DRAFT WORK IN PROGRESS

Thames Wharf DLR Station

Feasibility Study Report

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Thames Wharf DLR Station - Feasibility Study

FINAL

This document has been issued and amended as follows:

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Abbreviations

TfL	Transport for London
DLR	Dockland Light Railway
LU	London Underground
GLA	Greater London Authority
WW+P	Weston Williamson+Partners
OAPF	Opportunity Area Planning Framework
EOS	Element Option Selection
SPO	Single Preferred Option
SFA	Step-free Access
TVM	Ticket Vending Machine
M&E	Mechanical and Electrical
HV	High Voltage
LV	Low Voltage
CER	Communications Equipment Room
SER	Signal Equipment Room
BOH	Back of House
RVAR	Rail Vehicle Accessibility Regulations
UKPN	UK Power Networks
TW	Thames Water
PRM	Persons with Restricted Mobility
RTD	River Terrace Deposits
RHS	Rectangualr Hollow Section
SHS	Square Hollow Section
CHS	Circular Hollow Section
MEP	Mechanical, Electrical and Public Health Engineering
DNO	District Network Operator
CCTV	Closed-circuit Television
LEER	Lift Electrical Equipment Room

NOTE: This Feasibility Report should be read in conjunction with the following documents;

- Drawing Pack
- Assumption Register
- Construction Planning Preliminary Activity Schedule
- Order of Magnitude Cost Estimate
- Programme
- Origin and Destination Figures
- Geotechnical Desk Study
- Stage 1 Option Selection Workshop (21-12-17)

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Appendix 2: Assumption Register

Appendix 3: Programme

Appendix 4: Order of Magnitude Cost Estimate

Appendix 5: Origin and Destination Figures

Appendix 6: Geotechnical Desk Study

Appendix 7: Option Selection Workshop (21-12-17)

1. Introduction

1.1 Project Brief

Thames Wharf station is a new station that needs to be designed as a focal point and catalyst for urban regeneration. It is critical that the station and urban realm are designed as an integrated flexible proposal to address the aspirations of the approving authorities, the large passenger uplifts and remain relevant within changing context.

In order to best develop robust options for the station this study looks to integrate these proposals into a wider strategic framework and will explore options for:

- **Urban Realm Integration;**
- **Station Layout and Capacity Demands.**

1.2 Urban Realm Integration

The nature of these infrastructure projects means that they are subject to a high level of scrutiny from a wide range of stakeholders. The 'hard' technical issues around the operational railways can have huge safety and cost implications and these must be balanced with 'softer' issues that are the concern of other consultees whose principle objective is to ensure that the building creates a humane environment and the passage experience for all.

The context driven design should present a simple, legible station building and integrated public realm that is intuitive, safe and responds to the existing and changing context by providing a new station square. The square will help form an important interchange node with new connections from this land locked site serving both the station and wider developments within the Royal Docks Development Capacity study and the Thameside West Greater London Authority (GLA) masterplan.

Stage 1 options (Section 7 and Appendix 7) will look to provide a flexible forecourt space for circulation and management of future passenger demands. It is intended that the station design should be visibly prominent and present a strong identity onto the square. Options will explore the station layout, including the entrance portal and all vertical circulation to the elevated station platforms in relation to this new station square/ concourse. This will help underpin a clear intuitive way-finding strategy and concept for wider contextual interchange.

The Single Preferred Option (SPO) will put forward sustainable, added value proposals that create a new destination supporting urban regeneration strategies and enhancement of the character as well as meeting the needs of existing and future communities.

1.3 Station Layout and Capacity Demands

A two-stage option selection process (Section 7 and Appendix 7) will look to evaluate key elements with the wider multidisciplinary team and client stakeholders for the construction of a new station around the existing viaduct, including;

- Defined concourse, flexible station square and entrance layout
- Vertical circulation (comprising of 4 stair cores (two per platform), 2 lifts (one per platform)
- Feasibility of both free standing and cantilevered new 3-car platform options with associated canopy arrangements
- Public realm and interchange opportunities
- The spatial provision for new Mechanical and Electrical (M&E) rooms and the location of these will need to be considered against existing viaduct column grid and available head height.
- Safeguard future vertical circulation with passive provision for future enclosed escalators/ additional lifts

Key elements will be evaluated by the client body, stakeholders and design team and combined into a single best fit option for stage 2 design development.

The study will deliver basic plans and costs (to ±40%) for the construction of the SPO, a new station adjacent to the existing bridge structure at Royal Victoria Dock between Canning Town and West Silvertown (Section 12). A pedestrian static analysis has been undertaken in Section 5. An assessment of the engineering feasibility (Section 8) and Track and Rail Vehicle Accessibility Regulations (RVAR) in Section 10 has been made for the design as well as a high-level indication of the construction impact and Programme (Section 11).

Figure 1a - Site Overview

2. Site Analysis

2.1 Existing Site/ Viaduct

Historically, the character of the area has been largely industrial. As a result of the wider-reaching GLA Thameside West masterplan the area is undergoing significant change.

The existing utilitarian Docklands Light Railway (DLR) viaduct structure is supported by a 3 columns arrangement as appose to twin or single column arrangements found on east London line extension, (Figs. 2a & 2b). Together with the two abutment ends these will constrain the design and permeability across the site. The central portion of the viaduct has 9 columns over three bays which are integral to the viaduct and as such have no bearings. However, maintenance access to the remaining 18 viaduct bearings (Fig.2a) will need to be considered with the placement of M&E plant rooms, vertical circulation and commercial opportunities.

The space between the columns and underside of viaduct appear to be adequate to support ground level M&E plant rooms (including HV, LV, Switch etc). Ground levels however vary considerably across site and are likely to be subject to alterations or may be reset as part of the wider reaching development plans. Flood defence and asset protection strategies will need to be developed accordingly as part of the next design stages.

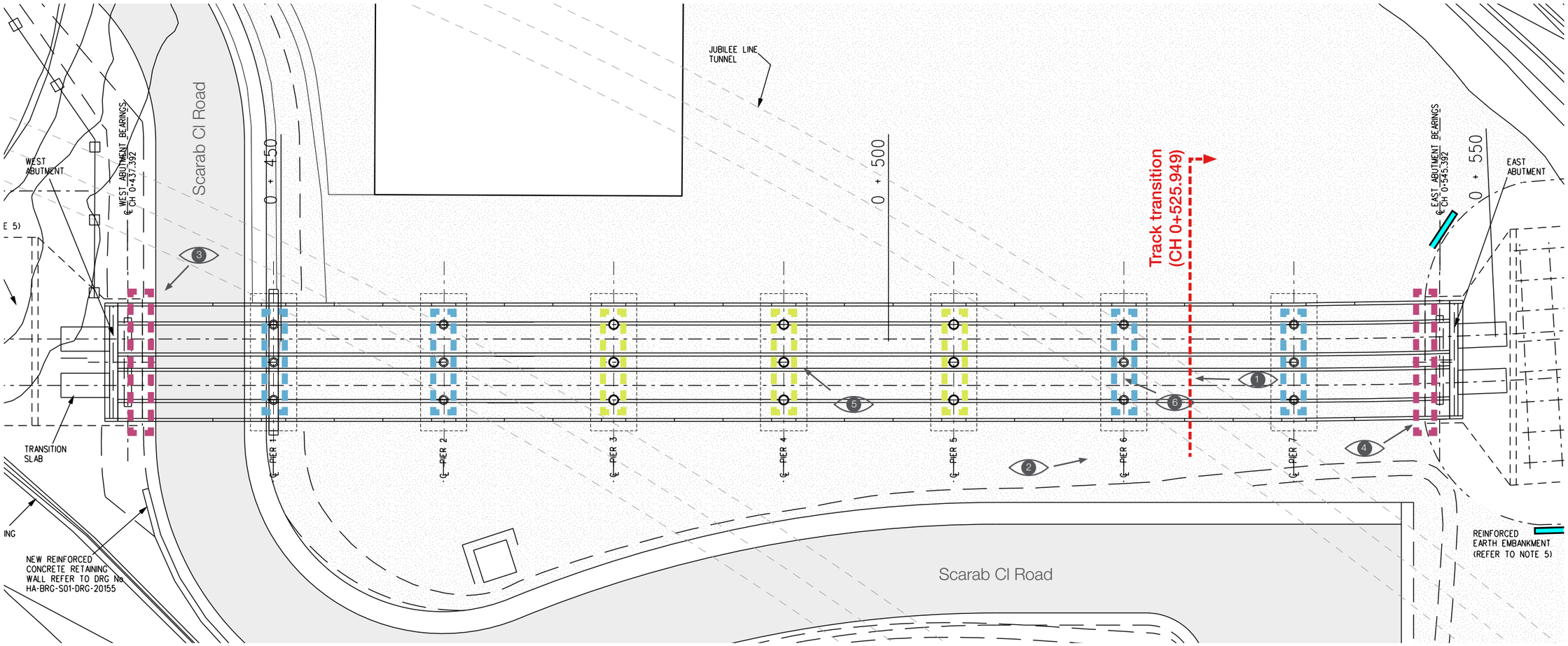
National Grid Overhead powerlines do not appear to impact or constrain the proposed station alignment. The Jubilee line tunnels pass under the existing viaduct/ site approx. 7m under the viaduct foundations (refer to Fig. 2b). Together these with the Silvertown Tunnel portal (permanent and temporary construction works sites) will impact the design layouts.

The station has to be positioned within a straight section of the viaduct tracks. An assessment of the Track and RVAR Assessment is captured in Section 10 of this report and defines the position of the station.

Key constraints and assumptions have been identified in Section 4.

Figure 2a - Site Photographs
1: Space under Viaduct looking to the West
2: Space under Viaduct looking to the East
3: West Abutment
4: East Abutment
5: Integral Columns
6: Columns with Bearings

Figure 2b - Site Plan



2.2 Access and Egress

The site is bounded by Thames to the north and the south and to the east by the DLR viaduct. Access from Royal Victoria Dock to East and the Thameside development area to the West is restrictive by Silvertown Way and vice versa. As such this 'island' site is land locked with very few routes in and out (Figs. 2c and 2d).

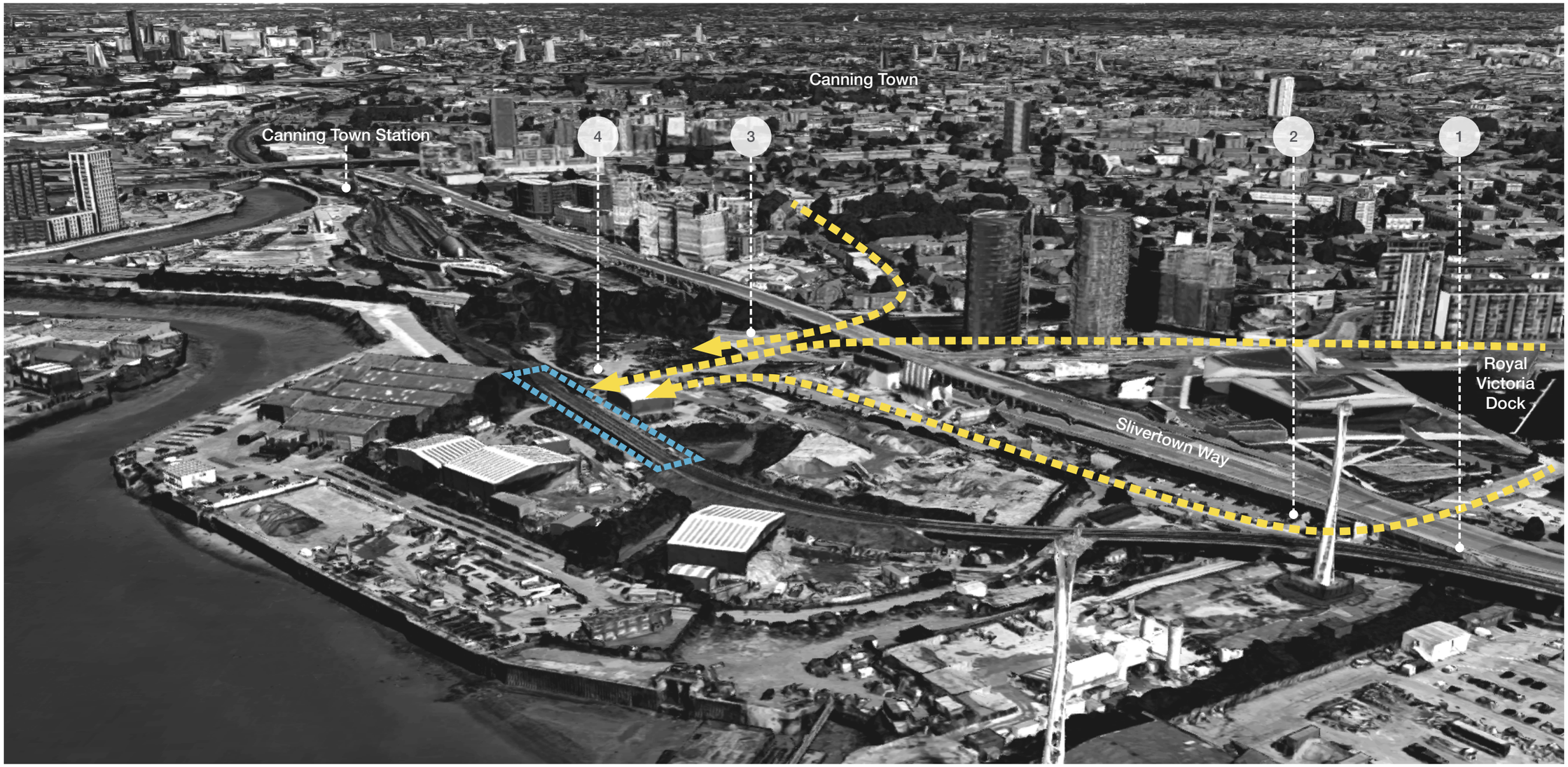
The design for a new station at this location and around an existing viaduct will explore access and egress strategies. Arrangement of vertical circulation and configuration of space under and around viaduct will be key design elements.

Although there is no direct connection from the Thames to the site of the station, it is anticipated that there will be GLA proposals in place to improve riverside and site wide connections.

Figure 2c - Key Approaches to Site
1: Looking to the site from Silvertown Way
2: Pedestrian Footpath under Silvertown Way Viaduct
3: Dock Road Roundabout
4:Scarab Road

N

Figure 2d - Exiting Access to site



3. Planning Context

3.1 Key Interfaces and Emerging Developments

The site has a series of interfaces with existing assets and new developments, summarised below. The new station design has been developed to best integrate with these.

Silvertown Tunnel Portal

The Silvertown tunnel located under the Thames connecting Greenwich Peninsula and Silvertown will surface in the vicinity of the station. The position of the tunnel will form a physical barrier to the station from the east and segregate the access and approach to the emerging developments area (Fig. 3a).

Existing road layouts together with new cycle/pedestrian routes will need to be reconfigured within the masterplan around the tunnel and station to enhance connectivity.

Royal Victoria Dock

In accordance with Royal Docks Opportunity Area Planning Framework (OAPF), Royal Victoria Dock would be linked by pedestrian/ cycle routes to Thameside West under the viaduct of South end of Silvertown Way (see photograph 2 in Fig. 2c). There is no specific proposal which connects Thameside West masterplan area and Royal Victoria Dock yet. Masterplan integration is essential to design Thames Wharf station that GLA aspirations will be effectively taken into consideration to incorporate new forecourt and new road layout as part of this feasibility study.

The Thameside West

The Thameside West development area is located at the southwestern end of the Royal Docks. The indicative Royal Docks development capacity study (part of the OAPF) identifies the site as having potential for 4,500 homes and 5.8ha of land available for employment uses. The site is also marked out as a ‘strategic site’ in London Borough of Newham’s Local Plan. This development would transform the industrial characteristic into active residential, leisure and commercial area relocating existing wharves.

Future development proposal in place as part of Royal Docks OAPF is expected to improve riverside environment and provide pedestrian/cycle network. The station and integrated public realm will be key to ensuring the connectivity of this developing area and supporting its growth. An indicative plan showing the station and station squares integration within these proposals has been presented for further discussion/ wider development (refer to Fig. 7c).

Scarab Cl Road

The new 3-car platforms need to be positioned within a straight section of the viaduct to comply with standards. As such the west section of the station will need to be located where the existing Scarab Cl road is.

A high-level study which explores the feasibility to relocate the road to east abutment has been undertaken as part of this study. Please refer to Section 8.1.5.

Whilst there are alternative options to retain the road, it is fundamental that both the station operational layout and station square are not compromised at this stage of design. The SPO option presented in Section 7 aligns all new structure, vertical circulation cores, plant rooms, commercial and station square to the existing viaduct grid. This considered alignment of new and existing structure maximises permeability through the station square, avoids visual clutter and provides a coherent and modular station layout.

3.2 New Station Square and Passive Provision

The impact of future developments within the Royal Docks Development Capacity Study undertaken as part of the Royal Docks OAPF will demand a great degree of flexibility, sustainability and safeguarding within the station and integrated urban realm design.

Key opportunity areas could include;

- A new station square and integrated urban realm to improve connectivity, interchange, intuitive wayfinding and to support future public amenities opportunities at the station.
- Passive future commercial use of the station undercroft as the masterplan develops and the area repopulates. The design and detailing of the station façade could be designed from the outset to facilitate future active street frontage for retail and commercial space.
- Passive provision for two escalators one per platform should be reviewed as future passenger demand rises.

This forward-thinking ambition to safeguard opportunities avoids abortive work, improves whole life cost (public money) and enables a sustainable and flexible adaption of the station as the Masterplan for the area unfolds around the station.

The design will look to put forward sustainable, added value proposals. These will look to create a new destination, supporting urban regeneration strategies and enhancement of the character, as well as meeting the needs of existing and future communities. Refer to Fig. 3a.

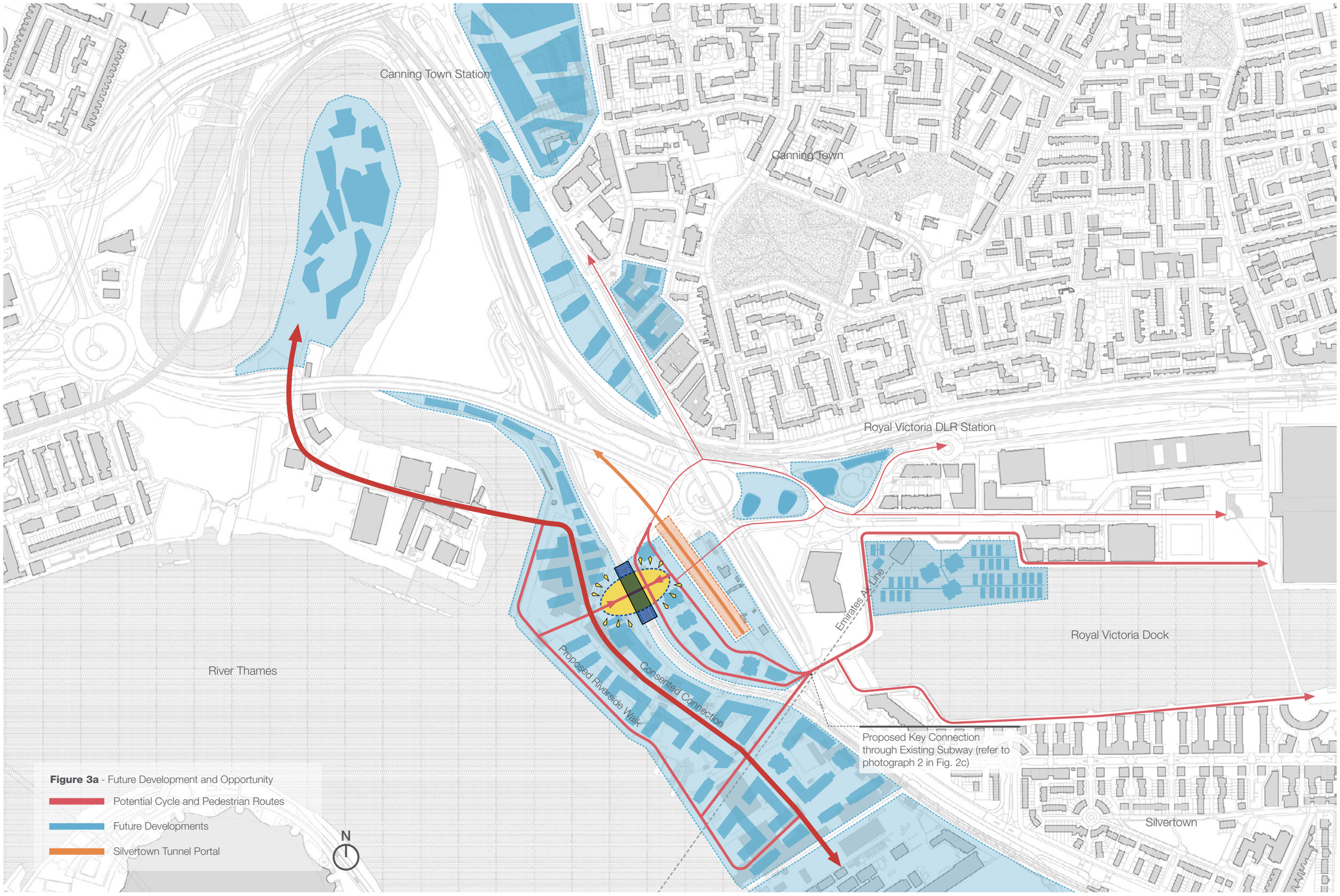


Figure 3a - Future Development and Opportunity

4. Design Consideration

4.1 Key Project Assumptions

The station upgrade options have been developed based upon a number of assumptions. These are listed in Appendix 2: Assumptions register.

4.2 Key Constraints

The following constraints may impact upon the proposed option (see Fig. 4b):

1. Jubilee Line Tunnels
2. Embankment/ Retaining Wall
3. Existing High Voltage Room
4. Foundation Locations and Capacity
5. Replacement of Bearing
6. Existing Road - Vehicular Clearance (Fig. 4a)

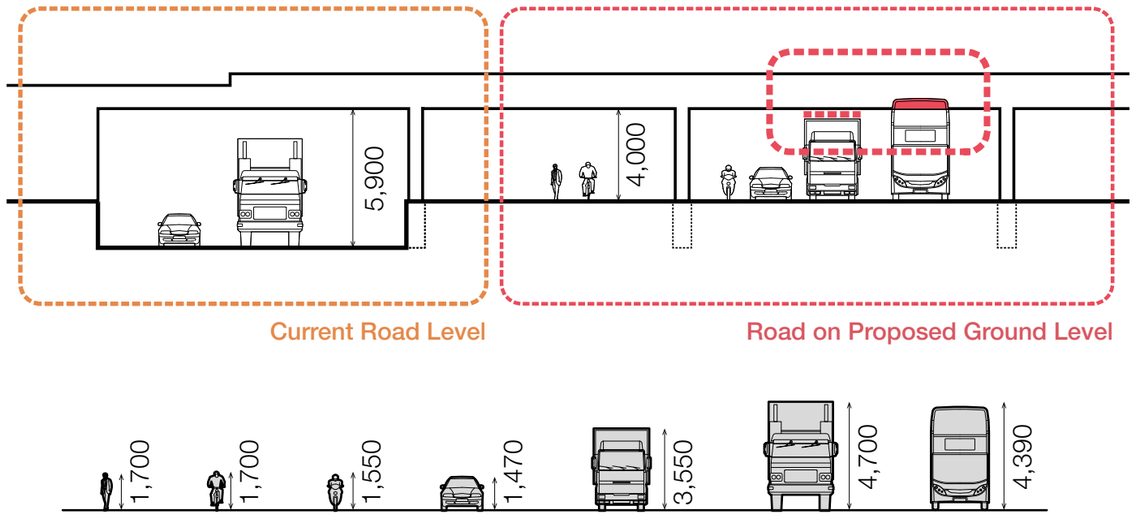


Figure 4a - Vehicular Clearance

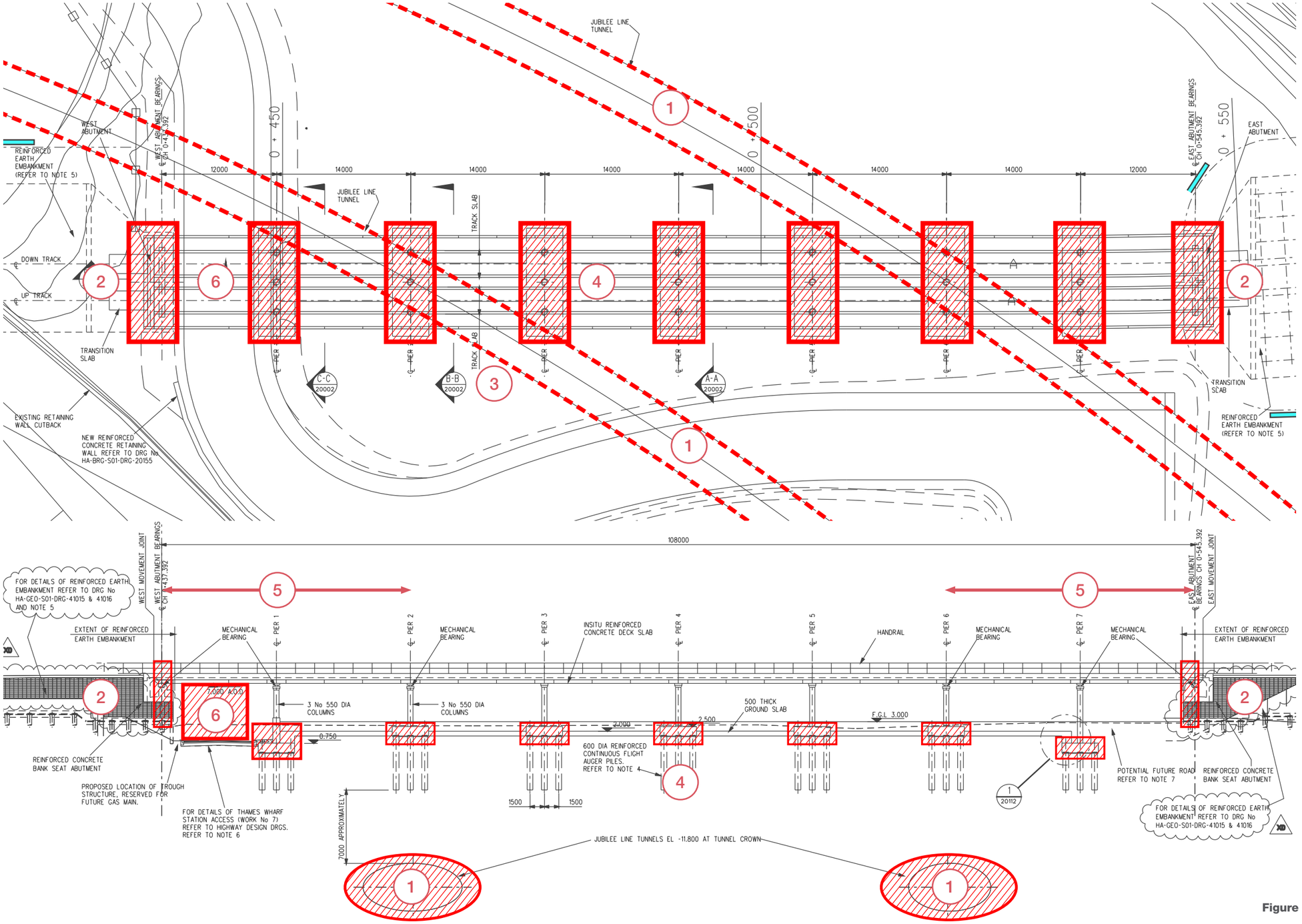


Figure 4b - Key Constraints

5. Pedestrian Static Assessment

5.1 Initial Proposed Layout

A static assessment of the vertical circulation requirement at Thames Wharf Station has been carried out, based on the London Underground S1371 Station Planning Category 1 Standard Issue A5 (LU S1371), June 2011, for three scenarios:

Scenario 1: Normal Operations

- Normal train service (30 trains per hour, 2-minute headway)
- Forecast passenger demand for 2041 AM and PM peak periods
- Two staircases are provided and both are available for two-way passenger flow

Scenario 2: Train on Fire

- This calculation is based on the number of passengers on the train on fire, after a gap in service of one cancelled train. The demand used is the practical crush capacity of the train on fire and the number of passengers waiting to board that train.
- Two staircases are provided and both are available for evacuation.

Scenario 3: Station on Fire

- This calculation is based on the sum of the boarding and alighting loads on the platform, which is doubled due to the delay of one train headway.
- Two staircases are provided, but only one is available for evacuation

The results of the static assessment indicated that, for each stair, the minimum stair width requirement of 2.4m (LU S1371) would be sufficient on both platforms for the 2041 AM and PM peak forecast passenger demand during Scenarios 1-3.

With this provision of vertical circulation, the target evacuation time from the platforms of 4 minutes (LU S1371 Clause 3.15.11) is achieved, based on the static calculation.

A static assessment for the platform width requirement has also been carried out, based on the LU S1371, under normal operations. The results of the assessment indicated that the minimum side platform width requirement of 3m would be sufficient for both platforms for the 2041 AM and PM peak forecast passenger demand.

A summary of the calculations is provided in Fig. 5a

5.2 Future Proofed Layout

A proposed future proofed layout with two escalators and one stair provided on each platform has also been assessed for four scenarios, with demand and train operation as above, and the following vertical circulation available:

Scenario 1: Normal Operations

- One escalator up, one escalator down and one two-way stair are available for passenger flow

Scenario 2: Train on Fire

- One working escalator and one stair are available for evacuation

Scenario 3: Station on Fire (escalators unavailable)

- One stair is available for evacuation

Scenario 4: Station on Fire (stairs unavailable)

- One working escalator is available for evacuation

The results of the static assessment indicated that the minimum stair width requirement of 2.4m (LU S1371) would be sufficient on both platforms for the 2041 AM and PM peak forecast passenger demand during Scenarios 1-3. One working escalator is sufficient for Scenario 4.

A summary of the calculations is provided in Appendix XX.

Note that this assessment has not considered separate evacuation routes for persons with restricted mobility (PRM).

Reference Information

Passenger Demand Forecast (2041)

Platform/Flow	AM peak passengers per minute	PM peak passengers per minute
Southbound- Alighting	6	20
Southbound- Boarding	2	2
Northbound - Alighting	2	3
Northbound- Boarding	38	11

[Source: THW Future Demand_received Feb 2018.xlsx]

Stairway Capacity

Two-way	28 passengers per minute per metre
One-way	35 passengers per minute per metre
Evacuation	56 passengers per minute per metre

[Source: LU S1371 2011, Clauses 3.10.6.2 & 3.15.1.11]

Escalator Capacity

Normal Operations	100 passengers per minute
Evacuation	120 passengers per minute

[Source: LU S1371 2011, Clauses 3.10.7.1 & 3.15.1.11]

Train Service Headway

Headway	2.0 minutes

[Source: TfL 91313 - Task 54 Workshop meeting 21-12-17 minutes.pdf]

Crush Load 788 passengers

[Source: South and Airport Route Future Train Capacities.xls]

Platform Parameters

Proportion of platform load	0.35
Space per passenger	0.93 square metre per passenger
Platform length	96 metres

[Sources: LU S1371 2011, Clause 3.11.3.2, CAD drawing SK-TW-OP5-0003]

Thames Wharf Initial Proposed Layout Vertical Circulation Requirements

Assumes 2 x stairs are provided

	Total Combined Staircase Width Requirement (worst-case AM/PM)	
Scenario	**Southbound**	**Northbound**
Normal Operations	2.4 metres	2.4 metres
Train on Fire	3.6 metres	4.2 metres
Station on Fire	2.4 metres	2.4 metres
Provision of two stairs from platform	**Total Individual Staircase Width Requirement (worst-case AM/PM)**	
Minimum width of each stair	**2.4 metres**	**2.4 metres**

Assumes the above provision of vertical circulation	Platform Evacuation Time (minutes)	
Scenario	**Southbound**	**Northbound**
Train on Fire	4.0 minutes	4.0 minutes
Station on Fire	2.5 minutes	2.5 minutes

Thames Wharf Future Proofed Layout Vertical Circulation Requirements

Assumes 2 x escalator and 1 x stair are provided

	Vertical Circulation Requirement (worst-case AM/PM)		
Scenario	**Southbound**	**Northbound**	***Assumed Additional VT Provision***
Normal Operations	2.4 metre wide stair	2.4 metre wide stair	*2 working escalators*
Train on Fire	2.4 metre wide stair	2.4 metre wide stair	*1 working escalator*
Station on Fire (escalators unavailable)	2.4 metre wide stair	2.4 metre wide stair	-
Station on Fire (stairs unavailable)	1 number escalators	1 number escalators	-

Assumes the above provision of vertical circulation	Platform Evacuation Time (minutes)	
Scenario	**Southbound**	**Northbound**
Train on Fire	4.0 minutes	4.0 minutes
Station on Fire (escalators unavailable)	2.5 minutes	2.5 minutes
Station on Fire (stairs unavailable)	2.5 minutes	2.5 minutes

Thames Wharf Platform Width Requirement

	Total Uniform Platform Width Requirement (worst-case AM/PM)	
Scenario	**Southbound**	**Northbound**
Normal Operations	**3.0 metres**	**3.0 metres**

Figure 5a - Pedestrian Static Assessment Summary

6. Structural Consideration

6.1 Existing Station Structure

The existing viaduct is an eight-span structure with three piers supporting each 14.0m span and abutments on both ends retaining embankments and providing end support to the viaduct. The three piers share a foundation comprising 24 No. short 600mm piles and associated pile cap. The pile length is governed by the 6.0m exclusion zone around the Jubilee line running directly below the viaduct. The central three groups of pier supports have fixed connections into the viaduct structure with the outer pier supports using bearings to allow horizontal movement without inducing bending in the piers. These bearings will need to be accessible for maintenance and replacement following the proposed works. The pile cap level is slightly lower in the final set of piers (either end of the viaduct) to provide allowance for a road running underneath the viaduct in the end spans. A road currently exists below the northernmost end span only, although allowance has been made for a road in the southernmost span in the design of the viaduct by Halcrow. Refer to Figure 1, Figure 2, and Figure 3 for archive information for the existing viaduct.

A geotechnical desk study has been undertaken to review ground conditions (see Appendix 6). It has been identified that the ground profile comprises made ground, alluvium with layers of peat, sandy gravel River Terrace Deposits (RTD), then London Clay. The viaduct drawing assumes RTD at -3.0mOD and borehole information attained shows peat to -4.68mOD. The peat and alluvium appears to vary up to 5.9m thick, with peat up to 1.5m thick, but maybe absent.

The viaduct is founded on short piles founded in RTD to carry loads below the alluvium and peat and to avoid conflict with the Jubilee line tunnel below, noting that LU require a 6m exclusion zone above their tunnels and 3m to the sides for bored piles and 15m all round for driven piles (see LU S1050).

Shallow foundations founded on peat are known to settle for more than 20 years when loaded and given the variable thickness of alluvium/peat, differential settlement would be very likely if foundations are founded above these soils. Additionally, the groundwater level will typically be higher than the top of the RTD so pad foundations on RTD are not practical.

It is also likely that the made ground will be contaminated from previous industrial uses of sites in this part of London, and advice should be taken from appropriately qualified staff when design is developed at next stage.

6.2 Geotechnical Consideration

Refer to ‘Appendix 6: Geotechnical Desk Study’.

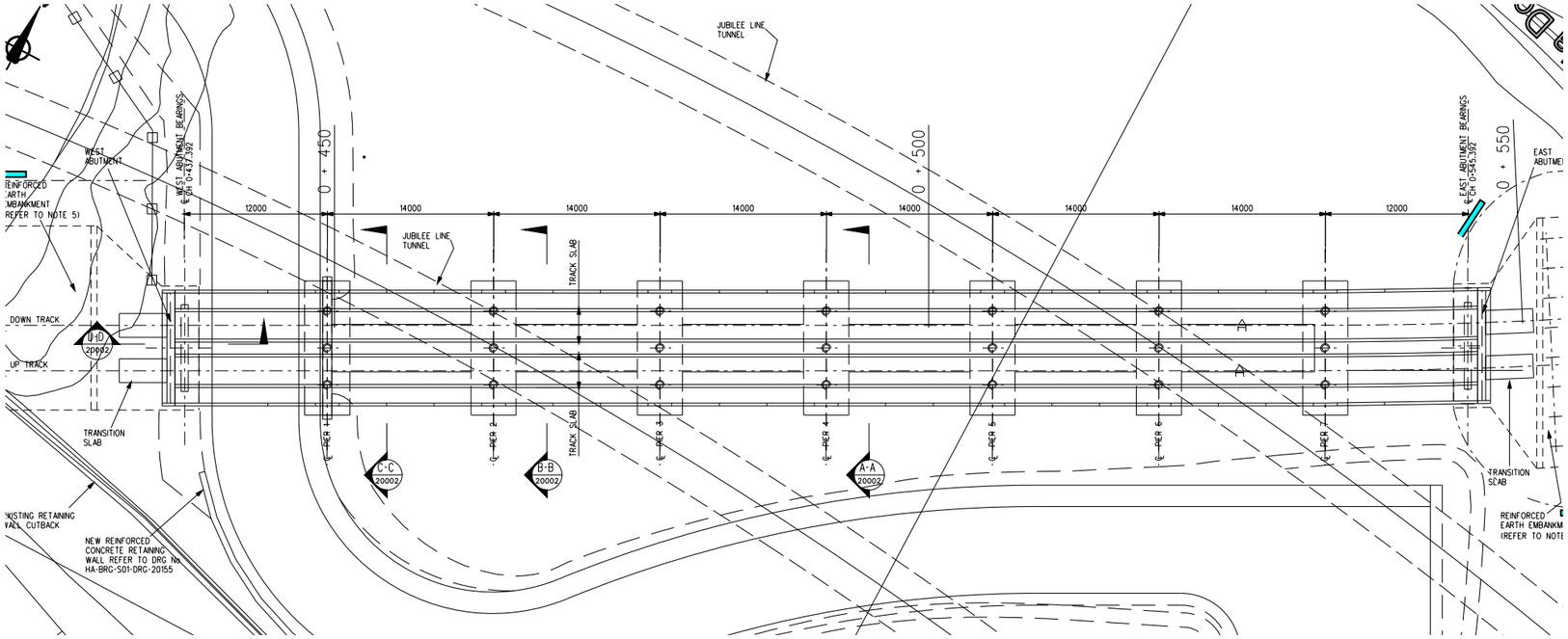


Figure 6a - Existing Viaduct Plan

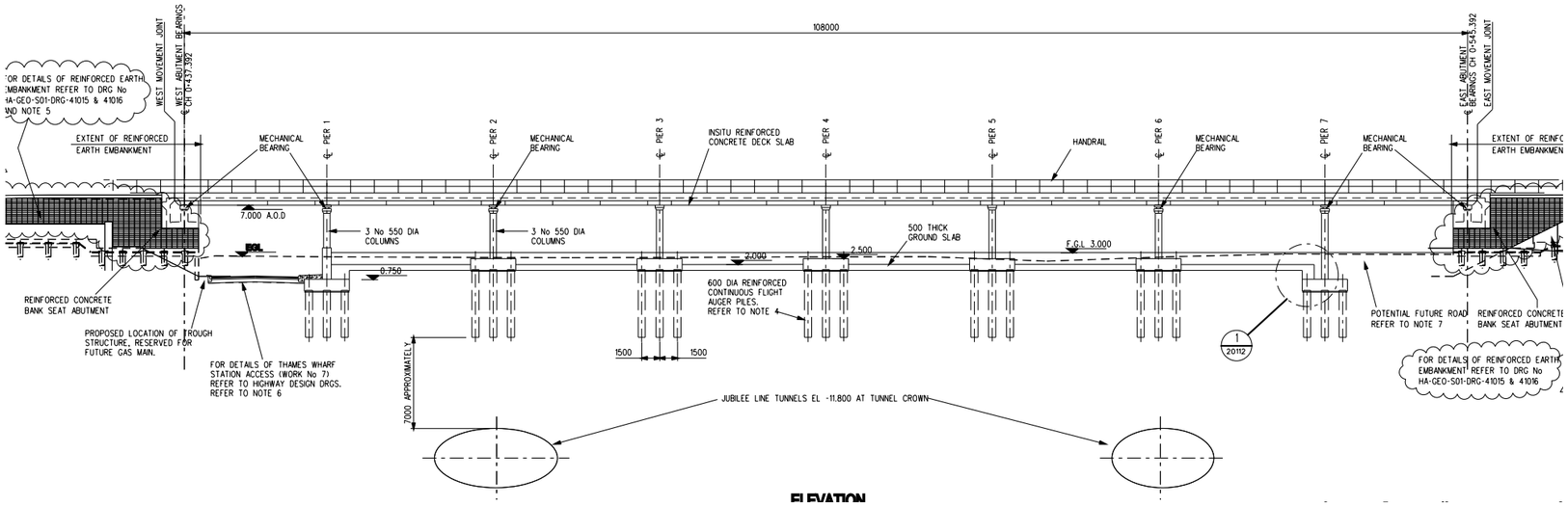
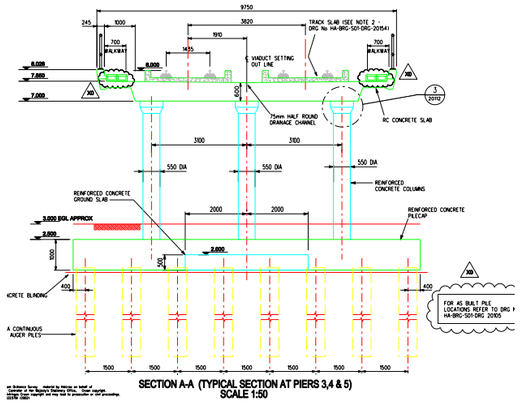


Figure 6b - Existing Viaduct Elevation



SECTION A-A (TYPICAL SECTION AT PIERS 3,4 & 5)
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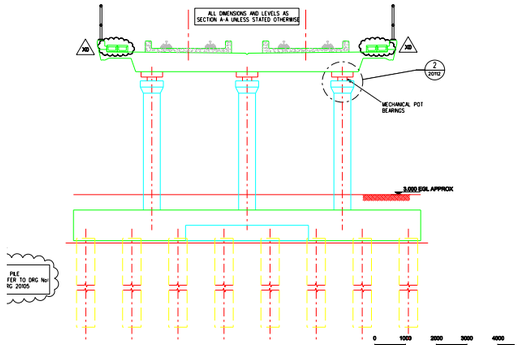

SECTION B-B (TYPICAL SECTION AT PIERS 2 & 6)
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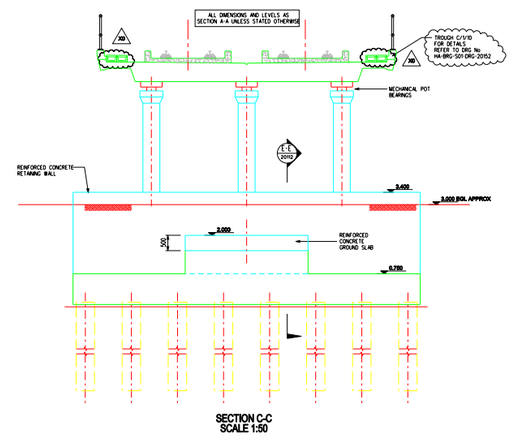


SECTION C-C
SCALE 1:50

Figure 6c - Existing Viaduct Sections

7. Optioneering Study and Option Selection

7.1 Optioneering Stage 1 (Workshop) & Stage 2

A comprehensive **two- stage optioneering** study was been implemented to explore and assess several high-level options and rapidly determine with the client body and multidisciplinary team the Single Preferred Option (SPO). Options were evaluated against an agreed assessment criteria noted below in section 7.2.

Stage 1 put forward 15 No. initial options (refer to Fig. 7a). Various combinations of key elements were reviewed for each option layout to balance station operation with urban realm integration/ placemaking. Subsequently, through a sifting process and discussions with key Transport for London (TfL) and DLR stakeholders, the SPO was selected (21 Dec 2017) for stage 2 development. A summary of the key points agreed at the workshop are included in an interim report provided in “Appendix 7: Stage 1 Option Selection Workshop (21-12-17).

Stage 2 developed the SPO operational layout within a wider masterplan. The updated architectural/ structural layouts and associated cost calculations were presented to the stakeholders at Stage 2 workshop (20-02-18).

The above methodology has provided a comprehensive and auditable trail of the options explored (Appendix 7) and has quickly reduced the number of viable options for the project, to unlock the optimal design.

7.2 Assessment Criteria

During stage 1 workshop, the 15 No. options were evaluated against the following assessment criteria;

- Operational layout -Passenger Flow/ Distribution/ Congestion/ Fire Egress
- Urban Realm Integration (Developing Masterplan)
- Passenger Experience - Aesthetics, Intuitive Wayfinding, Inclusive Design, Weather Protection
- Constructability/ Phasing and Structure
- Safeguarding of Station - Flexibility of Station; Future Provision for Commercial and Escalators
- Cost

Each option has been given a rating against each criterion (Red = poor, Amber = average, Green = good). Based on the evaluation results, the SPO was selected to be progressed. Example of assessment criteria (see Table 01):

Table 01 - Example of Assessment Criteria

Assessment Criteria	Notes	Score
Operational layout - Passenger Flow/ Distribution/ Congestion/ Fire Egress		
Urban Realm Integration (Developing Masterplan)		
Passenger Experience - Aesthetics, Intuitive Wayfinding, Inclusive Design, Weather Protection		
Constructability/ Phasing and Structure		
Safeguarding of Station - Flexibility of Station; Future Provision for Commercial and Escalators		
Cost		

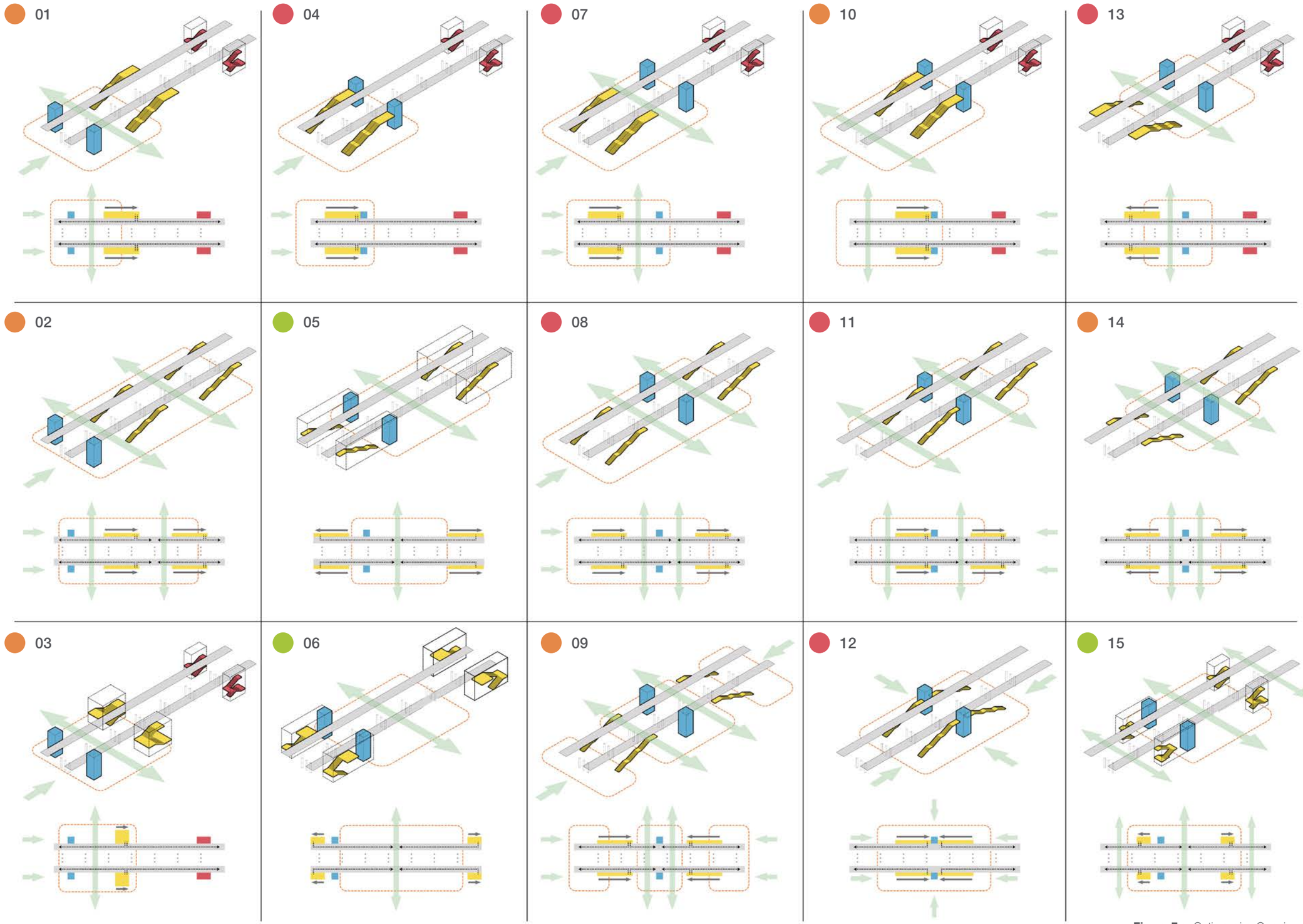


Figure 7a - Optioneering Overview

Thames Wharf Single Preferred Option

7.3 Single Preferred Option

1. New station square and concourse at ground level integrated with aspiration of Royal Docks OAPF masterplan
2. New enclosed vertical circulation cores comprising of; a 17 person through-lift with two 2.4m wide linear stairs per platform
3. Passive provision within west vertical circulation core for additional 17 person through-lift and or escalator/s
4. Full length canopy over platforms
5. Maximised natural daylight and views for enhanced passenger experience and intuitive wayfinding
6. Significant commercial opportunity safeguarded under viaduct
7. Provision for new plant and staff facilities
8. Provision for new road layout to facilitate head height vehicular access for TfL buses and articulated lorries

Table 02 - Stage 1 Optioneering Result

Assessment Criteria	Notes	Score
Operational layout - Passenger Flow/ Distribution/ Congestion/ Fire Egress		
Urban Realm Integration (Developing Masterplan)		
Passenger Experience - Aesthetics, Intuitive Wayfinding, Inclusive Design, Weather Protection		
Constructability/ Phasing and Structure		
Safeguarding of Station - Flexibility of Station; Future Provision for Commercial and Escalators		
Cost		

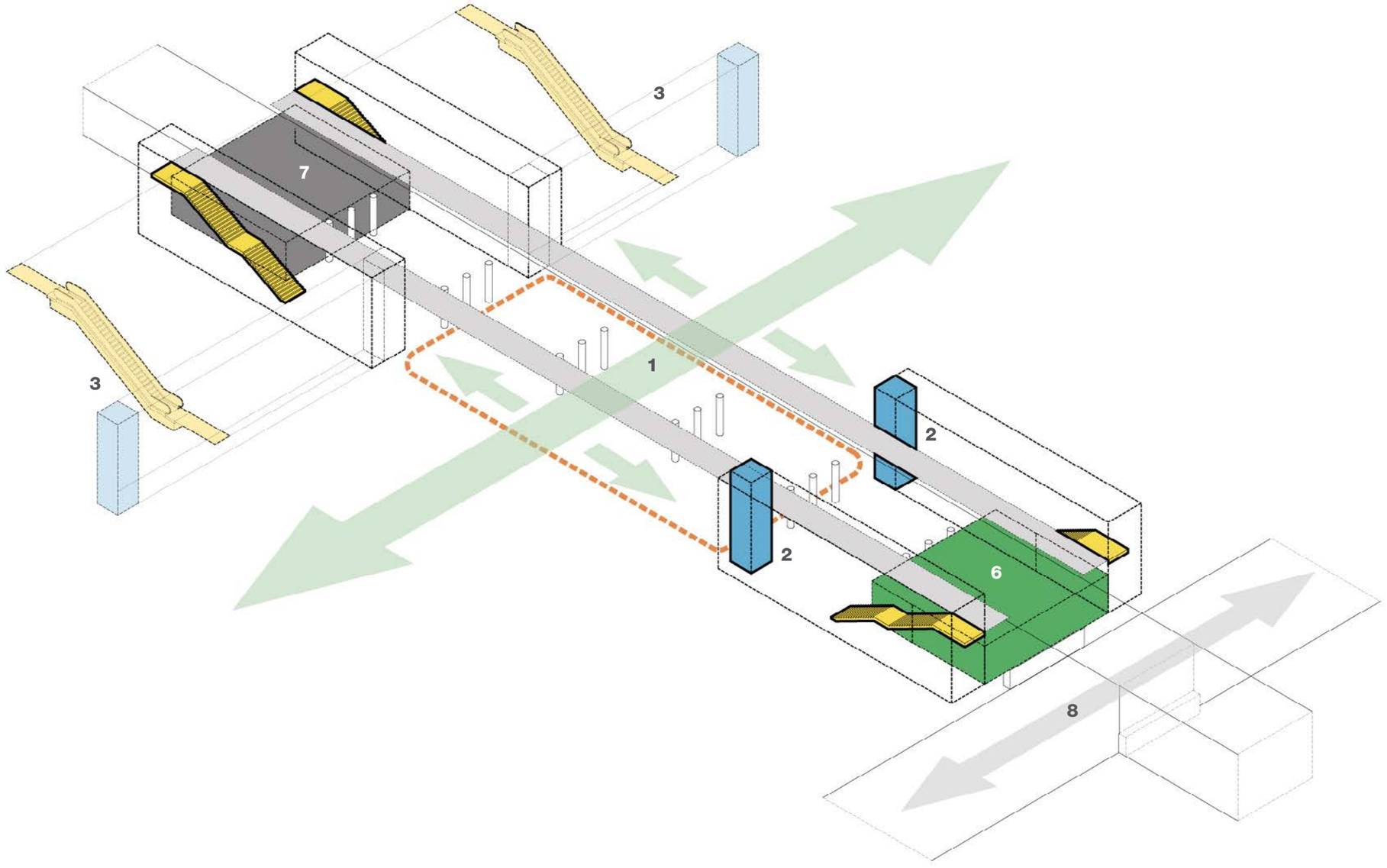


Figure 7b - Key Principle of Single Preferred Option

7.3.1 Operational layout

Passenger Flow/ Distribution/ Congestion/ Fire Egress

The new station layout is simple and intuitive, with a legible hierarchy of spaces that responds and integrates well within the changing context. The vertical circulation cores are strategically positioned either side of a new integrated station square.

The majority of passengers will approach the station by traversing the centrally positioned Station Square. This substantial forecourt area is to be left uncluttered and free of obstruction so that clear sightlines and routes are maintained, and large crowds can be safely managed.

The position of the station square forms a large station concourse which is sheltered by the existing DLR viaduct and the platform canopies.

Ticket machines and other associated facilities are located between each pair of vertical circulation cores to keep the concourse free from obstructions. The new structure has been positioned on grid to align with the existing 3 pier viaduct columns to reduce visual clutter and maximise sightlines, and permeability.

The operational layout positions the plant room and staff facilities to the west of the station. Commercial provisions are similarly positioned between the eastern vertical circulation cores to provide active frontage to the square and public realm as the areas develops. Exclusions zones have been provided around the viaduct columns at both sides of the station to not impair future bearing replacement.

The sizing of all of the vertical circulation and key passenger areas are in response to static passenger numbers and egress numbers identified in Section 5 of this report.

The layout ensures even, efficient and intuitive passenger distribution at platform and concourse levels.

7.3.2 Urban Realm Integration (Developing Masterplan)

The new DLR station at Thames Wharf set within the Royal Docks OAPF masterplan will be required to fulfil many functions as its locality changes and grows. Acting as a catalyst for urban growth, the station plays a central role in the wider development of the public realm and is both an entrance and exit point for the area. The station and urban realm have been designed together as an integrated and flexible proposal to create a sense of place, adding value and remaining relevant as the masterplan develops.

The station square is positioned central to the station, between 3 main grids of the viaduct and is 42m wide. Reconfiguring this space under the viaduct and forming this as a new station square avoids the station and DLR viaduct from becoming a physical barrier to the area/ emerging developments.

A new central positioned station square provides a focal point for the area and a flexible space to support an area primed for development. The square enhances connections across the site/ through the DLR viaduct whilst enabling a clear intuitive operation layout for the station.

The initial design options were presented and discussed to GLA and the outcome of this discussion has been incorporated in the development of the SPO.

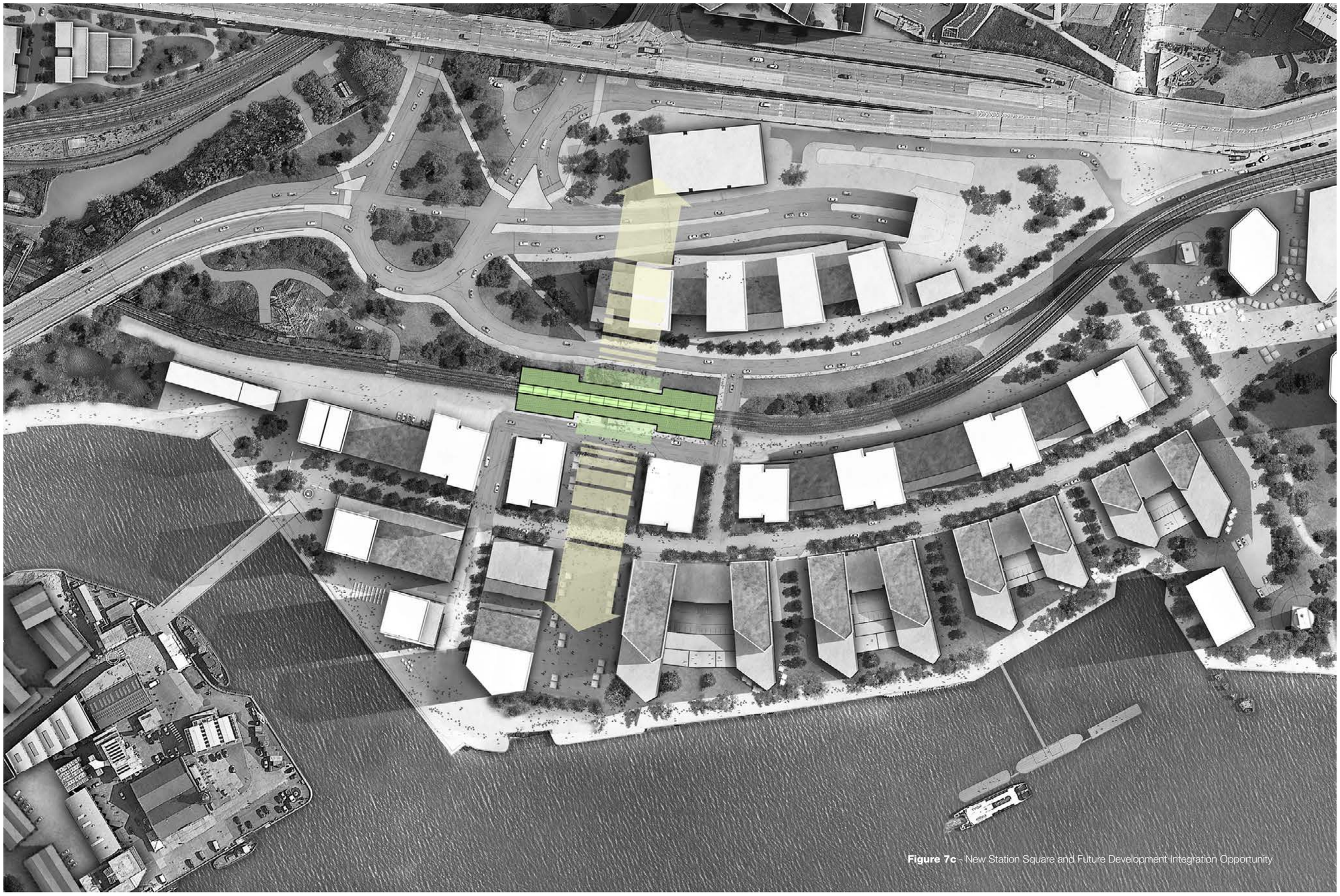


Figure 7c - New Station Square and Future Development Integration Opportunity

7.3.3 Passenger Experience - Aesthetics, Intuitive Wayfinding, Inclusive Design, Weather Protection

The design is driven by its context and presents a simple legible building and integrated public realm that is intuitive, safe and responds to the existing and changing context.

The public areas are visible and accessible and the non-public areas are hidden behind robust brick elevations. The main central entrance is also defined by vertical circulation cores which are directed onto station square for enhanced intuitive wayfinding and even passenger distribution.

The height of the new station is largely determined by track alignment and the height of the existing DLR viaduct which sets the platforms at 6m above surface level. Steel portals straddle the existing DLR viaduct, platforms and station facilities creating roof canopies to platform level and elevations that enclose the space. The roof and parapet levels give a total height for the proposed DLR station of 10m above street level.

The canopy extends over the length of the platform and incorporates passive provision for additional Step-Free Access (SFA - lifts/ escalators).

The operational layout (Section 7.3.1), massing and choice of materials enhances the passenger experience whilst underpinning a clear intuitive wayfinding. Perimeter glass maximises natural daylight and key views across the site for enhanced wayfinding. Enclosed vertical circulation cores and full-length platform canopies provide weather protection.

7.3.4 Maintenance, Constructability/ Phasing and Structure

The modular design of the station (typically on a 7m grid) standardises construction and ongoing maintenance.

Designated roof access hatches, walkways and fall restraint systems have been provided to facilitate safe maintenance at roof level. The façade can be maintained and replaced externally.

The station vertical circulation, BOH M&E rooms, commercial opportunities and new structures have been carefully organised to not compromise access to bearing maintenance/ replacement at existing viaduct piers on gridline 1,2,3,7,8 and 9. Exclusion zones in excess of 3m have been provided at key interfaces.

Refer to Sections 11 for further information on constructability phasing and structure.

7.3.5 Safeguarding of Station - Flexibility of Station; Future Provision for Commercial and Escalators

Critical to the future Royal Docks OAPF masterplan the station is designed with extensive growth provision as part of a sustainable (resilient) infrastructure strategy.

Key areas include;

- Passive provision within western stair-cores between gridlines 1 and 3 to facilitate additional through-lifts and/ or escalators.
- Significant commercial opportunity between eastern stair-cores, under viaduct as area develops.
- Flexible large station square and combine concourse.

7.3.6 Cost

Refer to ‘Section 12 Order of Magnitude Cost Estimate’.

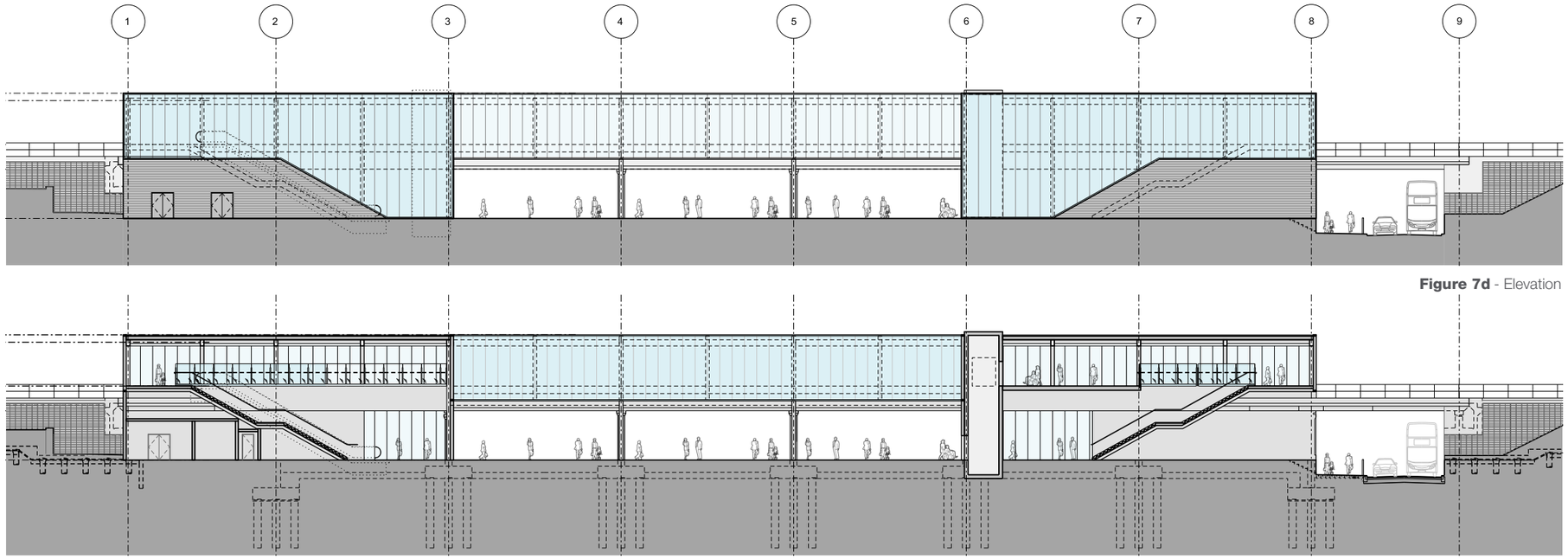


Figure 7d - Elevation

Figure 7e - Long Section through Staircore

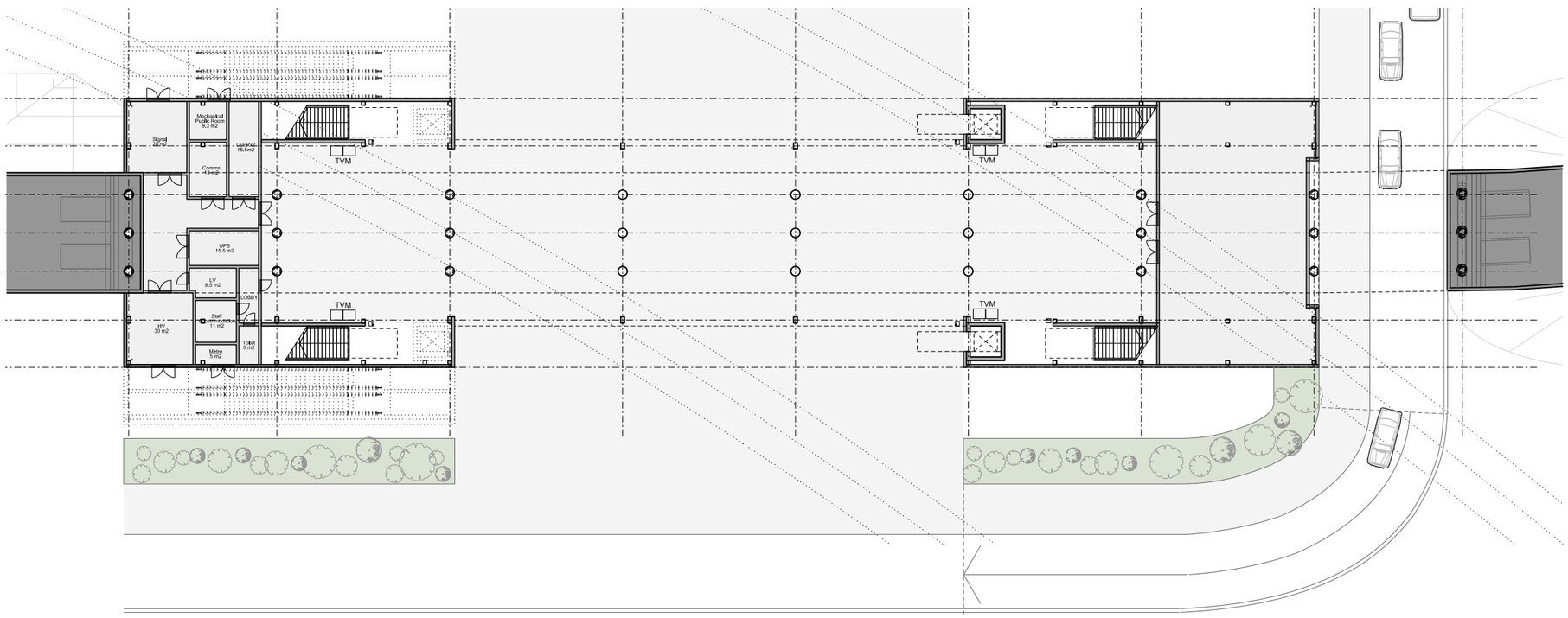


Figure 7f - Concourse Plan (Ground Level)

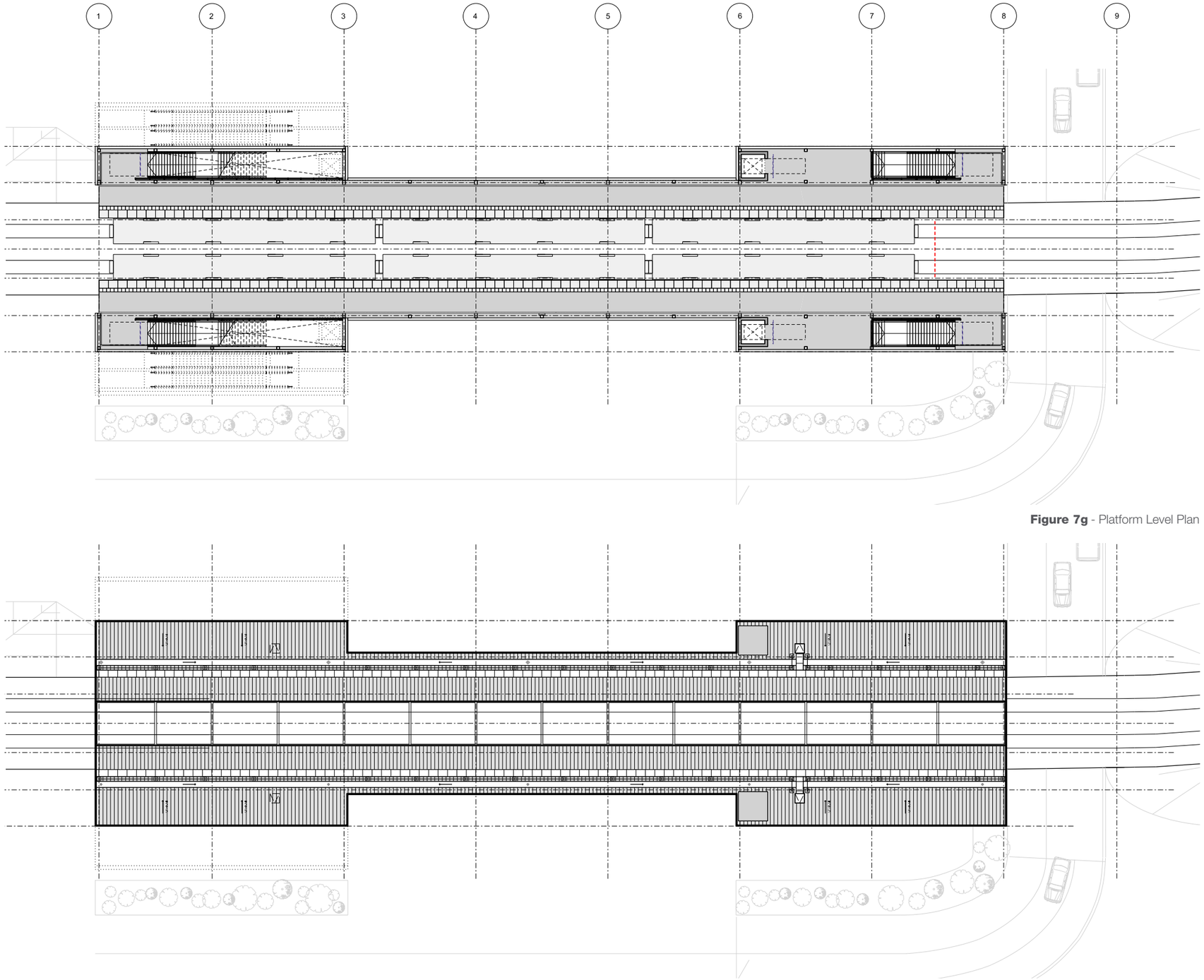


Figure 7g - Platform Level Plan

Figure 7h - Roof Level Plan

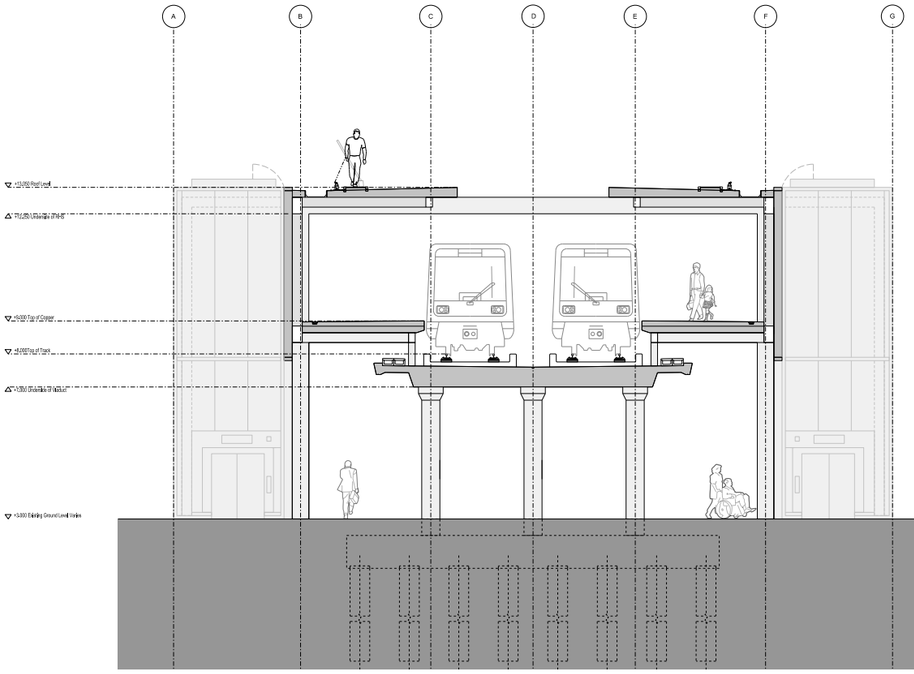


Figure 7i - Cross Section Typical

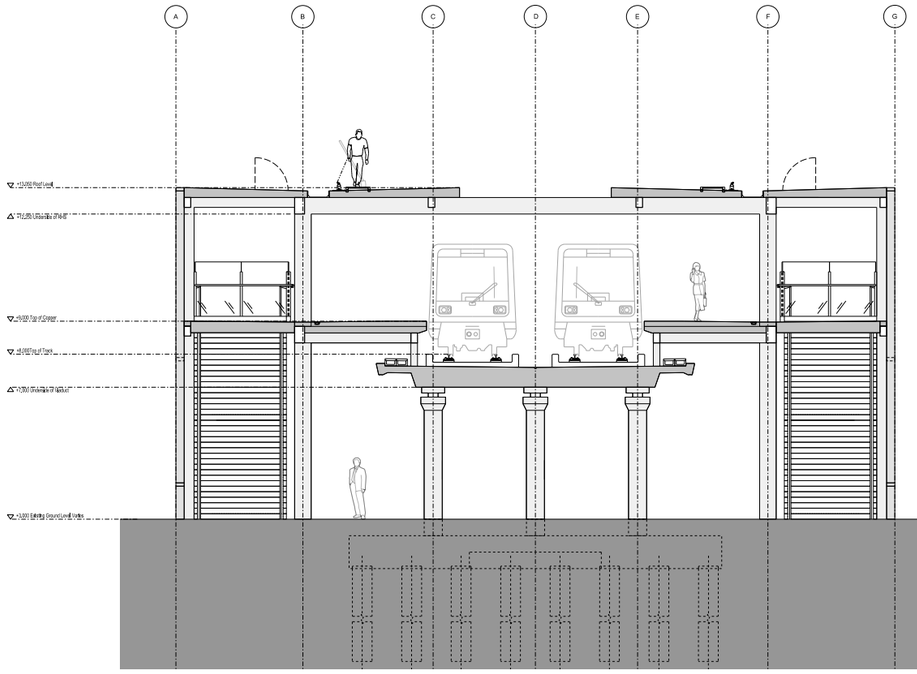


Figure 7j - Cross Section through Stair Core

7.3.7 Material Palette

Materials have been selected for their high-quality appearance, urban realm integration, longevity (life cycle) and maintenance properties.

Visually the choice of materials, refinement of cladding systems and minimalist intervention provides users with a high-quality passenger environment which encourages intuitive way-finding and allows the station to be managed and maintained efficiently and effectively.

The simplicity and functionality of the design is further expressed within the choice of materials and systems proposed. This reduced palette of material systems (visually represented in Fig. 7l) helps to develop a holistic language of material components, providing a consistency and quality that can be replicated throughout the station.

Key material choices include;

Structural Silicone Glazing

Glass has been introduced to break down the visual perceived bulk of the station, improve intuitive wayfinding, maximise natural daylight and visibility to and from the station for an enhanced passenger environment.

The use of glass in this manner also maximises visibility and sightlines for secure-by design

Precast brick panels

The use of precast brick panels at lower level provides a durable and' grounded base to the station. The angled interface between the glass and brick panels improves visibility of the stations vertical circulation for enhanced wayfinding.

Landscaping

It is proposed that station square will be largely hard landscaped and the expanse of paving will be broken down into a grid and a variety of module sizes used to create variation and to define key zones. The flooring material will run seamlessly from the square into the station concourse and platforms.

Trees and soft landscaping will delineate the route into the square and architectural lighting will be used to emphasise routes and elements of structure.

Public seating is proposed around viaduct columns to avoid obstructing main pedestrian flows. Similarly, sheltered cycle parking has been located underneath the viaduct between columns to ensure that clear pedestrian routes are maintained.

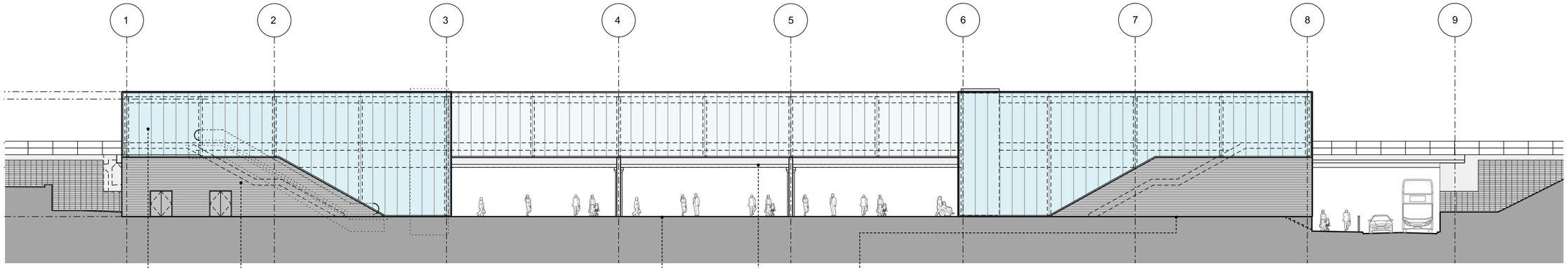
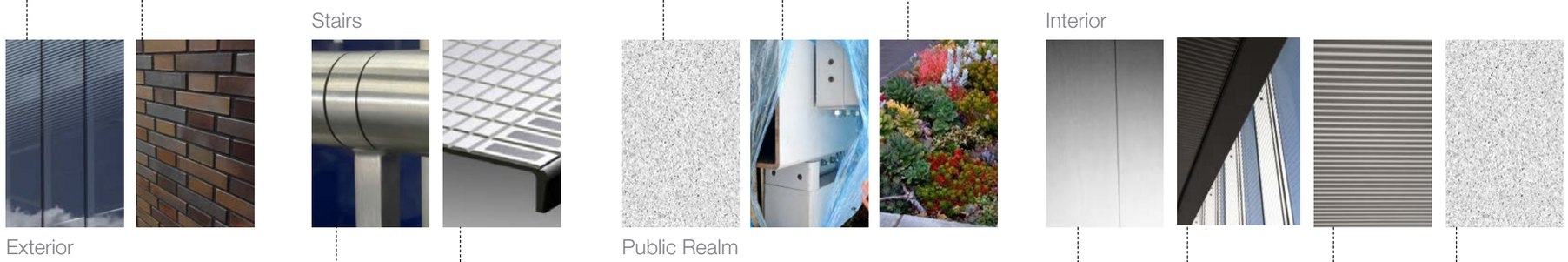


Figure 7k - Elevation



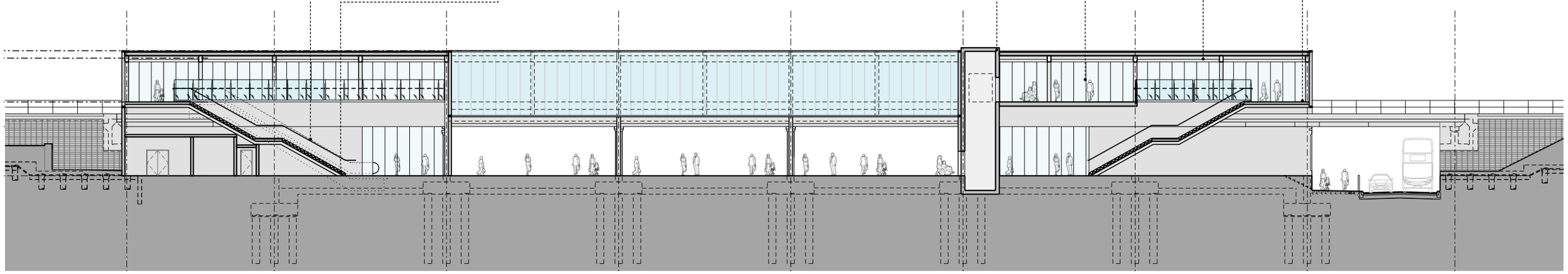


Figure 7l - Long Section through Stair Core

8. Structural Engineering for SPO

8.1 Structural Engineering

The new station requires the following structural engineering solutions to achieve the required layout.

8.1.1 Superstructure

A braced steel frame with the roof structure spanning over the viaduct and platforms will support roof and wall cladding, platform level slabs, and stairs from concourse to platform level(see Fig. 8a). Closed section steelwork has been preferred for aesthetic and maintenance reasons, with Rectangular Hollow Section (RHS) and Square Hollow Section (SHS) members forming all visible columns and beams and Circular Hollow Section (CHS) and tension rods forming bracing members. Lateral stability is achieved through plan bracing at roof and platform level tied back to elevation cross bracing in both orthogonal directions (See Figs. 8b and 8c).

To maximise circulation through the central concourse below the station, columns have been spaced at 14.0m centres to match the existing piers, with more regular 7.0m spacings at either ends of the station while the canopy uses 7.0m centres along the full length.

Stairs with steel stringers tie into the main structural frame with a precast lift to be cast off site and installed to reduce work on site. The staircases will be formed with steel treads spanning between stringers with precast concrete slabs at landing level. The lift shaft walls will be 250mm thick with a 1000mm thick lift pit slab forming the pile cap.

8.1.2 Substructure

All foundations (including lift shaft) will be piled due to the assumed ground conditions, but piles have been limited to 6.0m length due to the exclusion zone surrounding the Jubilee line below. A pile layout is presented in Fig. 8h.

8.1.3 Platforms

The platforms use a 200m thick reinforced concrete slab with architectural finish and have movement joints at maximum 42.0m centres, noting that diaphragm action is not relied upon due to the plan bracing (truss system) at platform level (see Fig. X) which takes horizontal loads back to the elevation bracing system. In accordance with ES 505c Section 4.3.6, the structure has been designed for an accidental impact load of 300kN distributed over any 3m length.

8.1.4 Interface with Existing Structure

Movement joints have not been specified in the steel frame as the frame is expected to expand and contract similarly to the viaduct (due to similar coefficients of thermal expansion). Stress caused by thermal loads is therefore to be included in the structural and geotechnical design solutions. The steel beams supporting the platforms takes vertical support from the viaduct (see Fig. 8d). It is assumed that the viaduct structure can safely withstand the additional load due to future provision being made for the station. This will need to be confirmed at the next design stage.

Transverse movement between the platform and the viaduct is controlled by the horizontal truss system at platform level which transfers the wind loads directly onto the new structure.

8.1.5 Road Relocation

Platform location restrictions due the cant in the tracks (Refer to ‘Section 10. Track and RVAR Assessment’ contained in the report) have been accounted for in the layout proposed and thus the existing road at the north end of the bridge will be relocated to the south end of the bridge to maximise concourse circulation and station facilities.

Such provision was made for a new road in the design of the viaduct so no additional structural works are required to form the new road. The existing road will require backfilling and excavation works will be required to prepare the ground for the construction of the new road. See Fig. 8i.

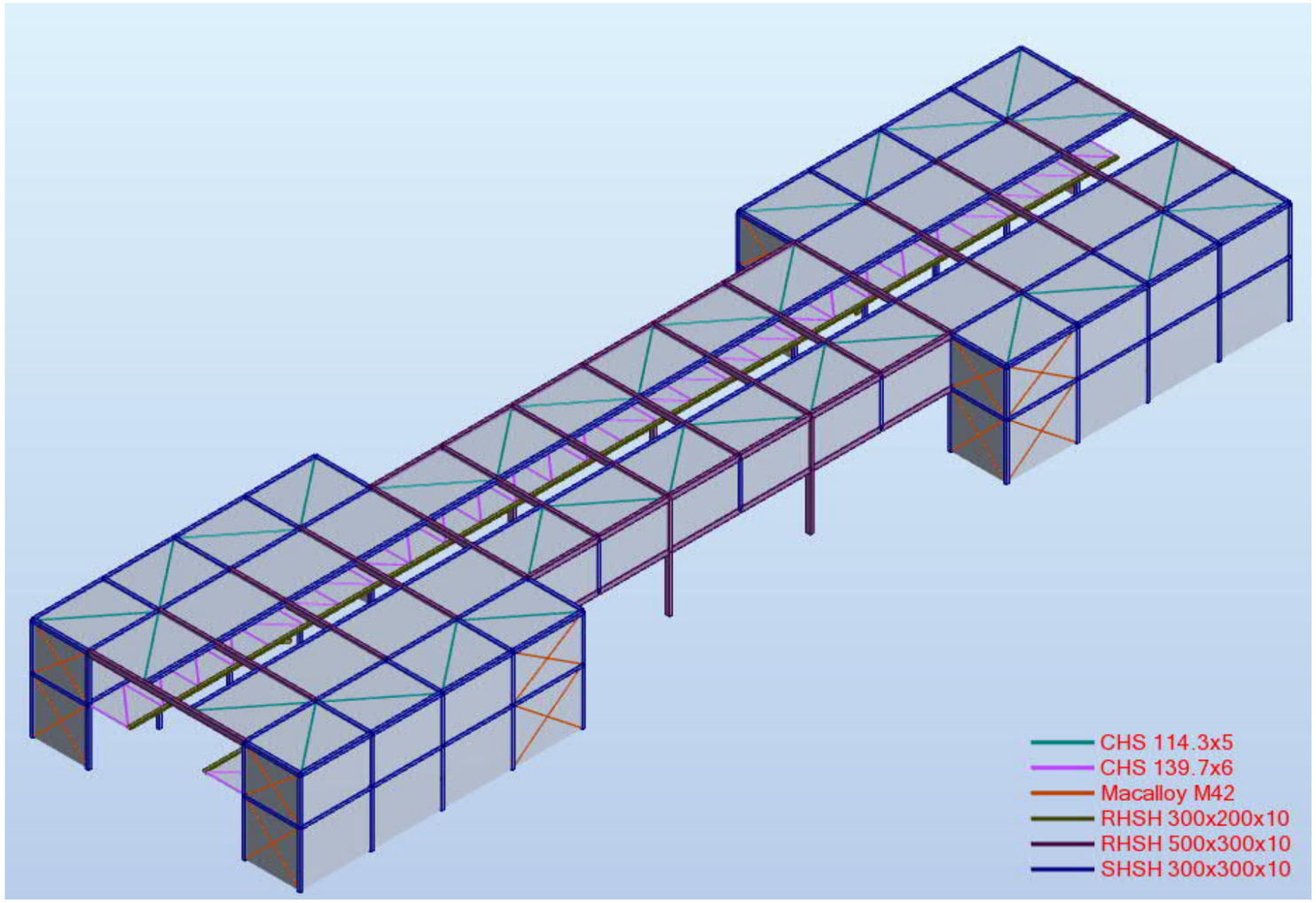


Figure 8a - Structural Frame

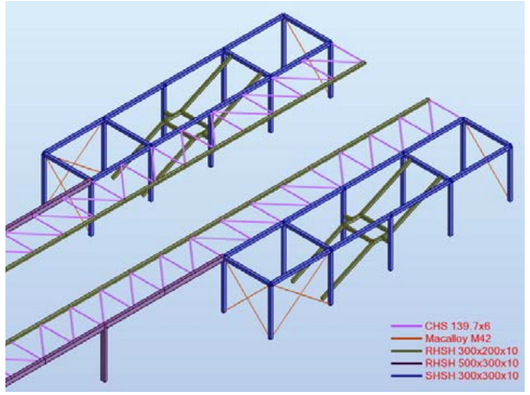


Figure 8b - Platform Level and Cores

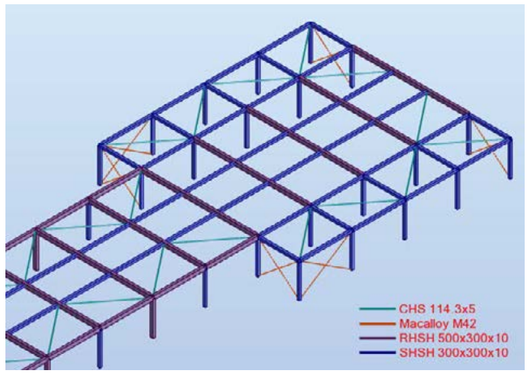


Figure 8c - Roof Level

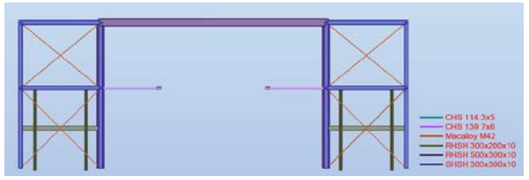


Figure 8d - North Elevation

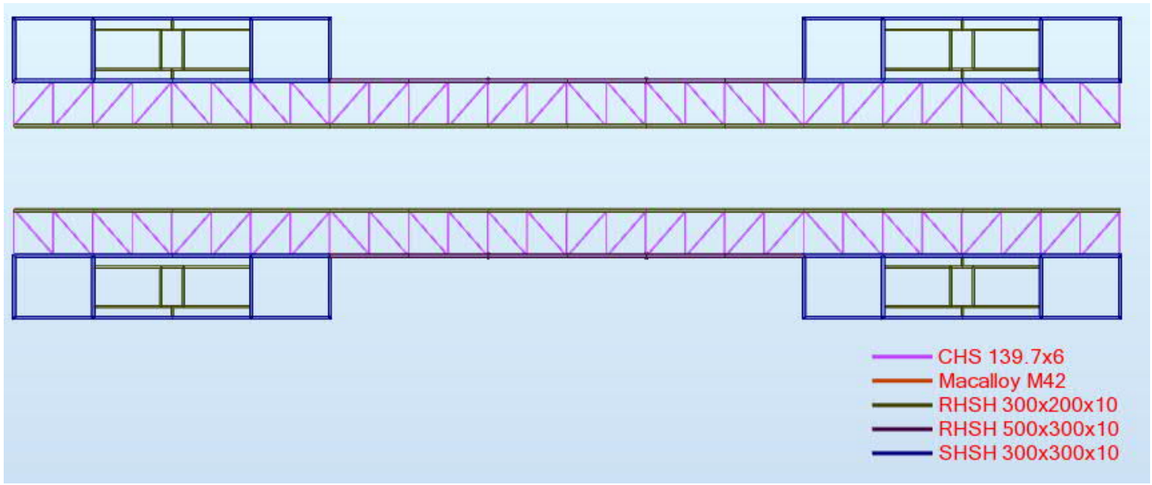


Figure 8e - Platform Level Plan

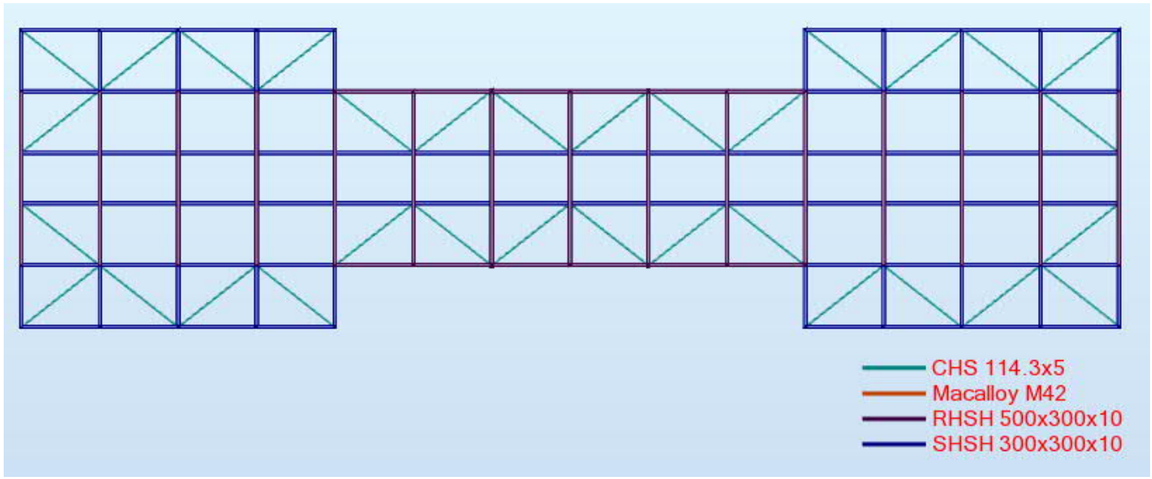


Figure 8f - Roof Level Plan

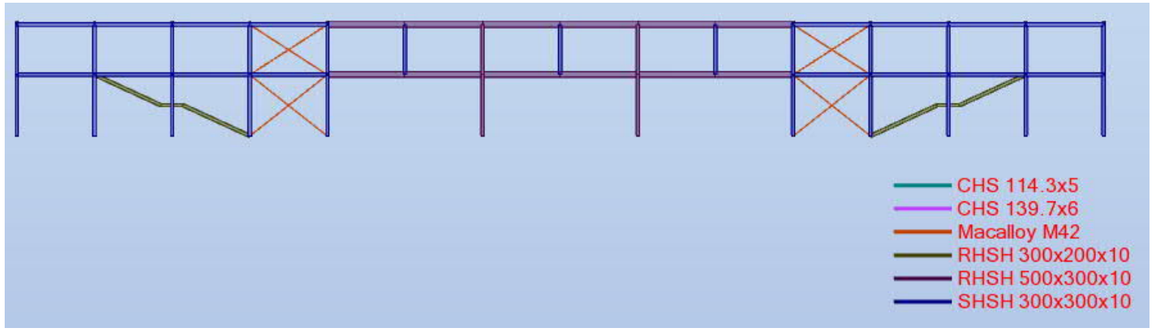
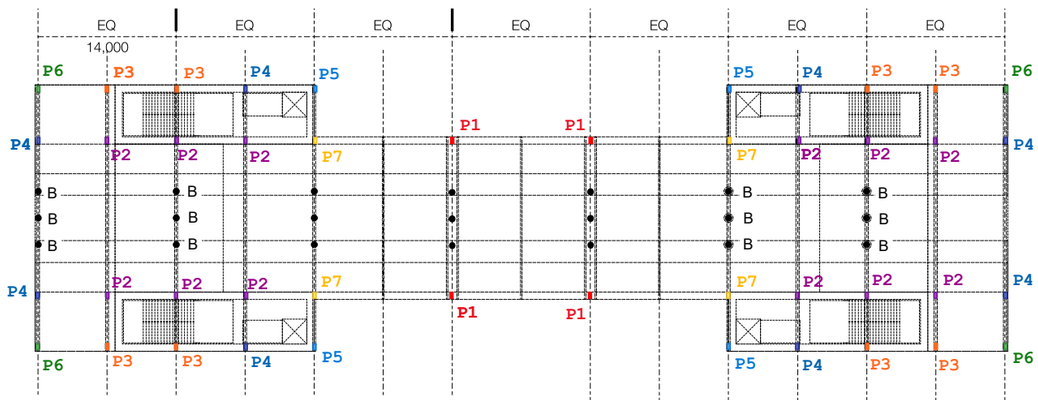


Figure 8g - West Elevation



Unfactored Loads at Base of Columns (kN)					
Key		Vertical			Horizontal
		Dead	Live	Wind	Shear
	P1	400	250		40
	P2	350	250		
	P3	200	120		40
	P4	200	120	+/- 80	80
	P5	100	60	+/- 240	150
	P6	100	60	+/- 120	80
	P7	350	250	+/- 240	150

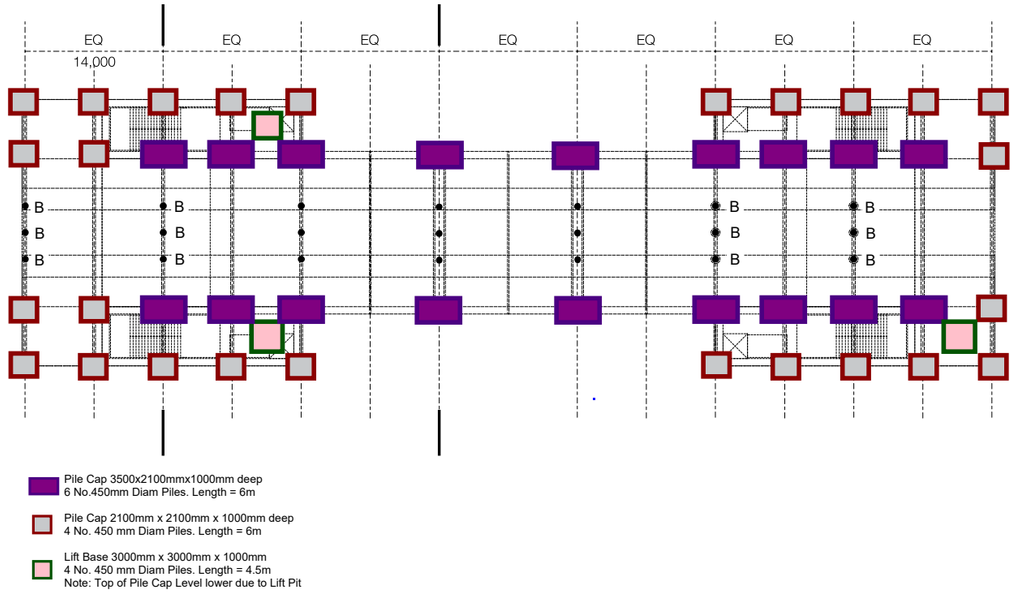
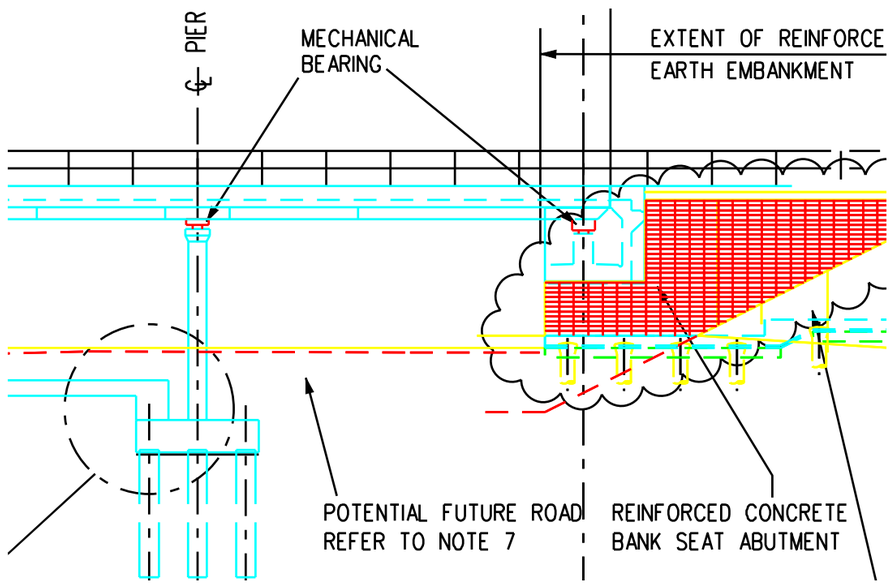


Figure 8h - Proposed Foundations



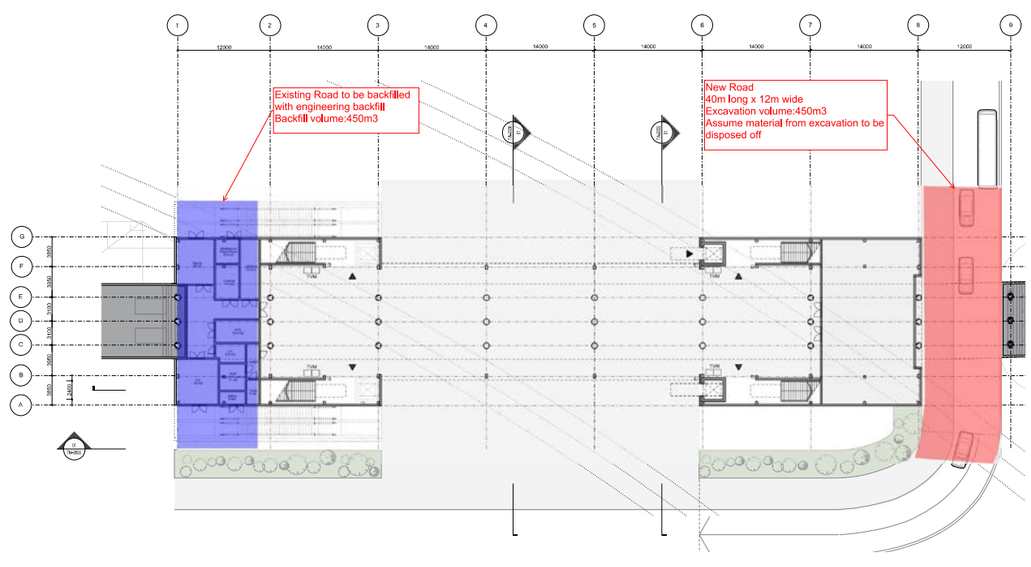


Figure 8i - New Road

9. Mechanical, Electrical and Public Health Engineering (MEP)

The following sections outlines the MEP systems for Thames Wharf station based on Architectural information, DLR standards and previous experience working on DLR projects.

This is a new station and so all MEP systems are new. The site footprint has an existing UKPN substation which we believe would serves the surrounding area. This can be confirmed at later stage. A new substation would be required whilst the existing is isolated decommissioned and removed and supplies reinstated to the existing buildings.

9.1 Electrical Engineering

From experience of designing other similar sized DLR stations current maximum demand is estimated to be 155kVA.

Within the majority of the DLR network stations take their primary power supply from the DLR '11kV network' with a backup supply from the District Network Operator (DNO). The assumption at this stage is no HV substation exists on site and that a new one will be provided. A new supply from the DNO would also be required to serve as the backup supply.

9.2 General MEP & Station Systems Requirements

In order to service the scheme, additional services will be required for:

- General lighting;
- General low voltage power to fixed equipment and Sockets;
- Cable containment and duct ways for new electrical systems;
- CCTV (and other security systems if required);
- Ticket vending machines;
- Oyster validators;
- Mechanical ventilation for the additional substation;
- Fire alarm;
- Public address;
- Public health services;
- Escalator sumps;
- Automatic passenger counters;
- Passenger information screen.

Table 03 - Equipment Room Requirement

The table below describes each of the estimated plant-room requirements in more detail for each option

Area	Notes
HV Room	Equipment : RMU, Transformer Size : 5mx6m = 30msq
LV Switchroom	Equipment: Panel Board. 2.7m x 2.2m = 6msq (previous project) ES-602 require min 5sqm
Meter Room	New meter room 3mx1.5m = 4.5 msq
Comms Room	New comms room 2.7m x 3.5m = 9.5 msq (previous project)
Signalling Equipment Room / Automatic Train Control Room (assumed)	4.7 x 4.8m = 23 ES-602 require min 20sqm
LMR / LEER	2x (2.4m x 3.2m) =7.7msq each (previous project) Existing equipment (believed to be located in a pit) to be decommissioned and removed
Mechanical /public room	To house condensing units and cold water booster set. To be louvered 2.9 x 2.7m
UPS room	4.7 x 3 m = 14.1 msq

NOTE: It will be necessary to consider sequenced construction of the new plant accommodation and, in particular, the associated cable connections in order to maintain operation of the railway during construction of the new station.

10. Track and RVAR Assessment

As part of the DLR Station feasibility study, Mott MacDonald is required to carry out a basic Rail Vehicle Accessibility Regulations (RVAR) assessment for the position of the platforms and vehicle stopping locations at the proposed Thames Wharf Station.

10.1 References

The following documents have been used in this assessment:

- DLR Technical Note TN-229 “Guidance of Setting Out of Station Platforms” Issue 10 (25 March 2008)
- DLR Engineering Standard ES-401
- DLR Drawing No. RS260b Structure Gauge for Open Track
- The Rail Vehicle Accessibility (Non-Interoperable Rail System) Regulations 2010
- 2003 archive design submission drawings:
  - HA-RAL-PWD-DRG-70022
  - HA-RAL-PWD-DRG-70023
  - HA-RAL-PWD-DRG-70043

10.2 Methodology

On a standard DLR B92 vehicle, the doors nearest to the articulation are designated as RVAR compliant i.e. they are designated as wheelchair-compatible doors which can be used without a boarding device. The locations of these and dimensions are shown in Figure 3 of TN-229. On a standard 3-car DLR train there are 6 of these in total.

Clause 1.1.1. of RVAR 2010 requires that all wheelchair-compatible doors to be used without a boarding device should have a gap between the platform and the vehicle step of not more than 75mm measured horizontally and 50mm measured vertically. To carry out an assessment against these values, the methodology outlined in TN-229 has been used to calculate offsets between the track and the platform edge along the length of the platform and horizontal stepping distances for each door location of a DLR B92 Vehicle based on an assumed vehicle stopping location.

TN-229 clause 6.3.1. states that due to the height of the B92 vehicle, the RVAR vertical stepping distance requirement of less than 50mm does not present a problem and so therefore hasn’t been considered as part of this assessment.

The proposed platform location has also been assessed for compliance against clause 6.4.5 in DLR Technical Note TN-229.

10.3 Assumptions

- 1It is assumed that the linespeed within the platform extents is to be reduced to 50km/h in accordance with Clause 6.3.1. of TN-229
- Any change in alignment as a result of the required speed change has not been considered
- Alignment has not been assessed against ES-401
- Based on overlaying Platform Plan SK-TW-P5-0003 and alignment drawing HA-RAL-PWD-DRG-70023 the start and end of the platform has been assumed to be at 436m and 532m respectively based on down line chainage and 440.2m and 535.6m based on up line chainage
- It is assumed that last (southernmost) 9m of the platform will be fenced and offset such that it is outside the structure gauge in DLR drawing RS260 and calculations are not required
- Stopping position of the train front coupler on the down line platform is assumed to be 523.0m
- Stopping position of the train front coupler on the up line platform is assumed to be at 440.2m

10.4 Evaluation

10.4.1 Cant within platform

The presence should be noted of a track alignment cant transition and curve in close proximity to the south end of the platform based on alignment drawing HA-RAL-PWD-DRG-70023. The transition starts at 526.9m (up line transition based on down line chainage).

ES-401 clause 6.4.5 states that canted track is not permitted within platform on DLR. Although it is noted that the cant transition starts within the proposed platform extents, it will be outside of the usable length of the platform (assumption 3) and therefore is compliant to this statement.

10.4.2 Offsets and RVAR Stepping

Clause 6.3.2. of TN-229 also states that where cant occurs within 24m of the platform ends the effects of cant must be included in the platform setting out location. The effects have therefore been taken into consideration when calculating the horizontal offsets and resulting stepping distances.

As can be seen from the results, assuming the current platform location, the first RVAR door at the front of the Down line car will be non-compliant by 6mm with an 81mm stepping distance and the last RVAR door at the back of the Up line car will be non-compliant by 1mm with an 76mm stepping distance.

Calculated stepping distances for all other doors are acceptable.

If full RVAR compliance is required for all doors on the Down line train the stopping location will need to be moved by 5.9m away from the transition to 517.1m.

If full RVAR compliance is required for all doors on the Up line train the stopping location will need to be moved by 4.5m away from the transition to 435.7m.

Table 04 - Summary of Key Values

Description	Value
Line speed	50km/h
Length of train (coupler to coupler)	86.4m
Down line start of platform (Down chainage)	436.0m
Down line end of platform (Down chainage)	532.0m
Up line start of platform (Up chainage)	439.6m
Up line end of platform (Up chainage)	535.6m
Down line stopping position (front of coupler)	523.0m
Up line stopping position (front of coupler)	440.2m
Down line start of transition (Down chainage)	526.1m
Up line start of transition (Up chainage)	529.6m

Table 05 - Down Line Platform Stepping Distances

	Vehicle 1				Vehicle 2				Vehicle 3			
Door	1	2	3	4	1	2	3	4	1	2	3	4
Chainage at door CL /m	444.846	451.316	457.896	464.366	473.646	480.116	486.696	493.166	502.446	508.916	515.496	521.966
SVP Semi-Width /mm	1325	1325	1325	1325	1325	1325	1325	1325	1325	1325	1325	1325
previous offset	1391	1391	1391	1391	1391	1391	1391	1391	1391	1391	1392	1394
next offset	1391	1391	1391	1391	1391	1391	1391	1391	1391	1391	1393	1394
Platform Setting Out Offset /mm	1391	1391	1391	1391	1391	1391	1391	1391	1391	1391	1392	1394
Distance SVP to door step /mm	9	9	9	9	9	9	9	9	9	9	9	9
Throw at door /mm	0	0	0	0	0	0	0	0	0	0	0	0
Stepping distance /mm	75	75	75	75	75	75	75	75	75	75	**76**	78

Table 06 - Up Line Platform Stepping Distances

	Vehicle 1				Vehicle 2				Vehicle 3			
Door	1	2	3	4	1	2	3	4	1	2	3	4
Chainage at door CL /m	518.360	511.890	505.310	498.840	489.560	483.090	476.510	470.040	460.760	454.290	447.710	441.240
SVP Semi-Width /mm	1325	1325	1325	1325	1325	1325	1325	1325	1325	1325	1325	1325
previous offset	1403	1398	1391	1391	1391	1391	1391	1391	1391	1391	1391	1391
next offset	1405	1397	1391	1391	1391	1391	1391	1391	1391	1391	1391	1391
Platform Setting Out Offset /mm	1404	1397	1391	1391	1391	1391	1391	1391	1391	1391	1391	1391
Distance SVP to door step /mm	9	9	9	9	9	9	9	9	9	9	9	9
Throw at door /mm	0	0	0	0	0	0	0	0	0	0	0	0
Stepping distance /mm	88	**81**	75	75	75	75	75	75	75	75	75	75

NOTE: The stepping distances for all vehicle doors are stated in Table 5 and Table 6 above. The designated RVAR compliant doors are highlighted in green. Any non-compliant stepping distances have been highlighted in red.

11. Construction Phasing

This section of the report provides preliminary construction planning information to establish:

- Extents of land to be acquired for temporary use;
- Approximate duration of the build;
- Preliminary information to support the development of an order of magnitude cost estimate.

The Contractor, who will be responsible for the construction of these works, will provide detailed method statements for each major activity associated with the works prior to construction.

11.1 Worksite

A temporary site compound for welfare accommodation and material storage will be required. This will nominally consist of:

- **Site Accommodation**
- **Parking**
- **Site Storage**

Temporary laydown areas will also be required for construction of the major structural elements to maximise the opportunity for off-site fabrication. This will include, at various stages during the construction of the works land under or adjacent to the DLR viaduct. The concurrent use of temporary laydown areas should be assessed during detailed construction planning to minimise disruption to the users of the existing Scarab Road, the general public and users of the adjacent sites.

For initial planning purposes an allowance of 350m^2 should be made for temporary laydown areas. Access to the site (including for the delivery of materials) will be directly from Silvertown way, onto Scarab Road.

11.2 Methodology

11.2.1 Preliminary works

The following site surveys will be required prior to completing detailed design and commencing activities on site:

- Topographical survey of the existing station at concourse and platform level. A Point Cloud survey is recommended as it collects accurate data about on-site conditions which can be used to create an accurate parametric 3D model to aid the design process at the next stages;
- Geotechnical Investigations to confirm ground conditions;
- Environmental Risk Assessment;
- Below ground utility survey (Ground Penetrating Radar) and trenches to confirm location, size and depth of existing utilities and foundations;
- Traffic surveys;
- Ecology mitigation (as required);

11.2.2 Enabling Works

The following enabling works will be required prior to commencing main construction activities on site:

- Site clearance and removal of foliage and trees within the footprint of the works
- Relocation of utilities
- Site compound set-up to the south/east of the site, between Scarab Road and viaduct
- Set-out and form new roadway to the west of site including below viaduct
- Cut and remove sections of existing Scarab Road to west of site including below viaduct;
- Connect new Scarab Road section to existing at cut-off points;
- Preparation of ground for foundations (levelling, removal of roots etc.)
- Prepare and construct foundations for new plant room ahead of disconnect and demolition of existing.

11.3 New Roadway at East end of existing DLR viaduct

Based on the proposed station layout the existing Scarab road line on the west will become redundant. Thus, the existing roadway will be removed at pre-determined cut-off points at the west and a new roadway constructed at grade below the viaduct on the east. The new road alignment will re-connect to existing Scarab Road at the cut-off points, by feathered road construction.Foundations

The proposed station structure will be on piled foundation while a ground bearing slab on gridlines 1-3 and 6- 8 will be provided a concourse level.

It is unlikely that arisings from foundation works can be reused on site. Contaminated arisings from intrusive ground works will require screening and assessment prior to appropriate disposal. Due to the industrial nature of the site, it is likely that significant contamination is present within the footprint of the site. Foundation locations will need to be checked against the results of additional utility surveys to minimise their impact upon existing buried infrastructure.

For piled foundations, it is anticipated that 450mm dia. Continuous flight auger piles will be adopted. Piling for foundations to the stair enclosures, will require limited road closures for pile rig set up and boring works, including cranage of pile reinforcement. Piling for the platform structure is typically within 5m of the existing DLR line and viaduct structure. A safe method for undertaking this work, which may include a combination of staged possessions and engineering hours working, will be agreed with DLR.

Where ground bearing slabs are adopted additional excavation will be required, including likely replacement of limited underlying contaminated material in made ground. Due to the limitations of made ground, the depth of excavation will require temporary support to maintain stability during excavation. The works will require small plant for excavation and placement of reinforcement.

Pile caps are proposed to be formed in reinforced concrete, located typically below ground. Installation of temporary works, erection of formwork and placement of reinforcement will generally be achieved by the use of small plant with prefabricated reinforcement cages utilised where possible to minimise manual handling.

Imported material by road will include:

- Material for bases of shallow pad foundations and pile caps;
- Concrete for piles and pile caps;
- Reinforcement cages for piles and pile caps.

11.4 Primary Structure

Comprising braced steel sections, fabricated off site wherever possible, the frame components will enable a piecewise construction. A site set down area for assembly of stair enclosure and other pre-assembled frames will be required on the larger site area on the south side of the existing DLR viaduct. Erection of pre-assembled frames will be by large mobile crane. The crane would be located within the site with outriggers positioned to avoid damage to any utilities. It is not envisaged that traffic management restrictions will be required.

The platform precast concrete decks will be underlain by long spanning horizontal ‘warren’ type trusses formed by tubular steel sections. The horizontal trusses will be supported from the edge of the existing viaduct concrete and the new super structure steel frame. Pre-assembly of the pre-cast concrete planks and sections of the horizontal girder may be possible, enabling more efficient use of the crane. The planked decking will be installed after the erection and fixing of the super structure steel frame (and/or permanent or temporary stability bracing) and the horizontal girder.

A method statement for crane operations will be agreed with DLR and operations may be limited to Engineering hours if there is a perceived risk to the railway.

11.5 Secondary Structures and Cladding

The external cladding to the stair enclosures and the platform level screening will comprise preassembled panels, fabricated off site. Installation of the panels will be by mobile crane with cherry pickers or other similar access platforms utilised for access where internal fixings cannot be accommodated. The external cladding to the lifts will also comprise pre-assembled panels.

Canopies will comprise steel frames integral with the main structure and roof metal cladding while the platform walls will be glazed.

Installation of the panels will be by mobile crane with temporary scaffold structures providing access to the structures for external assembly. Lift cladding will be in modular precast concrete.

11.6 New/ Modified Substation

The new plantroom, located beneath the viaduct to the west, will comprise in-situ ground bearing slab with masonry block work walls. Pre-cast concrete planks will be utilised for the roof slab of the building with screed applied to the roof as part of a sprayed waterproofing system. The existing substation located on the North-West corner of the viaduct will need to be relocated.

11.7 Programme

Based upon the preliminary activity schedule included within “Appendix 3” of this document an indicative programme for the works has been established. This programme should be considered preliminary only and will be subject to amendment as the detailed construction methodology for the preferred option is finalised.

12. Order of Magnitude Cost Estimate

Table 07 opposite provides summary costs for Single Preferred Option (OP5). For more information refer to ‘Appendix 4: Order of Magnitude Cost Estimate’.

Table 07 - Cost Summary

Thames Wharf

Option Summary

MOTT MACDONALD

	Construction Costs	Prelims @ 20%	OH/P @ 10%	Total Construction Costs	Design @ 10%	Test & Commission @ 2%	Client Costs @ 10%	Point Estimate Total	MAXIMUM +40%	MINIMUM -5%
Option	10,196,056	2,039,211	1,223,527	13,458,794	1,345,879	269,176	1,345,879	**16,419,728**	**22,987,620**	**15,598,742**

13. Conclusions & Recommendations

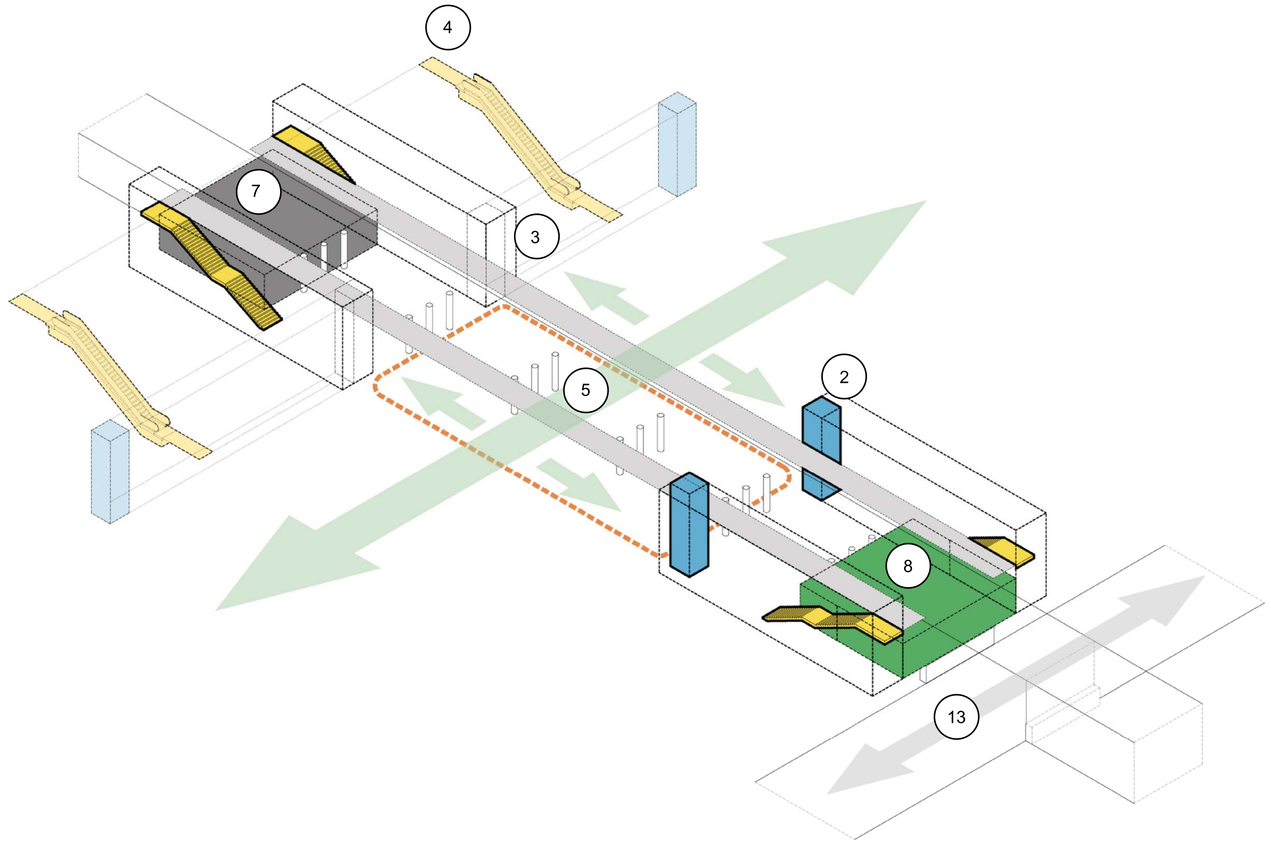
The proposed Thames Wharf DLR Station has been designed as a simple portal structure with raised platforms that sits comfortably adjacent to the scale of the proposed development under the Royal Docks OAPF masterplan.

The external appearance comprises of; a robust brick panel base with a glazed canopy above provides a simple and legible station design, with high quality finishes and detailing.

The fully glazed canopy at raised platform level will allow panoramic views of the developing site and Thames, and will appear as a floating lightbox at night, acting as a beacon and focal point for the area.

The proposed layout orientates the station entrance and vertical circulation cores directly onto station square. The design presents a simple, legible station building and integrated public realm that is intuitive, safe and flexible. The square will help form an important interchange node and civic space at the heart of future developments with new connections, from this land locked site. This integrated proposal will serve both the station and wider developments within the Royal Docks Development Capacity study and the Thameside West Greater London Authority (GLA) masterplan.

Appendix 1: Drawing Package



OPTION SUMMARY OF KEY WORKS

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13. Provision for new road layout subject to be change as GLA masterplan scheme developed.

KEY PLAN

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In addition to the hazard/risks normally associated with the type of works detailed on this drawing take note of the above It is assumed that all works on this drawing will be carried out by a competent contractor working where appropriate, to an appropriate method statement		

SAFETY HEALTH AND ENVIRONMENTAL INFORMATION BOX

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LEGEND:

*	Existing dimension to checked on site
SOP	Setting out point
xxL = xxx.xxx	Level on plan
xxL = xxx.xxx	Level on section
TAG	Tag reference to technical reference sheet
	Passenger entry point indicator
	Landscaping Feature

TFL RESTRICTED

REV	PURPOSE	CREATED BY	DATE	APPROVED BY	DATE	AUTHORISED BY	DATE

PROJECT: DLR THAMES WHARF

LOCATION

ASSET CLASSIFICATION

OWNER: LONDON UNDERGROUND

SUITABILITY CODE | SUITABILITY

TITLE: PRINCIPLE STRATEGY AXONOMETRY

Transport for London
Docklands Light Railway

DRAWING NUMBER: SK-TW-OP5-0001 | REV.: P01

Pen Table : $$pentable$$ Published by : $$user$$ at : $$$$$$sytime$$$$$ Drawing Definition file ID: CORE-LU-MAC-A001_Z-RF-K-0005 A 1

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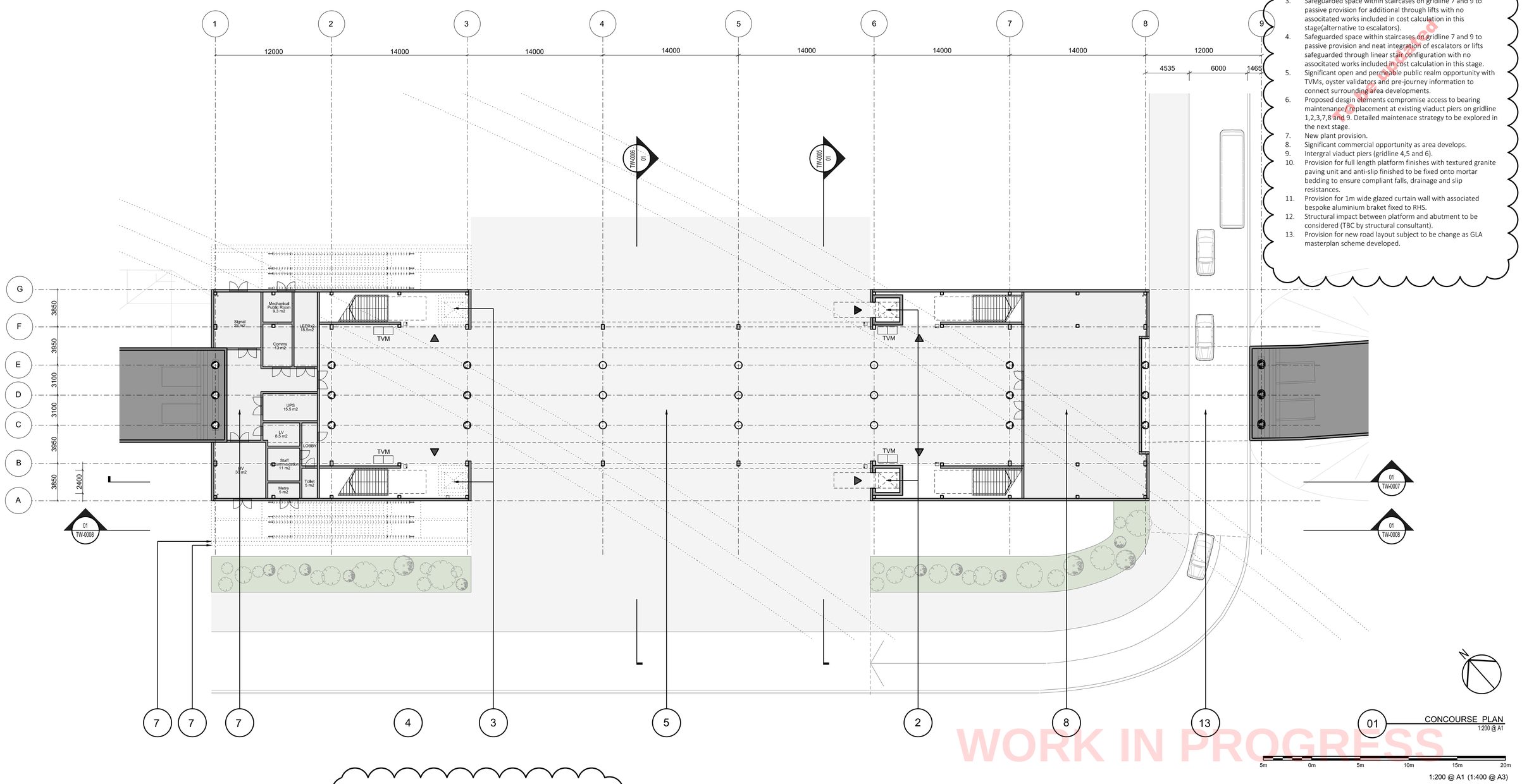

01 CONCOURSE PLAN 1:200 @ A1

5m 0m 5m 10m 15m 20m

1:200 @ A1 (1:400 @ A3)

KEY PLAN

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- xxL = xxx.xxx Level on section
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- Passenger entry point indicator
- Landscaping Feature

TFL RESTRICTED

REV	PURPOSE	CREATED BY	DATE	APPROVED BY	DATE	AUTHORISED BY	DATE

PROJECT: DLR THAMES WHARF

LOCATION:

ASSET CLASSIFICATION:

OWNER: LONDON UNDERGROUND

SUITABILITY CODE | SUITABILITY

TITLE: CONCOURSE PLAN

Transport for London
Docklands Light Railway

DRAWING NUMBER: SK-TW-OP5-0002 | REV.: P01

Pen Table : $$pentable$$
Published by : $$user$$ at : $$$$$$sytime$$$$$ Drawing Definition file ID: CORE-LU-MAC-A001_Z-RF-K-0005
A 1

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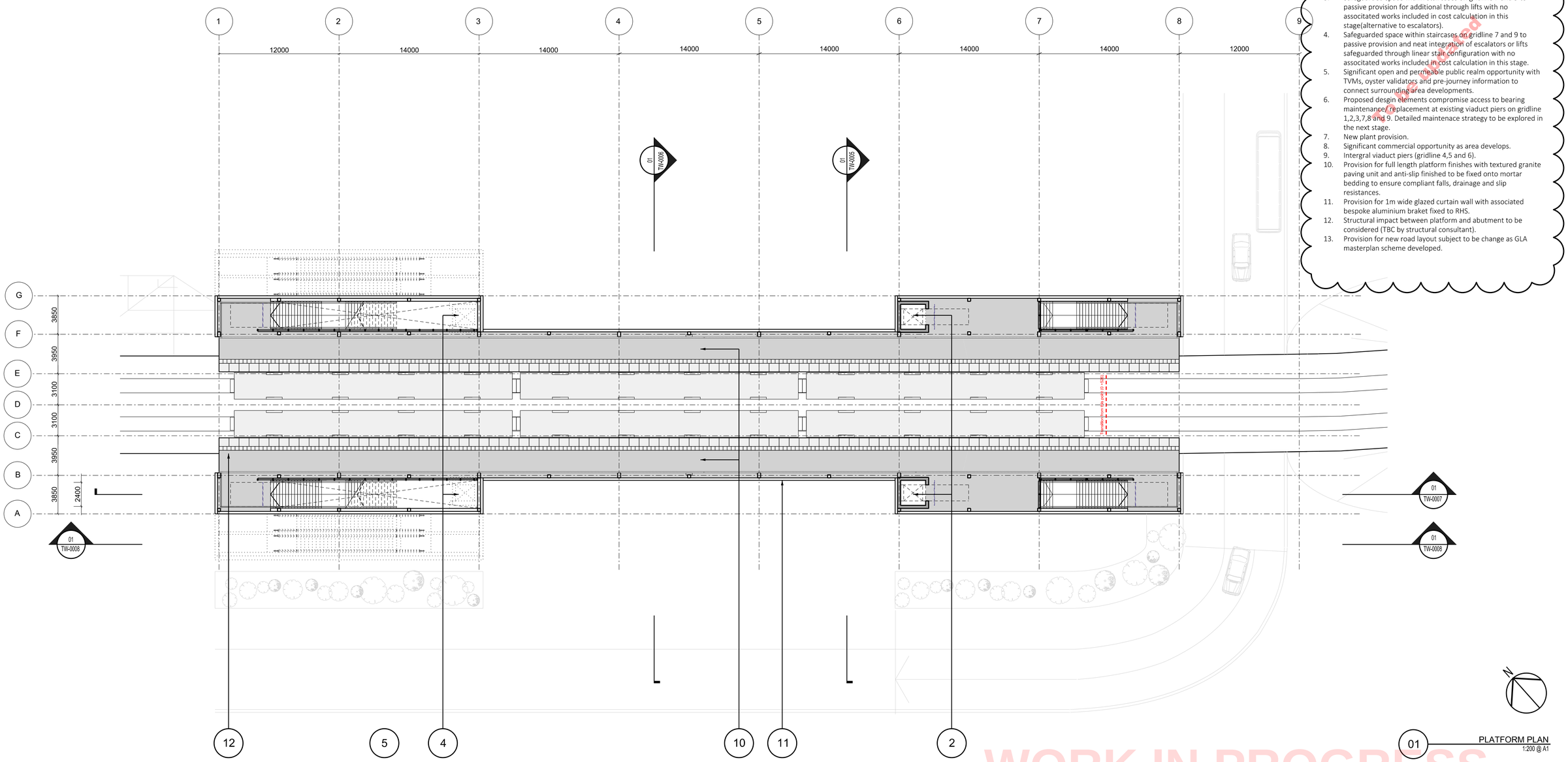

01 PLATFORM PLAN
1:200 @ A1

5m 0m 5m 10m 15m 20m

1:200 @ A1 (1:400 @ A3)

KEY PLAN

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PROJECT: DLR THAMES WHARF
LOCATION:
ASSET CLASSIFICATION:
OWNER: LONDON UNDERGROUND
SUITABILITY CODE:
SUITABILITY:

TITLE: PLATFORM PLAN

Transport for London
Docklands Light Railway

DRAWING NUMBER: SK-TW-OP5-0003
REV.: P01

Pen Table : $$pentable$$
Published by : $$user$$ at : $$$$$$sytime$$$$$ Drawing Definition file ID: CORE-LU-MAC-A001_Z-RF-K-0005
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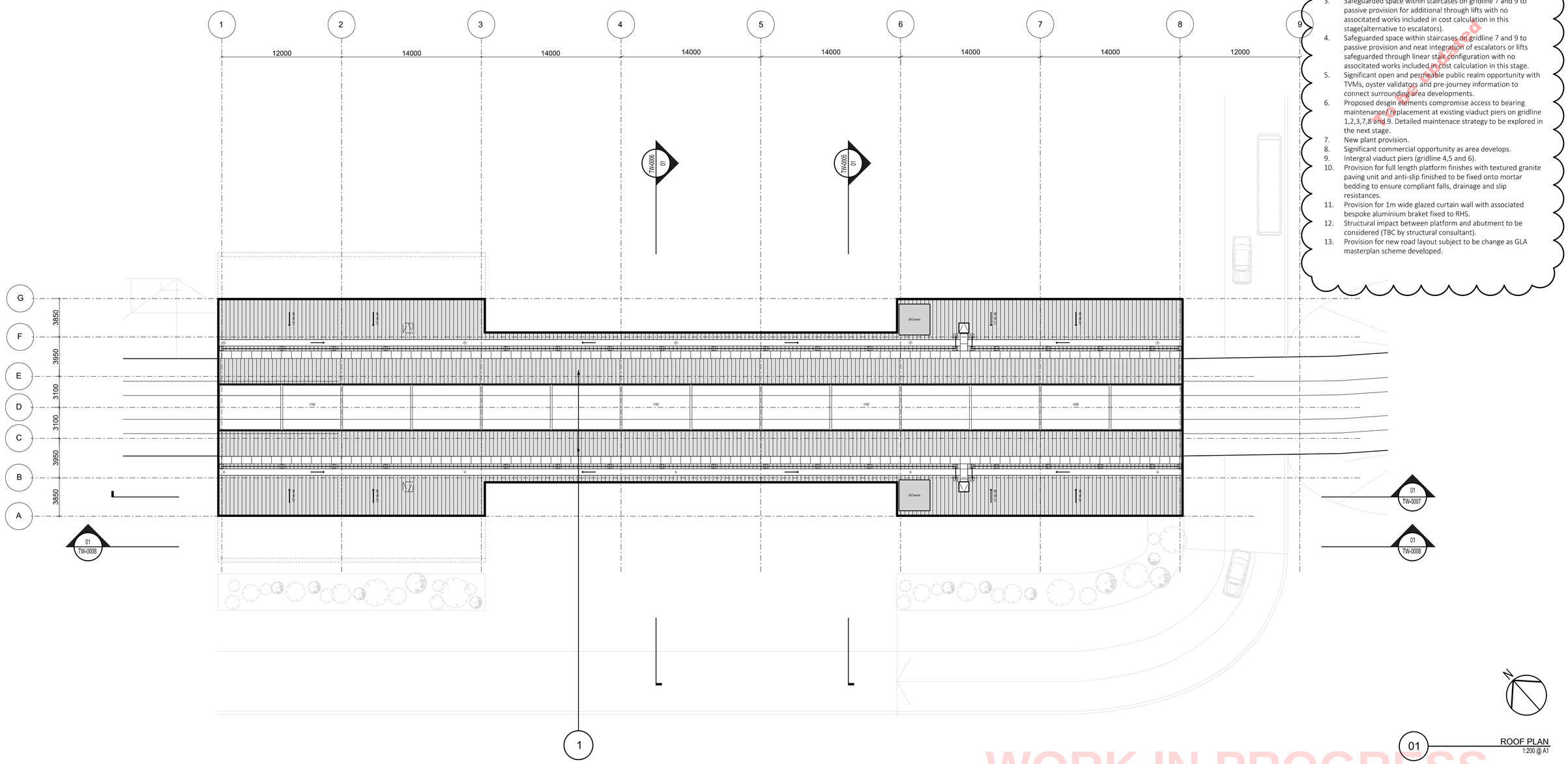

01 ROOF PLAN
1:200 @ A1

5m 0m 5m 10m 15m 20m

1:200 @ A1 (1:400 @ A3)

KEY PLAN

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PROJECT: DLR THAMES WHARF

LOCATION:

ASSET CLASSIFICATION:

OWNER: LONDON UNDERGROUND

SUITABILITY CODE | SUITABILITY

TITLE: ROOF PLAN

Transport for London
Docklands Light Railway

DRAWING NUMBER: SK-TW-OP5-0004

REV.: P01

Pen Table : $$pentable$$

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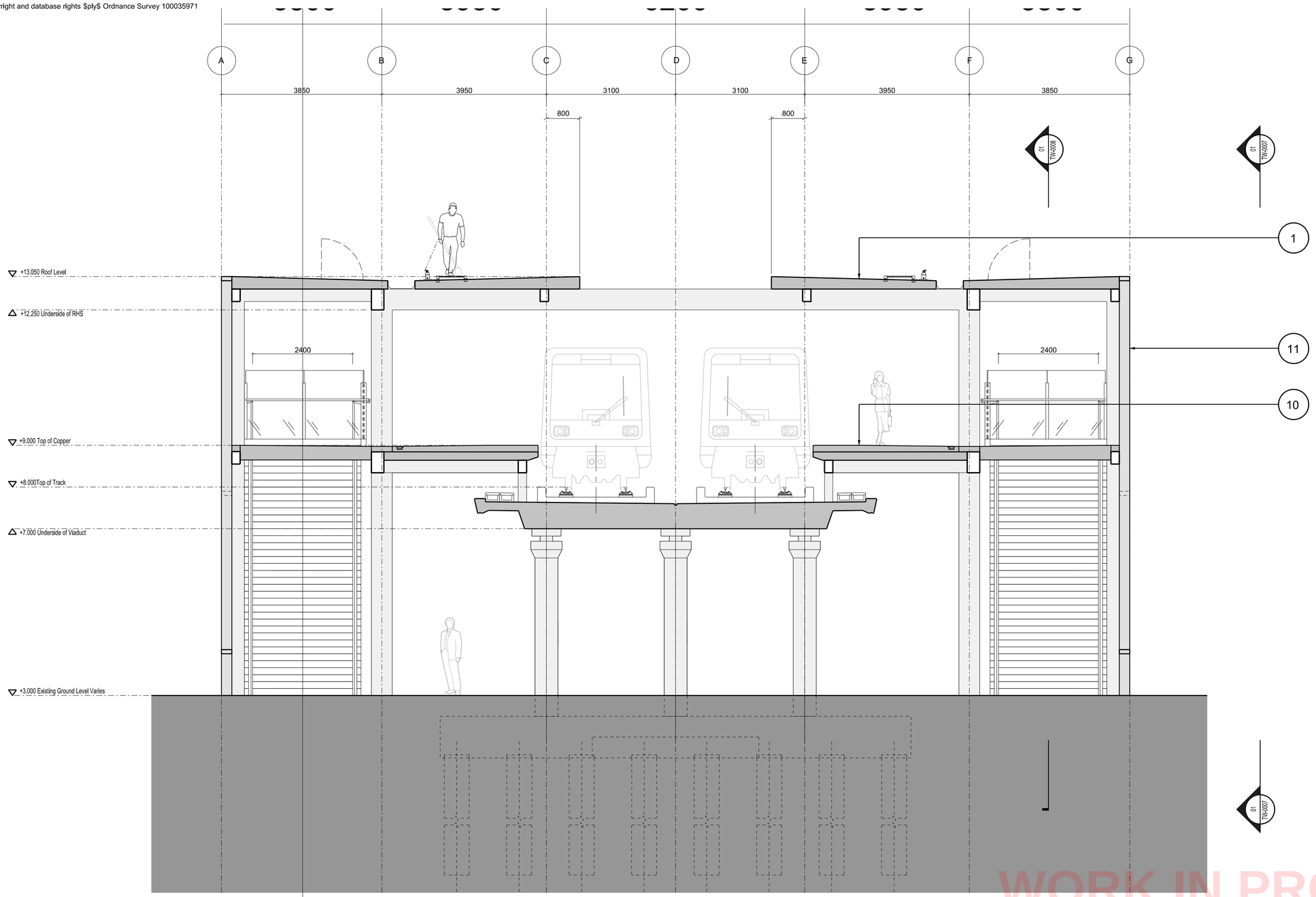
A 1



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01 CROSS SECTION THROUGH THE STAIRCORE
1:50 @ A1

1m 0 1m 2m 3m 4m 5m

1:50 @ A1 (1:100 @ A3)

KEY PLAN

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LEGEND:

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- SOP Setting out point
- xxL = xxx.xxx Level on plan
- xxL = xxx.xxx Level on section
- TAG Tag reference to technical reference sheet
- Passenger entry point indicator
- Landscaping Feature

TFL RESTRICTED

REV	PURPOSE	CREATED BY	DATE	APPROVED BY	DATE	AUTHORISED BY	DATE

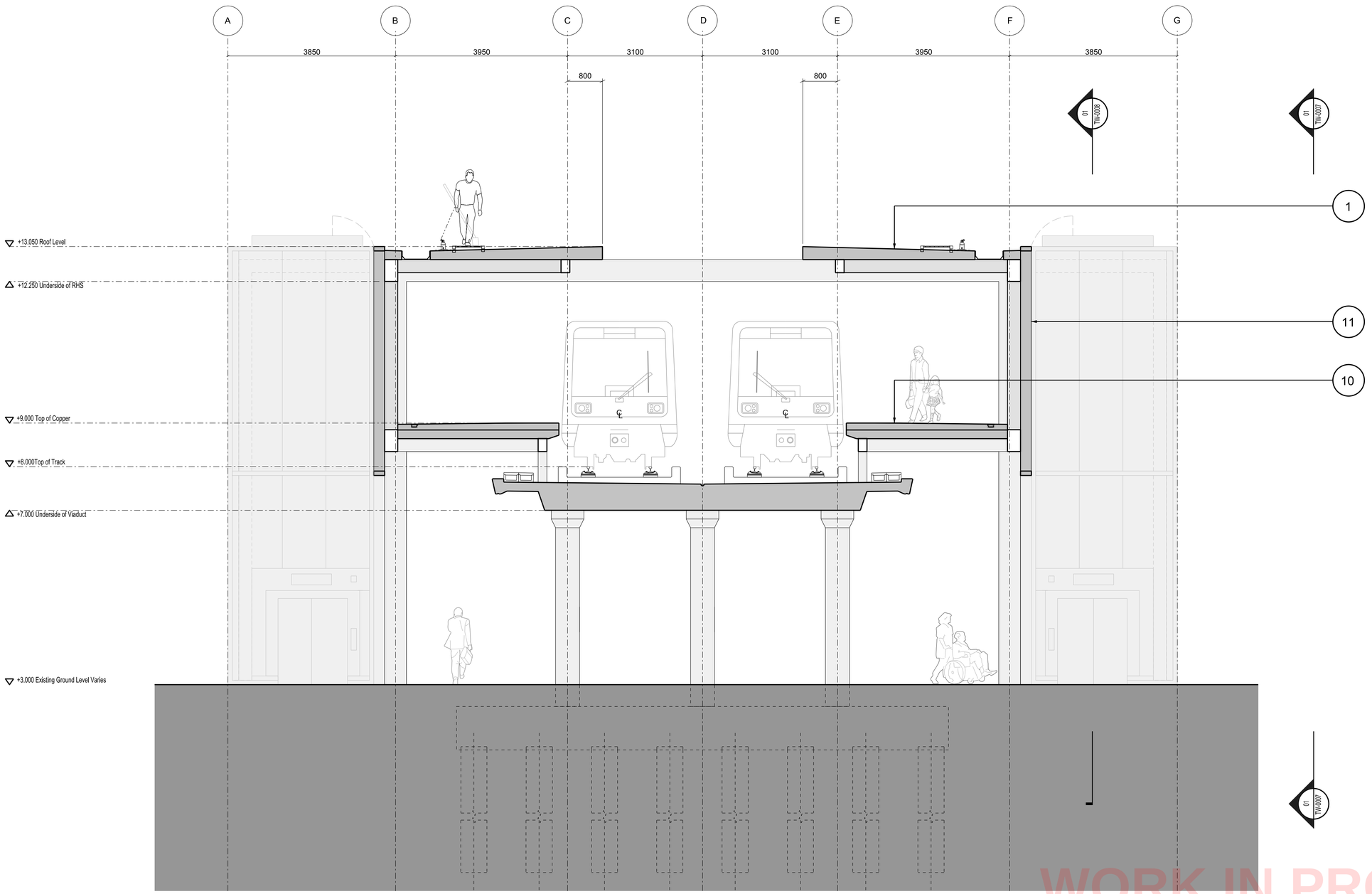
PROJECT: DLR THAMES WHARF
LOCATION:
ASSET CLASSIFICATION:
OWNER: LONDON UNDERGROUND
SUITABILITY CODE:
SUITABILITY:

TITLE: CROSS SECTION THROUGH THE STAIRCORE

Transport for London
Docklands Light Railway

DRAWING NUMBER: SK-TW-OP5-0005
REV.: P01

Pen Table : $$pentable$$
Published by : $$user$$ at : $$$$$$sytime$$$$$ Drawing Definition file ID: CORE-LU-MAC-A001_Z-RF-K-0005
A 1



OPTION SUMMARY OF KEY WORKS

1. Full length canopy (OP5 selected) with metal standing seam roof, associated M&E services, maintenance walkway and fall restraint systems. Portal structure to support the new full length canopy with RHS 500x300 and 300x300.
2. Two new 17 person through-lifts no cross flow issues with stairs. Perch seating to be provided on all lift levels.
3. Safeguarded space within staircases on gridline 7 and 9 to passive provision for additional through lifts with no associtated works included in cost calculation in this stage(alternative to escalators).
4. Safeguarded space within staircases on gridline 7 and 9 to passive provision and neat integration of escalators or lifts safeguarded through linear stair configuration with no associtated works included in cost calculation in this stage.
5. Significant open and permeable public realm opportunity with TVMs, oyster validators and pre-journey information to connect surrounding area developments.
6. Proposed desgin elements compromise access to bearing maintenance / replacement at existing viaduct piers on gridline 1,2,3,7,8 and 9. Detailed maintenace strategy to be explored in the next stage.
7. New plant provision.
8. Significant commercial opportunity as area develops.
9. Intergral viaduct piers (gridline 4,5 and 6).
10. Provision for full length platform finishes with textured granite paving unit and anti-slip finished to be fixed onto mortar bedding to ensure compliant falls, drainage and slip resistances.
11. Provision for 1m wide glazed curtain wall with associated bespoke aluminium braket fixed to RHS.
12. Structural impact between platform and abutment to be considered (TBC by structural consultant).
13. Provision for new road layout subject to be change as GLA masterplan scheme developed.

01 CROSS SECTION TYPICAL
1:50 @ A1

1m 0 1m 2m 3m 4m 5m

1:50 @ A1 (1:100 @ A3)

KEY PLAN

CONSTRUCTION RISKS	MAINTENANCE / CLEANING RISKS	DEMOLITION / ADAPTATION RISKS
In addition to the hazard/risks normally associated with the type of works detailed on this drawing take note of the above It is assumed that all works on this drawing will be carried out by a competent contractor working where appropriate, to an appropriate method statement		

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TFL RESTRICTED

REV	PURPOSE	CREATED BY	DATE	APPROVED BY	DATE	AUTHORISED BY	DATE

PROJECT: DLR THAMES WHARF
LOCATION:
ASSET CLASSIFICATION:
OWNER: LONDON UNDERGROUND
SUITABILITY CODE:
SUITABILITY:

TITLE: CROSS SECTION TYPICAL

Transport for London
Docklands Light Railway

DRAWING NUMBER: SK-TW-OP5-0006
REV.: P01

Pen Table : $$pentable$$ Published by : $$user$$ at : $$$$$$sytime$$$$$ Drawing Definition file ID: CORE-LU-MAC-A001_Z-RF-K-0005 A 1

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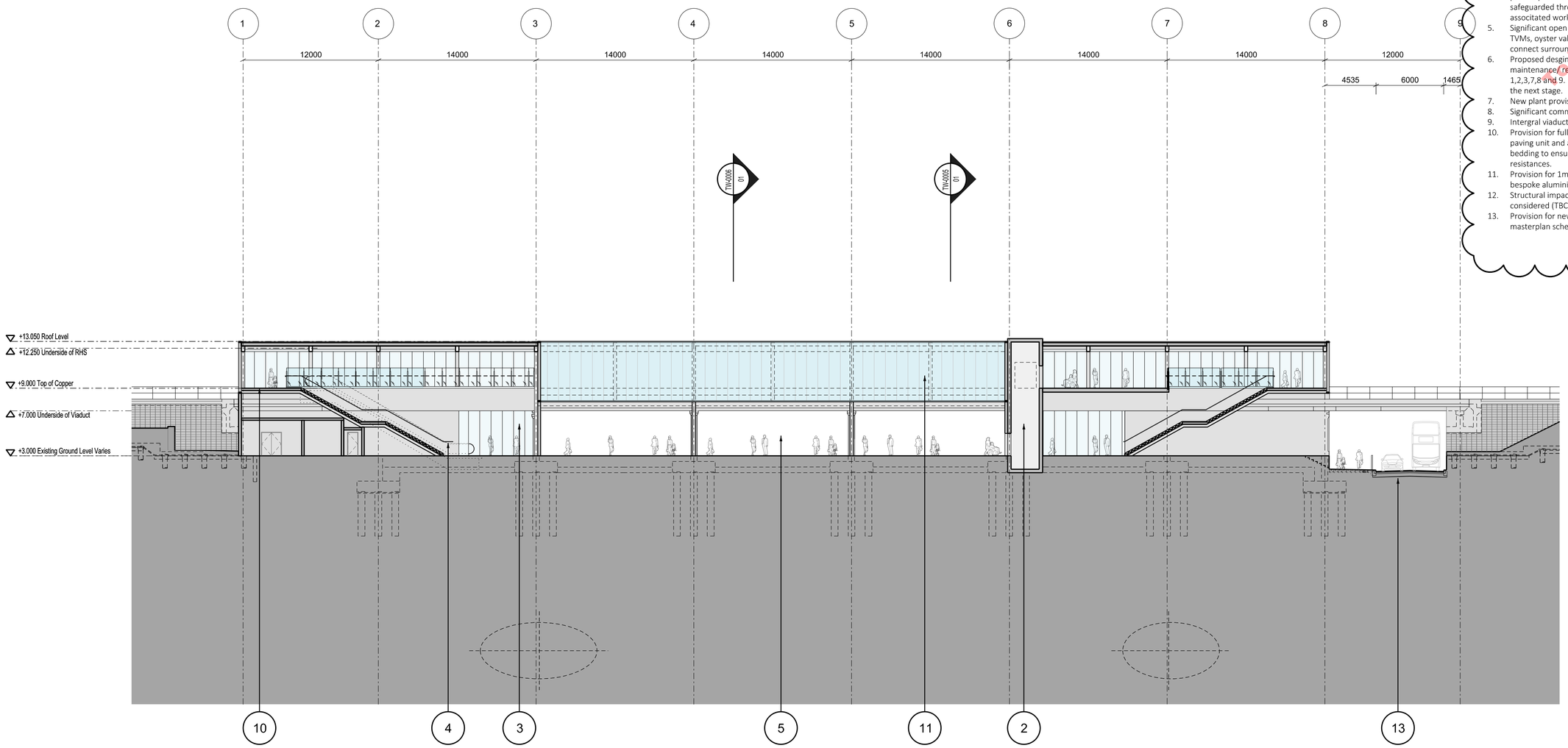

01 LONG SECTION/ ELEVATION THROUGH VERTICAL CIRCULATION
1:200 @ A1

5m 0m 5m 10m 15m 20m

1:200 @ A1 (1:400 @ A3)

KEY PLAN

CONSTRUCTION RISKS	MAINTENANCE / CLEANING RISKS	DEMOLITION / ADAPTATION RISKS
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TFL RESTRICTED

REV	PURPOSE	CREATED BY	DATE	APPROVED BY	DATE	AUTHORISED BY	DATE
a							

PROJECT: DLR THAMES WHARF

LOCATION

ASSET CLASSIFICATION

OWNER: LONDON UNDERGROUND

SUITABILITY CODE | SUITABILITY

TITLE: LONG SECTION/ ELEVATION THROUGH VERTICAL CIRCULATION

Transport for London
Docklands Light Railway

DRAWING NUMBER: SK-TW-OP5-0007 | REV.: P01

Pen Table : $$pentable$$ Published by : $$user$$ at : $$$$$$sytime$$$$$ Drawing Definition file ID: CORE-LU-MAC-A001_Z-RF-K-0005 A 1

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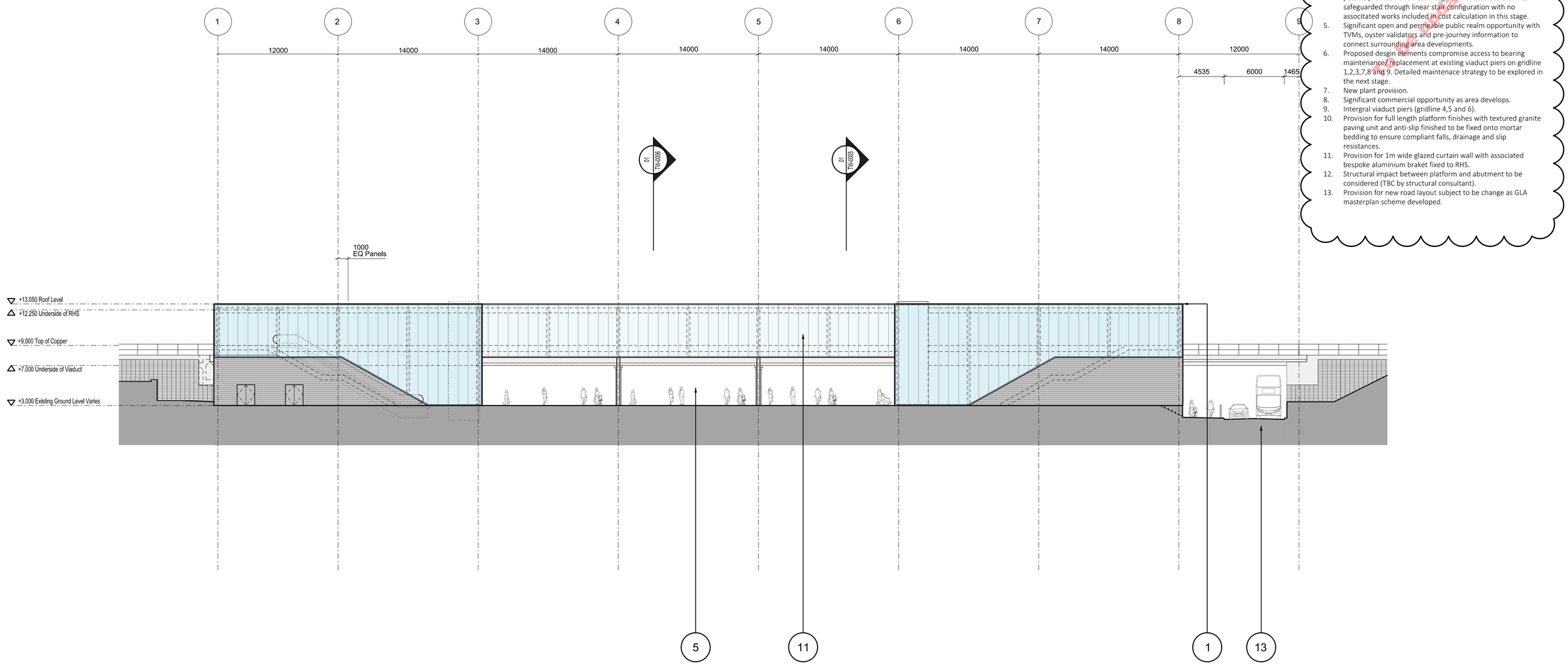

01 ELEVATION
1:200 @ A1

5m 0m 5m 10m 15m 20m

1:200 @ A1 (1:400 @ A3)

KEY PLAN

CONSTRUCTION RISKS	MAINTENANCE / CLEANING RISKS	DEMOLITION / ADAPTATION RISKS
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PROJECT: DLR THAMES WHARF

LOCATION:

ASSET CLASSIFICATION:

OWNER: LONDON UNDERGROUND

SUITABILITY CODE | SUITABILITY

TITLE: ELEVATION

Transport for London
Docklands Light Railway

DRAWING NUMBER: SK-TW-OP5-0008

REV.: P01

Appendix 2: Assumption Register

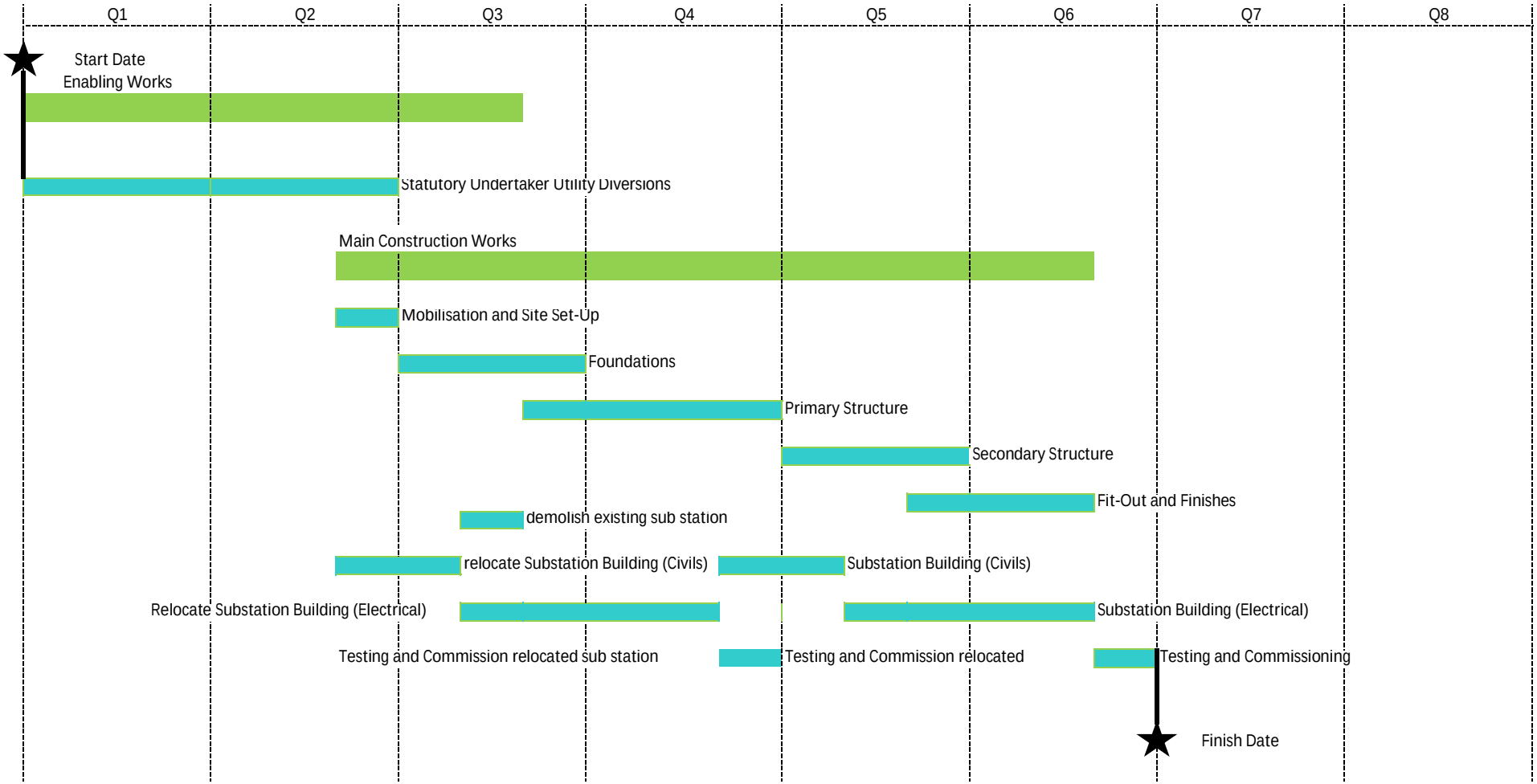
Design
Commercial
Sustainability
Operations
Construction

Open A
Closed L
C
CR

Thames Wharf Assumption & Riks Register

Assumption Number	Title	Date Issued	Date Response Due	Date of Response	Originator	Discipline	Assumption	Risk	Response	Status of Request	Status of Assumption	Assumptn /Request?	Further action / Notes
											L		
TW 01	Substation relocation				Gianluca B.	Electrical	Assume UKPN substation relocation is possible	Incorporation existing substation in the proposed layout has a major impact. Abortive works and redesign. Design Programme impact					
TW 02	Unknown utilities	20/12/2017			Gianluca B.	GEN	Structure can be supported on piled foundations at column locations indicated - with 6m clear exclusion required from Jubilee line. Assume no major utilites such as TW sewer near or under the viaduct	If underground services/ infrastructure exists below column locations other than Jubilee lines as identified on existing drawings, structural proposals may be invalid.					
TW 03	Lack of archive information and AIP	20/12/2017			Gianluca B.	STR	Platform supported vertically on existing structure - existing structure can take load (approx 40 kN/m run). Assume additional load from station platforms will not have adverse impact on the Jubilee line tunnel.	If provision in design has not be made for existing structure to take platform loads then, structural proposals are invalid. Abortive work and redesign. Design programme impact					
TW 04	Provision in design for new road	05/02/2018			Gianluca B.	GEO	Provision made in original design for new road on east embankment (gridline 8-9) as per As Built information.	Additional structure required to retain soil to form new road. Programme and cost impact					
TW 05	Ground conditions	05/02/2018			Gianluca B.	GEO	Ground conditions assumed from borehole information available from Geotechnical desk study	If ground conditions differs foundation proposal may not be viable. Ground investigation to be undertaken. No cost allowance made. Increase in project cost					
TW 06	Archive information	05/02/2018			Gianluca B.	STR	Archive information received relating to existing foundations to piers and abutment is accurate to as built condition	Foundations proposed not viable					
TW 07	Design Standards	20/12/2017			Elizabeth M	PED MOD	DLR Standard ES-502A and TfL/LU SPSG have different minimum stairs width requirement. It is assumed that design is to comply with LUS1371 which specifies a minimum clear stair width of 2400 mm as opposed to 2000 mm required on the DLR ES-502A. In addition it is assumed that no central handrail is required for the two-way stair as opposed to DLR 502 requirements (clause 4.27.20).	Proposed VC layout may not work if different standards are to be adopted. Wrong assumption may lead to abortive work and redesign. Design programme impact					
TW 08	Passenger flow estimation-VC layout	20/12/2017			Elizabeth M	PED MOD	Station passenger flow forecast provided for the static assessment is based on forecast numbers and train crush load provided by TfL	Impact on vertical circulation layout would need to be reassessed. Abortive work, redesign and programme impact					
TW 09	Passenger headways	21/12/2017			Elizabeth M	Ped Mod	Static assessments based on 30 trains per hour (TPH) or headway of 2 minutes	If TPH decreases then the demand on each train and using the platform will increase, which will require a reassessment of VC requirement. Potentially proposed VC layout may not be feasibile; Abortive work and programme impact					
TW 10	Proposed VC provisiion	13/02/2018			Elizabeth M	Ped Mod	Static assessment based on provision of two stairs per platform, or, for future proof scenario, two escalators and one stair per platform.	If number of VC provided reduces, the static assessment will need revising. Potentially proposed VC layout may not be feasibile; Abortive work and programme impact					
TW 11	Assessment for persons with restricted mobility (PRM)	13/02/2018			Elizabeth M	Ped Mod	Static assessment has not considered separate evacuation routes for persons with restricted mobility (PRM) as this is outside the scope	Evacuation routes for PRM may not be sufficiently sized. PRM may cause an obstruction to other evacuating passengers, resulting in longer evacuation times.					
TW 12	Ground contamination	05/02/2018			Gianluca B.	GEO	Due to the past usage of the site, there is potential for contamination to be present	A thorough risk assessment of the potential risk of contaminants in both groundwater and underlying strata should be undertaken at next stage. Increase in project cost					
TW 13	Alignment for linespeed change	12/02/2018			James. A.	Railway	Any change in alignment as a result of the required speed change has not been considered	Additional cost for track aligment this is found to be required. Impact on programme. Potential line possession required					
TW 14	Alignmen against ES-401	12/02/2018			James. A.	Railway	Alignment has not been assessed against ES-401	Additional cost for track aligment this is found to be required. Impact on programme. Potential line possession required					
TW 15	Linespeed change	12/02/2018			James. A.	Railway	It is assumed that the linespeed within the platform extents is to be reduced to 50km/h in accordance with Clause 6.3.1. of TN-229						

Appendix 3: Programme


Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Start Date
Enabling Works
Statutory Undertaker Utility Diversions
Main Construction Works
Mobilisation and Site Set-Up
Foundations
Primary Structure
Secondary Structure
Fit-Out and Finishes
demolish existing sub station
relocate Substation Building (Civils)
Substation Building (Civils)
Relocate Substation Building (Electrical)
Substation Building (Electrical)
Testing and Commission relocated sub station
Testing and Commission relocated
Testing and Commissioning
Finish Date

Appendix 4: Order of Magnitude Cost Estimate

THAMES WHARF DLR STATION

Outline Budget Estimate

New Station

FEBRUARY 2018

Issue and Revision Record:

Rev.	Date	Originator	Checked	Approved	Description
0	16.2.18	Z Heeley	M Jones	M Jones	Draft issued for review / comment
1	26.2.18	Z Heeley	M Jones	M Jones	For Information

35 Newhall Street
Birmingham B3 3PU

ASSUMPTIONS REGISTER

MOTT MACDONALD

Ref:	Assumptions:
1	Base date of this estimate is 1Q18
2	Preliminaries taken at 20%
3	Contractor's Overheads & Profit taken at 10%
4	Design costs based on 10% of main contactor's cost
5	All resources and materials can be procured to meet the programme. Rates are also 'sensible' (e.g. in line with estimate including inflation allowance)
6	All excavated material is inert and will be disposed of off site
7	Automatic ticket gates are not required
8	Estimating uncertainty +40/-5% allowed for
9	Allowance of £25 per m2 of GIFA included for a structured telecoms cable network
10	Allowances included for M+E equipment as the specifications are yet to be confirmed
11	Allowance of £20k has been included for connection to existing drainage
12	Allowance of £20k has been included for control equipment and integration into existing systems
13	Reinforcement assumed at various kg/m3 (see estimate)
14	Pile lengths, types and number are all as stated on drawings
15	Where possible quotations have been used to formulate the basis of the rates, where this has not been possible the rates utilised are based on market tested rates.
16	Lift shaft will be pre cast concrete
17	New substation will be constructed on site (location unknown)
18	Fifteen nr CCTV cameras have been allowed for
19	Allowance for audio frequency loops, speakers, perch seats, standard seats and passenger information displays
20	Public realm will be paved
21	Cladding to outside of stair areas will be metal cladding and precast brick cladding
22	New tactile paving and copers to edge of platform will be required
23	Existing bearings on existing viaduct will not need replacing
24	Platforms will be 200 thick slab
25	Ground floor slab will be 175 thick (gridlines 1-3 and 6-9)
26	Existing road will be filled
27	New road will be 12m wide and 40m long, type 1 sub base 400 thick, base course 200, binder 60, surface course 40, HB2 kerbs
28	Gullies will be every 30m

EXCLUSION REGISTER

MOTT MACDONALD

Ref:	*Exclusion:*
1	VAT
2	3rd party compensation charges
3	Planning and approval charges
4	Optimism Bias
5	Costs associated with taxes and levies, including VAT
6	Costs associated with licences and all associated costs and fees
7	Costs associated with changes in legislation and any form of applicable standards
8	Costs associated with changes in legislation, regulation and interpretation covering discriminatory, specific and general issues that may lead to design and cost changes
9	Costs associated with Statutory Fees (e.g. HMRI, Local Authority, etc.)
10	Costs associated with ground investigation
11	Allowances for adverse ground conditions / provisions for ground stabilisation unless specifically identified
12	Diversions/ protection of existing utilities unless specifically specified
13	Traffic Management during construction
14	Land purchases
15	Christmas, Easter or Bank Holiday working
16	Telecoms upgrade – only integration
17	Betterment of hard landscapping beneath viaduct
18	Upgrade to existing DLR infrastructure other than that explicitly stated
19	Concourse lighting
20	Asbestos removal and surveys (buildings)
21	Any upgrade works to SCAD software – only local integration of new telecommunications into station systems has been allowed for
22	Work to existing underground drainage
23	Rail system works including track, overhead line and signalling
24	No fit out required in retail unit
25	Buried service diversions
26	Contaminated materials for disposal
27	Furniture, fitting and fixtures are specifically identified in the estimate
28	Commercial opportunity

DRAWINGS REGISTER

MOTT MACDONALD

Ref:	*Title*	*Revision*
SK-TW-OP5-0001	Principle Axonometric	P01
SK-TW-OP5-0002	Concourse Level	P01
SK-TW-OP5-0003	Platform Level	P01
SK-TW-OP5-0004	Roof Level	P01
SK-TW-OP5-0005	Cross Section thorugh Staircore	P01
SK-TW-OP5-0006	Cross Section Typical	P01
SK-TW-OP5-0007	Long Section through Vertical Circulation	P01
SK-TW-OP5-0008	South Elevation	P01

Thames Wharf

Option Summary

	Construction Costs	Prelims @ 20%	OH/P @ 10%	Total Construction Costs	Design @ 10%	Test & Commission @ 2%	Client Costs @ 10%	Point Estimate Total	MAXIMUM +40%	MINIMUM -5%
Option	10,196,056	2,039,211	1,223,527	13,458,794	1,345,879	269,176	1,345,879	**16,419,728**	**22,987,620**	**15,598,742**

ESTIMATE BUILD UP

Project / Contract No.	**Thames Wharf DLR station**
Estimate Title :	**Outline Budget Estimate**
Engineering Discipline:	**General Civils**
Project Title	**Thames Wharf DLR station**
Estimate Revision:	**1**
Date:	**26-Feb-18**

ITEM	DESCRIPTION	QTY	UNIT	RATE	TOTAL	
	THAMES WHARF DLR STATION RIBA Stages 1/2					
	CLASS D: DEMOLITION AND SITE CLEARANCE					
	Site Clearance					
	General Clearance					
	General site clearance	2,768	m2	5.01	13,880.14	
	Demolition of existing substation - **allowance**	1	item	150,000.00	150,000.00	
	Allow for new substation - **allowance**	1	item	450,000.00	450,000.00	**£613,880.14**
	CLASS E: EARTHWORKS					
	Excavation for Foundations					
	Material other than topsoil, rock or artificial hard material					
	Material other than topsoil, rock or artificial hard material, maximum depth: 1-2m; pile caps	274	m³	20.00	5,480.00	
	Material other than topsoil, rock or artificial hard material, maximum depth: 1-2m; new road approx 40m long	450	m³	20.00	9,000.00	
	Excavation Ancillaries					
	Disposal of excavated material; material other than topsoil, rock or artificial hard material	724	m³	31.43	22,755.32	
	Filling					
	Imported natural material other than topsoil or rock - beding; filling to existing road	450	m³	51.34	23,103.00	
	Landscaping					
	Allowance for new landscaping	229	m²	25.00	5,725.00	**£66,063.32**
	CLASS F: INSITU CONCRETE					
	Provision of Concrete - Prescribed Concrete					
	Bases, footings, pile caps and ground slabs					
	Thickness: exceeding 500mm - supply and place reinforced concrete to pile caps	274	m³	142.63	39,080.62	
	Thickness: 150-300 - supply and place reinforced concrete to ground floor slab	90	m³	142.63	12,836.70	**£51,917.32**
	CLASS G: CONCRETE ANCILLARIES					
	Formwork: Rough Finish					
	Plane vertical					
	Width: 0.4-1.22m - pile caps	456	m²	73.20	33,379.20	
	Reinforcement					
	Deformed high yield steel bars					

	Nominal size: 16mm; reinforcement to pile caps; 250kg/m3	69	t	953.48	65,313.38	
	Nominal size: 16mm; reinforcement to ground floor slab; 250kg/m3	23	t	953.48	21,453.30	**£120,145.88**
	CLASS H: PRECAST CONCRETE					
	Segmental Units					
	Lift Shafts					
	Lift Shafts; 3m x 3m x 10 m high	2	nr	182,121.00	364,242.00	**£364,242.00**
	CLASS M: STRUCTURAL METALWORK					
	Fabrication of Members for Frames					
	Straight on plan; primary and secondary steel members to canopy	1,380	m²	185.54	256,040.37	
	Straight on plan; primary & secondary steel members to platforms	1,043	m²	185.54	193,514.57	
	Allowance for fitting, fixings and bolts; 15% of total quantity	1	item	67,433.24	67,433.24	
	Erection of Members for Frames					
	Trial erection					
	Trial erection				Included	
	Permanent erection					
	Permanent erection				Included	**£516,988.18**
	CLASS N: MISCELLANEOUS METALWORK					
	Fabrication and Erection					
	Stairways and landings					
	Steel staircases, approx 2.4m wide	4	nr	160,705.93	642,823.71	**£642,823.71**
	CLASS P: PILES					
	Bored Cast In Place Concrete Piles					
	Diameter: 450					
	Number of piles; 450mm diameter	224	nr	249.60	55,910.40	
	Concreted length; 450mm diameter; assuming 6m deep	1,344	m	63.45	85,276.80	
	Depth bored or driven to stated maximum depth; 450mm diameter; assuming 6m deep	1,344	m	119.84	161,064.96	**£302,252.16**
	CLASS Q: PILING ANCILLIARIES					
	Cast In Place Concrete Piles					
	Preparing heads					
	Diameter: 450mm	224	nr	48.72	10,913.28	
	Reinforcement					
	Straight bars, nominal size: not exceeding 25mm - to 450 dia piles, assuming 150 kg/m³	31.64	t	1,244.00	39,355.18	
	Pile Tests					
	Maintained loading with various reactions					
	Test load - Allowance - 450 dia piles	1	item	10,000.00	10,000.00	**£60,268.46**
	CLASS R: ROADS AND PAVING					
	Kerbs, Channels, Edgings, Footways and Paved Areas					
	Precast concrete, natural stone, block and clay slabs and pavers					

	Granite sett paving, 900 x 300 x 50 thick, to platforms	1,043	m²	188.02	196,106.12	
	Conservation pavers, Marshalls or similar, 900 x 300 x 50 thick, to concourse	1,205	m2	168.70	203,277.51	
	Conservation pavers, Marshalls or similar, 900 x 300 x 50 thick to open public realm area	1,563	m2	168.70	263,670.33	
	Tactile paving 400 x 400, to edge of platform	194	m	96.00	18,624.00	
	Precast concrete copers 930 x 760 , to edge of platform	194	m	108.32	21,014.44	
	Type 1 Sub base to new road construction, 400 thick	192	m3	45.13	8,665.06	
	Base course 200 thick, binder 60 thick, surface course 40, to new road construction	480	m2	58.17	27,920.74	
	Kerbs; HB2, to new road	80	m	20.06	1,604.64	
	Surface water drainage to new road	80	m	60.00	4,800.00	
	Gullies	2	nr	300.00	600.00	
						£746,282.82
	CLASS S: TRACKWORK					
	CLASS S4: OPERATIONAL TELECOMMUNICATION INSTALLATIONS					
	Customer information systems					
	Audio					
	Allowance for Speakers; assuming Molded Plastic Sound Projector including an allowance for cables (Prenton CAD 10/T or equivalent)	14	nr	781.65	10,943.10	
	Audio-visual management systems					
	Security installations					
	Allowance for CCTV Cameras; assuming PZT Camera (AXIS Q6044-E or similar) including allowance for tail cables	15	nr	4,030.40	60,456.07	
	Help Points					
	Allowance for Public Help Point; assuming PHP 400 by Gai Tronics or equivalent; including an allowance for tail cables	2	nr	3,149.84	6,299.68	
	Timetable management systems					
	Allowance for audio frequency induction loop	2	nr	1,047.63	2,095.26	
	Miscellaneous Telecoms					
	Allowance for Standard Station Ticket Vending Machine that can take both card and cash including one year support	8	nr	33,316.55	266,532.39	
	Allowance for Standard Oyster Validators	4	nr	5,014.50	20,058.00	
	Allowance for Automatic Passenger Counting Systems	6	nr	7,472.17	44,833.02	
	Allowance for single side Passenger Information Display; including integration to the existing system	6	nr	7,900.00	47,400.00	
	Ticket vending machines - Allowance	4	nr	30,000.00	120,000.00	
	E-Sub vending Machines - Allowance	1	nr	30,000.00	30,000.00	
	Cabling					
	Allowance for structured cable installation	2,767	m²	25.07	69,375.61	
	Controlled equipment and integration into existing systems					
	Allowance for control equipment and integration into existing systems	1	item	20,058.00	20,058.00	
						£698,051.12
	CLASS S6: FIXED PLANT					

	Lifts					
	Passenger					
	Hydraulic : two level (ground and platform) - 17 person	2	nr	130,950.00	261,900.00	
	Allowance					
	M+E fit out to platform area	1,043	m²	566.15	590,494.36	
						£852,394.36
	CLASS X: MISCELLANEOUS WORK					
	Drainage to structures above ground					
	Gutters to platform canopy; assuming aluminium	194	m	100.00	19,400.00	
	Rainwater down pipes; assuming aluminium	184	m	90.00	16,560.00	
	Channel drains; assuming BIRCO 200 channel and edge rail or similar approved; bedding, surrounding and haunching in concrete, grade GEN3; including extra over for ends	233	m	148.00	34,552.08	
	Allowance for connection to existing drainage	1	item	20,000.00	20,000.00	
						£90,512.08
	CLASS Z: SIMPLE BUILDING WORKS INCIDENTAL TO CIVIL ENGINEERING WORKS					
	Windows, Doors and Glazing					
	Glazing					
	Glass balustrade to staircases - top of stairs	45	m²	750.00	33,750.00	
	Glass balustrade to staircases	74	m2	750.00	55,500.00	
	Station					
	Platform Shelters					
	Construction of new platform; 200 thick planks	1,044	m²	1,339.22	1,398,436.20	
	Supply and construction of canopy on platform; with metal standing seam roof, associated M&E services, maintenance walkway and fall restraint systems; including fixings and connections to glass panels - 'all in rate'	1,380	m²	1,339.22	1,848,118.17	
	Glazed curtain walling to station	1,542	m2	750.00	1,156,500.00	
	Metal cladding to staircases - **allowance**	331	m2	150.00	49,680.00	
	Precast brick panel cladding - **allowance**	450	m2	175.00	78,750.00	
	Station furniture					
	Allowance for 1800mm Carleton™ Perch Seat	6	nr	700.00	4,200.00	
	Standard seating around lift areas	1	item	600.00	600.00	
	Allowance for station wide signage	1	item	10,000.00	10,000.00	
						£4,635,534.38

	Plant provision					
	Allowance for Signals installation	28	m2	2,149.29	60,180.00	
	Allowance for Mechancial installation	9	m²	6,560.00	59,040.00	
	Allowance for Comms installation	13.0	m²	3,790.77	49,280.00	
	Allowance for LEER installation	19	m²	2,086.32	39,640.00	
	Allowance for UPS installation	16	m²	2,466.25	39,460.00	
	Allowance for LV installation	9	m²	5,004.44	45,040.00	
	Allowance for Staff accommodation	11	m2	1,014.55	11,160.00	
	Allowance for HV installation	30	m²	2,543.33	76,300.00	
	Toilet	5	m2	3,160.00	15,800.00	
	Allowance for Meter installation	5.0	m²	7,760.00	38,800.00	**£434,700.00**
				Base Cost	**10,196,055.93**	

Appendix 5: Origin and Destination Figures

Rolling Stock Type/Formation	Guideline Capacity @ 3 pax/m2	hourly avg 'Maximum load"
B92 1-car	162	220
B92 2-car	324	440
B92 3-car	486	660
NTfD Fixed-Formation Train	542	788

Change Flag	Master component	Site ID	Subarea	Site Name	Source	Land Use Code	Site Status	Site type	Opening Year	Opening Employment / Car Ownership	Opening Capacity	Capacity Year	Capacity Year Employment / Car Ownership	Capacity Year Capacity	Closing Year	Note	Trips AM PT Out	Trips AM PT In	
	6288	6288	Thameside West	Thames Wharf	Masterplan feasib	H5	Potential	Component	2031	0	0	2031	25	5,500		Netted off 1500 units for Carlsberg Tetley site, assuming Royal Wharf density of 375h/ha			
	407514	407514	Thameside West	Carlsberg Tetley / Silvertown Landing	RD OAPF draft	H5	Potential	Component	2031	0	0	2040	25	1,500					
Amend	423701	423701	Leamouth South	Hercules, Union & Castle Wharves	14/03594	H5	Consented	Component	2019	0	0	2022	50	716					Peripheral - trips split between Canning Town (JL) and E
	423713	423713	Leamouth South	Orchard Wharf		H5	Potential	Component	2031	0	0	2040	0	520		Application for batching plant was refused. 1.3ha site, assumed 400h/ha similar to Hercules site			Peripheral - trips split between Canning Town (JL) and E

East India (DLR to City), depending on which end of the site you live at.

East India (DLR to City), depending on which end of the site you live at.

Site ID	Catchment?	Status	Site Name	AM/PM?	In/Out?	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
6288	Inside	Potential	Thames Wharf	AM	In	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	332	332	332	332	332	332	332	332	332	332	332
6288	Inside	Potential	Thames Wharf	AM	Out	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1476	1476	1476	1476	1476	1476	1476	1476	1476	1476	1476
6288	Inside	Potential	Thames Wharf	PM	In	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	853	853	853	853	853	853	853	853	853	853	853
6288	Inside	Potential	Thames Wharf	PM	Out	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	526	526	526	526	526	526	526	526	526	526	526
407514	Inside	Potential	Carlsberg Tetley / Silvertown Landing	AM	In	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	0	5	10	16	21	26	31	36	42	47	47
407514	Inside	Potential	Carlsberg Tetley / Silvertown Landing	AM	Out	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	45	89	134	178	223	267	312	357	401	401
407514	Inside	Potential	Carlsberg Tetley / Silvertown Landing	PM	In	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	26	51	77	103	129	154	180	206	232	232
407514	Inside	Potential	Carlsberg Tetley / Silvertown Landing	PM	Out	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	0	11	22	33	44	55	66	77	88	99	99
423701	Peripheral	Consented	Hercules, Union & Castle Wharves	AM	In	18	18	18	18	18	18	18	18	18	18	18	0	0	23	46	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69
423701	Peripheral	Consented	Hercules, Union & Castle Wharves	AM	Out	1	1	1	1	1	1	1	1	1	1	1	0	0	156	312	467	467	467	467	467	467	467	467	467	467	467	467	467	467	467	467	467	467	467	467
423701	Peripheral	Consented	Hercules, Union & Castle Wharves	PM	In	0	0	0	0	0	0	0	0	0	0	0	0	0	90	180	270	270	270	270	270	270	270	270	270	270	270	270	270	270	270	270	270	270	270	270
423701	Peripheral	Consented	Hercules, Union & Castle Wharves	PM	Out	18	18	18	18	18	18	18	18	18	18	18	0	0	43	85	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128
423713	Peripheral	Potential	Orchard Wharf	AM	In	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	4	5	7	9	11	13	14	16	16
423713	Peripheral	Potential	Orchard Wharf	AM	Out	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	31	46	62	77	93	108	124	139	139
423713	Peripheral	Potential	Orchard Wharf	PM	In	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	18	27	36	45	54	62	71	80	80
423713	Peripheral	Potential	Orchard Wharf	PM	Out	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	8	11	15	19	23	27	31	34	34

DLR Trips	2041 (Potential) - Catchment	2041 (Potential) - Peripheral	2041 (Potential) - Catchment + Peripheral
AM Boarders	1802	82	1884
AM Alighters	363	11	375
AM Total	**2166**	**93**	**2259**
PM Boarders	600	22	622
PM Alighters	1041	47	1088
PM Total	**1641**	**69**	**1710**

DLR % Mode Share of PT	96%
% Peripheral Trips using THW	14%

P13 16/17	Direction B/A?	Total Board	Total Alight	SB Board	SB Alight	NB Board	NB Alight
AM							
THW							
% B/A splits by direction				6%	72%	94%	28%
PM							
THW							
% B/A splits by direction				16%	88%	84%	12%
With Dev (2041)							
AM							
THW		1,884	375	104	268	1780	107
Peak 15 min flow				28	72	481	29
Peak one min flow				2	5	32	2
PM							
THW		622	1,088	101	953	522	135
Peak 15 min flow				26	248	136	35
Peak one min flow				2	17	9	2
MAX of AM and PM							
Peak one min flow				2	17	33	3
+20% buffer				3	21	40	4

Scaling Factors	Period	Peak 1 hour to Peak 1
	AM	0.27
	PM	0.26

15 min

Calculation of Peripheral Site Trips that are likely to use THW

Data from ACAMOD OD Matrix a

AM HPH	All	Rest	Int'l Route	EB Airport Route	
WSI	418	403	2	13	
PDK	250	167	74	9	
Total	668	570	76	22	
% WSI		96.4%	0.5%	3.1%	
% PDK		66.8%	29.6%	3.6%	
% Total		85.3%	11.4%	3.3%	14%

PM HPH	All	Rest	Int'l Route	Other Airport Route	
WSI	350	296	43	11	
PDK	236	230	0	6	
Total	586	526	43	17	
% WSI		84.6%	12.3%	3.1%	
% PDK		97.5%	0.0%	2.5%	
% Total		89.8%	7.3%	2.9%	3%

Calculation of THW pax Directional Split

AM HPH Section	Total Board	Total Alight	OB Board		OB Alight	IB Board	IB Alight	Flow OB	Flow IB
Airport Route			EB B		EB A	WB B	WB A	EB	WB
PDK	250	75	9		62	241	13	↑	↓
% B/A splits by direction				4%	82%	96%	18%		
WSI	418	313	28		216	391	97	↑	↓
% B/A splits by direction				7%	69%	93%	31%		
Combined	668	388		37	278	631	110		
				6%	72%	94%	28%		

PM HPH Section	Total Board	Total Alight	OB Board		OB Alight	IB Board	IB Alight	Flow OB	Flow IB
Airport Route			EB B		EB A	WB B	WB A	EB	WB
PDK	118	215	47		204	71	11	↑	↓
% B/A splits by direction				40%	95%	60%	5%		
WSI	538	318	59		263	480	55	↑	↓
% B/A splits by direction				11%	83%	89%	17%		
Combined	656	533		106	467	550	66		
				16%	88%	84%	12%		

Platform/Flow	Passengers per minute
Southbound - Boarding	3
Southbound - Alighting	21
Northbound - Boarding	40
Northbound - Alighting	4

South Route @ Crossharbour	Current	RSRP (2022)	Future (2024)
Frequency (tph)	22.5	22.5	30
Capacity (pax/hr/dir)	9720	12195	16260
Makeup	15tph 3-car, 7.5tph 2-car	22.5tph NTfD	30tph NTfD

Airport Route @ Thames Wharf	Current	RSRP (2022)	Future (2024)	Future (2034)
Frequency (tph)	15	15	22.5	30
Capacity (pax/hr/dir)	6075	8130	12195	16260
Makeup	7.5tph 3-car, 7.5tph 2-car	15tph NTfD	22.5tph NTfD	30tph NTfD

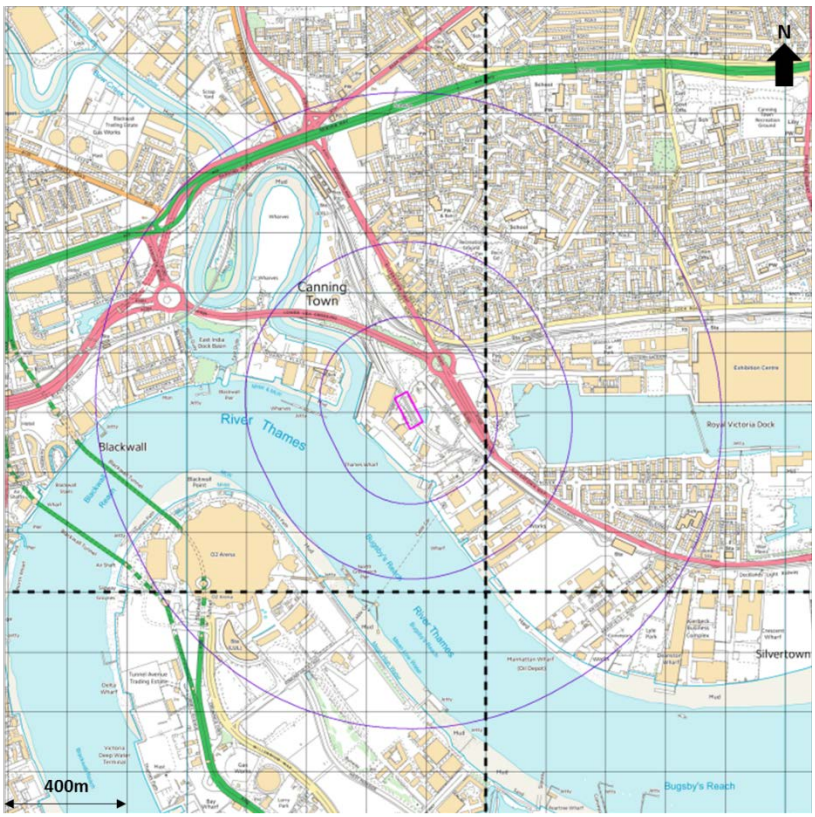
NTfD = 'New Train for Docklands' walkthrough trains with approximately 10% more capacity than current fleet

Appendix 6: Geotechnical Desk Study

1 Introduction

A geotechnical desk study is required to inform upon the ground conditions at the location of the proposed Thames Wharf Station. The station is approximately 7.2km from the City of London on the northern bank of the River Thames within the borough of Tower Hamlets. Site location plans are provided in Figure 1-1 and Figure 1-2.

Figure 1-1 Position of site in London



Source: Ordnance Survey © Crown copyright [2017]. All rights reserved. Licence number 100026791.

Figure 1-2 Site location plan

2 Limitations

This desk study is based solely upon the available information outlined in Section 4. There has not been a site walkover at the time of writing.

Only geotechnical information is outlined in this study. Hence, environmental considerations are not fully addressed in this report.

3 Site Description

The site trends NW/SE and has an area of approximately 4000m^2. Along the SW edge of the site, waste management/skip hire businesses are found, with other industry located along the NE edge. A wooded/vegetated area with a pond is found to the E, and a further (possibly connected) channel is located outside the site extends to the SW.

The proposed station is to be situated along a ~100m long straight section of the current dual track DLR line. The current line runs along a viaduct for most of the site length. The viaduct sits on seven piers (consisting of three reinforced concrete 0.55m diameter columns) which have a spacing of 14m. At ground level, there are 0.5m thick ground slabs between the piers. Each pier rests on a 1m thick reinforced concrete pile cap, which

covers three rows of eight 0.60m CFA piles at 1.5m spacing (between pile centres). The piles are founded within the River Terrace Deposits (Ref. 10 and 11).

At both NW and SE ends of the viaduct there is an embankment. These embankments are composed of Class 1 embankment fill and join to the viaduct via reinforced concrete bank seat abutments. At the exposed face of the abutments, reinforced earth retaining walls have been placed. The embankments rests upon six 0.45m diameter vibro concrete columns (founded in the River Terrace Deposits), which is capped by a 0.3m thick reinforced concrete slab. The slab rest upon a 0.30m thick granular piling platform, which itself rest upon a layer of Class 6F3 compacted fill (Ref. 10, 11 and 12)

4 Available Information

The following sources of information have been utilised during the preparation of this report:

1. Landmark Envirocheck Report (dated 08/12/2017) which comprises:
   a. Historic Mapping
   b. Geology
   c. Site Sensitivity
   d. Flood Screening Report
   e. Mining and Ground Stability
   f. Cranfield Soil Site Report
   g. Preliminary UXO Risk Assessment
2. BGS Geology of Britain Viewer (http://mapapps.bgs.ac.uk/geologyofbritain/home.html)
3. BGS Geoindex Viewer (http://mapapps2.bgs.ac.uk/geoindex/home.html). Boreholes that are within 50m of the site extents are outlined in Figure 6-1.

5 Site History

5.1 Historical Development

The historic development of the site is outlined in Table 5-1. This information has been gathered through the review of available historic mapping presented in the Envirocheck Report (Ref. 1).

Table 5-1 Overview of historical development

Map date	Scale	Map type	On site	Surrounding area
1869	1:1,056	London	Railway lines extend across the NW half of the site.	Docks are seen to the W and SE of the site. A church is noted to the N. Numerous residential properties are seen. Cement and iron works shown to the NW of the site, along with wharfs.
1869	1:2,500	London	No noticeable change.	No noticeable change.
1873	1:10,560	Middlesex	No coverage.	No noticeable change.
		Essex	No noticeable change.	No noticeable change.

1895	1:1,056	London	Railway lines have increased in number, now covering the entirety of the site.	Some residential properties have been removed and a cricket ground has been created to the ENE of the site. Further railway lines have been built. Royal Albert & Victoria Docks cut shown to the SE.
1896	1:2,500	London	No noticeable change.	No noticeable change.
1896	1:10,560	London	No noticeable change.	No noticeable change.
1898 to 1899	1:10,560	Essex	No noticeable change.	No noticeable change.
1899	1:10,560	Kent	No noticeable change.	No noticeable change.
1916 to 1919	1:2,500	Essex	No noticeable change.	No noticeable change.
1920	1:10,560	Essex	No noticeable change.	No noticeable change.
1938	1:10,560	Essex	No noticeable change	Cricket ground lost to A1011 and its connecting junction to Tidal Basin Road.
1940 to 1951	1:10,560	Ordnance Survey Plan	No noticeable change.	No noticeable change.
1947	1:2,500	Historic Aerial Photography	No noticeable change.	No noticeable change.
1948 to 1949	1:10,560	Historic Aerial Photography	No noticeable change.	Some buildings are erected in the area of the Tidal Basin Road junction.
1950 to 1955	1:10,560	Ordnance Survey Plan	No noticeable change.	No noticeable change.
1952	1:2,500	Ordnance Survey Plan	No noticeable change.	Noted that buildings erected in 1948 to 1949 1:10:560 mapping are possibly the garages, paint works and workshops shown on this map.
1952 to 1953	1:2,500	Ordnance Survey Plan	No noticeable change.	No noticeable change.
1953 to 1969	1:2,500	Ordnance Survey Plan	No noticeable change.	No noticeable change.
1962 to 1967	1:10,560	Ordnance Survey Plan	No noticeable change.	No noticeable change.
1969	1:2,500	Ordnance Survey Plan	Loss of numerous railway lines covering SE half of site.	Loss of railway lines. Garages now shown as transport depots. Dry docks to W of site have been lost and replaced by large building.
1973 to 1977	1:2,500	Ordnance Survey Plan	No noticeable change.	No noticeable change.
1974 to 1975	1:10,560	Ordnance Survey Plan	No noticeable change.	No noticeable change.
1981 to 1984	1:10,560	Ordnance Survey Plan	Loss of all railway lines.	No noticeable change.
1990 to 1996	1:10,560	Ordnance Survey Plan	No noticeable change.	No noticeable change.

1991	1:2,500	Ordnance Survey Plan	No noticeable change.	Some slight building development.
1991 to 1992	1:2,500	Ordnance Survey Plan	No noticeable change.	No noticeable change.
1995 to 1996	1:10,560	Ordnance Survey Plan	No noticeable change.	Track/road has appeared to the N of site which goes from Dock Road under the A1020.
1999	1:2,500	Historic Aerial Photography	No noticeable change.	No noticeable change.
1999	1:10,560	10k Raster Mapping	No noticeable change.	No noticeable change.
2006	1:10,560	10k Raster Mapping	DLR track shown along length of site on viaduct, with embankment to SE.	Watercourse trending NE/SW (known as Royal Albert & Victoria Docks cut) is cut by the embankment. An elongate pond is seen running along the NE edge of the site.
2017	1:10,560	VectorMap Local	A track/road running from the N of the site to the S has appeared, along with small buildings.	A triangular pond has appeared to the SE and there has been building development to the SW and S of the site.

5.1.1 Summary of Historical Development

The available historic mapping shows that land usage within the site extents has transitioned from partial railway cover in the NE in 1869; to being completely covered in railway lines in 1895; losing the SE section of railway lines in 1969; and then losing all railway lines in 1981. The current DLR viaduct and embankment are first noted on a map from 2006. Buildings and tracks were built around the site from 1995 to the present.

In the surrounding area the site has remained largely industrial throughout time. Residential properties to the E of the site that were noted in 1869, were gradually replaced by a cricket ground (built in 1895 and subsequently removed in 1938), industrial units (garages, paint works and workshops between 1948 to 1949) and the A1011 (built in 1938). Two dry docks were seen on the mapping from 1869 up until 1969, after which a large building is seen to be at this location. An elongated pond is noted just outside the eastern site boundary in 2006. This then disappears on 2017 mapping and a large triangular pond is seen to the SE of the site instead.

5.2 Unexploded Ordnance

A preliminary UXO risk assessment specifies that the probability of encountering unexploded ordnance within the site area is classified as medium. A medium rating infers that the site requires further action to establish and mitigate any UXO risk posed. It is stated that the site experienced a very high level of bombing during WW2 (>79 bombs per 100 hectares). Luftwaffe aerial reconnaissance identified port installations (70m SE and 480m NW) and a warehouse (370m E) as primary bombing targets. Secondary targets include docks and a goods and coal depot which are both on site.

The assessment states that ARP records did not identify any high explosive bomb strikes on site. However, strikes are noted 85m E, 85m N, 85m SSE, 100m N and 120m NW of the site. Official bomb damage mapping recorded “general blast damage” approximately 215m WNW. The assessment also states that ordnance manufacturing, WW2 decoy bombing sites or WW2 defensive features were not located within 1km of the site.

6 Previous Ground Investigations

6.1 Borehole Records

The BGS borehole catalogue (Ref 3) contains records for 11 boreholes within 50m of the site extents. Table 6-1 outlines the details of these boreholes. A plan of the borehole locations can be seen in Figure 6-1.

Table 6-1 BGS borehole records within 50m

BGS Reference	BGS Name	Distance from site extents (m)	Depth (m)	Date	Easting	Northing
TQ38SE1278	Jubilee Line Ext 906	0	29.52	17/10/90 to 25/10/90	539732	180613
TQ38SE4127	London, Thames Wharf 4	0	10.50	06/07/88	539740	180650
TQ38SE4128	London, Thames Wharf 5	0	12.00	05/07/88	539780	180570
TQ38SE4145	London, Thames Wharf Tp 19	3	2.60	11/07/88	539790	180570
TQ38SE1276	Jubilee Line Ext 904t	19	28.05	09/10/90 to 03/11/90	539714	180568
TQ38SE4129	London, Thames Wharf 6	34	11.00	30/06/88	539750	180510
TQ38SE1499	Main Drainage Phase 1 30	40	18.00	10/05/84 to 14/05/84	539801	180630
TQ38SE1316	Jubilee Line Ext 984	44	15.00	16/11/90 to 19/11/90	539687	180692
TQ38SE4144	London, Thames Wharf Tp 18	44	2.60	11/07/88	539780	180680
TQ38SE1284	Jubilee Line Ext 911	46	13.00	20/10/90 to 22/10/90	539742	180714
TQ38SE1500	Main Drainage Phase 1 31	50	17.00	15/05/90 to 16/05/90	539748	180717

A summary of the geology recorded in the boreholes can be seen in Table 6-2. Scans of the borehole logs are appended to this report in Appendix A.

Figure 6-1 Borehole location plan

Source: Reproduced with permission of the British Geological Survey ©NERC. All rights Reserved (Ref 2)

Table 6-2 Summary of recorded geology

Stratum	Typical description	Elevation to top of stratum (m OD)	Thickness (m)	Boreholes encountered
Made Ground	Black angular GRAVEL sized fragments of flint, brick and clinker with some grey clay.	1.46 to 4.72	0.69 to 3.2	All boreholes
Alluvium	Firm grey very silty CLAY with some to a little decomposing organic matter composed of rootlets and root trails (20 to 30mm length; 5mm width).	-0.3 to 4.03	0.9 to 5.9	All boreholes
	Grey very clayey SILT	-6.42	0.7	TQ38SE1276
Peat	Black spongy and fibrous clayey PEAT. Plant debris >20mm in length.	-3.02 to 0.58	0.2 to 1.1	TQ38SE1316, TQ38SE1499 & TQ38SE1500
River Terrace Deposits (referred to as Thames Gravel)	Medium dense grey to orangish brown clayey sandy coarse sub-angular to rounded flint and sandstone GRAVEL.	-3.76 to -0.52	2.5 to 4.4	All boreholes except TQ38SE4144 & TQ38SE4145
London Clay	Firm to stiff brownish grey extremely to very closely fissured CLAY. Fissures sub-vertical, planar, smooth occasionally locally slightly polished.	-8.16 to -3.42	1.9 to 15.44	All boreholes except TQ38SE4144 & TQ38SE4145
Harwich Formation (referred to as Blackheath Beds)	Very dense, dark green grey, very silty fine SAND, with occasional to much rounded, fine to medium black flint gravel. Silt is glauconitic.	-22.56 to -22.4	0.15 to 0.55	TQ38SE1276 & TQ38SE127
Lambeth Group (referred to as Woolwich and Reading Beds)	Very stiff (friable) grey thinly to thickly laminated fine slightly sandy to sandy, very silty CLAY and very clayey SILT, with some partings (<4mm) of grey silty fine sand.	-23.11 to -22.55	>5.23	TQ38SE1276 & TQ38SE127

6.2 Groundwater

Table 6-3 outlines the groundwater levels for all boreholes within 50m of the site extents.

Table 6-3 Recorded groundwater levels

BGS Reference	Elevation of Groundwater strike (m OD)	Stratum
TQ38SE1276	-4.42	River Terrace Deposits
TQ38SE1278	-6.26	River Terrace Deposits
TQ38SE1284	-1.91	River Terrace Deposits
TQ38SE1316	-3.12	Peat overlying River Terrace Deposits
TQ38SE1499	-5.04	River Terrace Deposits
TQ38SE1500	-0.58	River Terrace Deposits
TQ38SE4127	-1.3	Alluvium
TQ38SE4128	-2.6	River Terrace Deposits
TQ38SE4129	-2.8	River Terrace Deposits
TQ38SE4144	No recorded groundwater	
TQ38SE4145	No recorded groundwater	

7 Ground Conditions

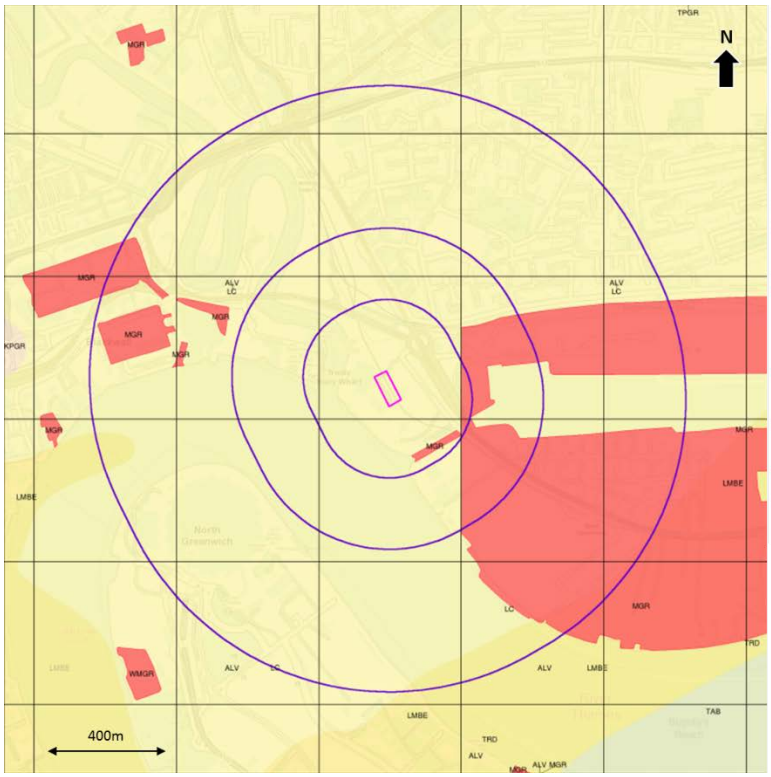
7.1 Topography

The ground level changes from approximately 1.7m OD in the NE to 2.9m OD (not including embankments) in the SE of the site.

7.2 Published Geology and Anticipated Ground Conditions

It can be seen on the extract BGS 1:10,000 extract from the Envirocheck Report (Figure 7-1) that the underlying sequence of strata consists of Thanet Formation, successively overlain by Lambeth Group, London Clay, River Terrace Deposits, Alluvium and Made Ground. The following is an overview of ground conditions at the site based upon this extract and borehole records. Please note that ground conditions may vary locally.

Figure 7-1 Extract of the Superficial and Bedrock Geology Map 1:10,000



Geology 1:10,000 Maps Legends

Artificial Ground and Landslip

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	MGR	Made Ground (Undivided)	Artificial Deposit	Holocene - Holocene
	WMGR	Infilled Ground	Artificial Deposit	Holocene - Holocene

Superficial Geology

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	ALV	Alluvium	Clay	Flandrian - Pleistocene
	ALV	Alluvium	Silt	Flandrian - Pleistocene
	TRD	Tidal River Or Creek Deposits	Silt	Flandrian - Pleistocene
	KPGR	Kempton Park Gravel Formation	Sand and Gravel	Devensian - Ipswichian
	TPGR	Taplow Gravel Formation	Sand and Gravel	Wolstonian - Chokierian

Bedrock and Faults

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	LC	London Clay Formation	Clay	Eocene - Eocene
	TAB	Thanet Formation	Sand	Thanetian - Thanetian
	LMBE	Lambeth Group	Clay	Paleocene - Paleocene
	LMBE	Lambeth Group	Sand and Clay	Paleocene - Paleocene

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7.2.1 Alluvium

Alluvium is a soft deposit primarily comprised of silts and clays with peat, sand and gravel appearing in discrete lenses and is approximately 0.7 to 5.9m thick. The alluvium represents low energy deposition of the River Thames and River Lea which surround the site.

7.2.2 River Terrace Deposits

Between the Anglian glaciation and the Devensian stage, the course of the River Thames was diverted into its current valley. Due to neotectonic uplift and lower sea levels, the valley cut downwards consequentially leading to a series of granular sheets being deposited at successively lower elevations, resulting in the formation of river terraces.

The River Terrace Deposits recorded on site are thought to belong to either the Kempton Park Gravel Member or Taplow Gravel Member (both identified near the site). They are described as medium dense, grey to orangish brown, fine to coarse flint gravel with fine sand. The thickness of the deposits varies between 2.5m to 4.4m.

7.2.3 London Clay

The London Clay represents a varied Eocene sequence of deep marine deposition within changing sedimentary environments. The London clay is broadly divided into five units (with the first further subdivided), which are: A1, A2, A3, B, C, D and E. These units represent a coarsening up sequence. On site London Clay is described as a firm to stiff grey to bluish grey fissured clay and it between 1.9 and 15.44m thick. It can also contain a form of gypsum (selenite). When weathered, London Clay is seen to oxidise to a brown colour. Carbonate concretions of varied sizes can also be found throughout the sequence (Ref. 4).

7.2.4 Lambeth Group

The Lambeth Group is a highly variable stratum, containing different proportions of sands, silts, clays and gravels split into three formations: the Upnor Formation, the Woolwich Formation and the Reading Formation. In London, the Lambeth Group is generally between 20m to 30m thick (Ref. 5). The dark grey to dark greenish grey Upnor formation (which rests unconformably on the Thanet Formation), consists of fine to medium grained sand, with varying proportions of glauconite, beds and stringers of well-rounded flint gravel and minor amounts of clay.

The Woolwich Formation consists of: the Lower Shelly Clay (fragmented shell debris in clay); the Laminated Beds (thinly interbedded fine to medium grained sand, silt and clay with scattered bivalve shells); and The Upper Shelly Clay (a grey shelly clay with thinly interbedded grey brown silt and very fine grained sand with distributed glauconite.

The Reading Formation is typically split into the Lower Mottled Clay and the Upper Mottled Clay. The Lower Mottled Clay is a turquoise to dark green and brown mottled structureless slightly clayey sand. The Upper Mottled Clay consists largely of mottled clay, silty clay and silt with similar colours to the Lower Mottled Beds.

On site it is described as a very stiff (friable) grey thinly to thickly laminated fine slightly sandy to sandy, very silty clay and very clayey silt, with some partings of grey silty fine sand.

7.2.5 Thanet Formation

Underlying the Lambeth Group, is the Thanet Formation which reaches a maximum thickness of approximately 30m (Ref. 5). The majority of the formation consists of a coarsening up sequence of fine grained sand with clayey/silty horizons in the lower components. Unweathered, the formation is pale to medium grey to brownish grey. At surface, this changes to a pale yellowish grey (Ref. 4).

7.2.6 Faults

Although the Envirocheck Report (Ref. 1) does not indicate that there are any faults within the vicinity of the site, this does not mean that faulting is not present. For example, evidence of faulting was noted at a Crossrail site approximately 500m NW and numerous fault zones, associated with the Greenwich syncline, are located within 1 to 2km of the site. The Greenwich Fault (trending NE/SW) is also approximately 2km SE of the site.

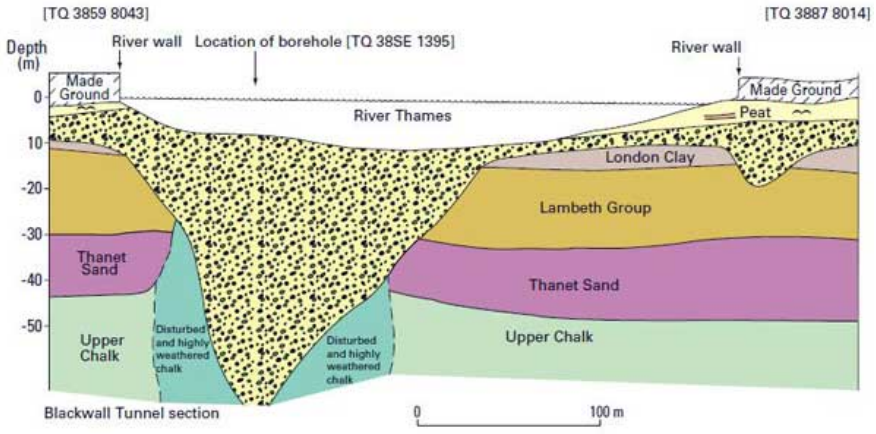
7.2.7 Mining

There are no man-made mining related cavities within 1km of the site. However, there is one BGS mineral site recorded (a dormant, crushed rock wharf 90m S).

7.2.8 Drift Filled Hollows

Drift filled hollows are associated with a distinct change in ground conditions where the original stratum such as London Clay, is eroded away and infilled with permeable and collapsible material such as River Terrace Deposits (Figure 7-2). One of the most famous examples can be found roughly 1km W of the site where the Blackwall Tunnels were constructed (Ref 5). Only one drift filled hollow is noted, 218m W of the site (539480, 180680)

Figure 7-2 Example of drift filled hollow at Blackwall



Source: After Ellison, R.A., et al. (2004) (Ref. 4)

7.2.9 Ground Stability Hazards

7.2.9.1 Compressible/Collapsible ground

The Envirocheck Report (Ref. 1) states that there is no collapsible ground hazard and that compressible ground hazard is very low, except for 109m SW (539635, 180503) where it is moderate risk.

7.2.9.2 Ground Dissolution/Landslide

The Envirocheck Report (Ref. 1) states that there is no ground dissolution hazard and that landslide hazard is very low to low.

7.2.9.3 Running Sand/Shrinking or Swelling Clay

The Envirocheck Report (Ref. 1) states that running sand hazard is very low and that shrinking or swelling clay hazard is low, except for 156m SW (539643, 180424) where it is moderate risk.

7.3 Hydrogeology and Hydrology

7.3.1 General

Groundwater is primarily encountered at the top of the River Terrace Deposits, however there are occasions where groundwater was struck within the base of the alluvium or within peat, overlying the river terrace deposits. It should be considered that the groundwater level is influenced by the proximity of the site to the River Thames and hence may fluctuate in response to the tides.

7.3.2 Flood Risk

The site resides within both the extreme flooding and flooding from rivers or sea without defences areas (Zone 2 and 3 respectively), but also sits within an area protected by flood defences. However, the EA/NRW Historic Flood Map with the Envirocheck Report (Ref. 1) shows that due to the River Thames channel capacity being exceeded, flood waters have overtopped these defences and flooded the site area.

7.3.3 Groundwater Vulnerability

The Groundwater Vulnerability map presented in the Envirocheck Report (Ref. 1) shows site to be situated upon a minor aquifer (variably permeable). The Bedrock Aquifer Designation map highlights that the bedrock

is unproductive strata, whereas the Superficial Aquifer Designation highlights that the superficial deposits are a secondary undifferentiated aquifer.

7.3.4 Source Protection Zones

There are no source protection zones within 1km of the site.

7.3.5 Surface Water Features

There is pond 3m E of the site (539774, 180603) which covers around 700m^2.

8 Environmental Considerations

8.1 Current Industrial Land Use

Within 250m of the site extents there are numerous contemporary industrial land usages noted in the Envirocheck Report (Ref. 1). These include: waste disposal businesses, commercial cleaning services, printers, car dealers, medical equipment manufacturers and gum & resin manufacturers.

8.2 Potential Contaminative Industrial Use (Past Land Use)

Table 8-1 outlines land usage up to 250m from the site which is a potential source of contamination.

Table 8-1 Potentially contaminative past land use

Land Use	Distance (m)	Direction	Date of mapping	Easting	Northing
Cement, lime and plaster products (manufacture)	194	NW	1882	539520	180730
Chemical manufacturing	233	SE	1882	539890	180358
Metal casting/foundries	144	NW	1882 to1898	539626	180773
Railways	73	NE	1882 to 1950	539825	180677
	181	N	1995	539805	539818
	189	N	1882 to 1995	539818	180841
	198	NE	1882 to 1898	593864	180821
Transport manufacturing and repair	0	NW	1882 to 1949	539689	180630
	0	SE	1882 to 1949	539742	180607
	144	NW	1920 to 1949	539626	180773
	171	W	1882 to 1995	539526	180668
	211	SE	1882 to 1995	539988	180499
	211	SE	1896 to 1995	539881	180377

8.3 Extractive Industries or Potential Excavations

Table 8-2 outlines extractive industries and potential excavations up to 100m from the site between 1950 and 1980.

Table 8-2 Extractive industries/Potential excavations

Land Use	Distance (m)	Direction	Date of mapping	Easting	Northing
Dry Dock	0	W	1952	539695	180626
	34	W	1952	539674	180615
Royal Albert and Victoria Docks Cut	6	E	1952	539802	180610
Unspecified Industrial Water Feature	37	NW	1952	539657	180653
	40	W	1952	539670	180611

8.4 Potential Infilled Land (Water)

Table 8-3 outlines land filled with water up to 250m from the site extents.

Table 8-3 Potential infilled land

Land Use	Distance (m)	Direction	Date of mapping	Easting	Northing
Unknown Filled Ground (Pond, marsh, river, stream, dock etc.)	186	SE	1950	539861	180395
	222	SE	1950	539994	180486

8.5 Tanks

Table 8-4 outlines tanks within 100m of the site extents.

Table 8-4 Recorded tanks

Land Use	Distance (m)	Direction	Date of mapping	Easting	Northing
Tank	27	NE	1952 to 1953	539784	180634
	27	NE	1952	539785	180632
	48	W	1969	539668	180597

8.6 Recorded Landfill Sites

Table 8-5 outlines recorded landfills within 250m of the site extents.

Table 8-5 Recorded landfills

Land Use	Distance (m)	Direction	Date of mapping	Easting	Northing
Historical Landfill (Deposited waste including inert waste)	136	S	1981 to 1982	539748	180408
Registered Landfill	201	SE	Not supplied	539871	180383

8.7 Sensitive Land Uses

Table 8-6 outlines sensitive land usage within a 1km radius of the site extents.

Table 8-6 Sensitive land usage

Land Use	Distance (m)	Direction	Easting	Northing
Thames Estuary	109	SW	539637	180502
Nitrate Vulnerable Zones	709	NW	539123	181066

8.8 Pollution Incidents to controlled waters

Table 8-7 details recorded pollution incidents recorded up to 250m from the site.

Table 8-7 Pollution incidents

Pollutant	Incident Severity	Distance (m)	Direction	Date	Easting	Northing
General	Category 3 – Minor incident	107	W	18/03/99	539600	180600
Miscellaneous – Urban runoff	Category 3 – Minor Incident	107	NW	29/05/92	539600	180700
Unknown Sewage	Category 2 – Significant Incident	109	NW	10/08/1989	539600	180700

8.9 Potential Contamination

Due to the past usage of the site, there is potential for there to be contamination present. Table 8-8 summarises the possible contamination associated with the sites usage according to the relevant Department of Environment Industry Profile. For a more in-depth overview, please consult these documents.

Table 8-8 Summary of potential contamination associated with past usage

Past usage	Reference	Type of contaminant	Potential Contaminants
Railway	Ref 6	Organic	Hydrocarbons (i.e. diesel, lubricating oils and paraffin), PCBs, PAHs, solvents, ethylene glycol, creosote and herbicides
		Metals	Ferrous residue and metal fines
		Other	Asbestos, ash & fill and sulphates
Dockland	Ref 7	Organic	Petrol, diesel, phenols, benzene, solvents, pesticides, PAHs and PCBs
		Metals	Metals and metalloids (including radioactive elements)
		Other	Asbestos, sulphides, sulphates and cyanides
Transport and haulage centres	Ref 8	Organic	Petrol, diesel, phenols, benzene, esters, TML, TEL, MTBE, solvents, pesticides, anti-freeze, brake fluid, PAHs and PCBs
		Metals	Copper, zinc, lead, chromium, vanadium and heavy metals
		Other	Asbestos, battery acid
Miscellaneous Industry	Ref 9	Organic	Hydrocarbon fuels, methanol, naphtha, phenols, benzene, esters, TML, TEL, MTBE, solvents, pesticides, anti-freeze, brake fluid, PAHs and PCBs
		Metals	Metals and metalloids
		Other	Asbestos and acids

9 Engineering Considerations

An overview of the potential geotechnical risks identified from the broad engineering geological assessment of the scheme is provided below. These risks should be addressed by project specific ground investigation and design.

9.1 Faults

Materials will have modified strength and stiffness characteristics where faulting occurs. This particularly apparent if the faults are infilled, or if localised fracturing has been induced. Faults can also act as conduits or barriers for groundwater flow, creating locally variable groundwater conditions. Hence due to sudden changes in ground conditions, the performance of materials may differ over short distances, potentially leading to settlement and stability issues.

9.2 Drift Filled Hollows

Drift filled hollows are associated with sharp changes in ground conditions due to the sudden and localised increase in thickness of permeable and collapsible material (such as river terrace deposits), where the original stratum has been eroded away. This also may lead to settlement and stability issues.

9.3 Organic Soils/Peat

Organic soils such as peat pose a challenge to geotechnical design, due to their low strength and high compressibility. Hence, large settlements may occur if a structure was to be founded on such a material.

9.4 Shrinking/Swelling Clay

There should be consideration of the potential of shrinking and swelling of high plasticity clays such as the London Clay. For example, where dense vegetation, such as in the SE of the site, is removed for works, heave may occur due to an influx in soil moisture. However, when considering borehole records, the London Clay is recorded at depth (-8.16 to -3.42m OD) and hence effects may be negligible.

9.5 Embankment Stability

Maintaining the stability of the embankment at the SE of the site is another important consideration. Construction works must ensure that destabilising factors such as: an increase in pore pressure; loading at the crest of the slope; removal of support at toe; desiccation of the ground profile through removal of vegetation; changes in the soil fabric/structure; and/or changes through chemical effects are not introduced.

9.6 Aggressive Soil and Groundwater Conditions

In areas of Made Ground, Alluvium and London Clay, it is possible to find aggressive soil and groundwater conditions, which can accelerate concrete and steel attack. The Cranfield Soil Site Report (part of Envirocheck Report (Ref. 1)) shows that the site has very highly aggressive soil.

9.7 London Underground Tunnels

Two London Underground (Jubilee Line) running tunnels pass directly under the site, with a tunnel crown height at -11.8m OD (Ref. 10). Consideration of these tunnels must be made when planning intrusive investigation and during the design phase.

9.8 Buried Services/Utilities

Due to the industrial nature of the site, it is likely that there are numerous utilities present. Therefore, it is crucial that a detailed services search is undertaken to avoid service strikes during GI and construction, which could have significant consequences on the work personnel.

The search must encompass the entire working area and may also involve the excavation of trial holes to prove the locations of services. The location and direction of buried services must be determined before any intrusive works can begin.

9.9 Contaminated Ground

The potential risks of contaminants from previous/current land use should be considered. The potential disposal requirements/mitigation of contaminants should also be considered before the initiation of works. Possible contaminants at the site may include:

- Contaminants from current land use
- Contaminants that have migrated from adjacent sites
- Contaminants from the current DLR operation i.e. herbicide and general railway waste

A summary of potential contaminants can be found in Figure 8-8.

9.10 UXO

The preliminary UXO risk assessment has identified that the site as medium risk. It is proposed that a detailed assessment is undertaken and any mitigation measures are followed throughout ground investigation and construction works.

9.11 Environmental

Both the embankment and wooded area (including pond) to the SE of the site may support plants and animals. Therefore, before works can begin, a detailed survey of the ecology should be carried out to ascertain whether any protected species reside at or near the site.

The presence of invasive plant species such as Japanese Knotweed should also be considered. An assessment of the area should be carried out to ascertain the presence of non-native species on the site and outline the necessary working requirements to avoid further contamination on site, along with suitable spoil requirements where appropriate.

10 Recommendations for further work

A summary of the work that should be carried out before construction works begin can be found below.

10.1 Ground Investigation

It is suggested that a preliminary site walkover, followed by a ground investigation are to be undertaken, both in accordance with BS EN 1997-2 and BS EN 1997-1. This will ensure that the ground conditions, such as strata levels, discontinuities and groundwater levels at the site can be fully realised. Therefore, this will aid in design of the new station. Further, the investigation can also establish the presence/lack of presence of contaminants, particularly in the Made Ground which is proposed to reside across the entire site.

10.2 Utilities Survey

Before any ground investigation or construction can commence, it is crucial that a detailed survey of utilities is carried out to avoid costly and potentially harmful service strikes.

10.3 Detailed UXO Risk Assessment

The current preliminary UXO assessment identified that the site has a medium risk rating. However, it is crucial that a detailed assessment is undertaken to characterise the UXO risk on site and in the surrounding area. This allows the risks to be managed through mitigation. Encountering UXO can pose serious risk to both the site personnel and the surrounding public.

10.4 Contamination Risk Assessment

A thorough risk assessment of the potential risk of contaminants in both groundwater and underlying strata should be undertaken.

10.5 Geotechnical Risk Register

It is recommended that both a geotechnical risk register (to record information from the geotechnical desk study) and the project wide risk register are created. For example, information regarding the risks of utilities, UXO and contamination, as discussed above, should be included. These registers should be live documents which must be regularly reviewed and updated as the project advances.

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A. Appendix

Appendix 7: Stage 1 Option Selection Workshop (21-12-17)

ELEMENTAL OPTION SELECTION WORKSHOP

Crossharbour & Thames Wharf DLR Stations

Workshop Held on 22-12-17 (updated 12-01-18 to reflect comments)

MOTT MACDONALD

WestonWilliamson+Partners

PRESENTATION STRUCTURE

CROSSHARBOUR

- site analysis
- key site constraints
- key assumptions & project risks
- passenger numbers & standards (subject to change)
- option evaluation criteria
- option summary slide
- low intervention options
- medium intervention options
- high intervention options
- low SPO, medium SPO, high SPO

THAMES WHARF

- site analysis – justification of location straight alignment and level track.
- key site constraints
- key assumptions & project risks
- passenger numbers & standards (subject to change)
- option evaluation criteria
- option summary slide
- options review
- structural principle
- selected SPO

CLARIFICATION OF STANDARDS

DLR STANDARD ES-502A

- DLR 502 - Clause 4.27.5 states - No stair shall exceeds 2.4m clear width between handrails without an intermediate handrail. - This clause allows us to divert to LUL standards for a two-way stair of a minimum of 2.4m clear width.
- DLR 502 - Clause 4.27.1 states stairways shall be designed to ...5395-1:2010 which states a maximum of 2m between handrails.
- DLR 502 - Clause 4.27.20 states -There shall be two central handrails for a two-way stair.
- BS5395 standard states the minimum clear width for regular two-way traffic is 1000 mm
- The minimum DfT standard states: 1.6m clear width.

LONDON UNDERGROUND – S1371 STATION PLANNING
(as per tender document)

- London Underground - S1371 Station Planning (2010)- clause 3.10.6.5 The minimum width for a two-way stairway shall be 2.4m between handrails. The minimum width for a one-way stairway shall be 2m between handrails. This supersedes BS 8300:2009+A1:2010 - National Standards.

Design team were requested to proceed to LUL standard S1371 (2.4m wide stairs)

THAMES WHARF DLR STATION

MOTT MACDONALD

WestonWilliamson+Partners

PROPOSED STATION LOCATION/ ALIGNMENT

- Approx. 100m straight section of viaduct
- Approx. 100m of level track
- Positioned to serve develop sites

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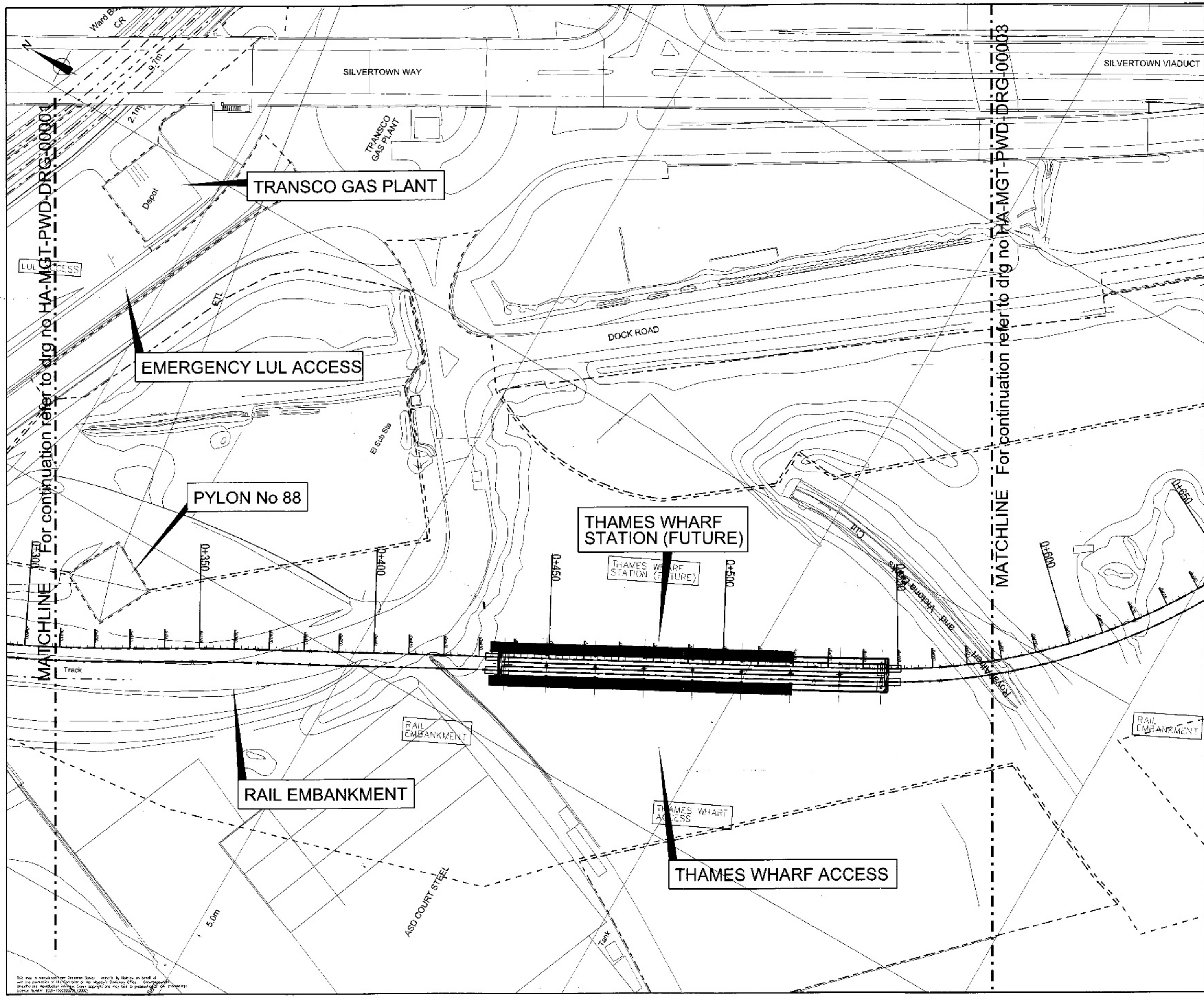
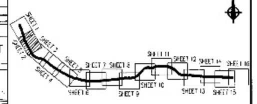


Key Plan:



Key Health and Safety Risks:

Notes:

- Rail Alignment
- Limits of Deviation and of Land to be Acquired or Used
- Limits of Additional Land to be Acquired or Used
- Limits of Land to be Used Temporarily

0 10 20 30 40 50 METRES

SCALE 1:500 (A1)
SCALE 1:1000 (A3)

Rev	By	Chkd	Apprvd	Date	Description
00	CH	MA	AJA	27/03/03	FIRST ISSUE

Client: Transport for London, DOCKLANDS

Concessionaire: Amec Royal Bank of Scotland Joint Venture — City Airport Rail Enterprises

Client: Amec Group Ltd — amec

Designer: Halcrow Group Limited — Halcrow

Project: DOCKLANDS LIGHT RAILWAY EXTENSION TO SILVERTOWN AND LONDON CITY AIRPORT

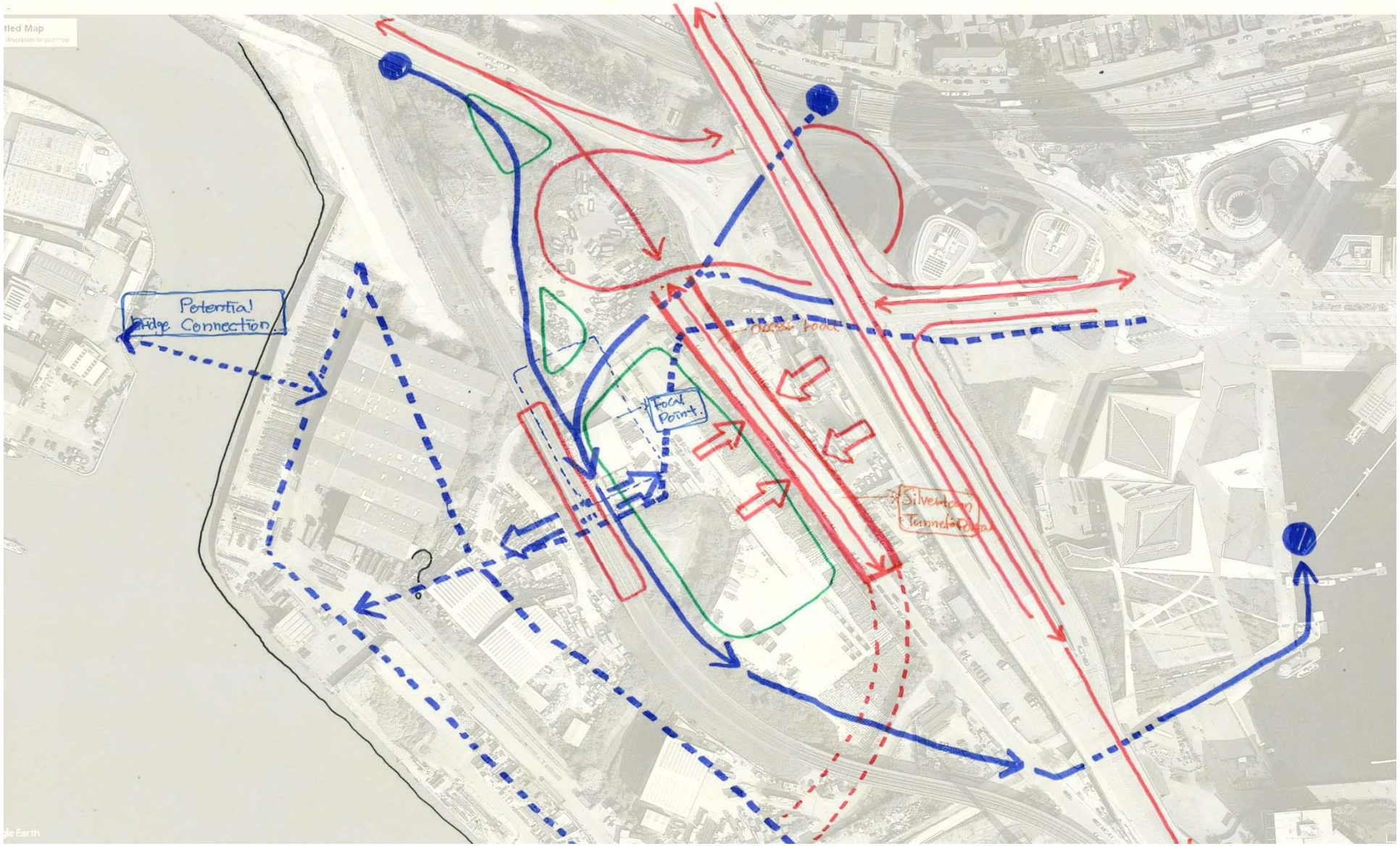
Drawing: ROUTE LAYOUT Sheet 2 of 16

Drawn by CH	Date 27-03-03
Checked by MA	Date 27-03-03
Approved by AJA	Date 27-03-03

Drawing No. HA-MGT-PWD-DRG-00002 — Revision 00

Drawing Scale: 1:500 at A1

SITE ANALYSIS



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KEY SITE PHOTOGRAPHS

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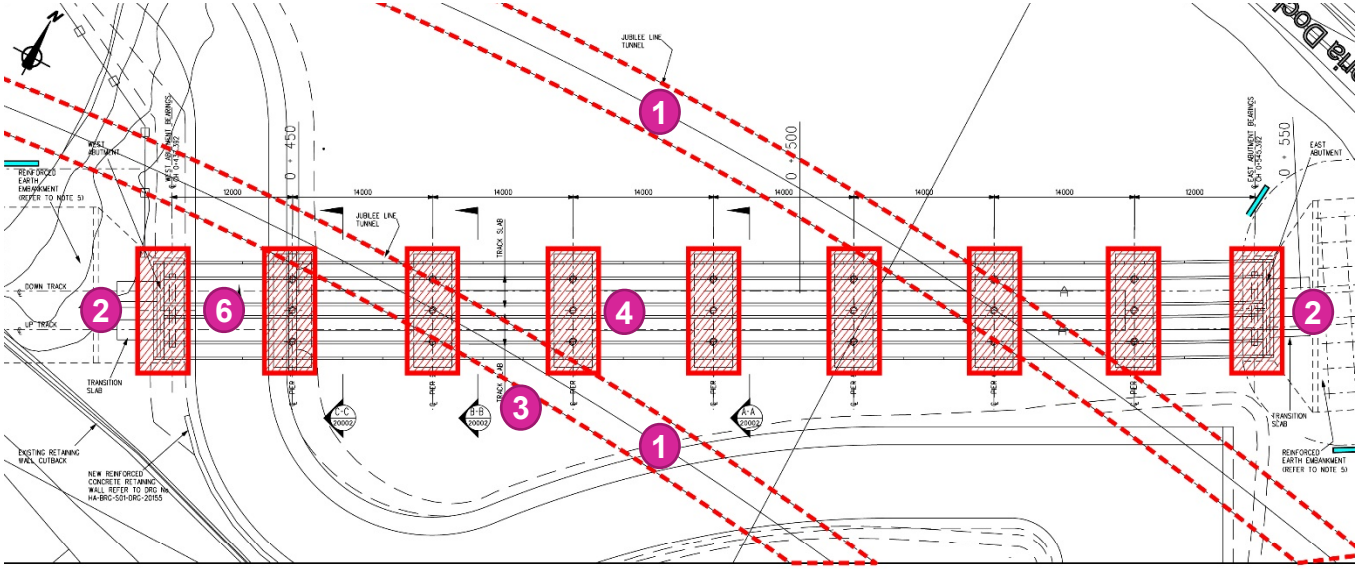
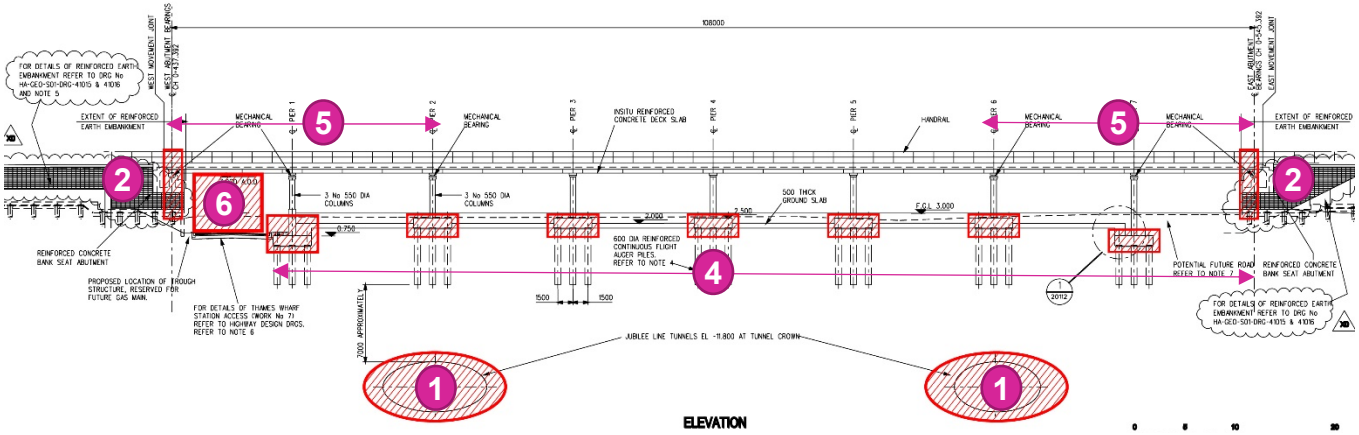
KEY CONSTRAINTS



PLAN



ELEVATION

1. Jubilee line tunnels
2. Embankment/ retaining wall
3. Existing high voltage room
4. Foundation locations and capacity
5. Replacement of bearing
6. Existing road- vehicular clearance

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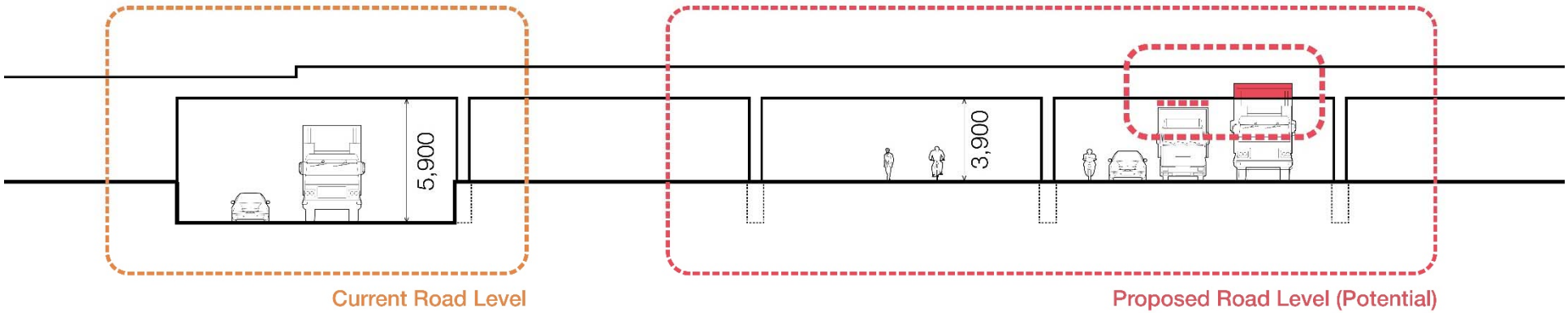
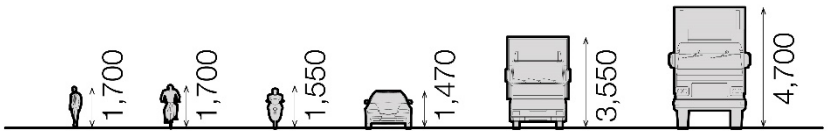
KEY CONSTRAINTS - ACCESS





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KEY ASSUMPTIONS & PROJECT RISKS

Assumption Number	Title	Date Issued	Assumption	Risk
TW 01	Substation relocation		Assume UKPN substation relocation is possible	Incorporation existing substation in the proposed layout has a major impact. Abortive works and redesign. Design Programme impact
TW 02	Unknown utilities	20/12/2017	Assume no major utilites such as TW sewer near or under the viaduct	Exclusion zone for TW sewer may be required. Utilities diversion not possible. Abortive work, redesign.
TW 03	Lack of archive information and AIP	20/12/2017	Platform supported vertically on existing structure - existing structure can take load (approx 40 kN/m run). Assume additional load from station platforms will not have adverse impact on the Jubilee line tunnel.	If provision has not been allowed for platform loads in existing structure design and/or existing structure does not have capacity for additional loads, structural proposals are invalid. Abortive work and redesign. Design programme impact
TW 04	Design Standards	20/12/2017	DLR Standard ES-502A and TfL/LU SPSG have different minimum stairs width requirement. It is assumed that design is to comply with LUS1371 which specifies a minimum clear stair width of 2400 mm as opposed to 2000 mm required on the DLR ES-502A. In addition it is assumed that no central handrail is required for the two-way stair as opposed to DLR 502 requirements (clause 4.27.20).	Proposed VC layout may not work if different standards are to be adopted. Wrong assumption may lead to abortive work and redesign. Design programme impact
TW 05	Passenger flow estimation-VC layout	20/12/2017	Station passenger flow forecast provided for the static assessment is based on forecast numbers provided	Impact on vertical circulation layout would need to be reassessed. Abortive work, redesign and programme impact

PASSENGER NUMBERS

London Underground - S1371 Station Planning (2010)

Staircase Width Requirements		
	Total Staircase Width Requirement (worst-case AM/PM)	
Scenario	Southbound	Northbound
Normal Operations	2.4 metres	2.4 metres
Train on Fire	3.0 metres	3.5 metres
Station on Fire	2.4 metres	2.4 metres
Provision of two stairs from platform		
Minimum width of each stair	**2.4 metres**	**2.4 metres**
Provision of three stairs from platform		
Minimum width of each stair	**Not Required**	**Not Required**

DLR STANDARD ES-502

Staircase Width Requirements		
	Total Staircase Width Requirement (worst-case AM/PM)	
Scenario	Southbound	Northbound
Normal Operations	2.0 metres	2.0 metres
Train on Fire	3.0 metres	3.5 metres
Station on Fire	2.0 metres	2.0 metres
Provision of two stairs from platform		
Minimum width of each stair	**2.0 metres**	**2.0 metres**
Provision of three stairs from platform		
Minimum width of each stair	**Not Required**	**Not Required**

CROSSHARBOUR EVALUATION CRITERIA

ASSESSMENT CRITERIA	NOTES	SCORE
• Constructability/ Phasing, Maintenance and Structure		
• Passenger experience – Aesthetics, intuitive wayfinding, Inclusive design, Weather protection		
• Passenger flow/ distribution/ congestion/ fire egress		
• Urban realm integration (developing masterplans)		
• Safeguarding of station – flexibility of station; future provision for commercial and escalators		
• Cost		

High- level scoring

3	Highest scoring option/ Selected option
2	Second best option
1	Lowest scoring option
★	Options are scored relative to each other

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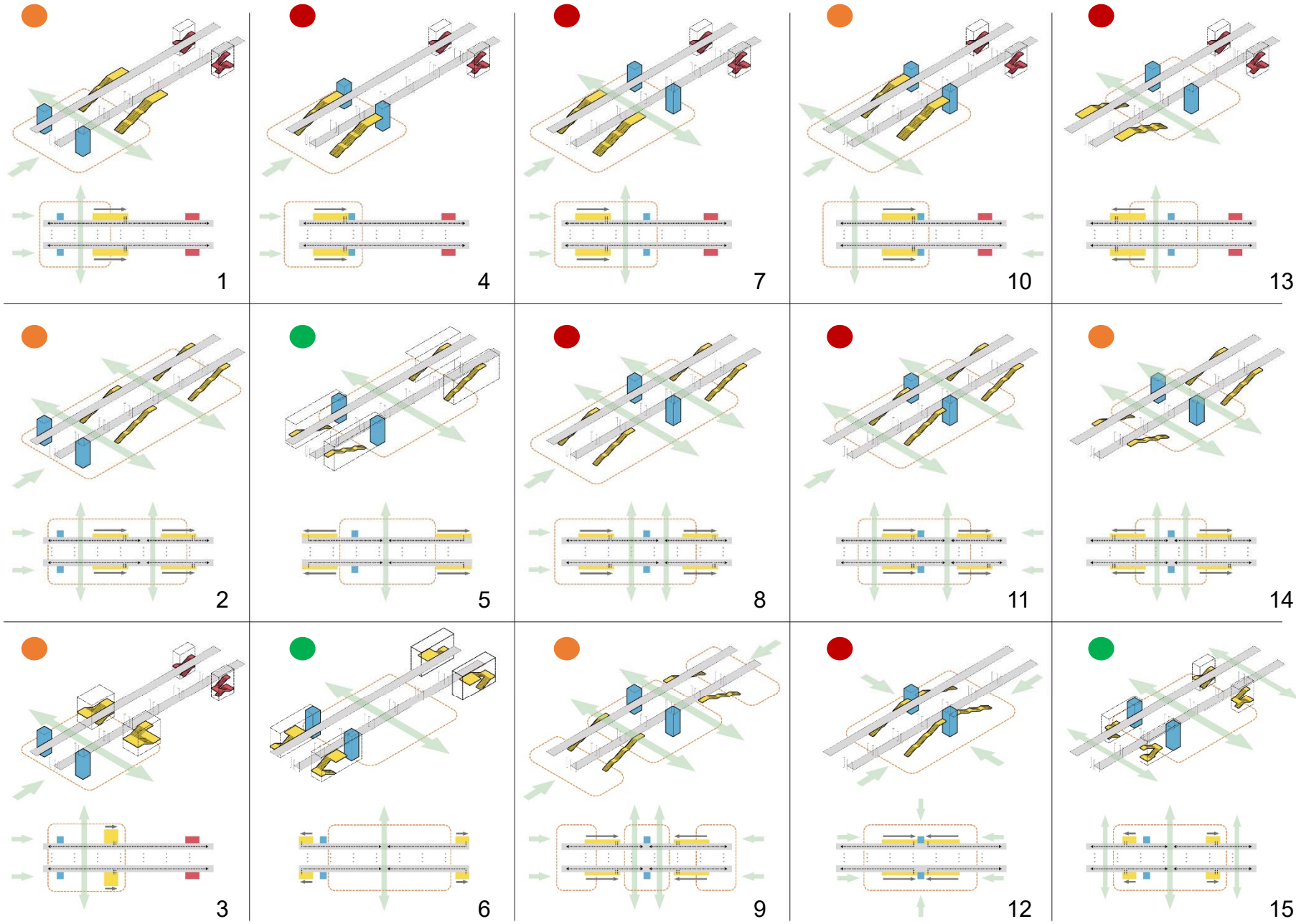
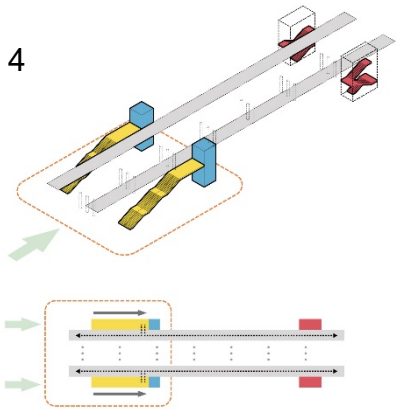
THAMES WHARF OPTIONS OVERVIEW



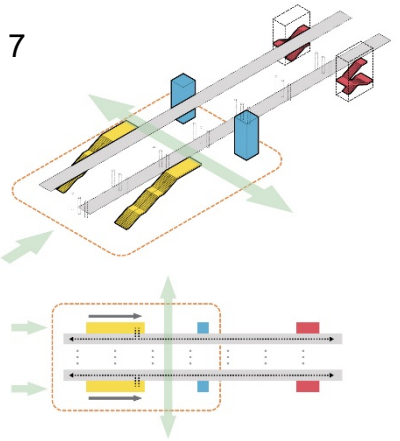
DISCOUNTED/ LOWEST SCORING OPTIONS

4



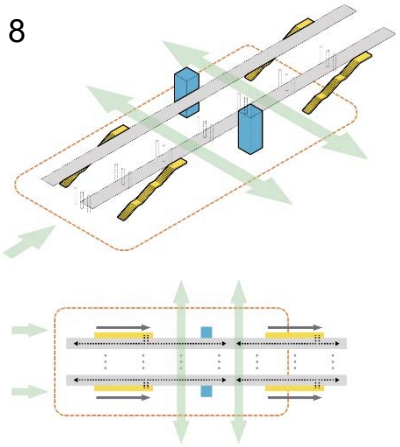
ASSESSMENT CRITERIA	NOTES	SCORE
Constructability/ Phasing, Maintenance and Structure	Limited opportunity to standardised elements and arrangement of station for prefabrication and ease of maintenance	
Passenger experience – Aesthetics, intuitive wayfinding, Inclusive design, Weather protection	Less intuitive layout, reduced sightlines to stairs	
Passenger flow/ distribution/ congestion/ fire egress	Top loaded distribution of passengers at platform level, Poor orientation of stairs	
Urban realm integration (developing masterplans)	No defined station square and urban realm	
Safeguarding of station – flexibility of station; future provision for commercial and escalators	Escalators can be accommodated adjacent to straight stairs Commercial units cannot be easily added without further compromising/ fragmenting concourse, concourse capacity and intuitive wayfinding. Fire escape stairs could be utilised to provide additional vertical circulation in future	
Cost		

7



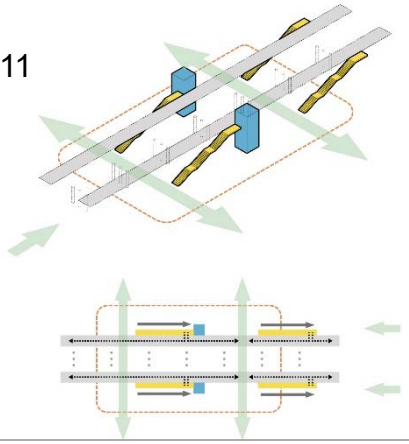
ASSESSMENT CRITERIA	NOTES	SCORE
Constructability/ Phasing, Maintenance and Structure	Limited opportunity to standardised elements and arrangement of station for prefabrication and ease of maintenance	
Passenger experience – Aesthetics, intuitive wayfinding, Inclusive design, Weather protection	Less intuitive layout, reduced sightlines to stairs	
Passenger flow/ distribution/ congestion/ fire egress	Top loaded distribution of passengers at platform level, Poor orientation of stairs	
Urban realm integration (developing masterplans)	Lack of defined station square, compromised orientation of vertical circulation	
Safeguarding of station – flexibility of station; future provision for commercial and escalators	Escalators can be accommodated adjacent to straight stairs Commercial units cannot be easily added without further compromising/ fragmenting concourse, concourse capacity and intuitive wayfinding. Fire escape stairs could be utilised to provide additional vertical circulation in future	
Cost		

8



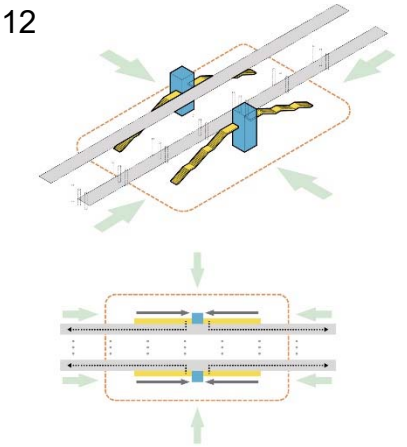
ASSESSMENT CRITERIA	NOTES	SCORE
Constructability/ Phasing, Maintenance and Structure	Separate lift cores, combined stair and lift core would offers benefits for construction. Stairs can be standardised	
Passenger experience – Aesthetics, intuitive wayfinding, Inclusive design, Weather protection	Less intuitive layout, , reduced sightlines to stairs	
Passenger flow/ distribution/ congestion/ fire egress	Poor orientation of stairs, good distribution of passengers at platform level.	
Urban realm integration (developing masterplans)	Arrangement of vertical circulation fragments urban realm/ station concourse	
Safeguarding of station – flexibility of station; future provision for commercial and escalators	Escalators can be accommodated adjacent to straight stairs Commercial units cannot be easily added without further compromising/ fragmenting concourse, concourse capacity and intuitive wayfinding.	
Cost		

11



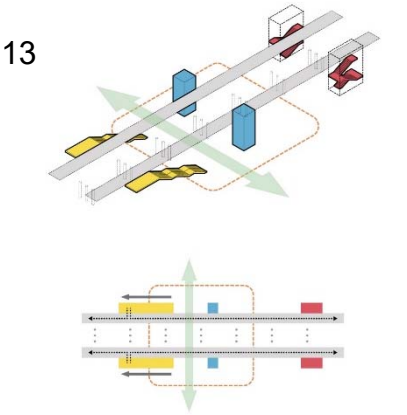
ASSESSMENT CRITERIA	NOTES	SCORE
Constructability/ Phasing, Maintenance and Structure	Stair and lift can be combined to one core	
Passenger experience – Aesthetics, intuitive wayfinding, Inclusive design, Weather protection	Less intuitive layout, reduced sightlines to stairs	
Passenger flow/ distribution/ congestion/ fire egress		
Urban realm integration (developing masterplans)	No defined station square, urban realm, less flexible, fragmented concourse arrangement as a result of vertical circulation	
Safeguarding of station – flexibility of station; future provision for commercial and escalators	Escalators can be accommodated adjacent to rear stair only Commercial units cannot be easily added without further compromising/ fragmenting concourse, concourse capacity and intuitive wayfinding. Dominating vertical circulation (i.e. underside of stairs reduces permeability and quality of public realm	
Cost		

12



ASSESSMENT CRITERIA	NOTES	SCORE
Constructability/ Phasing, Maintenance and Structure	Separate lift cores, combined stair and lift core would offers benefits for construction. Stairs can be standardised	
Passenger experience – Aesthetics, intuitive wayfinding, Inclusive design, Weather protection	Less intuitive layout, reduced sightlines to stairs	
Passenger flow/ distribution/ congestion/ fire egress	Poor distribution to platform level, potential to create crossflows	
Urban realm integration (developing masterplans)	No defined station square, urban realm, less flexible, fragmented concourse arrangement. Dominating vertical circulation (i.e. underside of stairs reduces permeability and quality of public realm.	
Safeguarding of station – flexibility of station; future provision for commercial and escalators	Escalators could not be aligned to stairs due to required run-offs. Commercial units cannot be easily added without further compromising/ fragmenting concourse, concourse capacity and intuitive wayfinding. Dominating vertical circulation (i.e. underside of stairs reduces permeability and quality of public realm	
Cost		

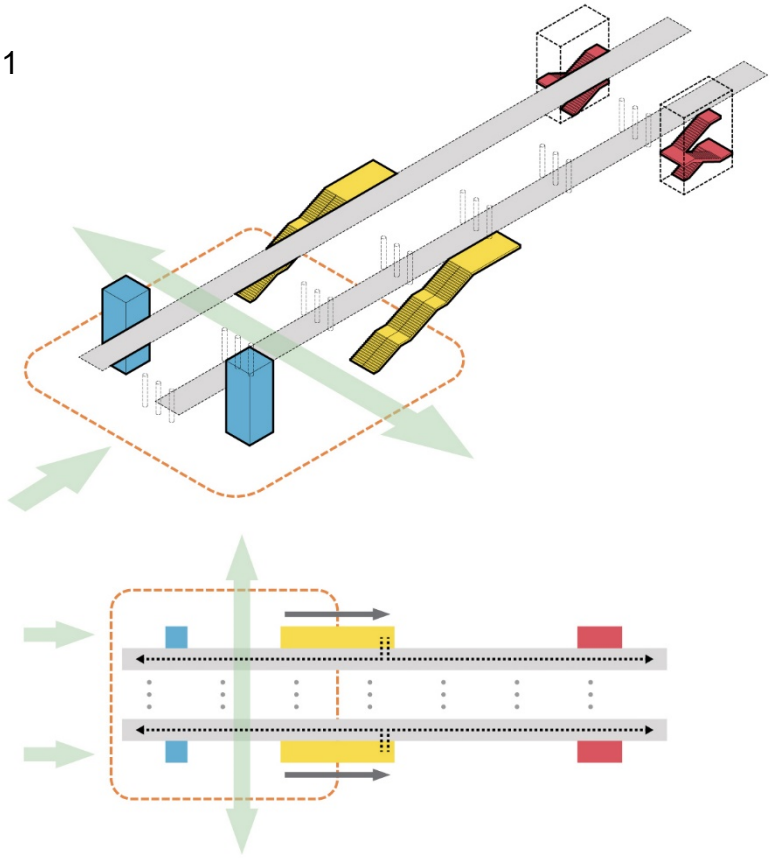
13



ASSESSMENT CRITERIA	NOTES	SCORE
Constructability/ Phasing, Maintenance and Structure	Limited standardisation of gird/ vertical circulation cores	
Passenger experience – Aesthetics, intuitive wayfinding, Inclusive design, Weather protection	Intuitive layout at concourse level, less intuitive at platform level due to single stair provision with end fire escape stairs	
Passenger flow/ distribution/ congestion/ fire egress	Poor passenger distribution to platform level –Top loaded unless fire escape stairs sized accordingly and opened up as second access	
Urban realm integration (developing masterplans)	Vertical circulation fragments ground plane. Less flexible urban realm/ permeability	
Safeguarding of station – flexibility of station; future provision for commercial and escalators		
Cost		

MEDIUM SCORING OPTIONS

1



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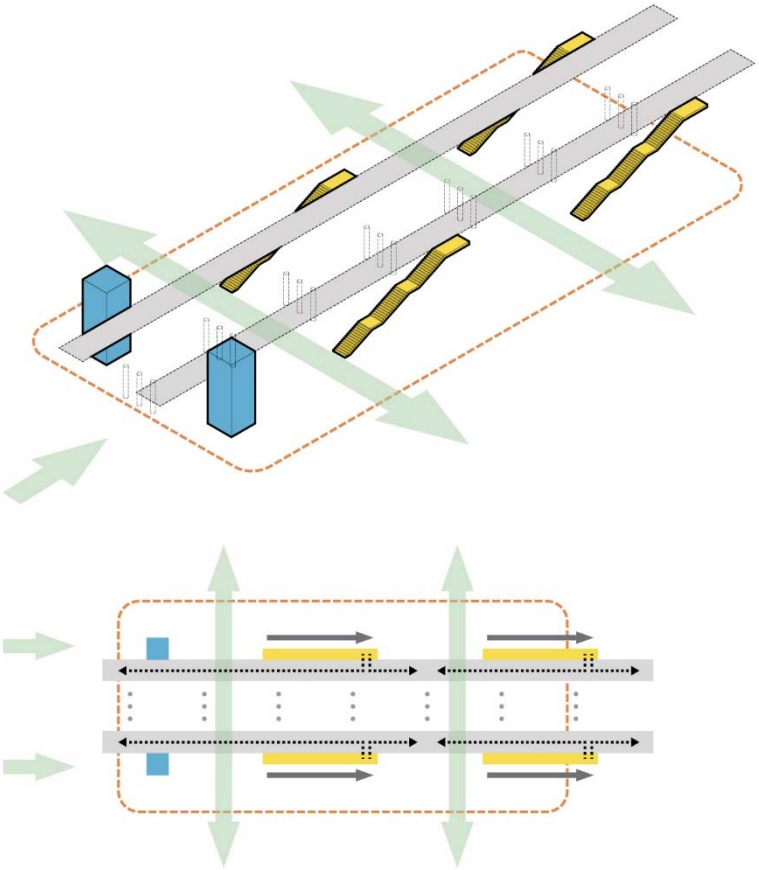
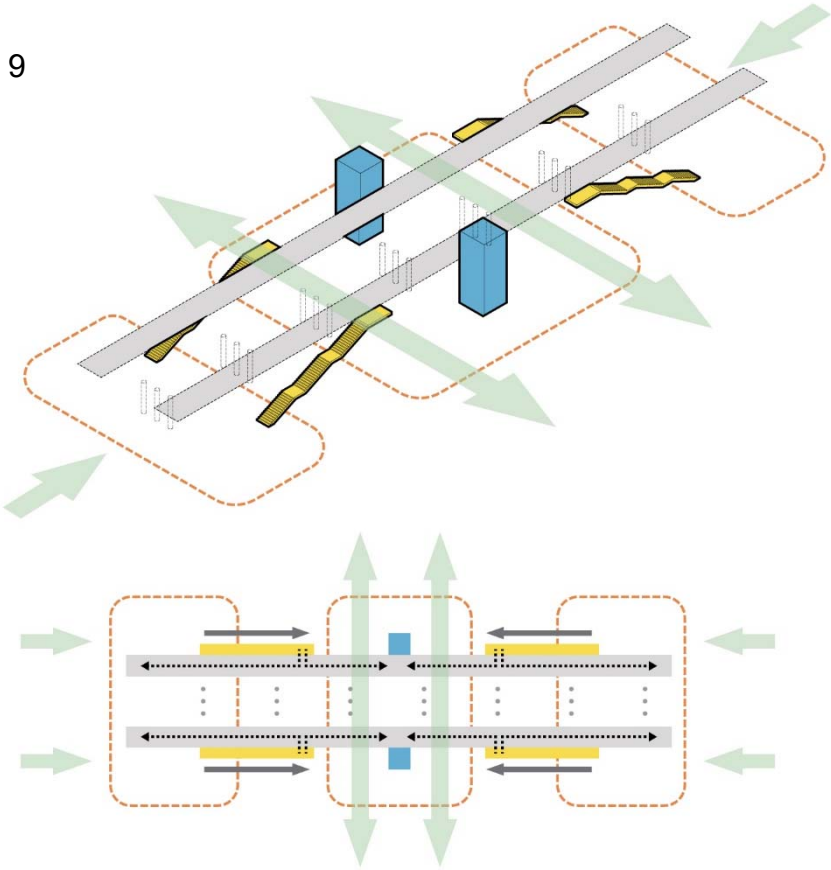


ASSESSMENT CRITERIA	NOTES	SCORE
Constructability/ Phasing, Maintenance and Structure	Limited standardisation of gird/ vertical circulation cores	
Passenger experience – Aesthetics, intuitive wayfinding, Inclusive design, Weather protection		
Passenger flow/ distribution/ congestion/ fire egress	Limited access to station square due to site typology (barriers) and capacity.	
Urban realm integration (developing masterplans)	Defined station square	
Safeguarding of station – flexibility of station; future provision for commercial and escalators	Potential to partially enclose under croft of station for commercial use. Escalators can be provided adjacent to stairs	
Cost		

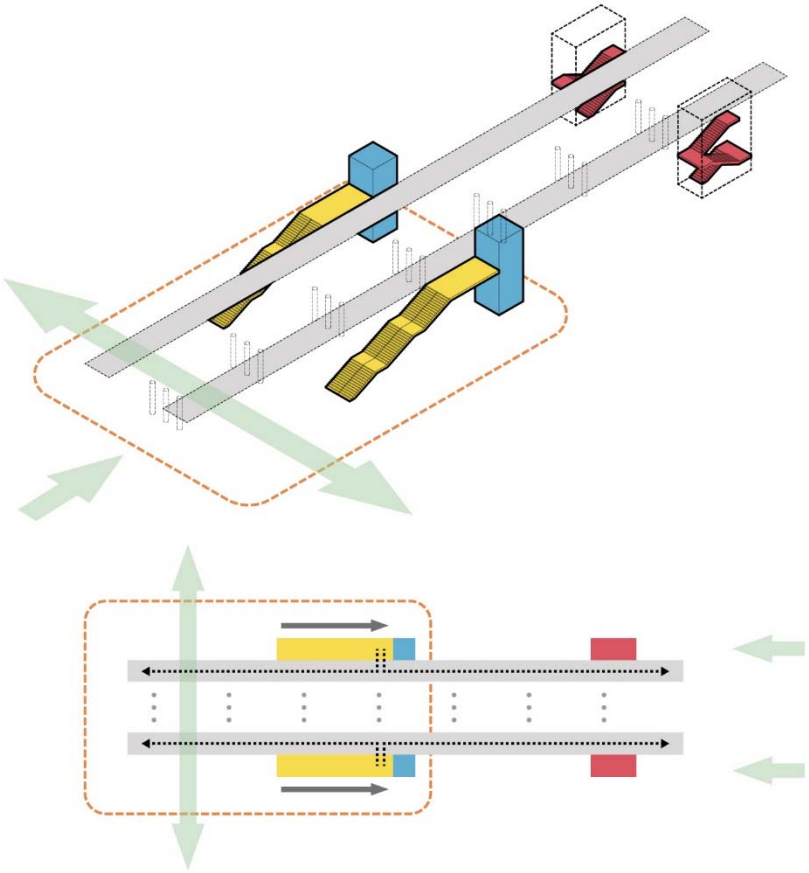
ASSESSMENT CRITERIA	NOTES	SCORE
Constructability/ Phasing, Maintenance and Structure		
Passenger experience – Aesthetics, intuitive wayfinding, Inclusive design, Weather protection		
Passenger flow/ distribution/ congestion/ fire egress		
Urban realm integration (developing masterplans)		
Safeguarding of station – flexibility of station; future provision for commercial and escalators	Escalators could be easily accommodated adjacent to linear stairs. Commercial opportunity cannot be easily accommodated without fragmenting concourse arrangement	
Cost		

9



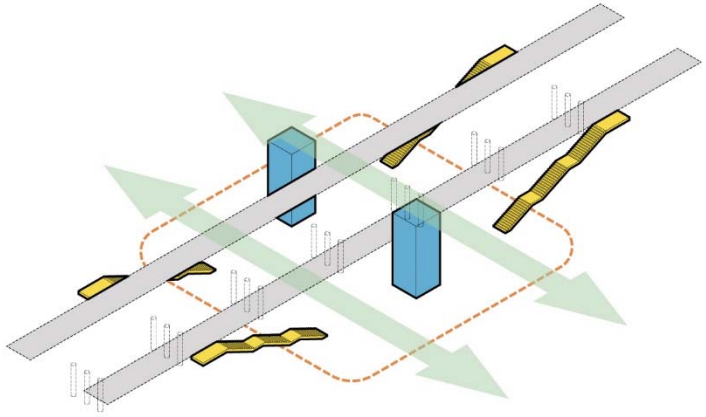
ASSESSMENT CRITERIA	NOTES	SCORE
Constructability/ Phasing, Maintenance and Structure		
Passenger experience – Aesthetics, intuitive wayfinding, Inclusive design, Weather protection	Fragmented concourse	
Passenger flow/ distribution/ congestion/ fire egress		
Urban realm integration (developing masterplans)	Fragmented concourse with dominating vertical circulation (i.e. underside of stairs reduces permeability and quality of public realm)	
Safeguarding of station – flexibility of station; future provision for commercial and escalators		
Cost		

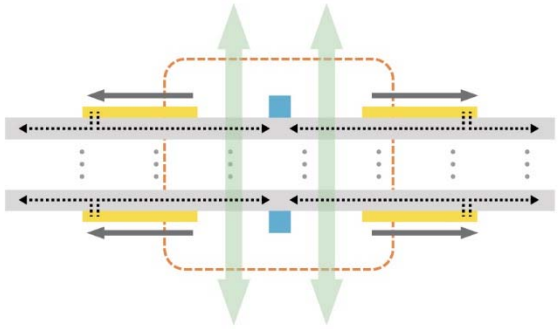
10



ASSESSMENT CRITERIA	NOTES	SCORE
Constructability/ Phasing, Maintenance and Structure	Limited standardisation of gird/ vertical circulation cores	
Passenger experience – Aesthetics, intuitive wayfinding, Inclusive design, Weather protection		
Passenger flow/ distribution/ congestion/ fire egress		
Urban realm integration (developing masterplans)		
Safeguarding of station – flexibility of station; future provision for commercial and escalators		
Cost		

14

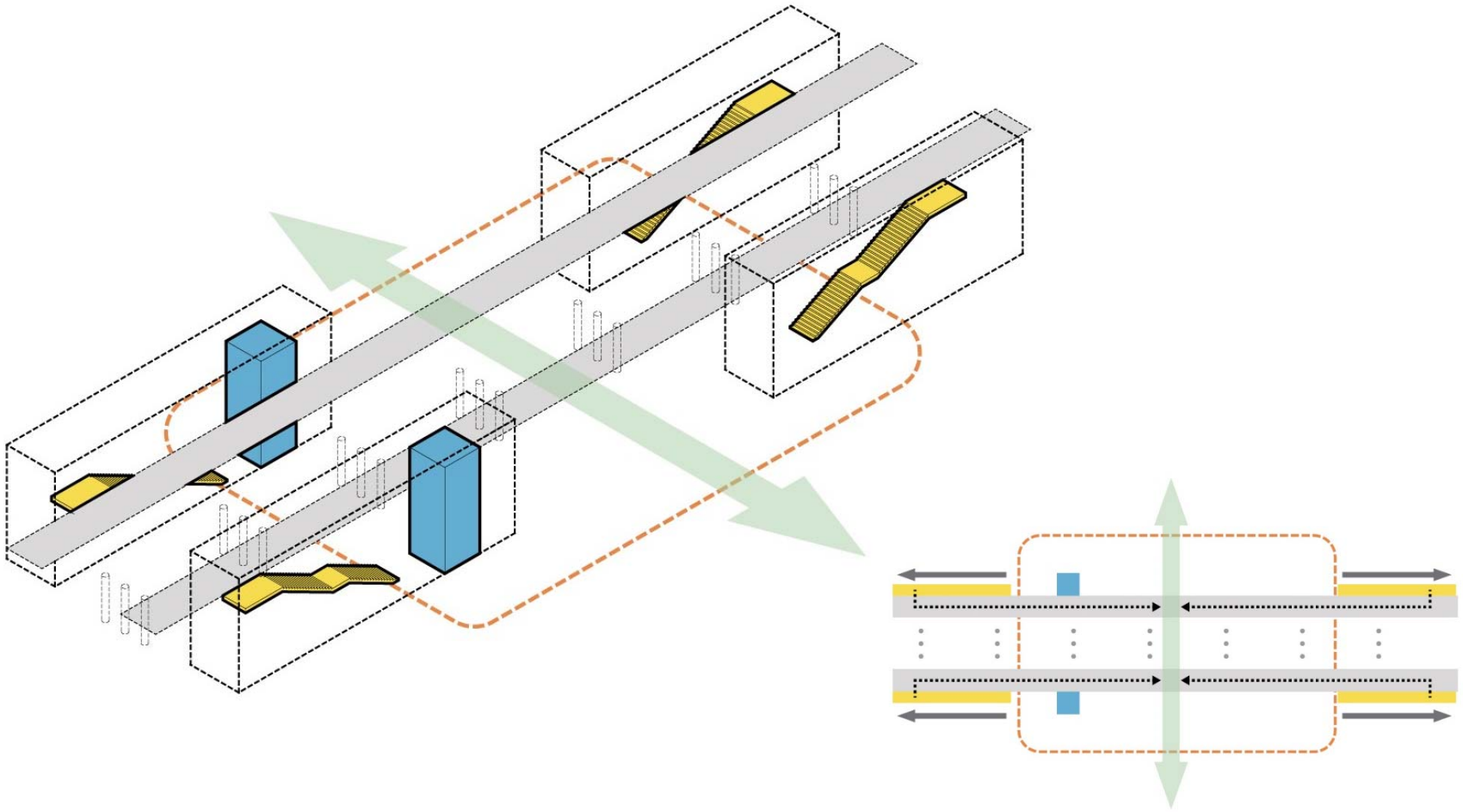




ASSESSMENT CRITERIA	NOTES	SCORE
Constructability/ Phasing, Maintenance and Structure		
Passenger experience – Aesthetics, intuitive wayfinding, Inclusive design, Weather protection	Clear wayfinding strategy, through lifts can be provided	
Passenger flow/ distribution/ congestion/ fire egress	Good distribution of passengers at platform level	
Urban realm integration (developing masterplans)		
Safeguarding of station – flexibility of station; future provision for commercial and escalators	Vertical circulation fragments ground plane. Less flexible urban realm/ permeability	
Cost		

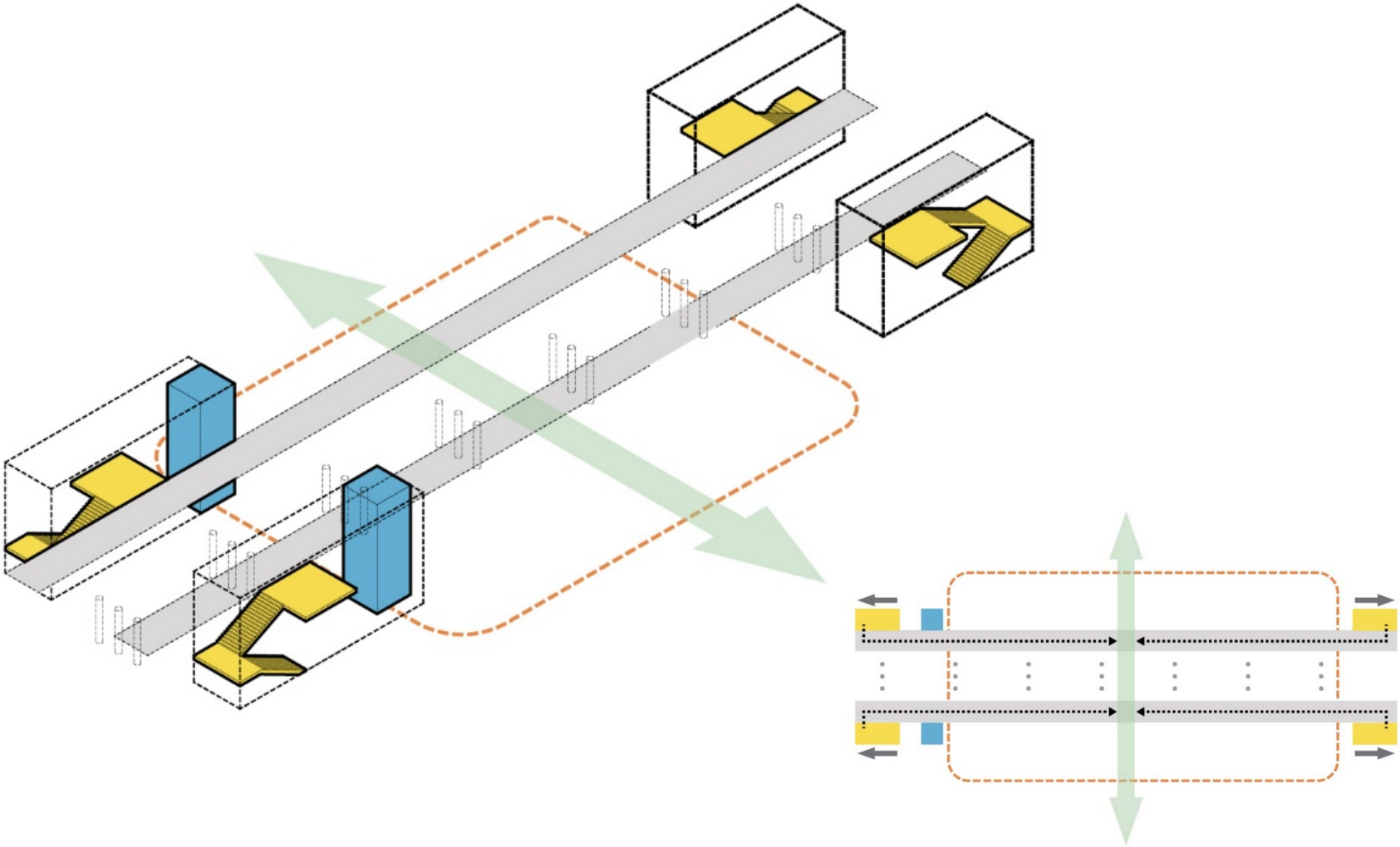
HIGHEST SCORING OPTIONS

5

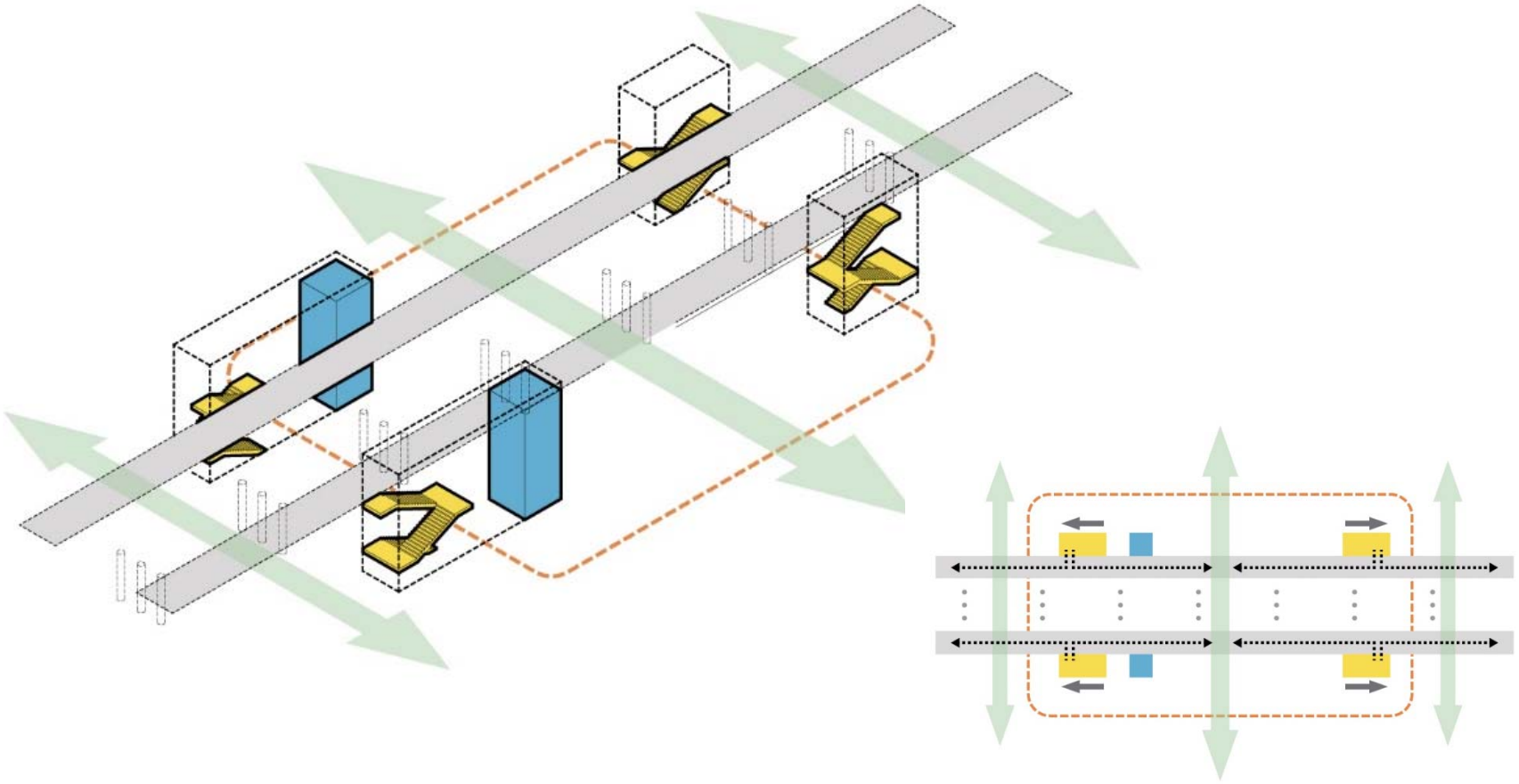


ASSESSMENT CRITERIA	NOTES	SCORE
Constructability/ Phasing, Maintenance and Structure		
Passenger experience – Aesthetics, intuitive wayfinding, Inclusive design, Weather protection	Through-lifts can be provided, intuitive layout, covered lifts	
Passenger flow/ distribution/ congestion/ fire egress		
Urban realm integration (developing masterplans)	Permeable, flexible concourse, station square, significant commercial opportunity	
Safeguarding of station – flexibility of station; future provision for commercial and escalators	Significant commercial opportunity can be added as area develops. Commercial units can be added without compromising passenger circulation, concourse capacity and intuitive wayfinding. Escalators and through lifts can be easily accommodated	
Cost	Long term cost savings through in-built flexibility, passive provision, long but thin vertical ciculation core	

6



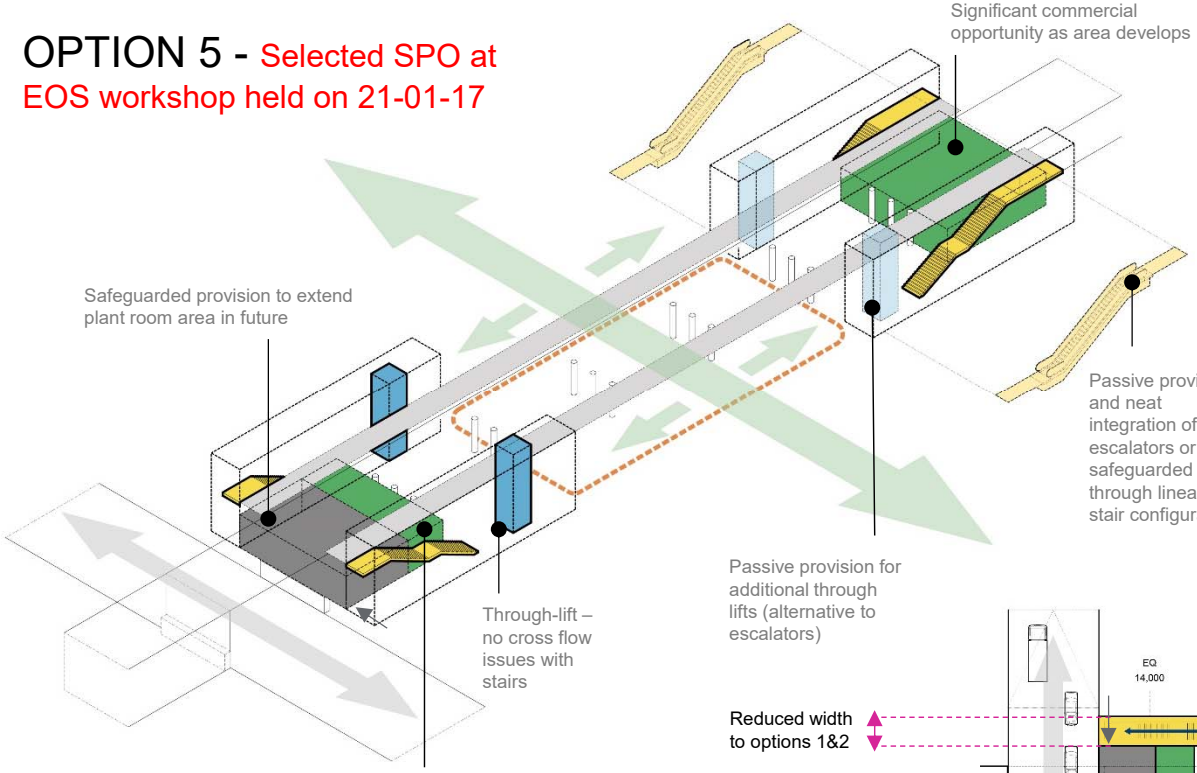
ASSESSMENT CRITERIA	NOTES	SCORE
Constructability/ Phasing, Maintenance and Structure		
Passenger experience – Aesthetics, intuitive wayfinding, Inclusive design, Weather protection		
Passenger flow/ distribution/ congestion/ fire egress	Through-lifts cannot be provided without increasing core size or creating cross flows. Non-compliant with LU standards.	
Urban realm integration (developing masterplans)	Permeable, flexible concourse, station square, commercial opportunity	
Safeguarding of station – flexibility of station; future provision for commercial and escalators	Layout does not easily facilitate neat integration of escalators to existing vertical circulation. Layout does facilitate commercial opportunity.	
Cost	Simple core arrangement, futureproofing of escalators is limited	



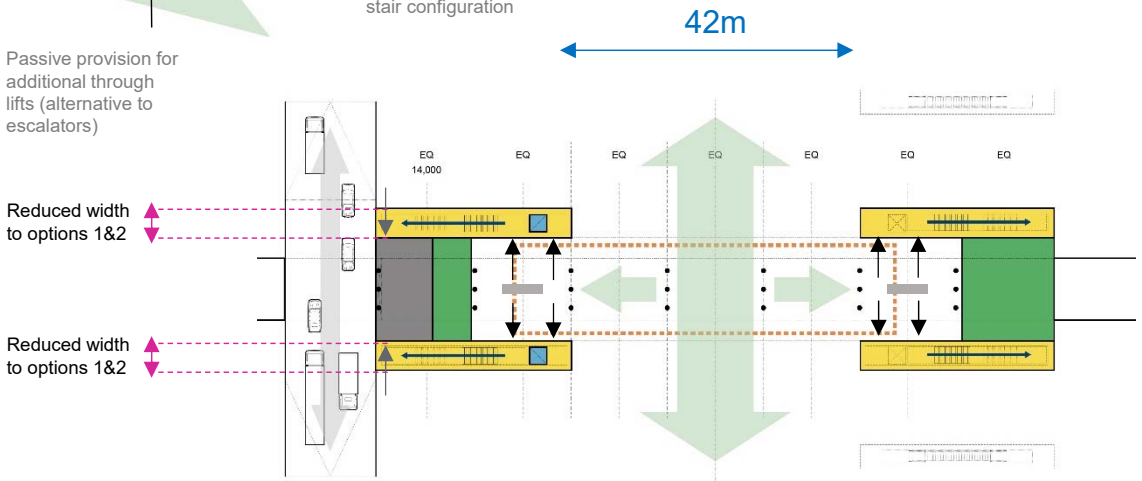
ASSESSMENT CRITERIA	NOTES	SCORE
Constructability/ Phasing, Maintenance and Structure	Simple core arrangement	
Passenger experience – Aesthetics, intuitive wayfinding, Inclusive design, Weather protection	Through-lifts cannot be provided without increasing core size. Non-compliant with LU standards.	
Passenger flow/ distribution/ congestion/ fire egress		
Urban realm integration (developing masterplans)	Permeable, flexible concourse, station square, commercial opportunity	
Safeguarding of station – flexibility of station; future provision for commercial and escalators	Layout does not easily facilitate neat integration of escalators to existing vertical circulation. Layout does facilitate commercial opportunity.	
Cost	Simple core arrangement, futureproofing of escalators is limited	

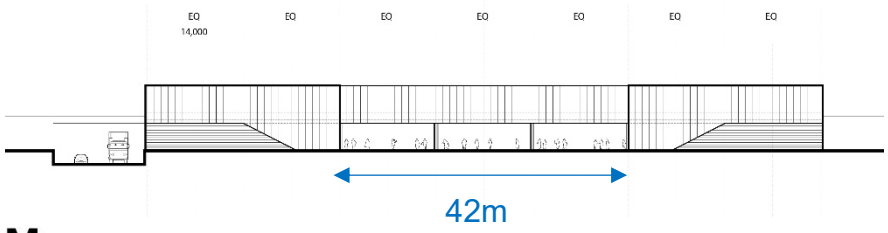
PREFERRED OPTIONS

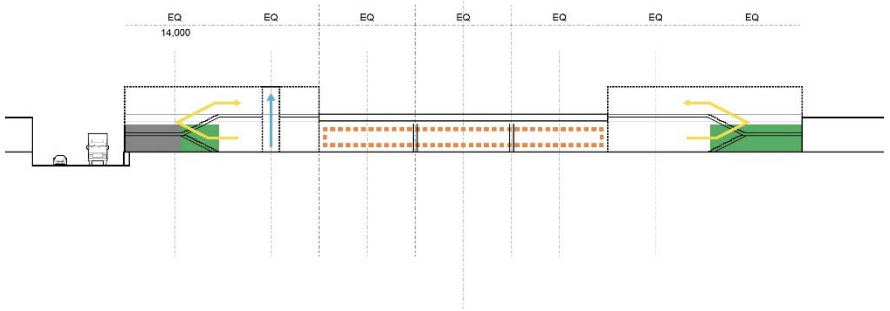
OPTION 5 - Selected SPO at EOS workshop held on 21-01-17



ASSESSMENT CRITERIA	SCORE
Constructability/ Phasing, Maintenance and Structure	
Passenger experience – Aesthetics, intuitive wayfinding, Inclusive design, Weather protection	
Passenger flow/ distribution/ congestion/ fire egress	
Urban realm integration (developing masterplans)	
Safeguarding of station – flexibility of station; future provision for commercial and additional mechanical vertical circulation	
Cost	







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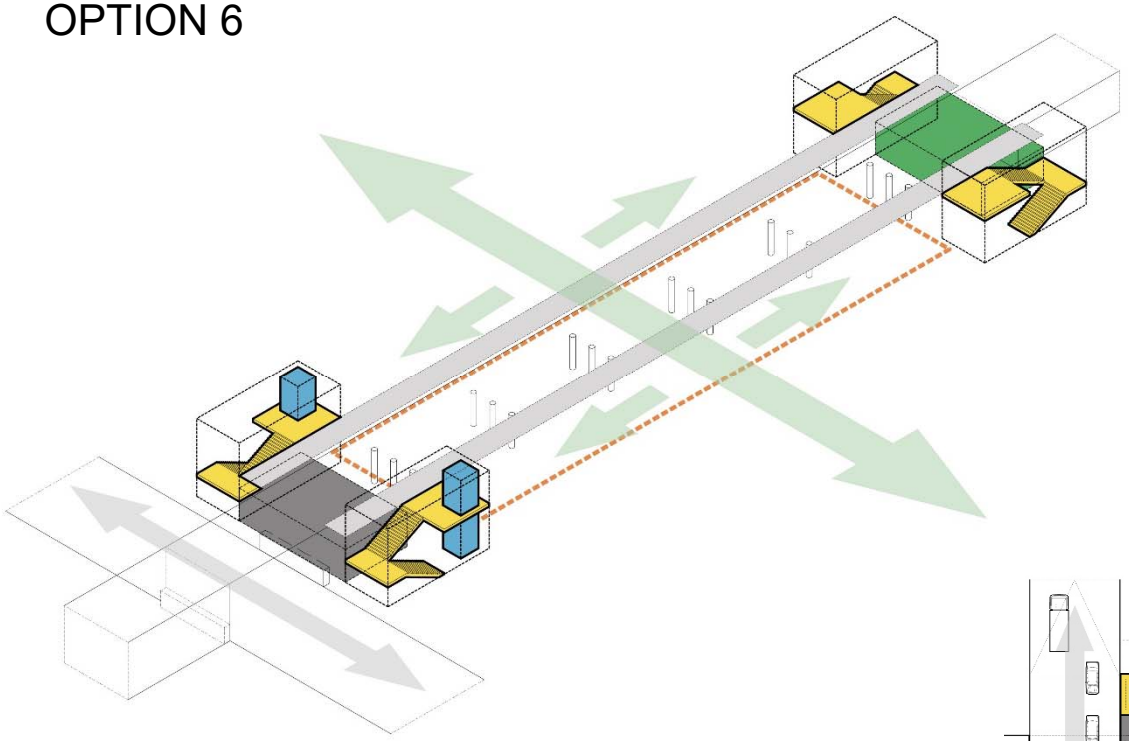
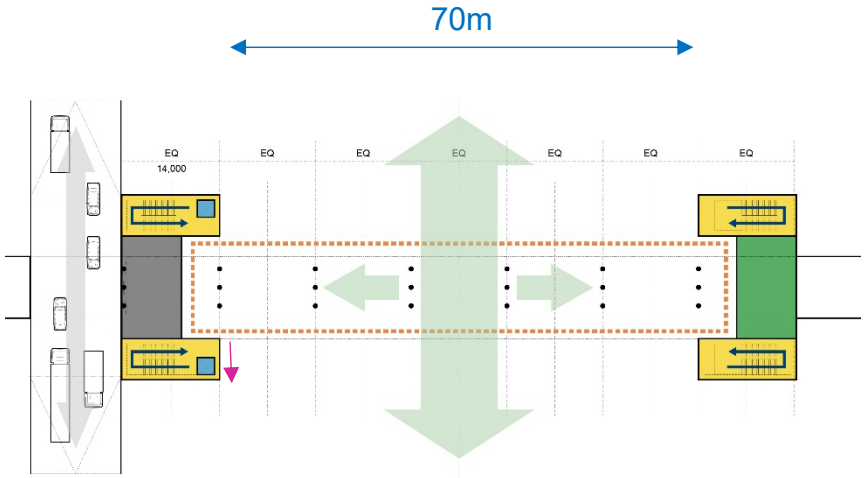
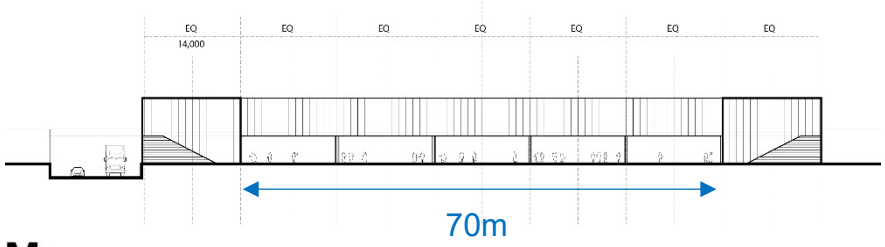
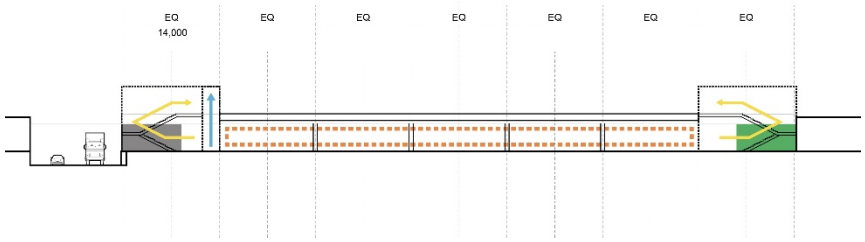
OPTION 6



ASSESSMENT CRITERIA	SCORE
Constructability/ Phasing, Maintenance and Structure	
Passenger experience – Aesthetics, intuitive wayfinding, Inclusive design, Weather protection	
Passenger flow/ distribution/ congestion/ fire egress	
Urban realm integration (developing masterplans)	
Safeguarding of station – flexibility of station; future provision for commercial and additional mechanical vertical circulation	
Cost	







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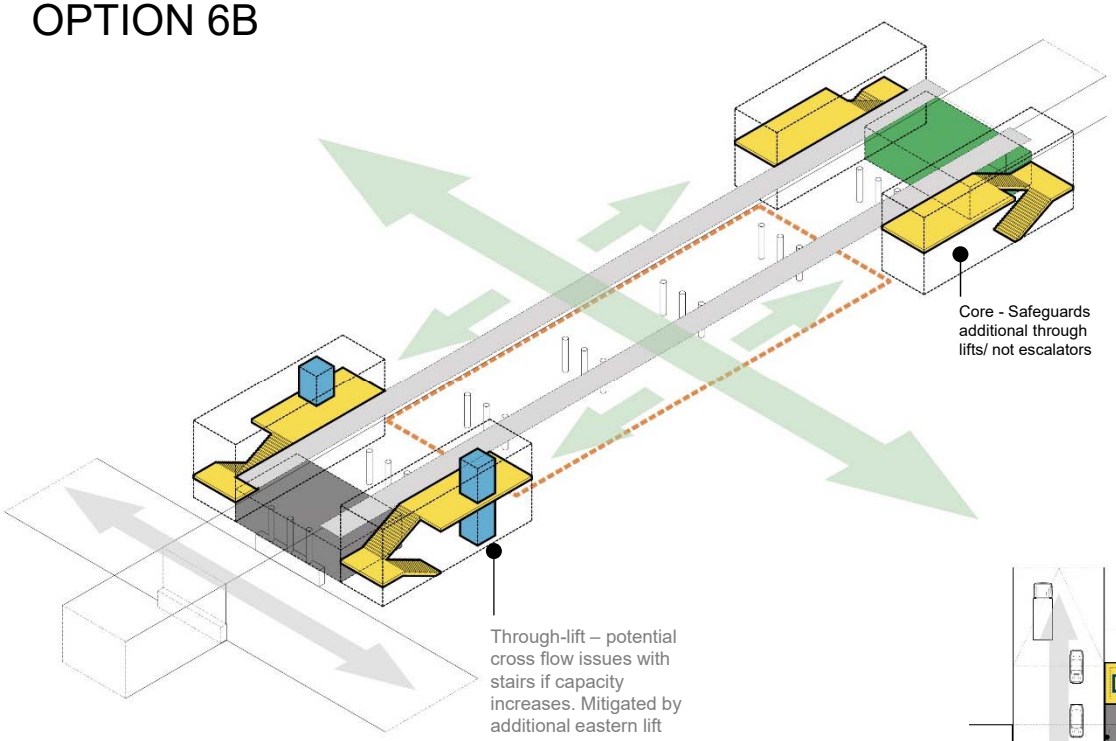
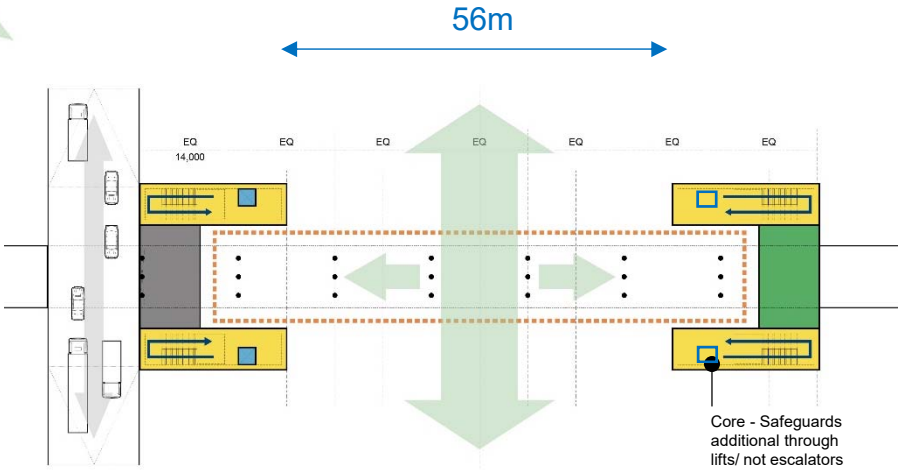
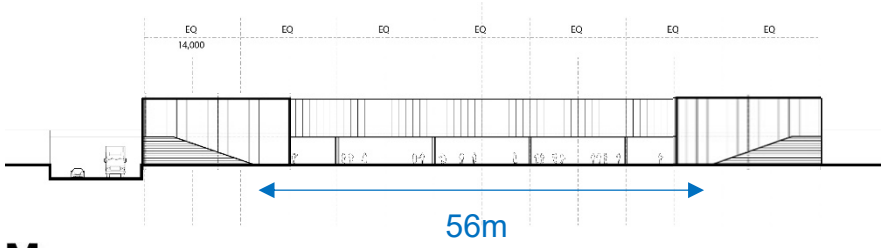
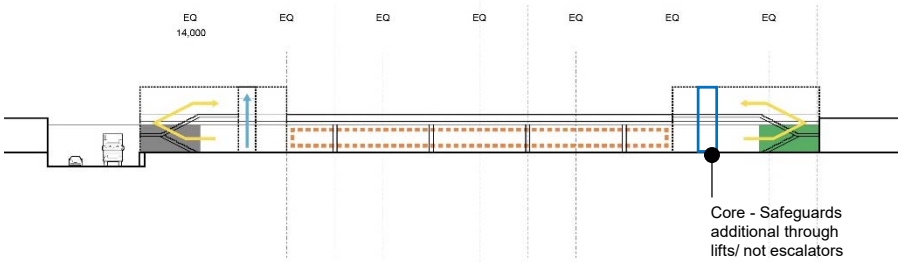
OPTION 6B

ASSESSMENT CRITERIA	SCORE
Constructability/ Phasing, Maintenance and Structure	
Passenger experience – Aesthetics, intuitive wayfinding, Inclusive design, Weather protection	
Passenger flow/ distribution/ congestion/ fire egress	
Urban realm integration (developing masterplans)	
Safeguarding of station – flexibility of station; future provision for commercial and additional mechanical vertical circulation	
Cost	









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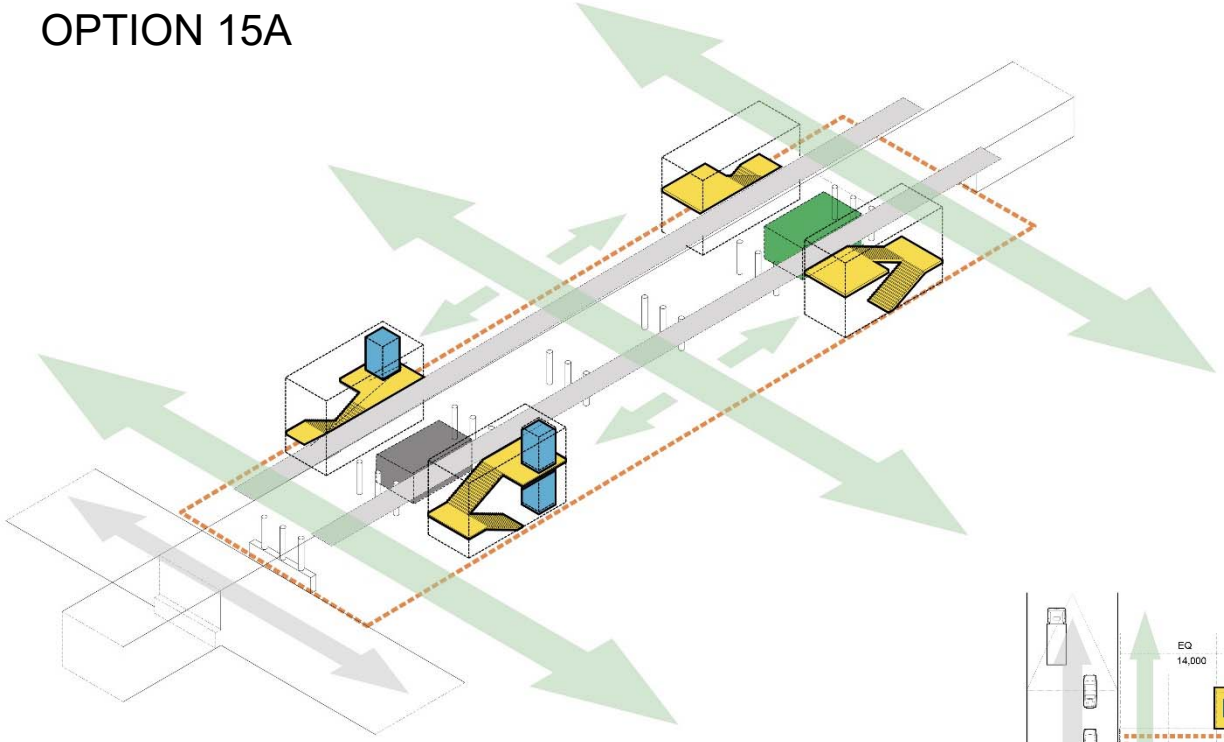
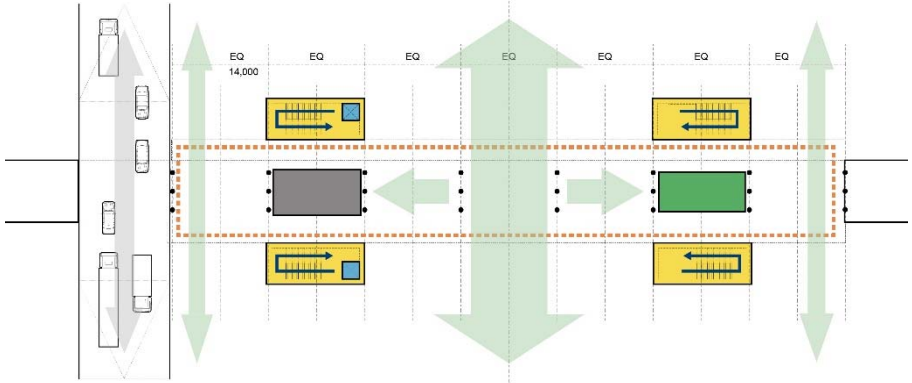
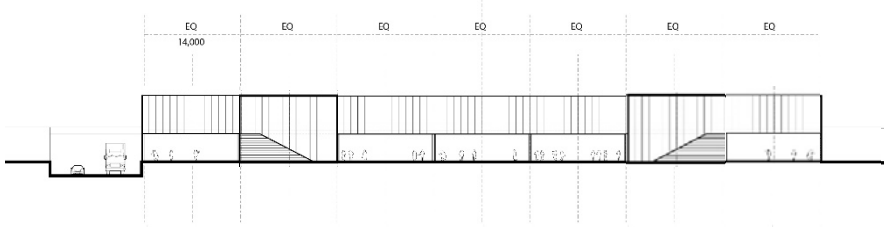
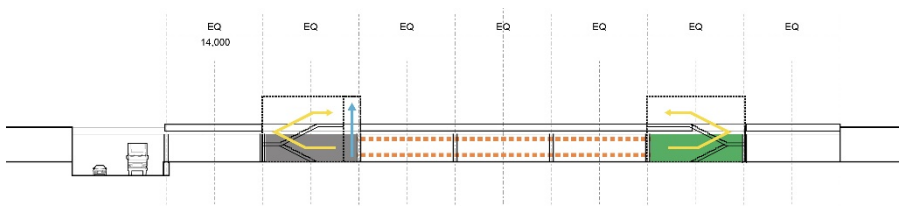
OPTION 15A



ASSESSMENT CRITERIA	SCORE
Constructability/ Phasing, Maintenance and Structure	
Passenger experience – Aesthetics, intuitive wayfinding, Inclusive design, Weather protection	
Passenger flow/ distribution/ congestion/ fire egress	
Urban realm integration (developing masterplans)	
Safeguarding of station – flexibility of station; future provision for commercial and additional mechanical vertical circulation	
Cost	







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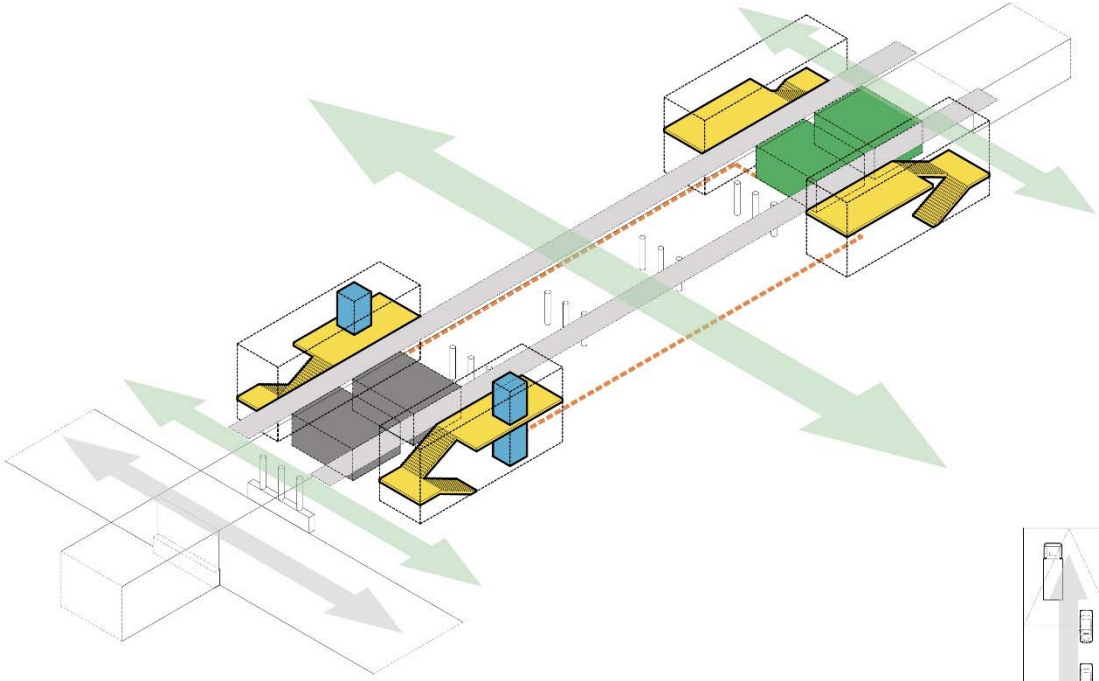
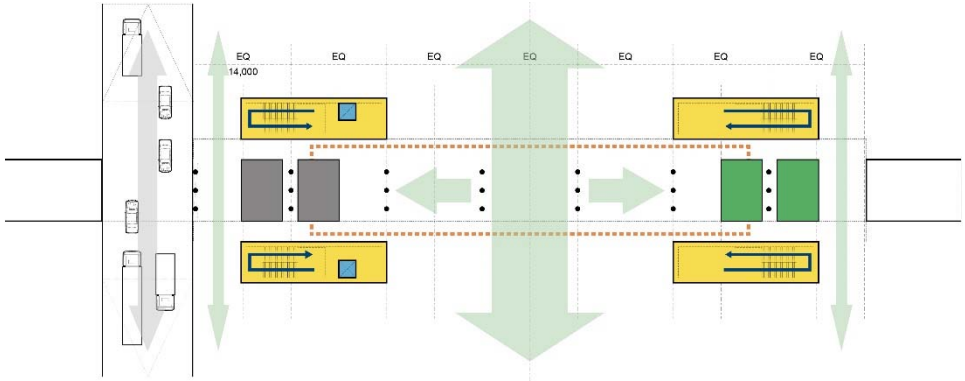
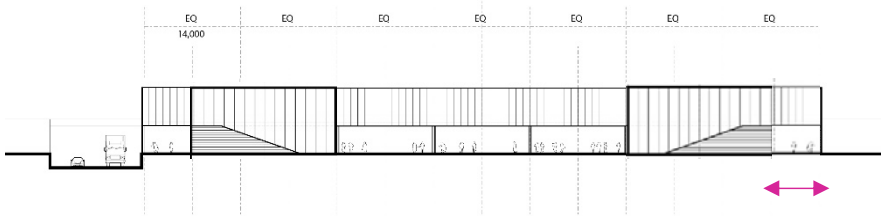
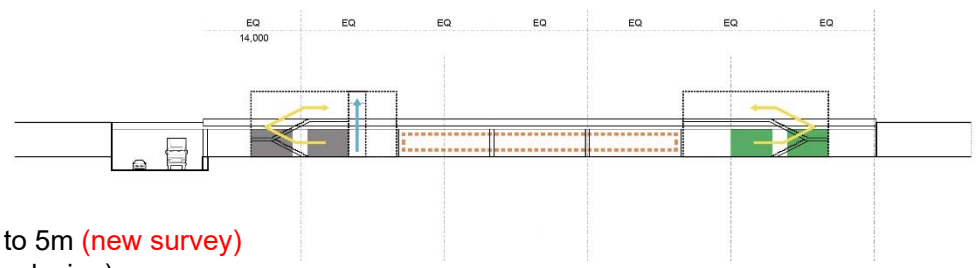
OPTION 15B

ASSESSMENT CRITERIA	SCORE
Constructability/ Phasing, Maintenance and Structure	
Passenger experience – Aesthetics, intuitive wayfinding, Inclusive design, Weather protection	
Passenger flow/ distribution/ congestion/ fire egress	
Urban realm integration (developing masterplans)	
Safeguarding of station – flexibility of station; future provision for commercial and additional mechanical vertical circulation	
Cost	









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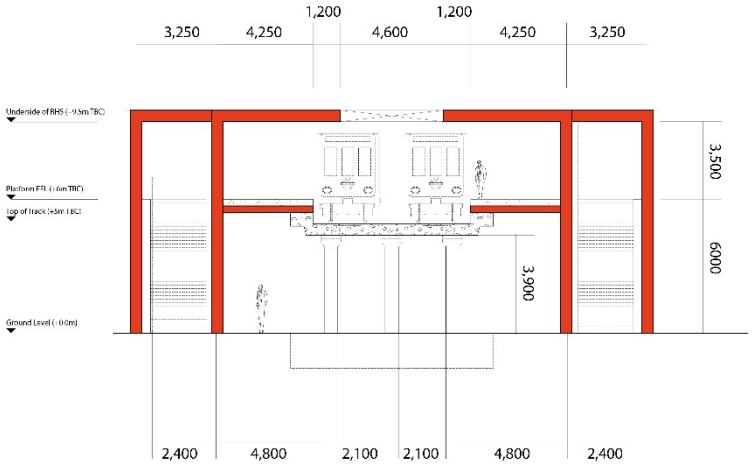
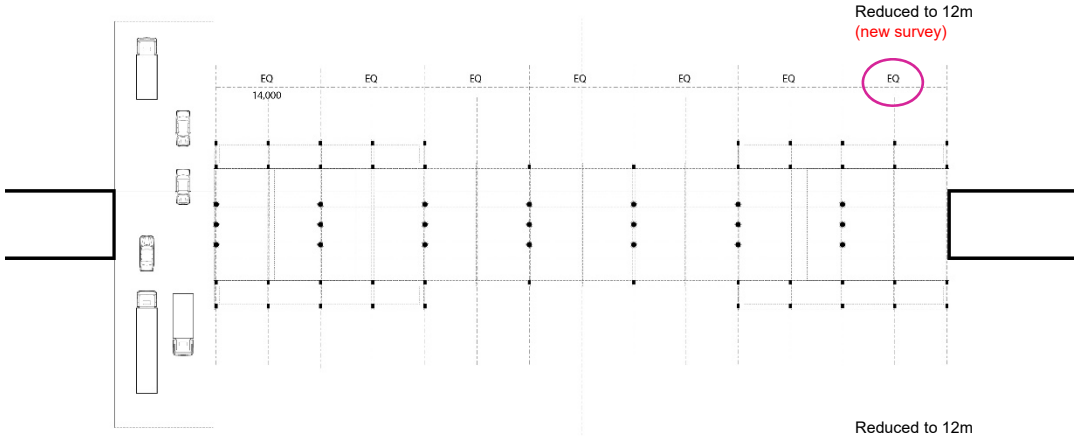
Reduced to 5m (new survey)
(secure by design)

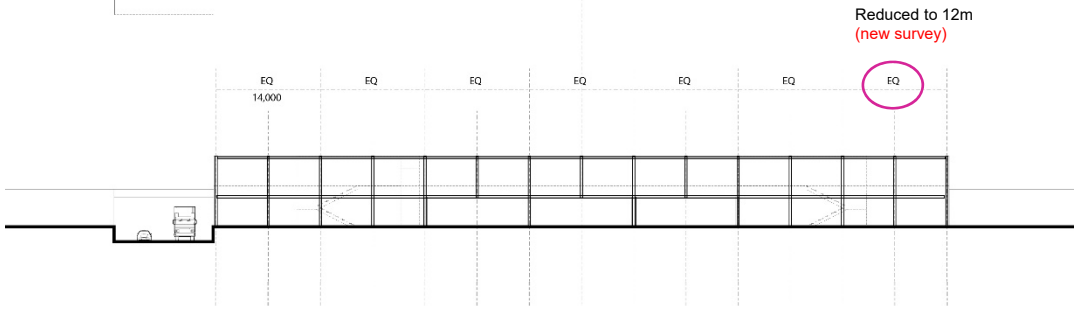
Structural Principle Layouts

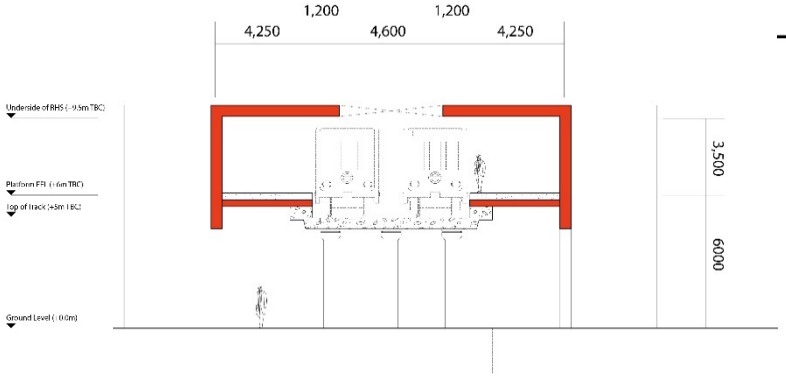
Option 5 selected for consistency

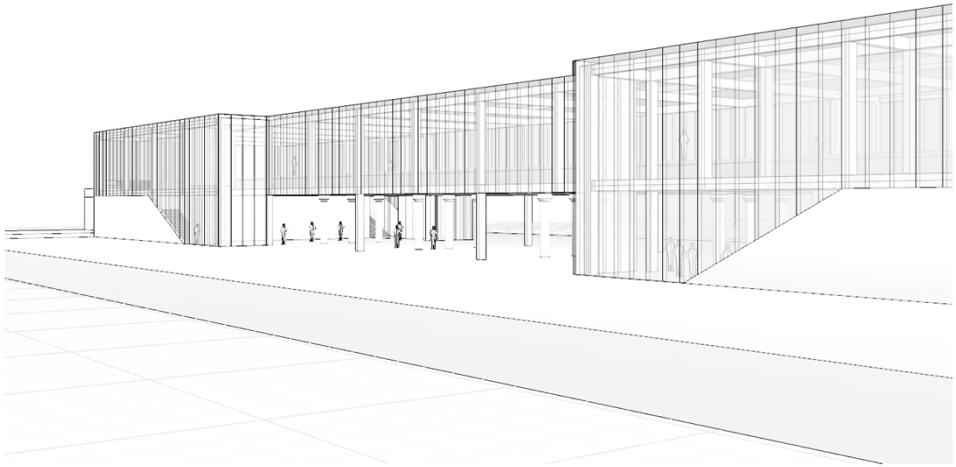
STRUCTURAL PRINCIPLE 1 – Portal - Selected at EOS workshop held on 21-01-17











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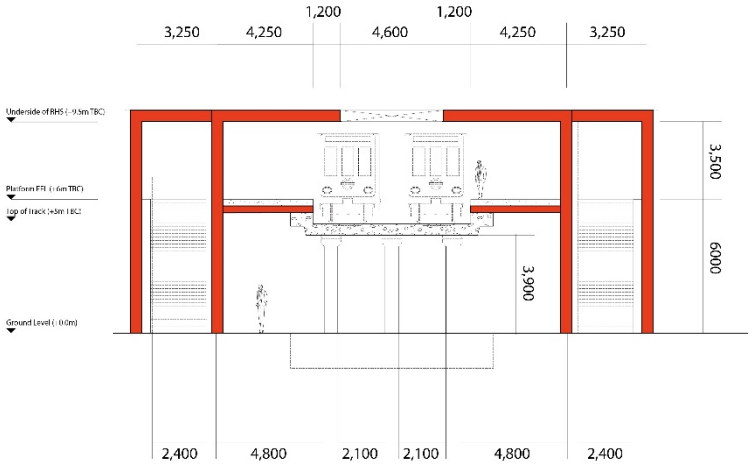
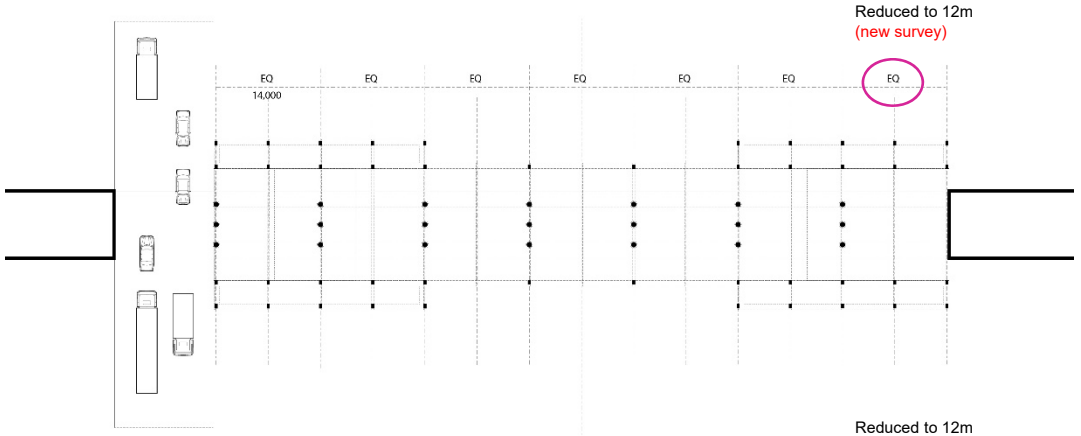
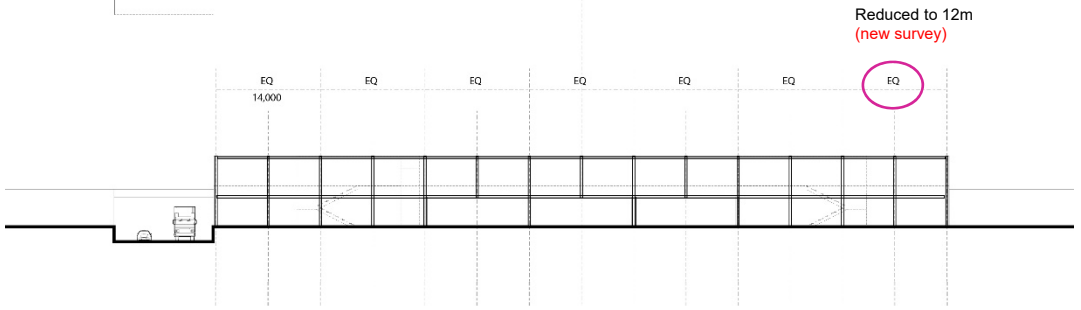
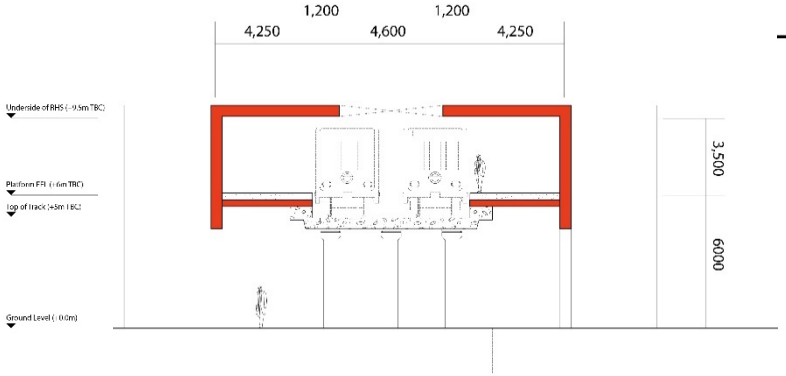
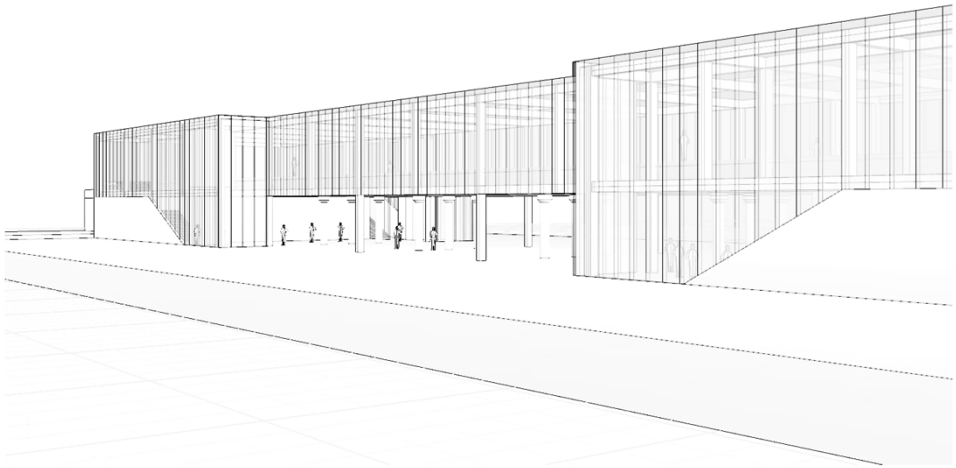
STRUCTURAL PRINCIPLE 1 - Portal











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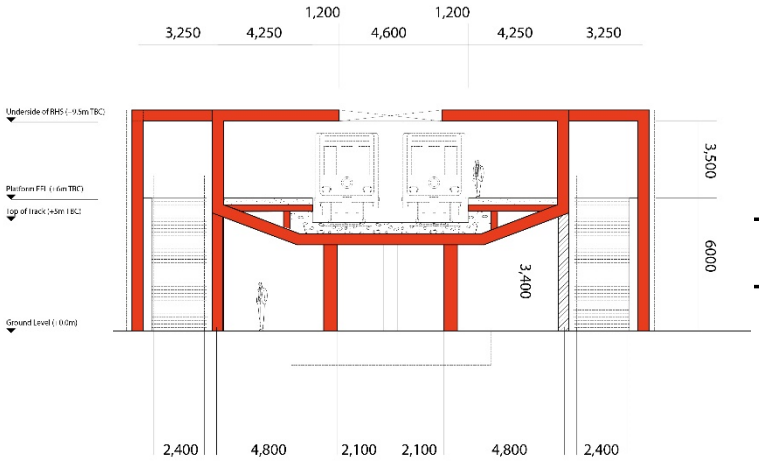
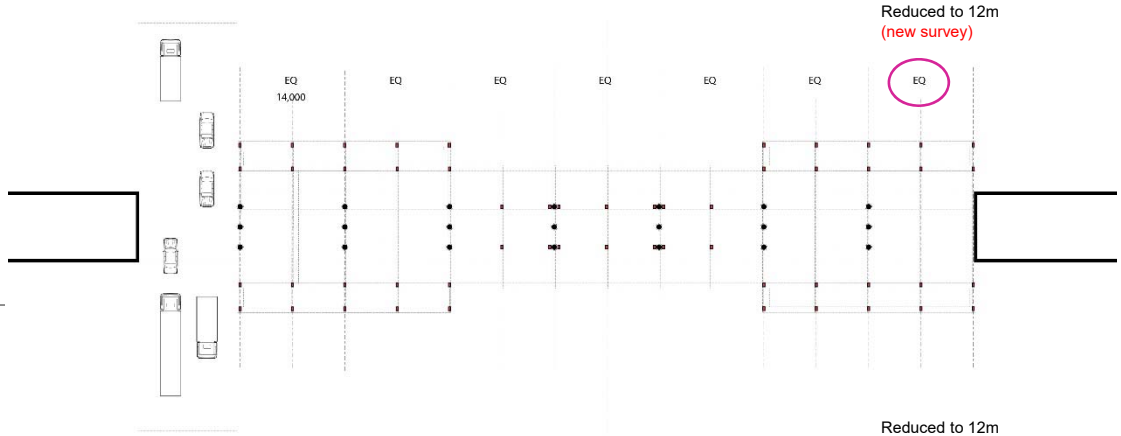
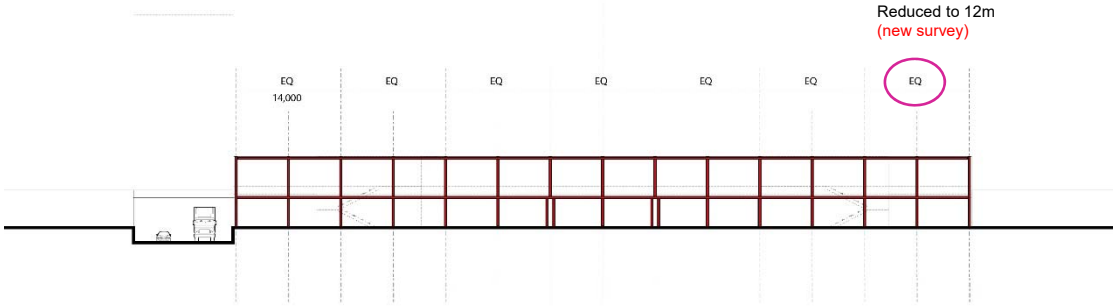
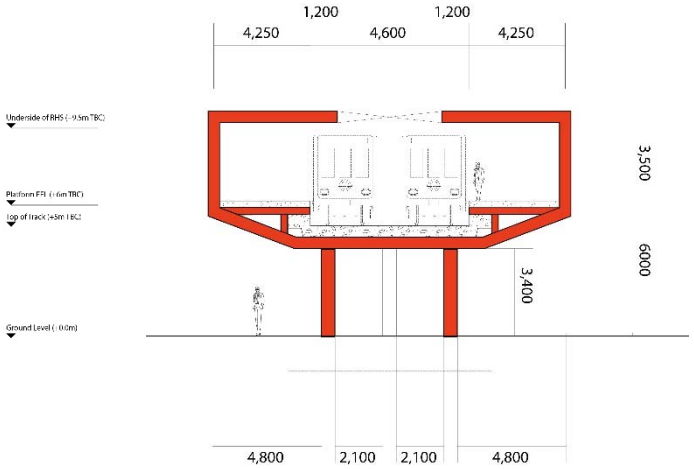
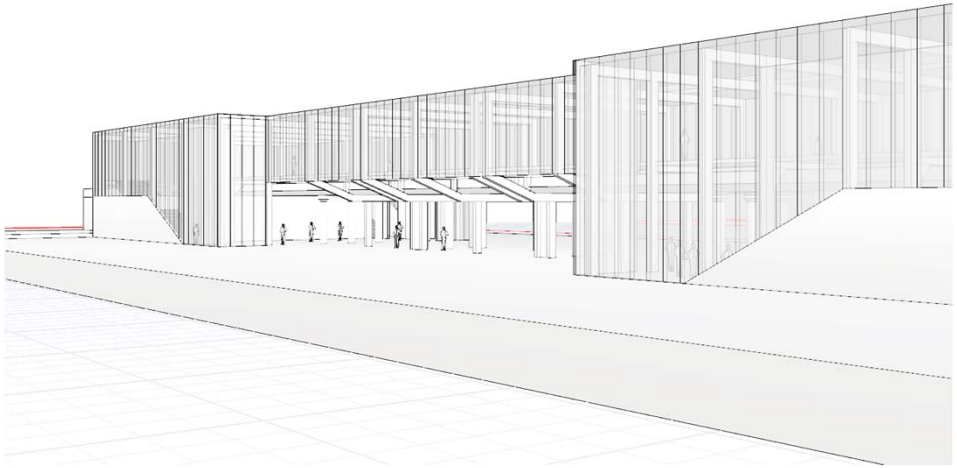
STRUCTURAL PRINCIPLE 2 – Hybrid 1











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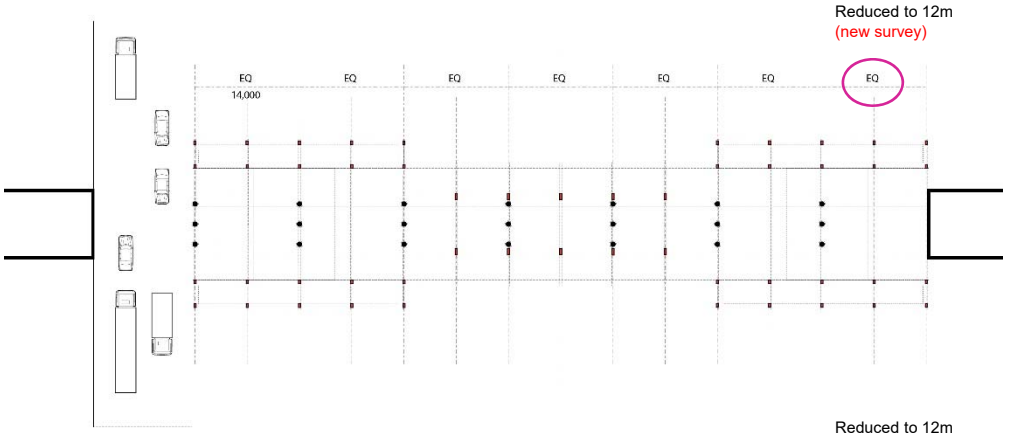
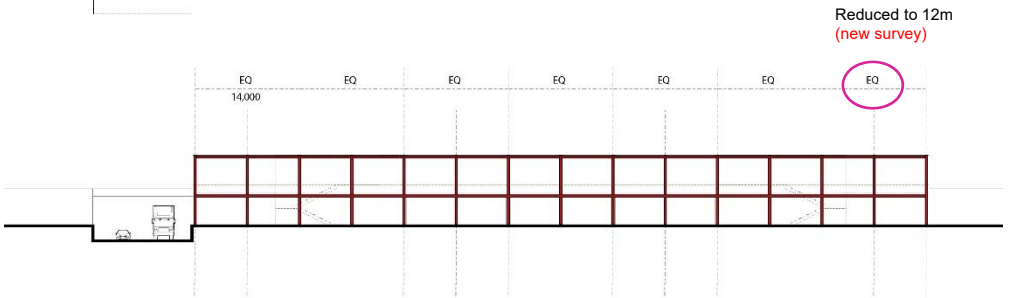
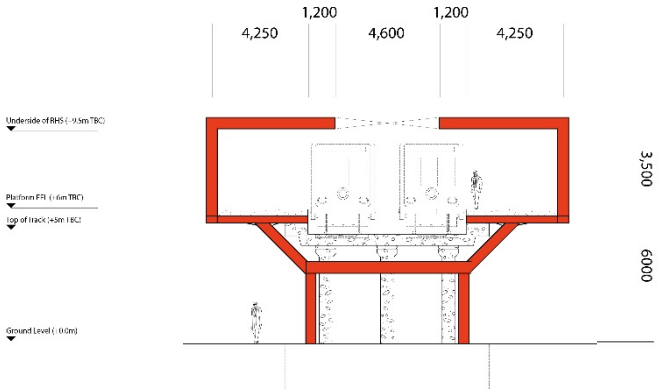
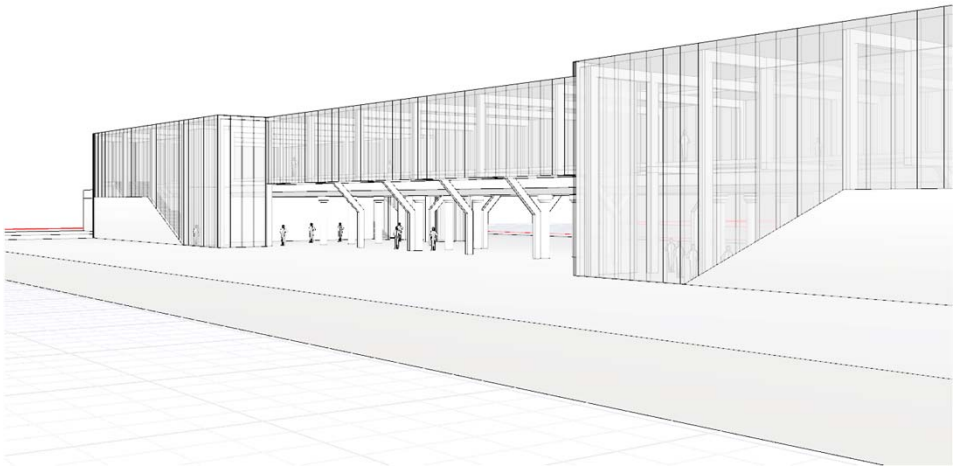
STRUCTURAL PRINCIPLE 3 – Hybrid 2









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