jetty-service but rather a walk-out operation.

All three nodes have a 1:20 external ramp with handrails to provide access from the internal ground floor to the external apron level.

At Node C, passengers are required to cross the inter-stand clearway road via a dedicated zebra crossing. All passenger movements to and from Node C will require operational marshalling. PRMs will be taken up to the aircraft via a dedicated ambi-lift when required.

Figure 2-25 – Aircraft transfer of PRMs using ambi-lift

2.7. Fire and Life Safety Strategy

The Pier 3 decagon building was constructed in the 1970's prior to the introduction of the modern Building Regulations. The proposed upgrade of Pier 3 provides an excellent opportunity to assess the existing provisions and ensure the building is ready for its next generation. New works will be designed in compliance with BS 9999 in consultation with the Fire Authorities.

The existing fire safety provisions of Pier 3 and recommendations as part of the upgrade works are outlined below:

2.7.1. Means of Escape

In line with Dublin Airport Authority fire safety management protocol Pier 3 is considered a single evacuation zone where both arrivals and departures will mix when evacuating. Where possible, escape will be managed by way of phased evacuation within the building into separate compartments, i.e. into the terminal. In the event of escape on to the apron, the evacuation thereafter will be managed in accordance with airport protocols including ensuring safe distance from the building. L20 is provided with 8 escape stairs having adequate capacity to deal with the additional occupants expected from the introduction of the new fixed links.

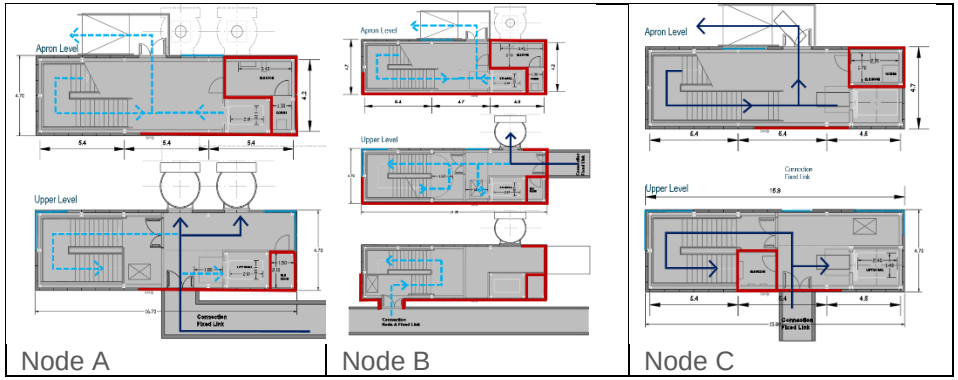
The new fixed links will likely increase the number of persons with restricted mobility within the Pier and, as such, additional protective measures should be introduced. These measures shall include the provision of large refuge areas with voice communication systems along with utilising some of the existing circulation lifts for evacuation.

The proposed travel distance from each of the fixed links is summarised by the below table.

	Node A	Node B	Node C
Total Walkway Length	158m	100m	89m
Maximum Distance Between Exits	42m	50m	44.5m

The distances comply with all recommended international guidance for travel distance for unsprinklered accommodation as outlined in BS 9999, NFPA 101 and the requirements of NFPA 415. The escape stairways at each end of the fixed links are designed to have a clear width of 1650mm to account for a maximum occupancy of 400 persons within the fixed links. Evacuation lifts will also be provided to ensure the escape of wheelchair users.

The proposed fire protection of each of the nodes is outlined in red below:



Node A | Node B | Node C

2.7.2. Fire Detection and Alarm Systems

The current practice in Dublin Airport is to provide an L1 grade fire detection and alarm system with a public address voice alarm system in all terminals and piers. As part of the upgrade works the existing system within the Pier shall be reviewed and upgraded as required.

2.7.3. Structural Fire Resistance

As outlined above, Pier 3 was constructed prior the introduction of the modern Building Regulations. To ensure Pier 3 is ready for its next generation the existing passive fire safety measures shall be surveyed and upgraded where necessary to ensure compliance with Regulation B3.

In line with NFPA 415, the structural resistance shall be sufficient to provide a safe means of egress of 5 minutes under fire conditions equivalent to a free burning jet fuel spill fire. Preliminary evacuation models with conservative assumptions of the physical capabilities of the typical airport show that the evacuation time is significantly less than the 5 minutes egress required by NFPA 415.

2.7.4. Sprinkler Systems

Pier 3, in line the remainder of Dublin Airport, is provided with an automatic sprinkler system.

Notwithstanding the commentary in Section 2.7.1 that the proposed travel distances in the fixed links comply with all recommended international guidance for un-sprinklered accommodation, daa have requested that the project should safeguard for sprinklers in the fixed links and nodes.

Existing Sprinkler Provision

Pier 3 is currently provided with a 150mm wet Ordinary Hazard group 3 (OH3) life safety automatic sprinkler installation throughout all levels and a tail end dry system serving external canopy areas. All systems are served by duplicate fire pumps and a full holding water storage tank housed in Terminal 1 Basement area, all in accordance with BS 5306 part 2 (now BS EN 12845) LPC Rules for Automatic Sprinkler installations.

Description of Proposed Sprinkler Modifications

If it is determined at the next design stage that sprinklers are required to one or more fixed links and nodes, it is proposed to connect into the existing 150mm fire main fed from the Fire Pump Room sprinkler header and extend protection to the new fixed links and nodes. Connection is proposed to the upstream side of the existing branches that currently serve the Pier 3 Pavilion and provide individual zone valve arrangements for each new link/node.

A suitable location for connection into the existing 150mm fire main is within the central plant area in the Pier 3 decagon. However, daa have advised that the existing plant area is congested and that a reconciliation is planned to simplify the building services configuration within the area.

A single 150mm sprinkler main will therefore be routed from the central plant area to level 30, at which point branches would then be extended to the fixed links, with a zone valve arrangement located adjacent to the entrance of each link. A distribution main would then be provided downstream of the zone valve to serve sprinkler protection for the entire length of the fixed links and nodes.

A hydraulic calculation will need to be provided at the next design stage confirming available capacity within the system to serve the new fixed links and nodes based upon Ordinary Hazard Group 3 (OH3) assumed maximum area of operation (AMAO) 216m^2 or 18 No heads discharging simultaneously.

2.7.5. Smoke Management System

Pier 3 is provided with a smoke management system. A survey will be undertaken on the existing smoke management system to determine its efficacy. The provision of a smoke hazard management system would provide full commercial flexibility in the Pier vis a vis new restaurant and is highly recommended as part of an extended BS 9999 strategy deployed in Terminal 1.

2.8. Building Services Strategy

2.8.1. Internal Comfort Levels in the Fixed Links and Nodes

Fixed Links and nodes are traditionally utilised as external structures with similar characteristics and comfort levels to passenger boarding bridges, given that they are transient spaces. Prolonged periods of occupation are therefore not anticipated, and the environmental design has been carried out in this respect.

Heating will be limited to a background level to avoid freezing/condensation within the fixed links structure. No cooling or heating for comfort of passengers in the fixed links or nodes has been afforded in the design.

Background heating is to be either by radiant panel heaters integrated with the ceiling or underfloor heating mats, both provided as part of the prefabricated module solution.

Ventilation will be provided at a reduced, background level (proposed at 4 air changes per hour) to purge the link and prevent build-up of moisture-laden air, condensation and odours. This would be achieved by the provision of supply/extract fans located intermittently along the link and provided as part of the prefabricated module solution. In order to reduce drafts along the fixed links, it is proposed that the supply fans deliver air through linear diffusers and thereby effectively act as air curtains. The supply air units would be located on the roof of the fixed links and incorporate filters and electric heaters, the latter to avoid cold draughts being experienced by fixed link users. Maintenance of these fans will be via a mobile elevating work platform (MEWP).

The nodes are two-storey structures that open onto the link at high level and to the apron at low level. It is considered that natural infiltration and the natural convection of air will be sufficient to ventilate the space. To protect the envelope, overdoor electric heaters are proposed at the doors to the fixed link and the apron.

Electric heating is proposed for the links and nodes for the following reasons:

- It has been confirmed by daa that there is no spare capacity in the existing hot water heating system serving Pier 3. (This is a medium temperature hot water (MTHW) system that feeds a low temperature hot water (LTHW) system).
- Extending heating pipework to serve the links and nodes can attract additional cost (capex) over the installation of electrical cables, take additional space, require insulation and is not practical for a modular approach, unless retro fitted. Electrical supplies are required to the links and nodes in any case for other systems.
- Additional space and access will be required for LTHW heat emitters, valve configurations, etc.
- The heating demand will be low, at a background level, and energy consumption is not considered to be significant.
- If electricity is sourced by daa from a sustainable energy supplier, this solution will contribute to the net zero carbon target.

2.8.2. Services Distribution

The source of electrical supplies for the links and nodes is yet to be confirmed but is assumed, through discussion with daa, to be available from the Pier 3 main electrical intake (room ref. DT1-P3-EPR-L10-01 at level 10 in the Pier). It is understood that the existing electrical switchgear in the Pier forms part of the scope of a proposed asset replacement programme. The new electrical supplies for the fixed links and nodes should therefore be coordinated with the new switchgear design and ideally be implemented at the same time to reduce operational down time.

A ceiling void space is to be provided within the proposed modular link in which to install services. The space is to accommodate LV distribution cable tray for sub-main cabling to each node, LV trunking to service the Fixed Link (normal lighting, heating, etc.), Fire Alarm cable tray, LV Life Safety System cable tray (for Emergency Lighting) and data cable tray.

Consideration has been given to locating the main electrical distribution cables on the roof of the fixed links but has been rejected to mitigate the risks of installing and maintaining at high level above a roadway.

As identified in section 2.7.4, daa has requested that the project should safeguard for sprinklers in the fixed links and nodes. The ceiling void in each fixed link is therefore also to accommodate sprinkler pipework.

The new electrical supplies for the fixed links and nodes are also to accommodate the electrical requirements for the airbridge, the airbridge comms

cabinet and the stand fixed electric ground power (FEGP), as identified in Appendix B (Electrical Connection Schematic) of daa's Specific Specifications & Design Criteria for All Passenger Boarding Bridges at Dublin Airport.

New electrical services distribution boards are to be provided in each node to facilitate the requirements in the previous paragraph. In addition, a 'disconnect panel' is to be provided in accordance with the requirements of the aforementioned daa document.

Smoke extract fans are to be provided to the fixed links, mounted on the roof. (refer to Fire and Life Safety Strategy section.) Quantities and locations are to be determined at the next design stage. It is proposed that each fan will have a single duct penetration through the roof of the fixed link, i.e. no significant lengths of internal ductwork. Maintenance of these fans will be via a MEWP. Automatic air vents will be required to provide a route for replacement air should the smoke extract fans operate. These are proposed to be situated within the side walls of the fixed links.

2.8.3. Connection to Pavilion Building

The Pier 3 decagon is currently provided with fan coil units situated around the perimeter of the building. Where the new fixed link connections are to be made, the fan coil units are to be removed and the heating and chilled water pipework serving them reconfigured. Similarly, the existing ventilation ductwork within the ceiling void at these locations is to be modified.

New doors with access control are to be provided at each new fixed link location.

As the new fixed links are not being provided with heating to the same requirements as the Pavilion, new high velocity overdoor air curtains are to be provided to prevent cold draughts being experienced in the Pavilion when the doors open. It is anticipated that the air curtains will operate via door contact switches with a timed overrun to reduce fan motor start/stop cycles.

2.8.4. Other Building Services Systems

Other systems to be provided within the fixed links and nodes are:

Lighting and Emergency Lighting – luminaires containing light emitting diode (LED) light sources would be employed for general illumination. Emergency lighting can be facilitated by either standalone fittings with individual battery backup (possibly integrated with the general illumination fittings) or fittings fed via a central battery unit (CBU). The merits of each system arrangement would need to be assessed at design stage. daa's preferred option is the central battery system, monitored via the Eclipse Control System using the Philips Dynalite lighting control platform.

Fire Detection – In line with the remainder of the airport campus strategy an L1 fire detection and alarm system with PAVA shall be provided in the fixed links and nodes. This system shall be provided in accordance with IS 3218:2013 + A1 2019. The design of the system will be developed and agreed with the Airport's Fire Safety Officer and connected to the Terminal 1 loop. If the nodes are considered separate evacuation zones, they will require a dedicated fire alarm panel per evacuation zone.

PAVA – the existing public address and voice annunciation system will be extended from the existing system in either the Pavilion, Pier or main terminal building, subject to an assessment as described for the fire detection system. Each fixed link will be configured as a separate zone.

IT & Comms – it is anticipated that each link will accommodate a fibre backbone for both airport and airline IT and communications, which would originate in the Pavilion secondary comms rooms at Arrivals and/or Departures level. It is anticipated that two independent, separately routed fibres would be installed for resilience purposes.

LV Power – the power supplies for heating, ventilation and lighting will be derived from local distribution boards at each node. In addition, power supplies will be required for equipment such as lifts, access control, node IT equipment, etc.

Access Control – the extent and nature of the access control to the nodes and links will be developed during design stage. This could be a managed arrangement or via card-activation of motorised doors/maglocks. This assessment is based upon the assumptions not only that the existing systems in the Pavilion and/or Pier 3 have the spare capacity and adaptability for extension, but also that the systems are suitable for extension in view of the proposed demolition of these buildings.

2.9. Structural Strategy

The scope of the outline structural design is summarised in Figure 2-26 and includes the new fixed links and their foundations, the connection of these to the existing decagon / Pavilion building and the new node structures and foundations located on the apron. Refer to Appendix A for further structural information.

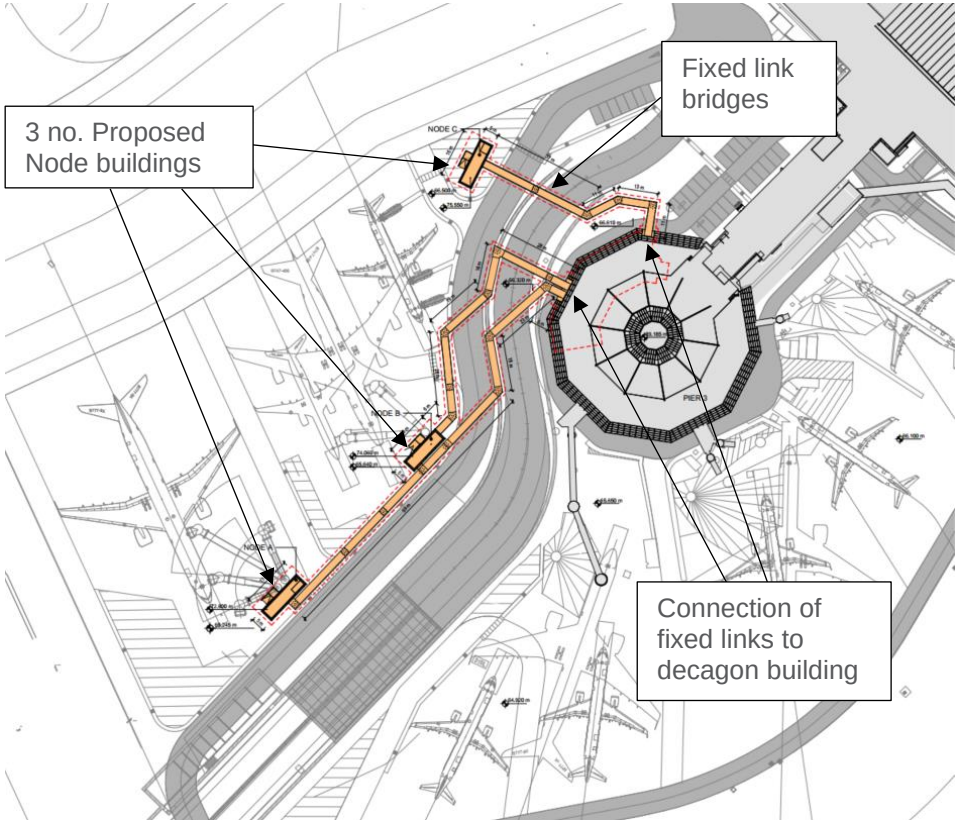


Figure 2-26 - Proposed Layout of Stand Reconfiguration

2.9.1. Outline Design Solution – Node Structures

Three new Node structures are proposed. The buildings are of similar form with plan dimension of c. 5m wide by 15m to 17m long and heights ranging between 8.5m to 9.3m. The structures are all two-storey with a stair and lift serving ground and first floor. The nodes are accessed by new fixed link bridges at first floor level.

The node building structural frames are anticipated to be economically constructed using traditional braced steel frames with a concrete upper floor and light-weight roof.

Where fixed links are connected it is recommended that separate fixed link support columns are provided near the Node buildings to avoid long-spans of fixed link being supported on the Node structures. This will simplify the design solution. The foundations of the Node building and adjacent fixed link support column could be integrated to a common foundation.

2.9.2. Outline Design Solution – Fixed Link Structures

The design assumption is for the fixed links to be modular prefabricated structures similar to the fixed links at Heathrow Terminal 5. The advantage of a prefabricated modular solution is minimized cost and time on site, the latter looks to reduce impact on airfield operations. In addition, delivery and assembly of prefabricated units improves product quality and safety performance.

The fixed links are typically light-weight steel structures formed using box-trusses and can be clad in either solid or glazed envelope. For the purposes of this Architectural Design Statement (ADS) it is anticipated that the airbridges will be a proprietary modular system by ThyssenKrupp or similar. The modules can be made to order for varying arrangements and standard modules typically span a maximum of 25m between support columns. The design of the support columns would be packaged with the design of the fixed links. Support columns are typically a mono-post system and anticipated to be supported on a single large pad foundation and located at bridge change of direction and at the end of modules at their maximum span.

It is anticipated that vehicle impact protection design will be provided as part of the next design stage. Either a barrier system can be provided or where layout space is constrained, a purpose designed raised reinforced concrete plinth can

be provided which would be sized slightly larger than the column base plate. Notwithstanding this, the Fixed Links have been designed to provide for more than the required vehicle clearance associated with tunnel and road users

The current Fixed link layout will require 19 support columns each with their own concrete pad foundation. Where pad foundations are in close proximity to one another, or close to the Node structure foundations, these will be combined. A single fixed link column supporting the end of two 25m span sections will have a pad footing approximately 4m x 4m x 2m in size. Eight of the fixed link column foundations will need to be integrated with the design of the road ramp retaining walls.

2.9.3. Outline Design Solution – Connection of New Fixed Links to Decagon / Pavilion Building

Two existing fixed link bridges will be removed from two of the facets of the decagon building, as the current headroom clearance below will be insufficient for the proposed underpass entrance / exit road that will be located in the vicinity.

The new fixed links will connect into the Pavilion higher that the existing fixed links at Departures level. This can be achieved without the need for additional vertical support structure (columns and foundations). This is assuming that there is not a significant net increase in vertical loads; which can be achieved through situating new fixed-link support columns in close proximity to the Pavilion building thus ensuring the spans of the fixed-links supported by the Pavilion structure are short-spans. The works would likely involve the following modifications to the existing structure and façade:

1. Removal of previous airbridges and existing airfield support columns (and possibly their foundations);
2. Removal of a portion of façade above departures level over width of proposed airbridge;
3. Demolition of a portion of the Departures level projecting slab edge. Portion of slab to be removed 1.5m x 5.8m length approximately.
4. Replacement of the steel beam connecting to existing columns to provide bearing support at the correct level for the proposed fixed link bridges;
5. Installation of the new airbridge; and
6. Reinstatement of façade around the new airbridges.

3. Detailed Development Descriptions

3.1. Description of Operation

The existing decagon comprises four levels including Level 30 office accommodation, Level 20 departure gates with open lounges, Level 15 mezzanine providing access to the fixed links and nodes and Level 10 arrivals immigration hall. The main intervention will occur on Level 20 departures where the new fixed links will connect with the decagon. The design proposes to continue using the existing internal vertical circulation cores in the decagon to minimise impact on the existing structure and layout.

Fixed Link A will serve passengers from gate lounge 303, Fixed Link B will serve passengers from gate lounge 302 and Fixed Link C will serve passengers from gate lounge 301. Departing passengers will wait in the respective gate lounges until time to board, from there they will enter the fixed links direct from Level 20 and proceed towards the nodes on the stands. The fixed links are ramped and sloped to provide level transition from Level 20 Departures to the lower node and rotunda levels.

At Nodes A and B, departing passengers will be able to board the aircraft via the attached airbridges without any level changes. In the event of airbridges being out of action, passengers will be able to use the escape stairs and lift down to the apron level and steps up to the aircraft.

Node C does not provide jetty service and therefore departing and arriving passengers will use the escape stairs and lift for access to and from the apron.

Within the decagon a new partition, creating an airlock, will be required between the entrance/ exits of Fixed Links A and B to ensure full segregation of departing and arriving passengers. Arriving passengers requiring the shared lift in the VCC will have to be escorted by operational staff to ensure segregation.

Fixed Link C will be positioned to join the departures level where it has the least impact on the existing food and beverage concession.

Due to the retained stand arrangement to the South, no changes are required to the fixed links and gate lounges serving these stands.

3.2. Description of Works

The introduction of the new Western Apron Underpass will result in a new underpass road curving around the Pier 3 decagon to the north, connecting with the existing airside road network adjacent to Terminal 1. The stands to the north of Pier 3 will be reconfigured as a result to include two Code E stands, one of which is reconfigured as a Multi Aircraft Ramp System (MARS) stand. The existing stand arrangement to the South will be retained with a realigned centreline for Stand 315L.

The revised stand arrangement creates the need for new fixed links and nodes to connect the proposed stands to the Pier 3 decagon. The nodes are positioned in the most optimal location on the stand to serve the connecting airbridges and have the least impact on the operational stand activity.

Node A, serving two airbridges and parallel with the HoS road, is the furthest away from the Pier 3 decagon and produces the longest fixed link. Node B, serving one airbridge, is the middle node positioned parallel with the HoS road. Node C, located nearest to the Pier, does not provide jetty-service due to site constraints.

The fixed links span from the Pier 3 departures level, approximately 7.1m above the surrounding apron, and gradually slope down and connect with the nodes. The fixed links connect with the existing Pier building along the same façade facets where the existing demolished fixed links were connected, making use of the existing structural support. The fixed link support columns are positioned on either side of the tunnel and HoS road, no more than 25m apart to allow for the maximum structural span between columns.

Consideration has been given to the positioning of safety barriers and segregated pedestrian walkways adjacent to the nodes.

Appendix A. Structural Engineering

A.2. Introduction

This section of the report describes the pre-concept structural strategy to support the planning application for new Pier 3 Fixed Links, Nodes and alterations to the Pier 3 decagon building, required to enable the construction of the Western Apron Underpass.

A.3. Scope of Structural Design

The scope of the outline structural design includes the new fixed links and their foundations, the connection of these to the existing decagon / Pavilion building and the new node structures and foundations located on the apron.

A.4. Site Description and Constraints

The original decagon building at the end of Pier 3 was constructed around 1970 at the same time as the Terminal 1 8-Bay structure. It was originally a two-storey building with a small plant room in the central core above the main roof level. Since then an additional storey has been added on the roof level and several internal reconfigurations have been made.

The structure is of steel framed construction forming a decagon shape on plan and is 64m across, between facets at Departures level.

Level 20 Departures is approximately 7.1m above the varying external apron level. This original floor typically comprised pre-cast concrete double-Tee planks spanning onto the steel beams that are oriented in a radial arrangement projecting from the central core of columns.

The existing fixed links connect to the decagon building at Level 15 Mezzanine (note this is not a major floor level) leaving approximately 3.8m clear below the fixed link bridges and limiting the head of stand clearance on the airside road.

The apron / pavement surrounding the Pier 3 decagon comprises panels of concrete slabs, typically 3-5m by 3-5m divided by expansion joints. Existing buried utilities exist in the proposed works location comprising surface water drainage, water, LV electrical. These will likely require diversion due to the limited flexibility that exists in the Node building positions, but also as the proposed vehicle underpass road ramp will require significant works to the existing services within the vicinity. Figure 3-2 shows the existing buried services impacted by the proposed works.

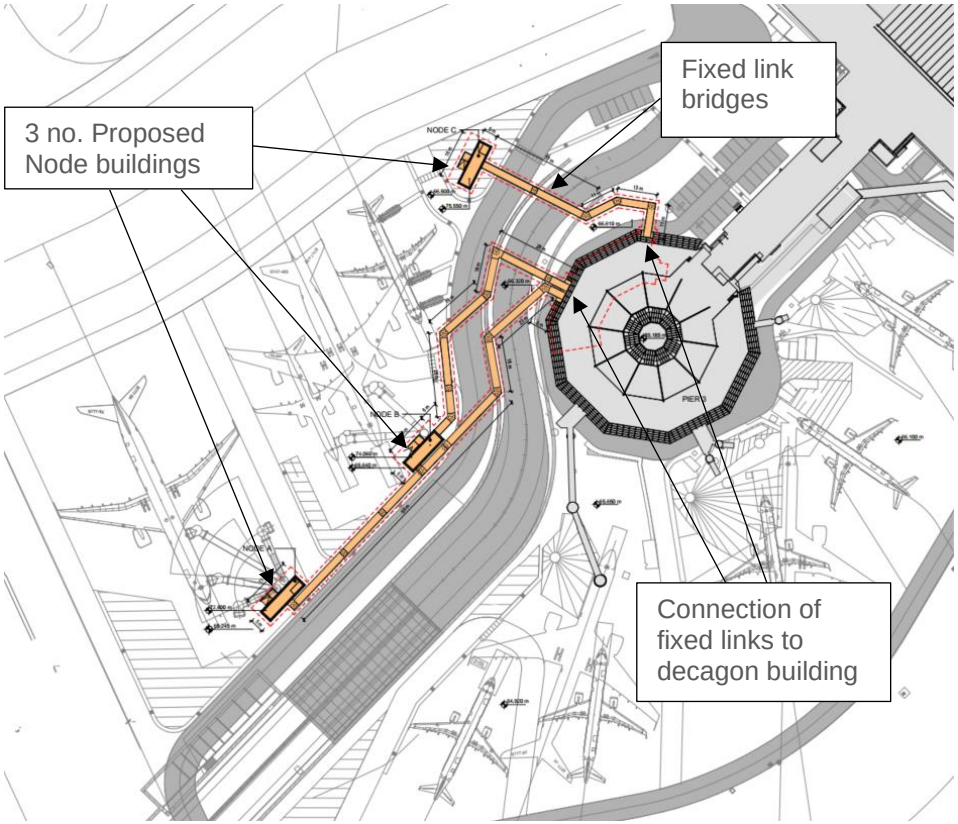


Figure 3-1 - Proposed Layout of Stand Reconfiguration

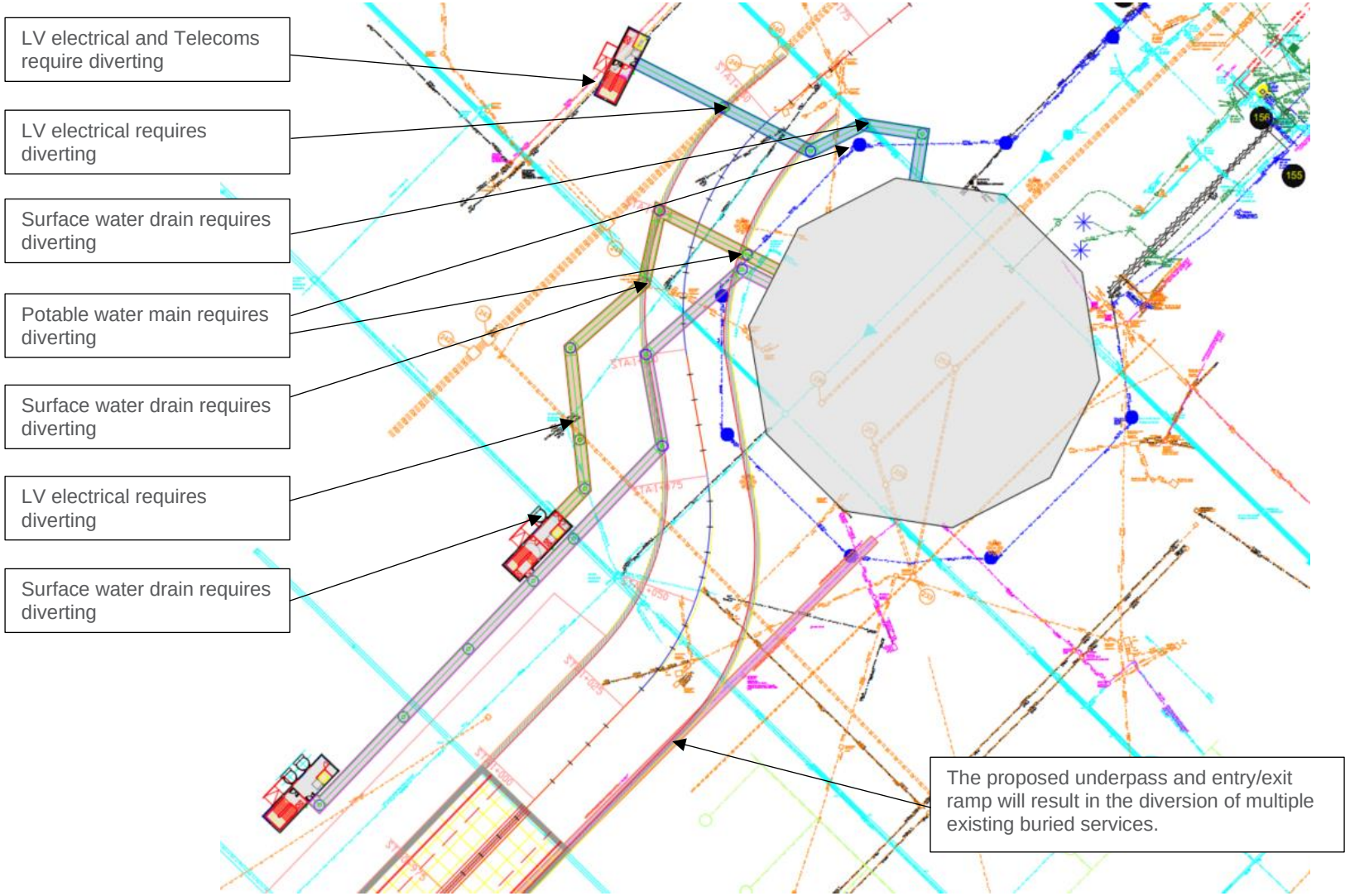


Figure 3-2 - Impact to Existing Buried Services

A.5. Design Interfaces

The outline design proposals for the scope described in this section interface with elements of design that are by others. These include:

- Western Campus vehicle underpass including the entrance / exit ramp and its retaining walls – these walls will interface with the foundations of the proposed fixed link columns.
- Airbridge rotundas. These will interface with the proposed Node buildings and are not anticipated to be structurally connected (i.e. they are structurally independent).

A.6. Outline Design Solution – Node Structures

Three new Node structures are proposed. The buildings are of similar form with plan dimension of c. 5m wide by 15m to 17m long and heights ranging between 8.5m to 9.3m. The structures are all two-storey with a stair and lift serving ground and first floor. The nodes are accessed by new fixed link bridges at first floor level.

The node building structural frames are anticipated to be economically constructed using traditional braced steel frames with a concrete upper floor and light-weight roof.

Where fixed links are connected it is recommended that separate fixed link support columns are provided near the Node buildings to avoid long-spans of fixed link being supported on the Node structures. This will simplify the design solution. The foundations of the Node building and adjacent fixed link support column could be integrated to a common foundation.

A proposed outline foundation solution is shown in Figure 3-3 comprising shallow pad footings connected via ground beams. A lift pit is incorporated into the foundation solution. Further design development would require geotechnical information to be provided however stiff clay is anticipated on the site hence shallow footings are expected to be the appropriate solution here.

An opportunity exists to reduce excavation and construction works on site by situating the Node buildings on top of the existing apron slab. To achieve this, the allowable bearing capacity beneath the existing apron slab would need to be established through on site testing. For this alternative option, it is anticipated that a 1000mm x 500mm concrete upstand connected to a 300mm ground slab would be required to provide sufficient mass to avoid instability of the structure when experiencing the full design wind plus jet blast loading.

For reduced cost and complexity, it is proposed that vehicle impact protection is to be provided by external barrier system and not integral with the building.

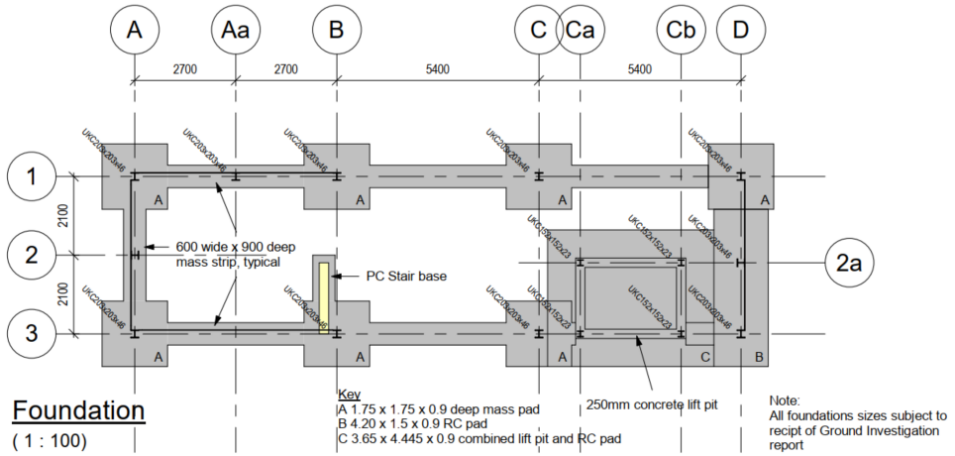


Figure 3-3 - Proposed Typical Node Foundation Layout

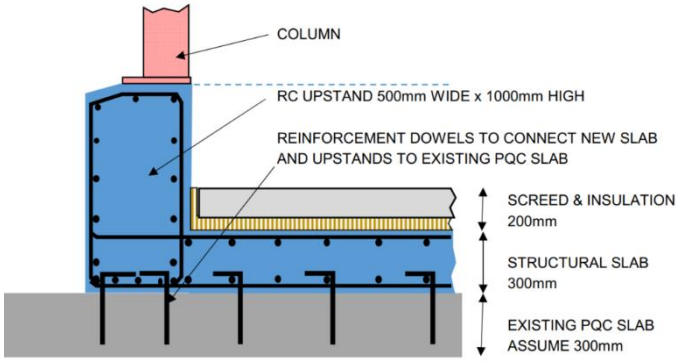


Figure 3-4 - Alternative Node Foundation Solution (part cross section)

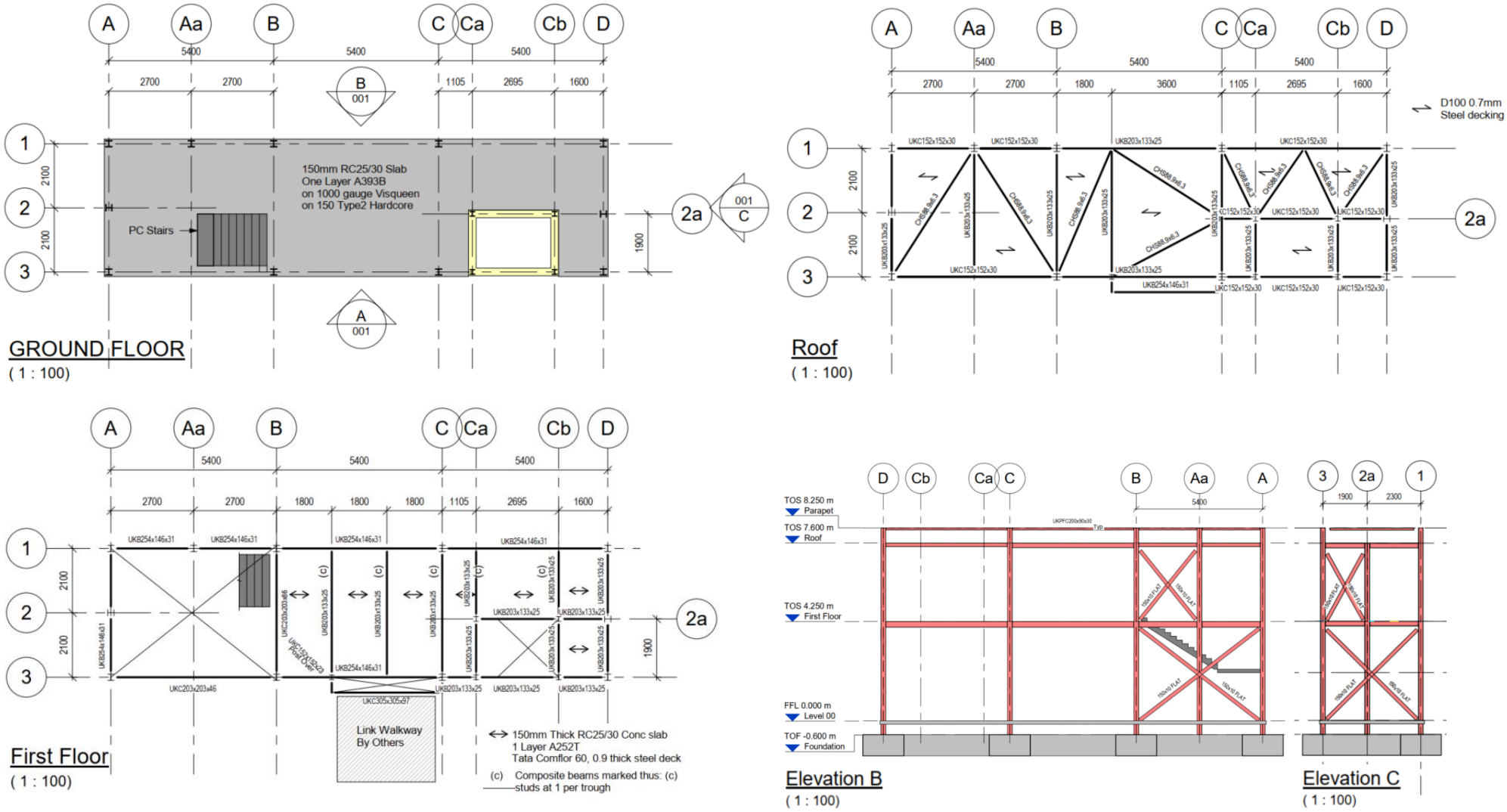


Figure 3-5 - Outline Design Solution - Typical Node Superstructure

A.7. Outline Design Solution – Fixed Links

The design assumption is for the fixed links to be modular prefabricated structures similar to the fixed links at Heathrow Terminal 5. The advantage of a prefabricated modular solution is minimized cost and time on site, the latter looks to reduce impact on airfield operations. In addition, delivery and assembly of prefabricated units improves product quality and safety performance.

The fixed links are typically light-weight steel structures formed using box-trusses and can be clad in either solid or glazed envelope. For the purposes of this study it is anticipated that the airbridges will be a proprietary modular system. The modules can be made to order for varying arrangements and standard modules typically span a maximum of 25m between support columns. The design of the support columns would be packaged with the design of the fixed links. Support columns are typically a mono-post system and anticipated to be supported on a single large pad foundation and located at bridge change of direction and at the end of modules at their maximum span.

It is anticipated that vehicle impact protection design will be provided as part of the airfield designer's scope and that the fixed link steel columns will not be designed to resist the effects of a vehicle impact. Either a barrier system can be provided or where layout space is constrained, a purpose designed raised reinforced concrete plinth can be provided which would be sized slightly larger than the column base plate.

Figure 3-6 - Example Prefabricated Fixed Link and Support Column

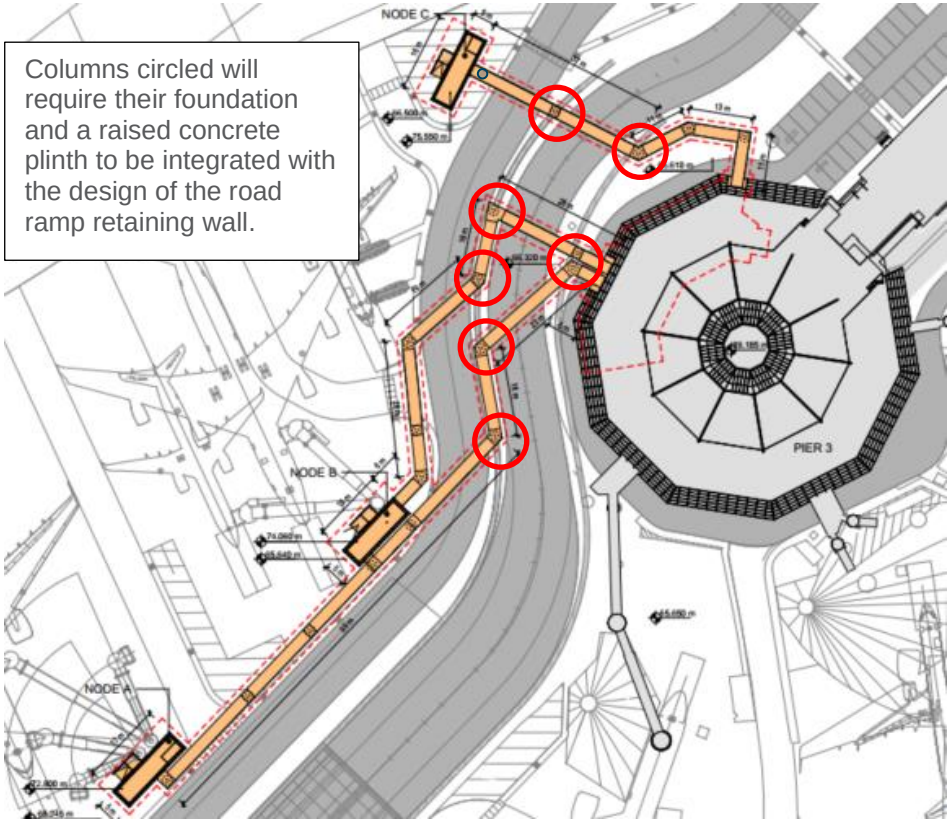


Figure 3-7 - Fixed Link Column Foundations to be Integrated with Ramp Wall Construction

The current Fixed link layout will require 19 support columns each with their own concrete pad foundation. Where pad foundations are in close proximity to one another, or close to the Node structure foundations, these will be combined. A single fixed link column supporting the end of two 25m span sections will have a pad footing approximately 4m x 4m x 2m in size. Figure 3-7 indicates where eight of the fixed link column foundations will need to be integrated with the design of the road ramp retaining walls.

A.8. Outline Design Solution – Connection of New Fixed Links to Decagon / Pavilion Building

The received record drawings and Figure 3-8 and Figure 3-9 confirm how the existing fixed links connect to the Pavilion structure. There are five facets of the Pavilion building that have existing fixed links connecting to them. The fixed links connect at an intermediate level between apron level and departures level (i.e. at Mezzanine level) and are access via stairs and lifts from departures level, as indicated in the cross section in Figure 3-12.

The existing fixed links are supported by a steel UB cross member which frames into two additional UC steel columns that also support part of the departure level floor. Facets that do not have airbridges do not have these additional columns. The clear spacing between these existing columns is approximately 5.8m, which is a limitation on the width of proposed fixed links to avoid more significant structural intervention.

Proposals for replacement fixed links involve locating new airbridges at Departures level.

Figure 3-8 - Existing Fixed Link Connection to Pavilion at Level L15

Figure 3-9 - Existing Fixed Link Connection to Pavilion at Level L15

A.8.1. Structural Interventions

It is feasible to connect new fixed links into the Pavilion at Departures level without the need for additional vertical support structure (columns and foundations). This is assuming that there is not a significant net increase in vertical loads; which can be achieved through situating new fixed-link support columns in close proximity to the Pavilion building thus ensuring the spans of the fixed-links supported by the Pavilion structure are short-spans. The works would likely involve the following modifications to the existing structure and façade:

1. Removal of previous airbridges and existing airfield support columns (and possibly their foundations);
2. Remove portion of façade above departures level over width of proposed airbridge;
3. Demolition of a portion of the Departures level projecting slab edge. Portion of slab to be removed 1.5m x 5.8m length approx'.
4. Replacement of the steel beam connecting to existing columns to provide bearing support at the correct level for the proposed fixed link bridges;
5. Installation of the new airbridge; and
6. Reinstatement of façade around the new airbridges.

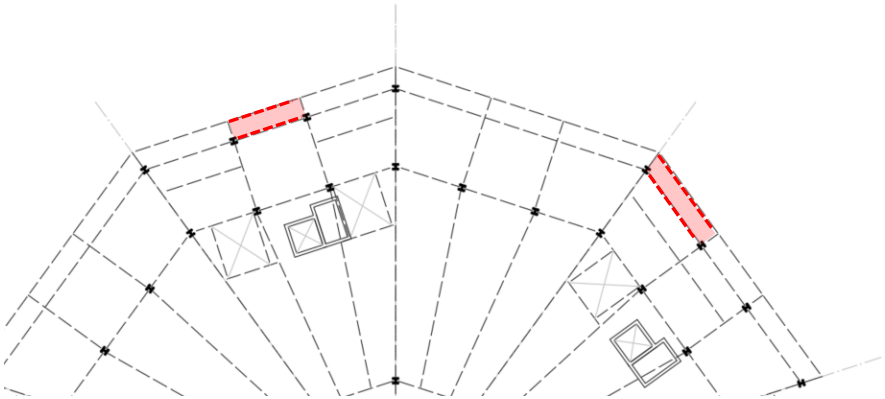


Figure 3-10 - Pavilion Departures Level - Existing Beams and Slab to be Demolished

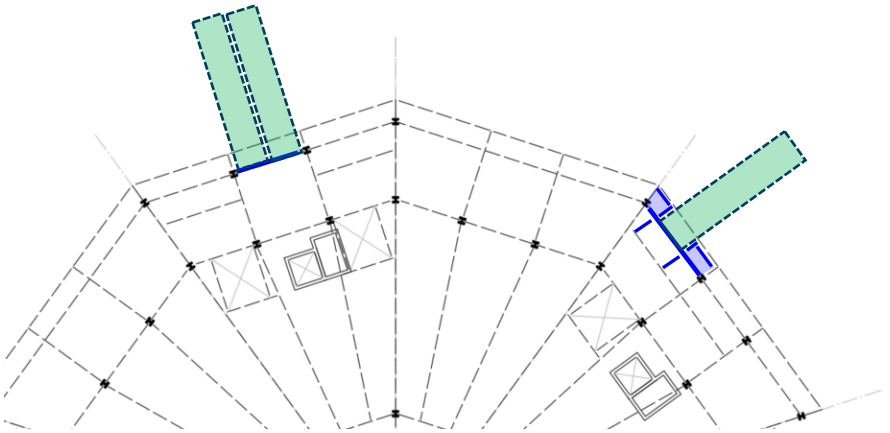


Figure 3-11 - Pavilion Departures Level - Proposed Fixed Link Bridges, Supporting Steelwork and Slab Infills

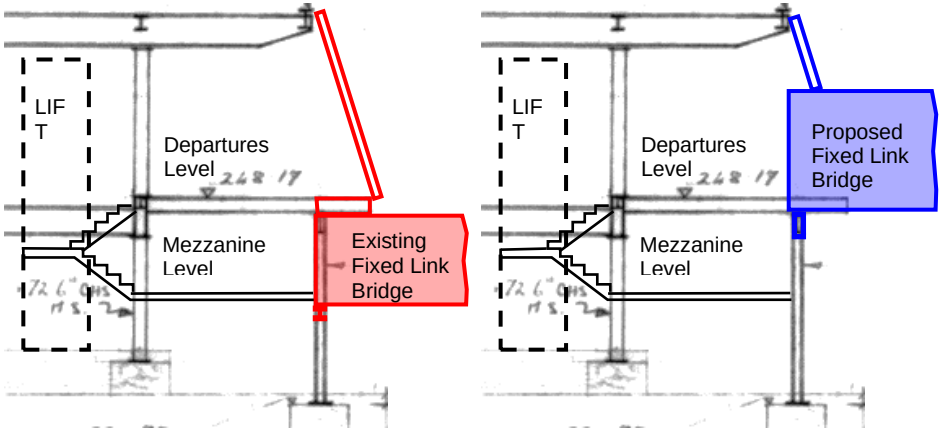


Figure 3-12 - Cross Section - Existing and Proposed Fixed Link Bridge Arrangements

Rob Jenner
Atkins Limited
Woodcote Grove
Ashley Road
Epsom
KT18 5BW

Tel: +44 (0)1372 726140
Fax: +44 (0)1372 740055
marilize.crafford@atkinsglobal.com