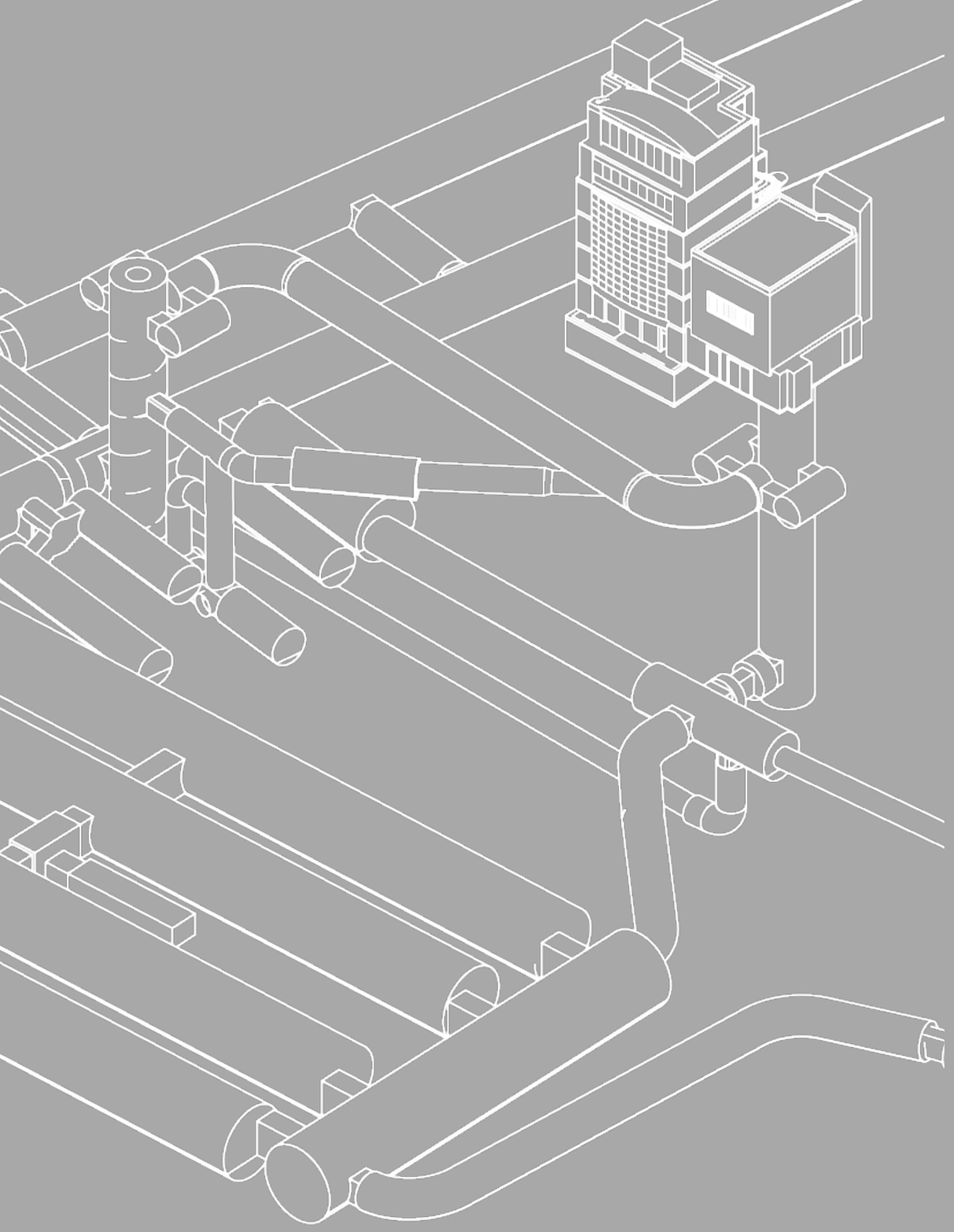


4.4 The Tunnels

4.4.1 The Tunnels

The Kingsway tunnels are subdivided into different elements:

1. The Streets

The Streets are part of the original construction phase of the Deep Shelter, consisting of two principal tunnels with a diameter of 5.2m. Their structural composition includes a mix of cast iron rings and pre-cast concrete rings. Upon closer examination, indications suggest that some alterations were made in the early 50s. Presently, the finish floor level comprises a concrete slab supported by a secondary steel frame. Currently there is limited available information regarding the underlying structure beneath the finished floor.

2. The Avenues

The Avenues are associated with the second phase of construction and are believed to be connected to the expansion efforts carried out by the Post Office upon acquiring the tunnels. Similar to the streets, the structure incorporates a combination of cast iron ring panels and pre-cast concrete panels. The available information about the floor build-up is also limited and assumed to be similar to that of 'the streets'.

3. The 'Dog Leg'

An additional tunnel linking the Furnival Street shaft to the construction shaft is positioned at a midpoint between ground level and the tunnels. Originating from the second phase of construction, this tunnel was initially designed as a construction tunnel. It serves as a connection between the Furnival Street shaft and the decommissioned construction shaft 2.

4. The Ventilation Tunnels

A secondary network of smaller tunnels functions as ventilation routes connecting adjacent tunnels. While these tunnels are too narrow for public use, they present opportunities for the distribution of services.

5. The Disused shafts

Their are a number of shafts that have been blocked or made unusable due to more recent developments above ground. These include:
- Chancery Lane tube station connection shaft
- Took's Court Shaft
- Staples Inn shaft

6. The Access Shafts

These include both shafts at Fulwood Place and the Goods Shaft at Furnival Street. The Scheme relies in these connections to provide safe access and evacuation to the tunnels.

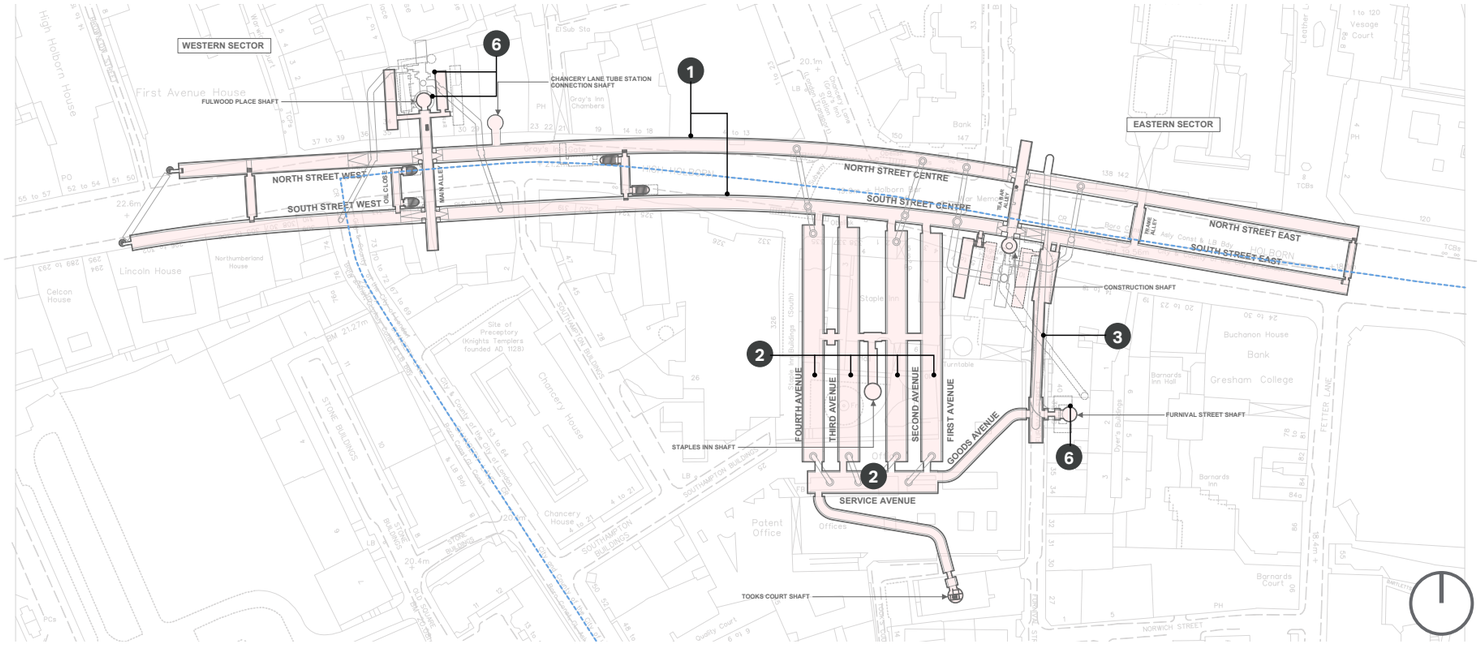


Figure 154. Location plan of The London Tunnels (not to scale)

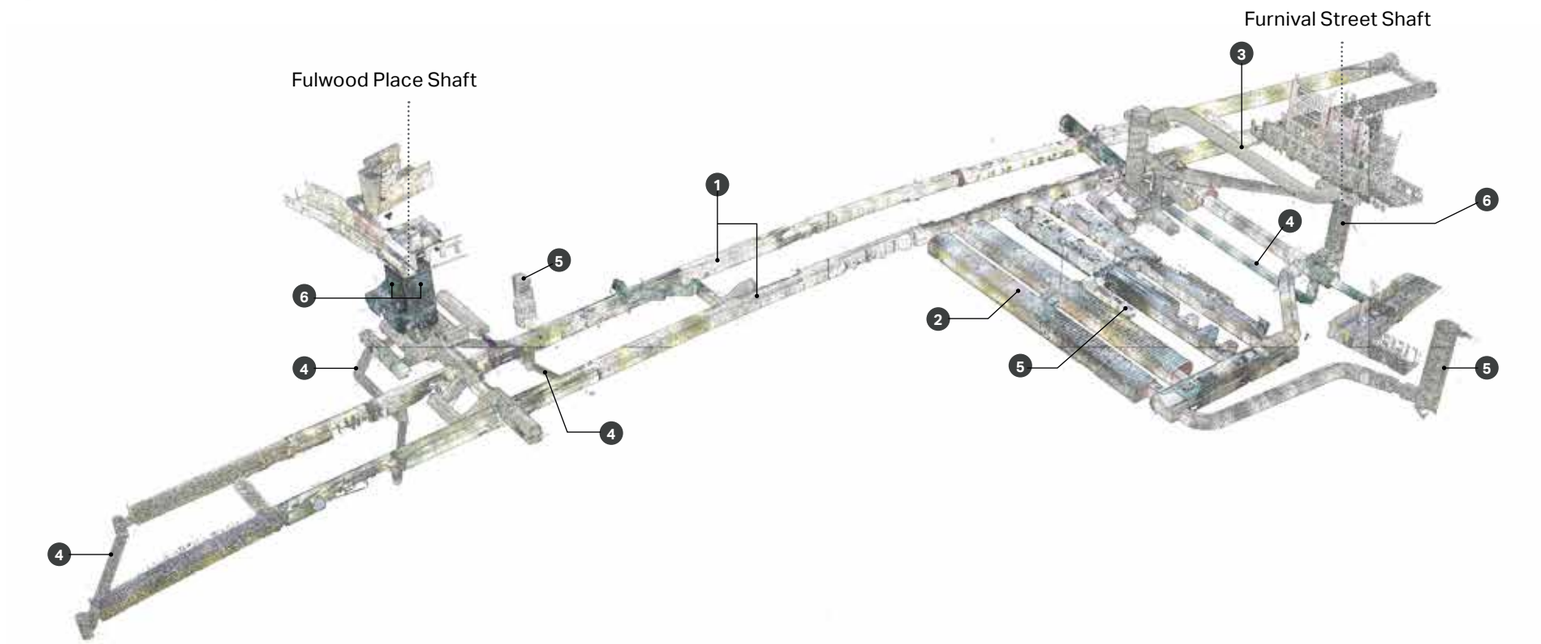
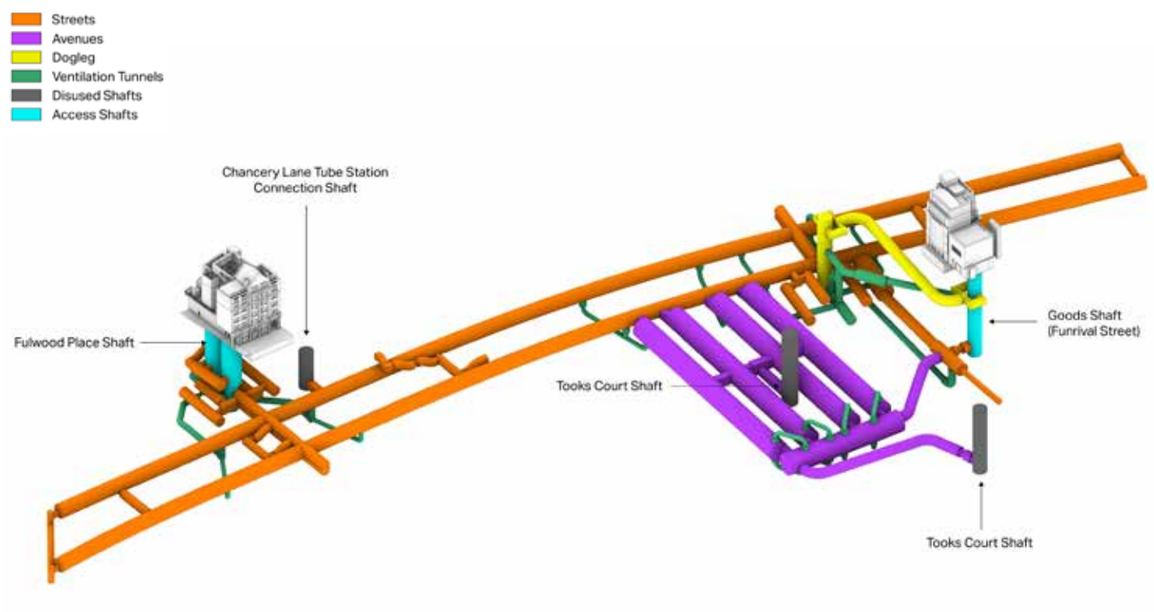


Figure 155. Perspective view of the 'point cloud' scan of the tunnels and their above the ground entrances



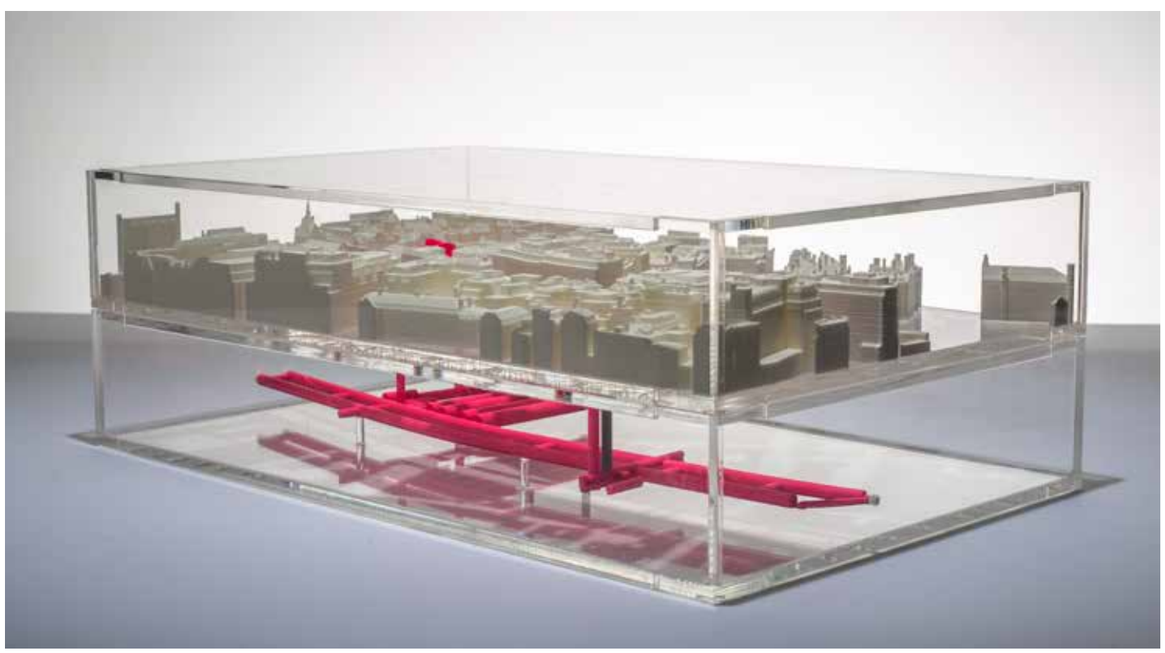


Figure 156. Model of The London Tunnels below Holborn with urban context

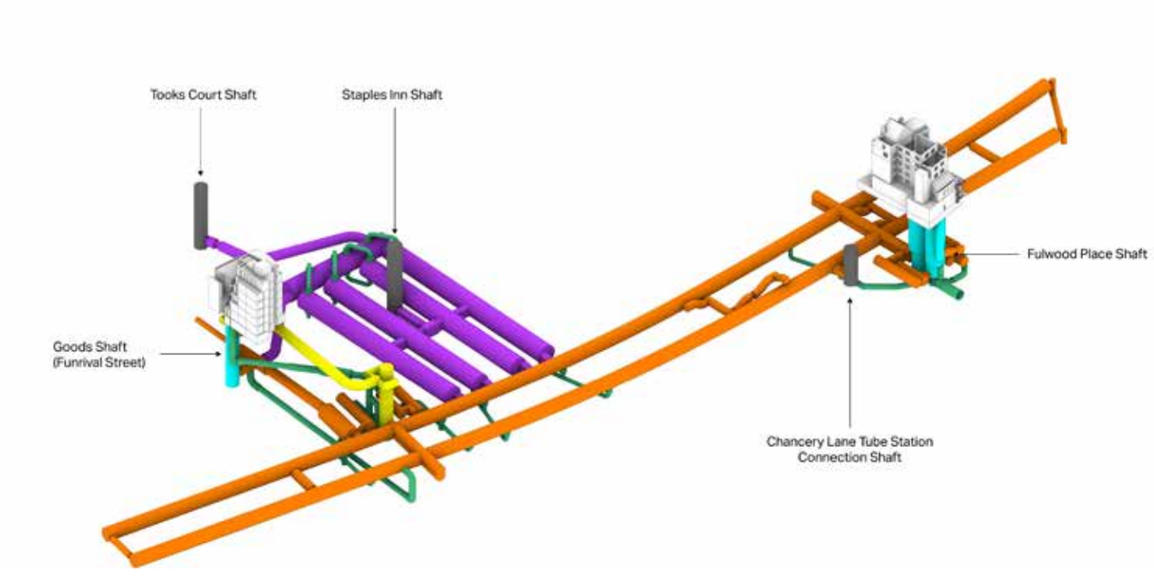


Figure 158. Tunnel sections isometric view: North and South views

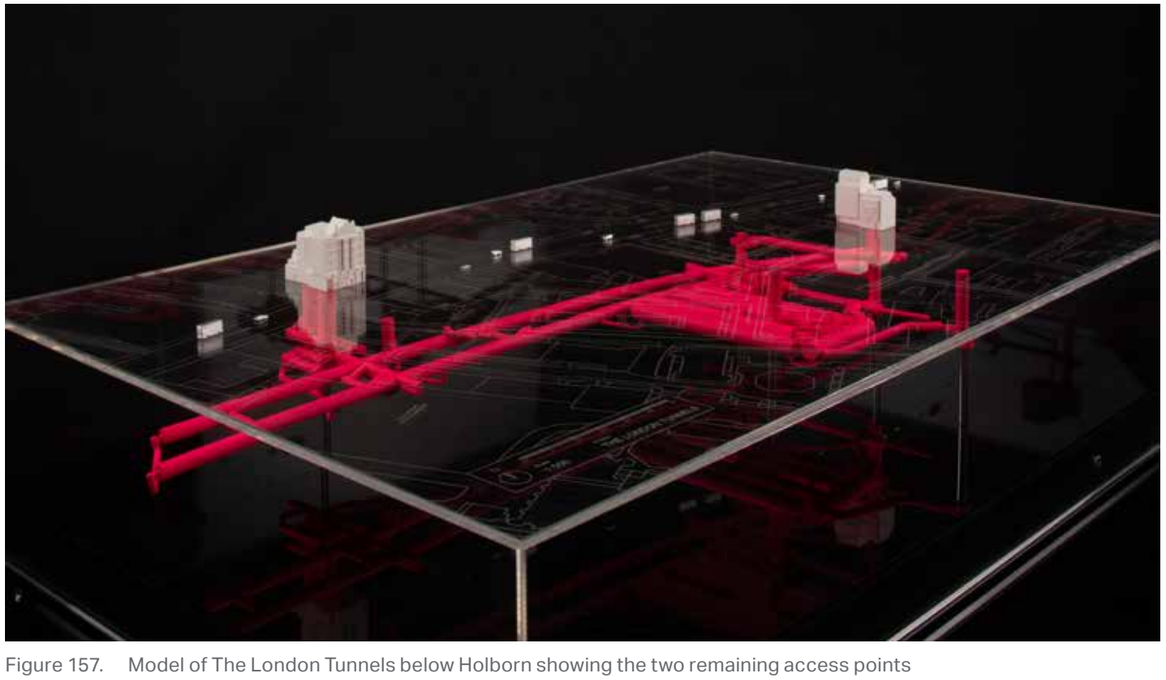


Figure 157. Model of The London Tunnels below Holborn showing the two remaining access points

4.4.2 Construction Phases & Uses

From a WWII deep bunker to home of 20th Century espionage and host of the telephone exchange connecting the White House to the Kremlin during the Cold War the Tunnels offer a diverse and captivating history to be shared

Chancery Lane Deep Shelter

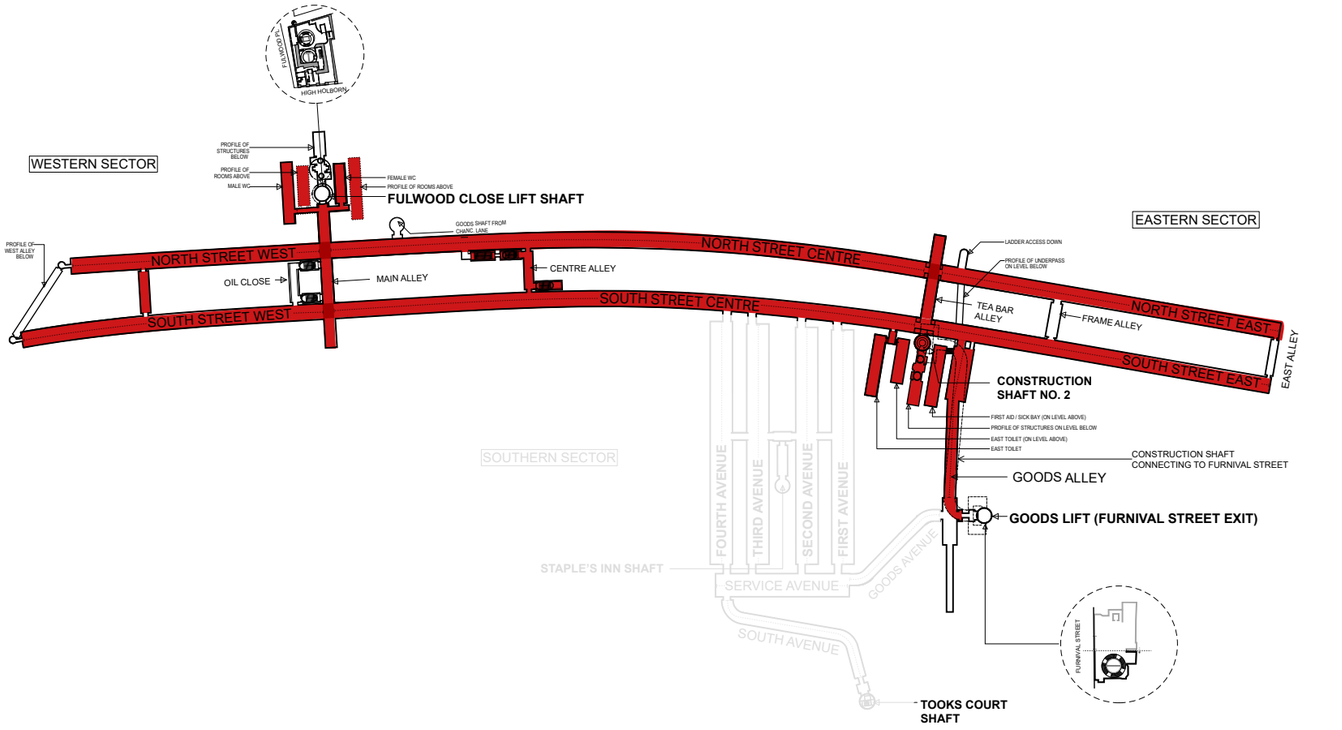
- Constructed 1940s. Work began in November 1940 and completed in 1942
- Consisted of two tunnels with a mid floor to provide shelter accommodation for 8,000 people. Provided canteens, medical posts, communications, toilets
- Constructed by London Transport - and designed with the intention that they could be incorporated into the underground network after the war.
- Never actually used as a public shelter - was adapted for Government use as a 'Citadel'.
- Used by the Special Operations Executive (SOE) formed in 1940 as a secret service under the aegis of the Minister of Economic Warfare. Operated under the cover name Inter-Services Research Bureau (ISRB).
- After the war it was used as storage for the Public Records Office between 1945-1949.

Kingsway Telephone Exchange

- In 1949 The General Post Office (GPO) took over the site and an additional 4 tunnels were constructed in the 1950s.
- Converted into an atomic bomb-proofed 500 line trunk telephone exchange with 6 weeks food supply and its own artesian well.
- Served as an internal communications exchange during the Cold War.
- In 1956 it became the termination point for the first transatlantic telephone cable TAT-1.
- In the 1960s, 70s and early 80s the PO had up to 200 staff on site. Following the introduction of subscriber trunk dialling from 1959 (direct dialling) the exchange became less important and was closed in 1980.

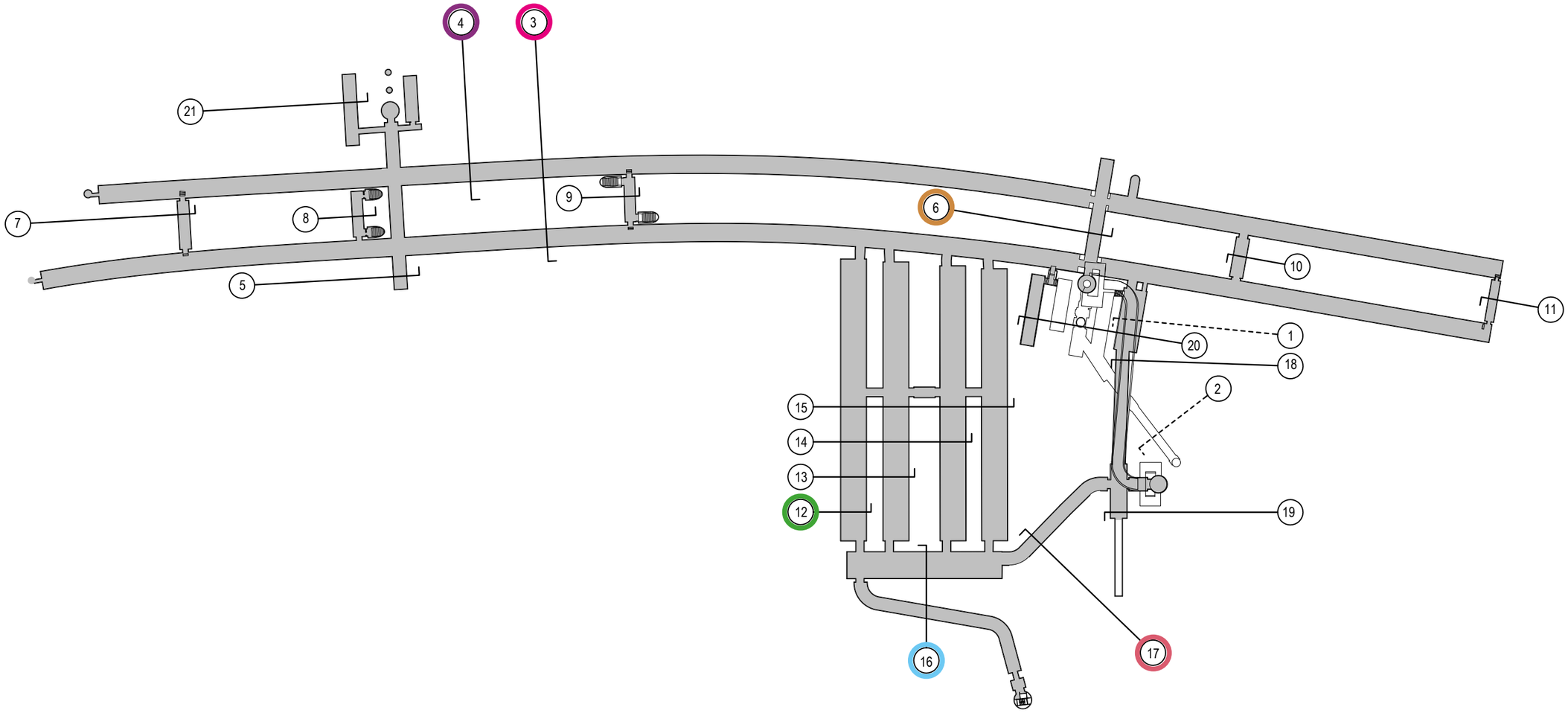
In the later 1980s the Government used part of the Tunnels as a backup for its PINDAR nuclear bunker located beneath the Ministry of Defence in Whitehall.

Since the 1990s it has been used for storage only.

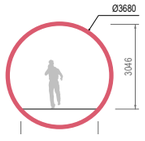


WESTERN SECTOR
EASTERN SECTOR
SOUTHERN SECTOR
FULWOOD CLOSE LIFT SHAFT
NORTH STREET WEST
SOUTH STREET WEST
NORTH STREET CENTRE
SOUTH STREET CENTRE
NORTH STREET EAST
SOUTH STREET EAST
EAST ALLEY
CENTRE ALLEY
MAIN ALLEY
OIL CLOSE
TEA BAR ALLEY
FRAME ALLEY
CONSTRUCTION SHAFT NO. 2
CONSTRUCTION SHAFT CONNECTING TO FURNIVAL STREET
GOODS ALLEY
GOODS LIFT (FURNIVAL STREET EXIT)
FOURTH AVENUE
THIRD AVENUE
SECOND AVENUE
FIRST AVENUE
STAPLE'S INN SHAFT
SERVICE AVENUE
GOODS AVENUE
SOUTH AVENUE
TOOKS COURT SHAFT
N
1:750
10m 0 10m 20m 50m

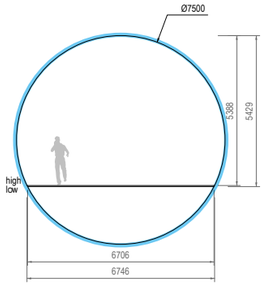
4.4.3 Volumetric Diagram



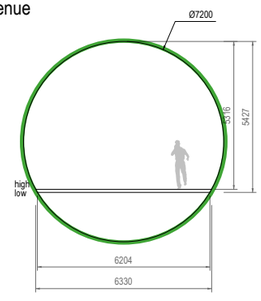
Section 17
Entrance Corridor



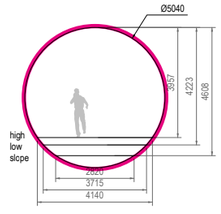
Section 16
Lobby



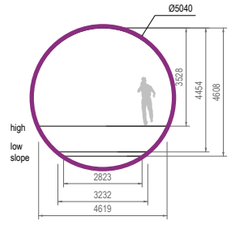
Section 12
Avenue



Section 3
South Street



Section 4
North Street



Section 6
Double-decker Alley

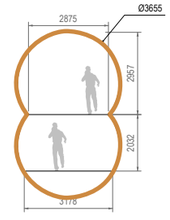
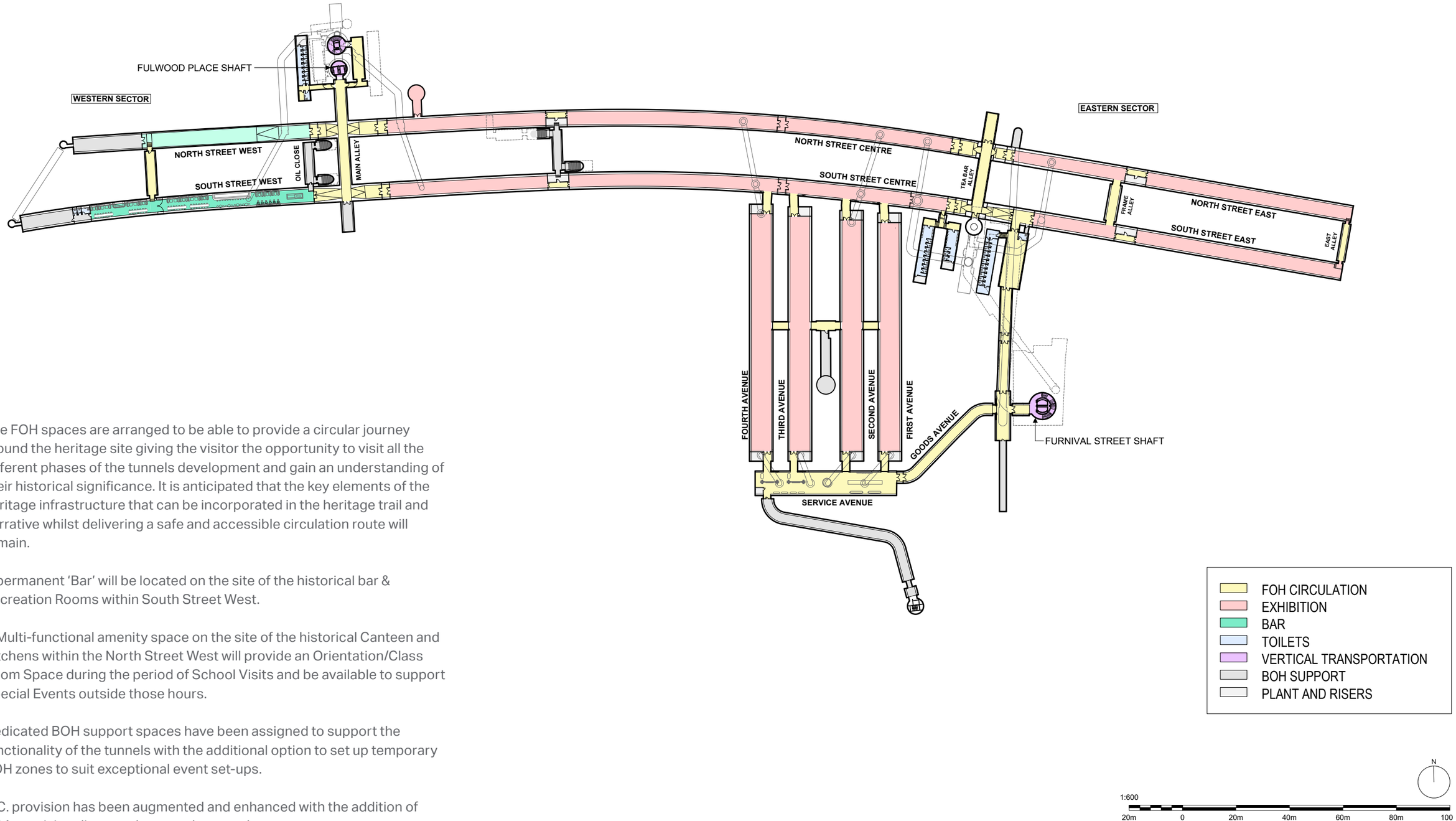


Diagram showing varying scale of The Tunnels. The larger scale tunnels were all part of the second phase of development

4.4.4 Proposed Functional Zoning



The FOH spaces are arranged to be able to provide a circular journey around the heritage site giving the visitor the opportunity to visit all the different phases of the tunnels development and gain an understanding of their historical significance. It is anticipated that the key elements of the heritage infrastructure that can be incorporated in the heritage trail and narrative whilst delivering a safe and accessible circulation route will remain.

A permanent 'Bar' will be located on the site of the historical bar & Recreation Rooms within South Street West.

A Multi-functional amenity space on the site of the historical Canteen and Kitchens within the North Street West will provide an Orientation/Class Room Space during the period of School Visits and be available to support Special Events outside those hours.

Dedicated BOH support spaces have been assigned to support the functionality of the tunnels with the additional option to set up temporary BOH zones to suit exceptional event set-ups.

WC. provision has been augmented and enhanced with the addition of DDA provision dispersed across the tunnels.

4.4.5 Exhibitions & Circulation

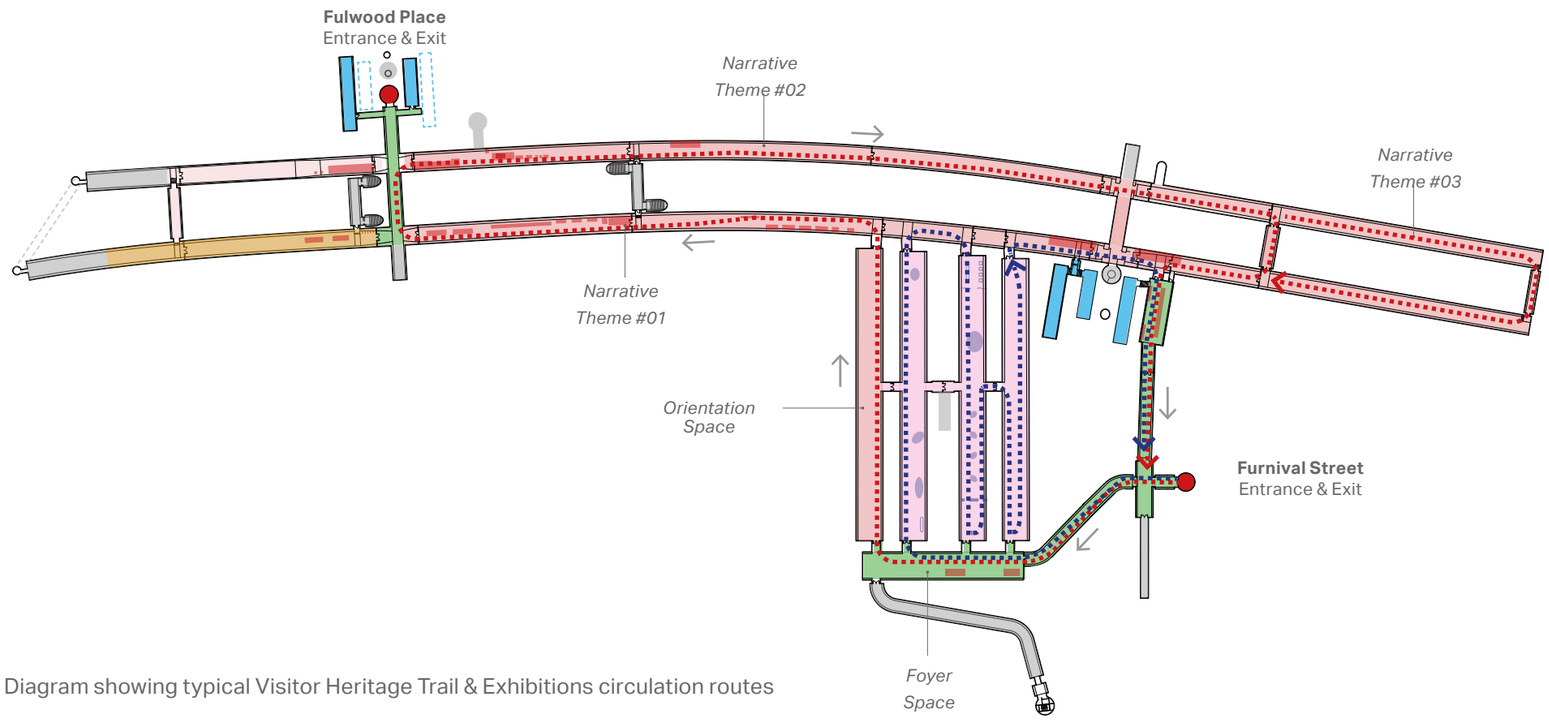


Diagram showing typical Visitor Heritage Trail & Exhibitions circulation routes

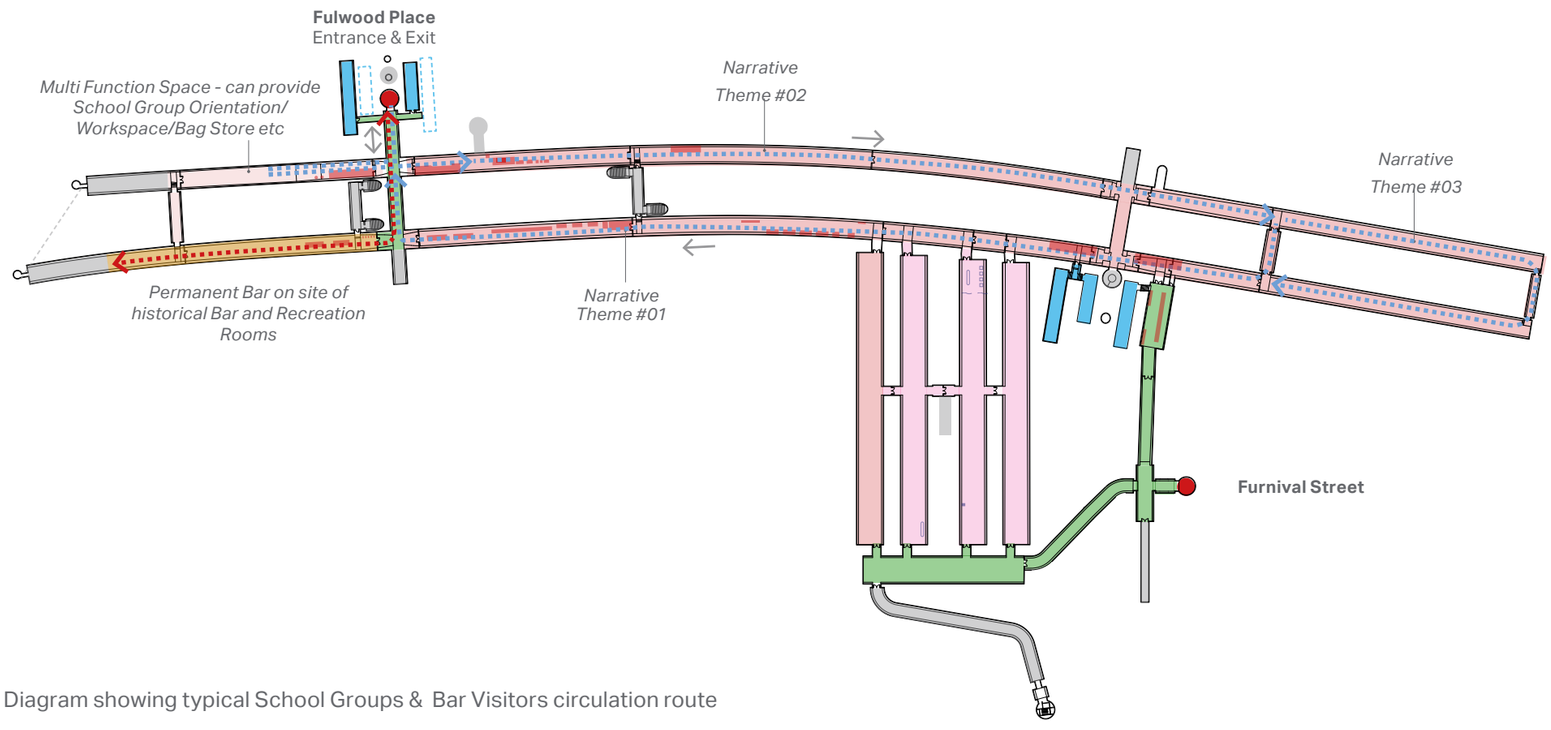


Diagram showing typical School Groups & Bar Visitors circulation route

The Tunnels will host a variety of exhibition spaces suitable for a range of permanent and temporary exhibitions and associated events:

The 'Streets' will primarily host a permanent exhibition focused on the heritage of the tunnels. It is anticipated that this will be split up into various narrative themes - see the following page for more detail. Part of the Streets could be used for medium term exhibitions on associated themes such as James Bond.

The 'Avenues' will support a varied cultural calendar of installations and events These are likely to be of a shorter duration and will aim to attract a diverse audience and encourage return visits.

The principle entrance and exit for both permanent and temporary exhibition ticket holders will be through the Furnival Street building. They will then be segregated into separate circular routes to re-converge in the exit corridor at the end of their visit.

WC. provision is dispersed throughout the route.

School Groups and visitors to The Bar(who are not intending to visit the exhibition spaces) will enter and exit through Fulwood Place.(31-33 High Holborn)

- A Multi-function Space located where the original canteen was can be used independently from The Bar. It can be used as a Group Orientation/Gathering spot/Workspace to support school visits.
- Outside school visiting hours it can be used as an extension of the Bar amenity offer and support a variety of corporate event settings.

- Permanent Exhibition Space
- Temporary Exhibition Space
- FOH Circulation
- WC.s
- Lift Access Points
- Heritage Trail Route
- Temporary Exhibition - indicative route
- School Groups - indicative route
- Historical Plant

4.4.6 Permanent Exhibition - Heritage Component

The permanent heritage exhibition will bring to life the fascinating history of the tunnels and the people that used them.

The thematic arrangement will focus on three key narrative themes;

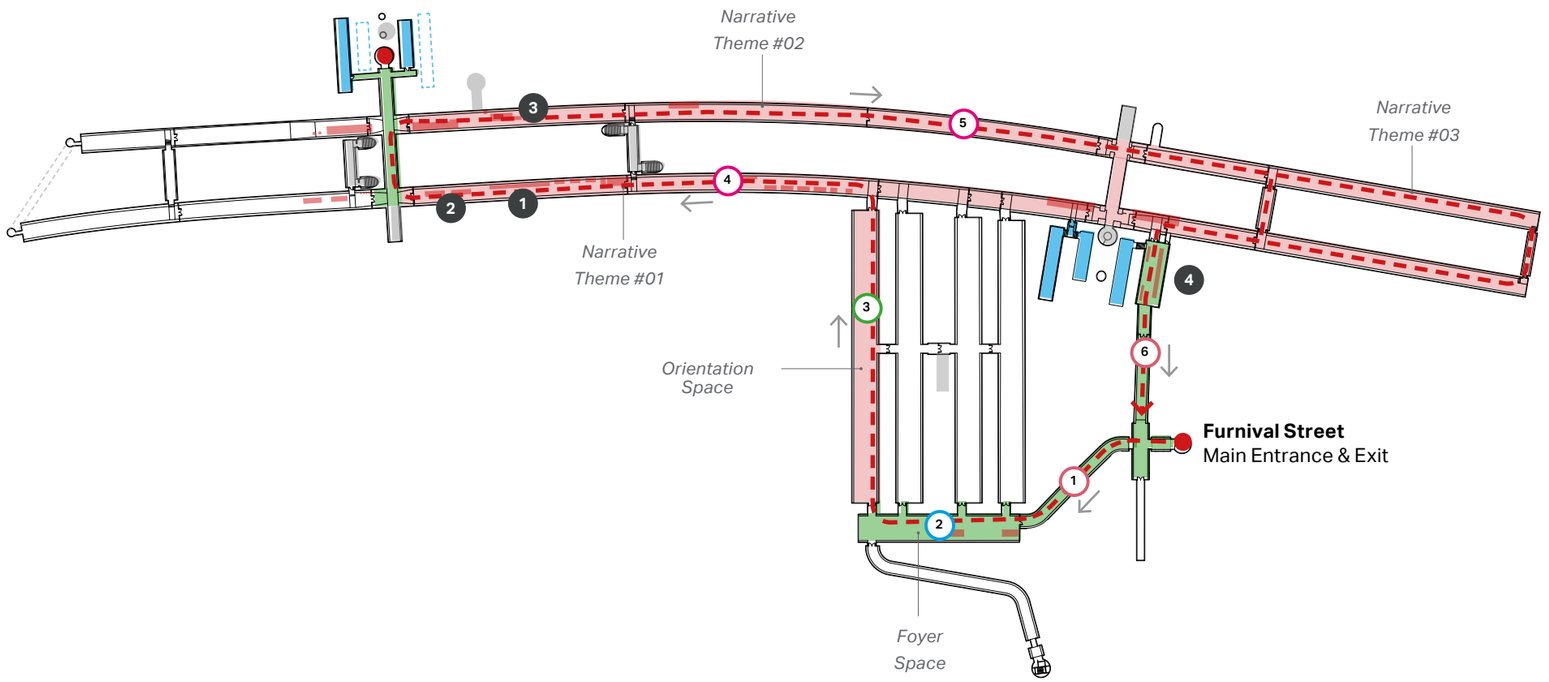
- The London Blitz and the building of the Deep Level Shelters.

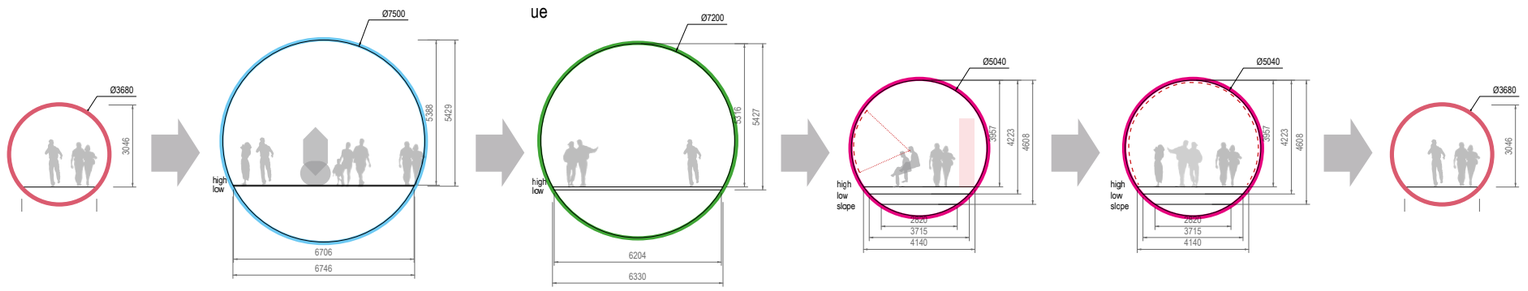
- The Use of The Tunnels by the Special Operations Executive (SOE) formed in 1940 as a secret service under the aegis of the Minister of Economic Warfare.

- The Cold War and the Tunnels secret life as the TZK or Trunk Zone Exchange Kingsway and the London terminal of the first Transatlantic telephone cable TAT 1.

It is intended that these narratives will be brought to life through the immersive use of large scale AV and digital interactivities.

It is anticipated that the key elements of the heritage infrastructure that can be incorporated in the heritage trail and narrative whilst delivering a safe and accessible circulation route will remain.





Entrance Corridor
(Goods Avenue)

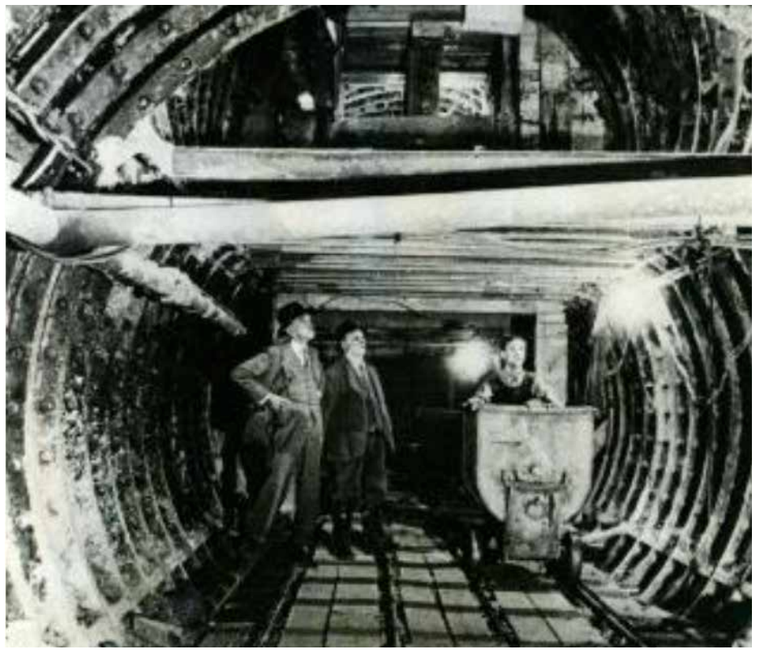
Exhibition Lobby
(Service Avenue)

Orientation Gallery
(Fourth Avenue)

Permanent Exhibition - Heritage Trail
(South Street)

Permanent Exhibition - Heritage Trail
(North Street)

Exit Corridor
(Goods Avenue)

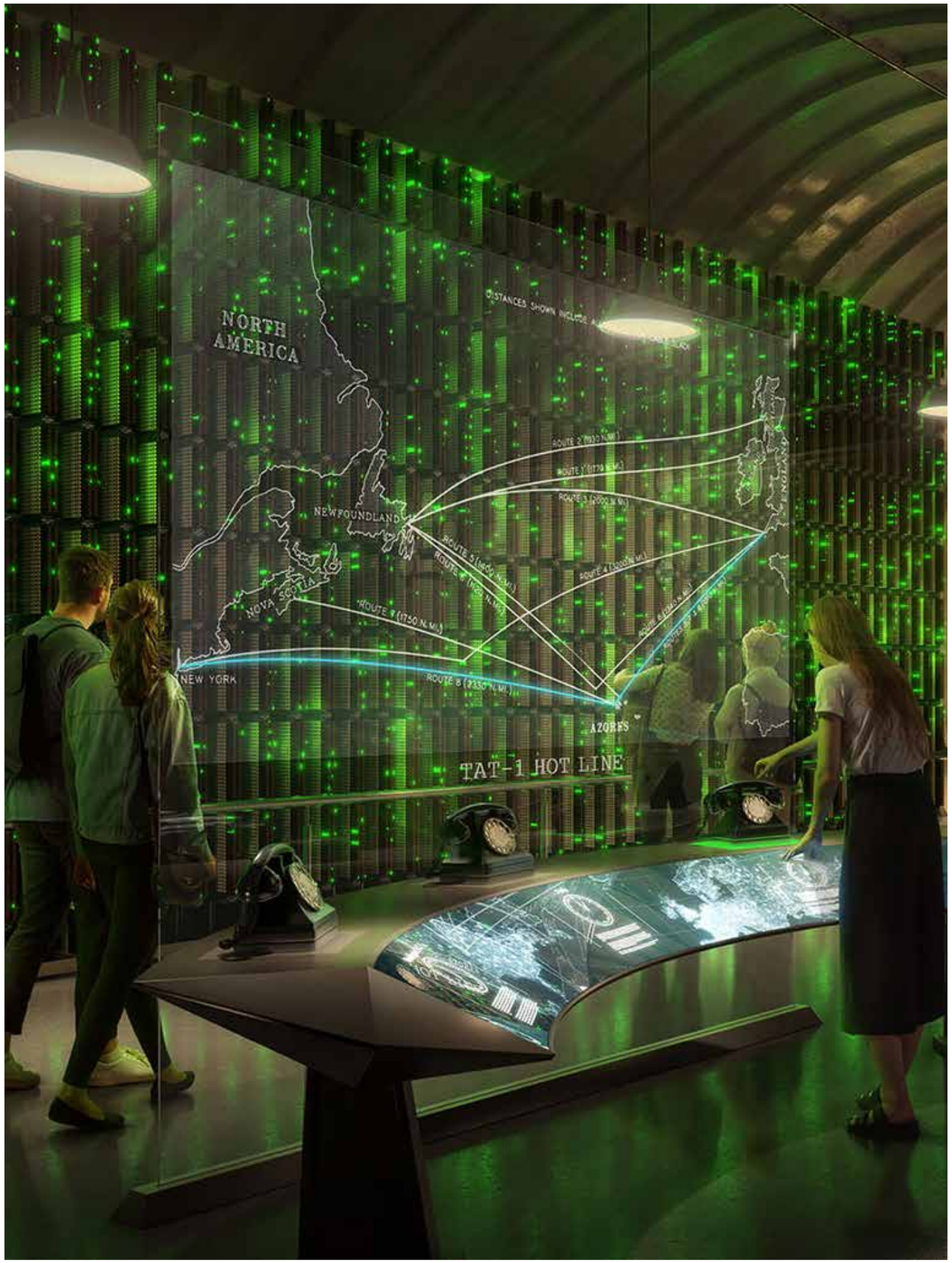


1 Trunk Exchange

2 Generator

3 Generator

4 Main Distribution Frame



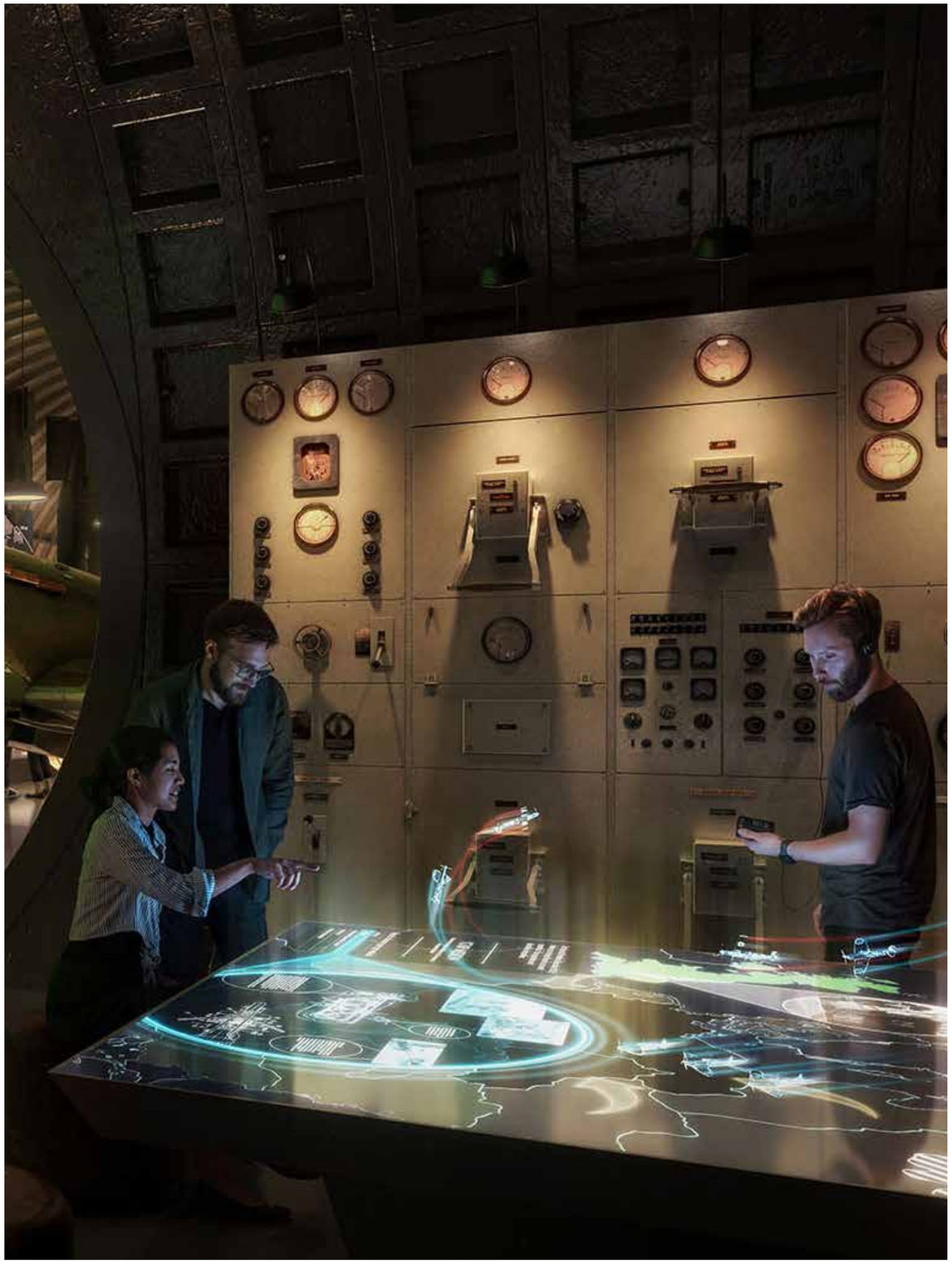


Figure 159. Artistic render of the type of interactive displays that will bring the rich historical narratives of the Tunnels to life on the Heritage Trail

4.4.7 Temporary Exhibition - Cultural Component

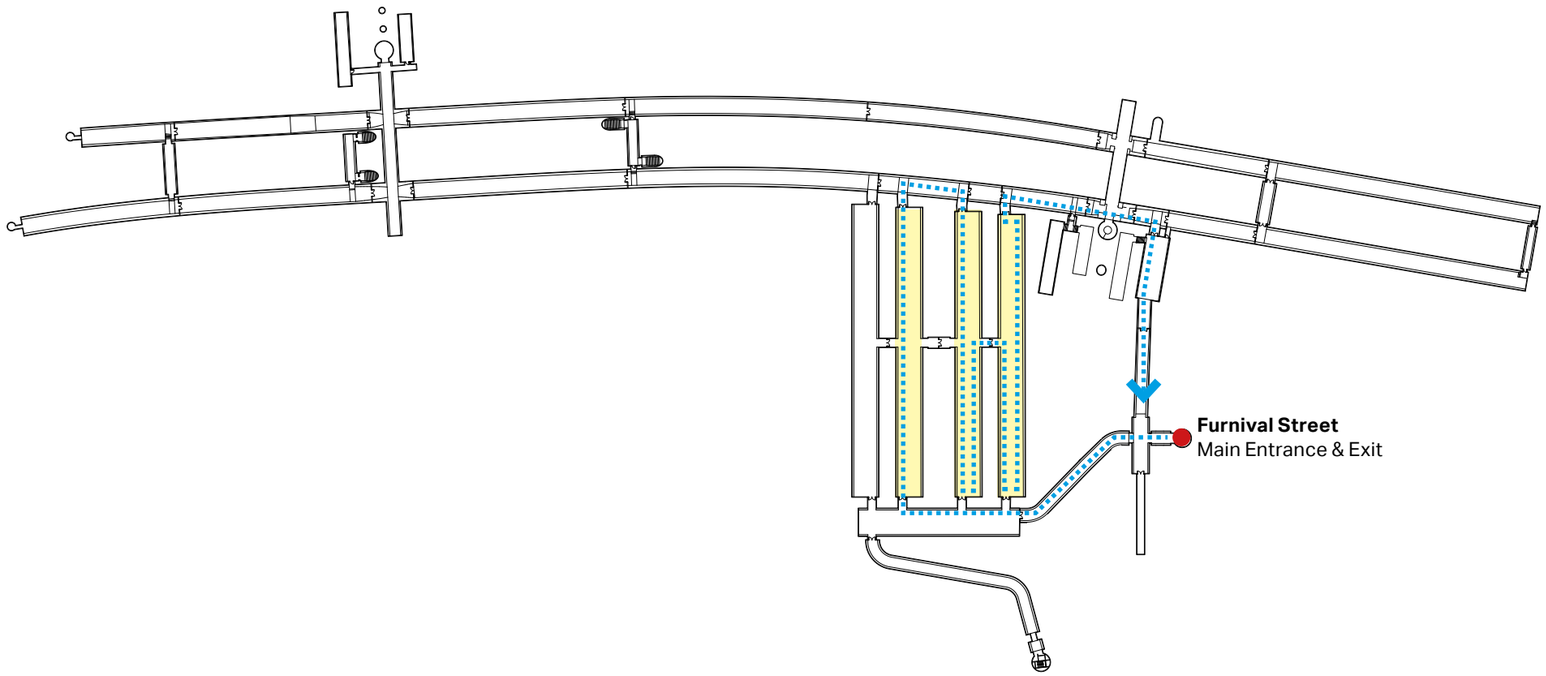
Alongside the heritage aspects of the tunnels, their unique environment provides a perfect background for a wide range of multi-sensorial cultural experiences, where sounds, smell, light levels and temperature can be carefully curated .

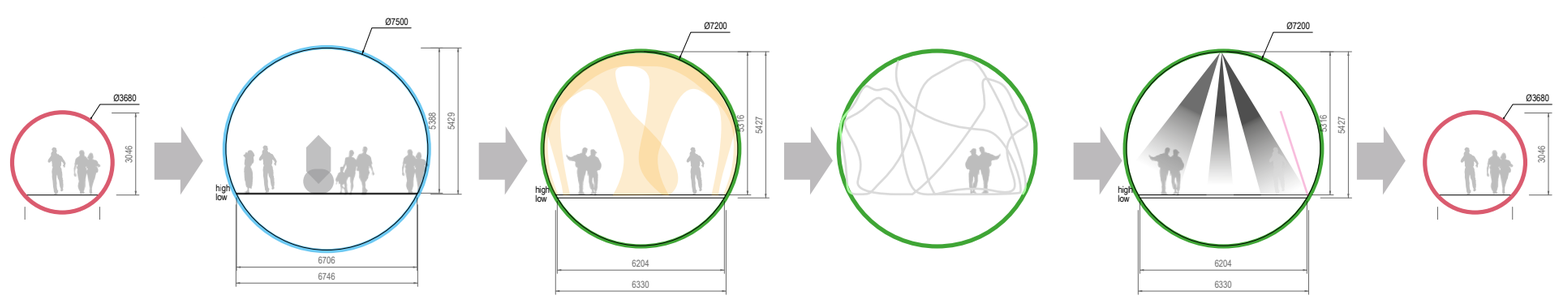
The Avenue tunnels offer the greatest volume (at over 7m diameter) and therefore flexibility to suit a wide range of events.

The Avenues surfaces will be used to showcase different digital environments, either with the use of cutting edge digital screens or with high resolution projectors. The setting will allow these spaces to create fully immersive environments that will transport visitors to unique real or imaginary spaces.

The digital nature of the content will provide the opportunity to collaborate with digital artists and alike to showcase the latest trends in digital art.

These spaces can also be adapted for a multitude of cultural events, expanding the use of the asset for other creative disciplines.





Entrance Corridor
(Goods Avenue)

Exhibition Lobby
(Service Avenue)

Temporary Exhibition
(Third Avenue)

Temporary Exhibition
(Second Avenue)

Temporary Exhibition
(First Avenue)

Exit Corridor
(Goods Avenue)

Figure 160. Artistic impression of the type of immersive installations that could be hosted in the Avenues.

4.4.8 The Deepest Bar in the UK

The Bar will sit on the site of the historical Bar and Recreation Rooms.

It is intended that this will provide a timely and atmospheric amenity break along the Heritage route. The Bar area will also be available for after hours events.

The Multi-function space within the North Street West will support these functions and can act as a Orientation/Class Room Space during the period of School Visits.

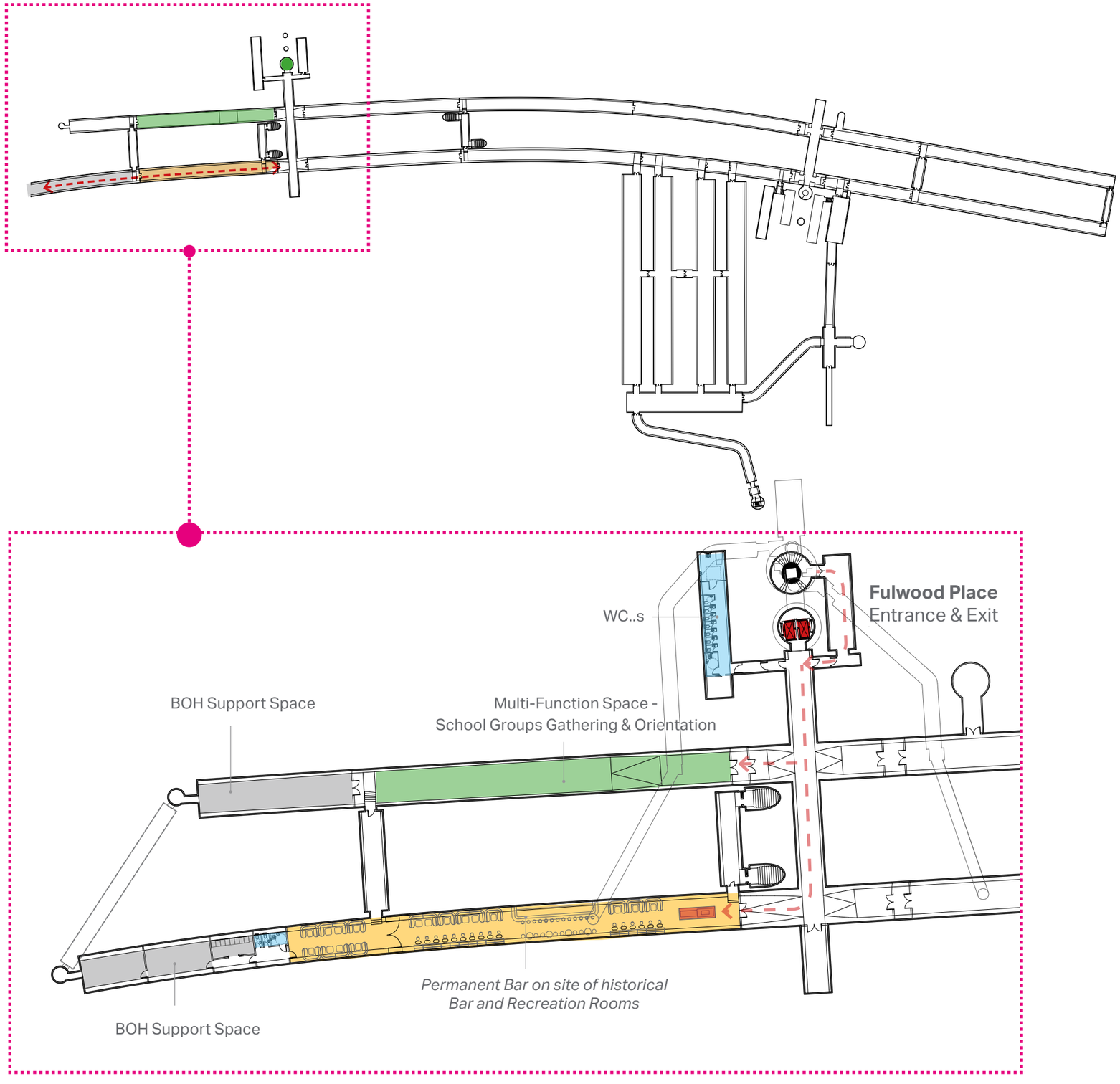


Figure 161. Artistic impression of the bar look and feel.

4.4.9 Other Uses - Fashion Show

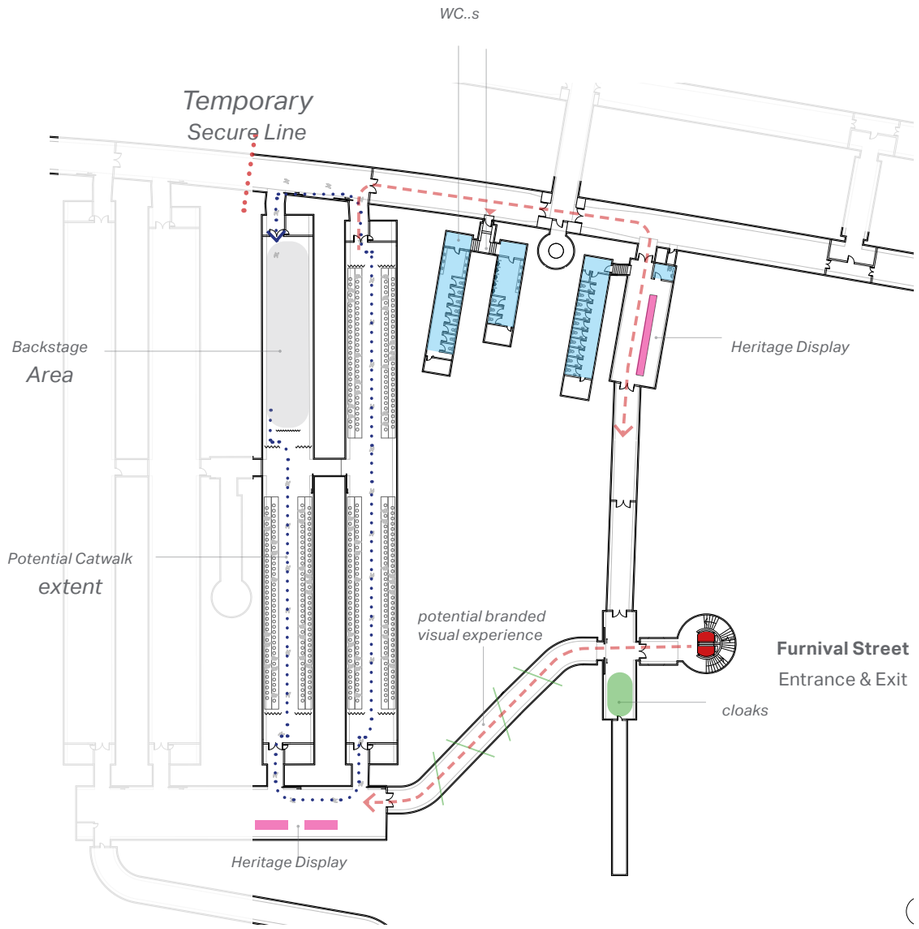
It is intended that the London Tunnels will be able to host a wide range of Cultural events in addition to their Heritage Experience. There will be opportunities to run partner events throughout the London Cultural Calendar which will attract a diverse audience and encourage return visits.

This indicative layout shows the potential to host a Fashion Show during biannual London Fashion Week in two of the Avenues.

It is assumed that this would take place outside key Heritage Experience hours.

Assumptions:

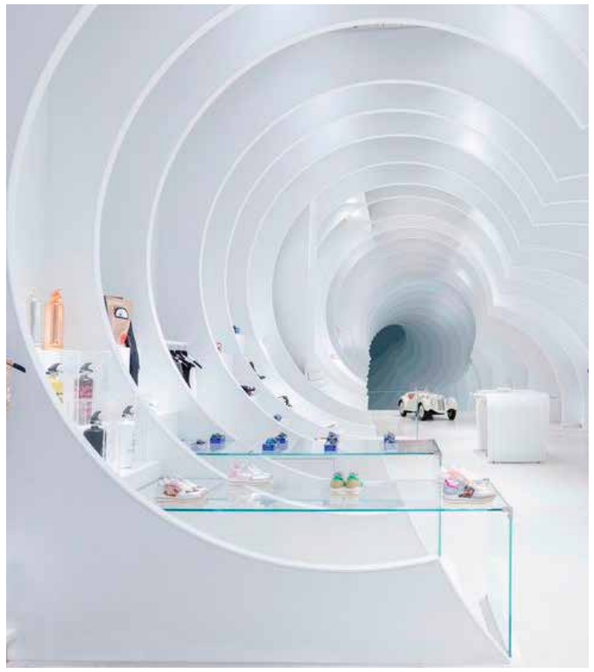
- Access assumed to be from Furnival Street.
- Integration of market leading AV technologies will allow for innovative and immersive installations and branding.
- Amenities will be upgraded and expanded to support and optimise the visitor experience.
- Backstage area provided within Avenue.
- Assume furniture stored within tunnels for ease of set up/breakdown.
- Beautifully lit heritage assets will complete the unique setting.
- Indicative capacity of 500pax.

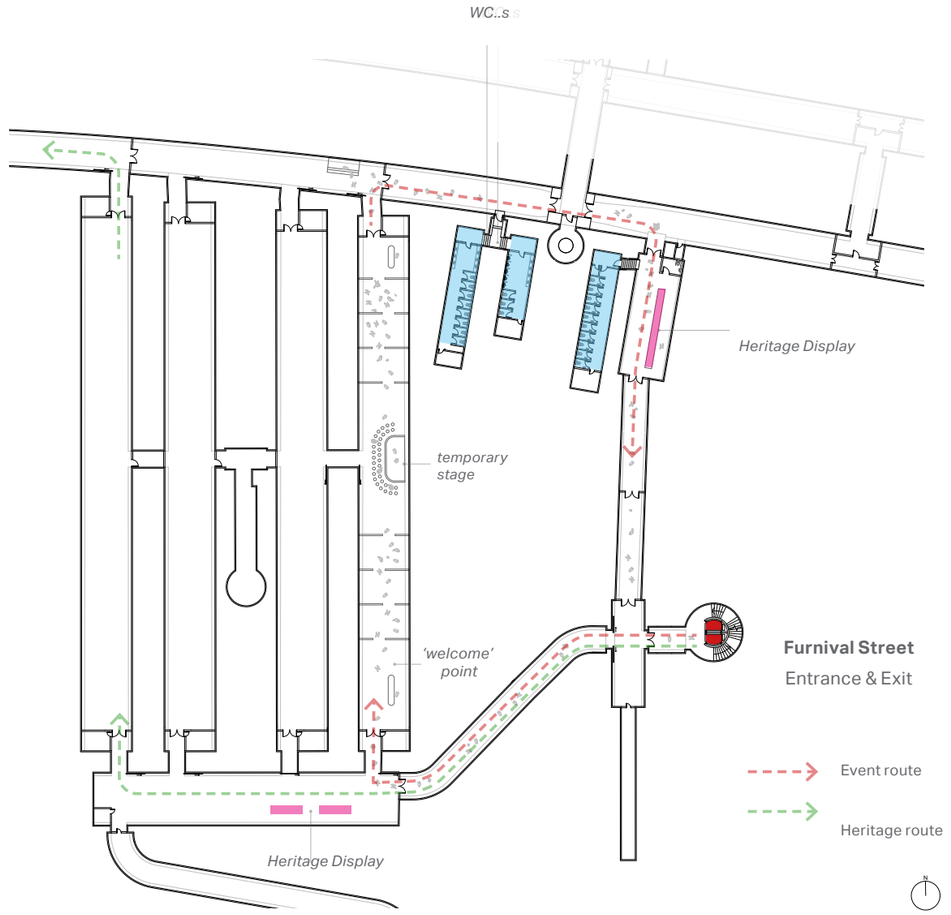


Event showing approximately 500 pax Fashion Event (seated)

NOTE: Assumes show is out of hours from Heritage Experience

4.4.10 Other Uses - Corporate Product Launch





- Event showing single tunnel used for Corporate event - Product Launch with Press presentation.
- Assume could be run concurrently with Heritage Trails & Temporary Exhibitions in other Avenues

This indicative layout shows the potential to host a corporate product launch and exhibition in one Avenue to coincide with London Design Week which happens annually in September.

Assumptions:

- Access assumed to be from Furnival Street.
- Integration of market leading AV technologies will allow for innovative and immersive installations and branding.
- Beautifully lit heritage assets will complete the unique setting.
- Amenities will be upgraded and expanded to support and optimise the visitor experience.
- Indicative capacity of 150pax.

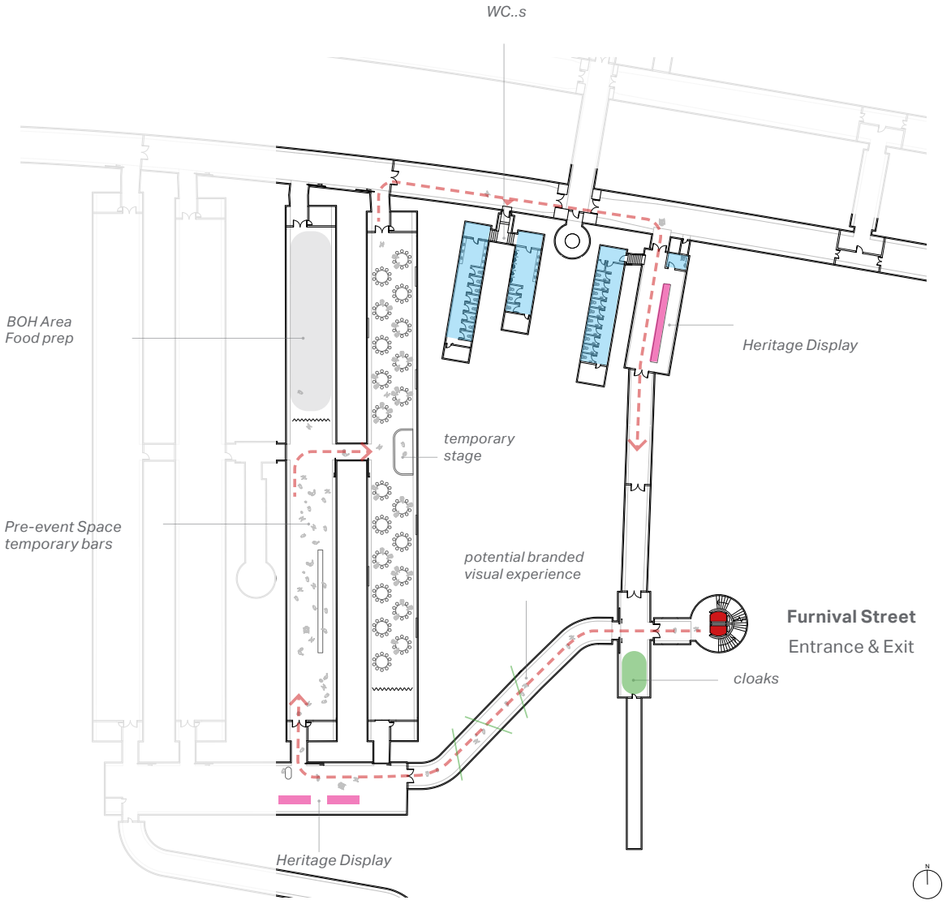
It is assumed that a launch event would take place outside key exhibition opening hours but an exhibition can run concurrently with Heritage Trails and Temporary Exhibitions in the other Avenues.

4.4.11 Other Uses - Corporate Gala Event

This indicative layout shows the potential to host a seated corporate event or gala event.

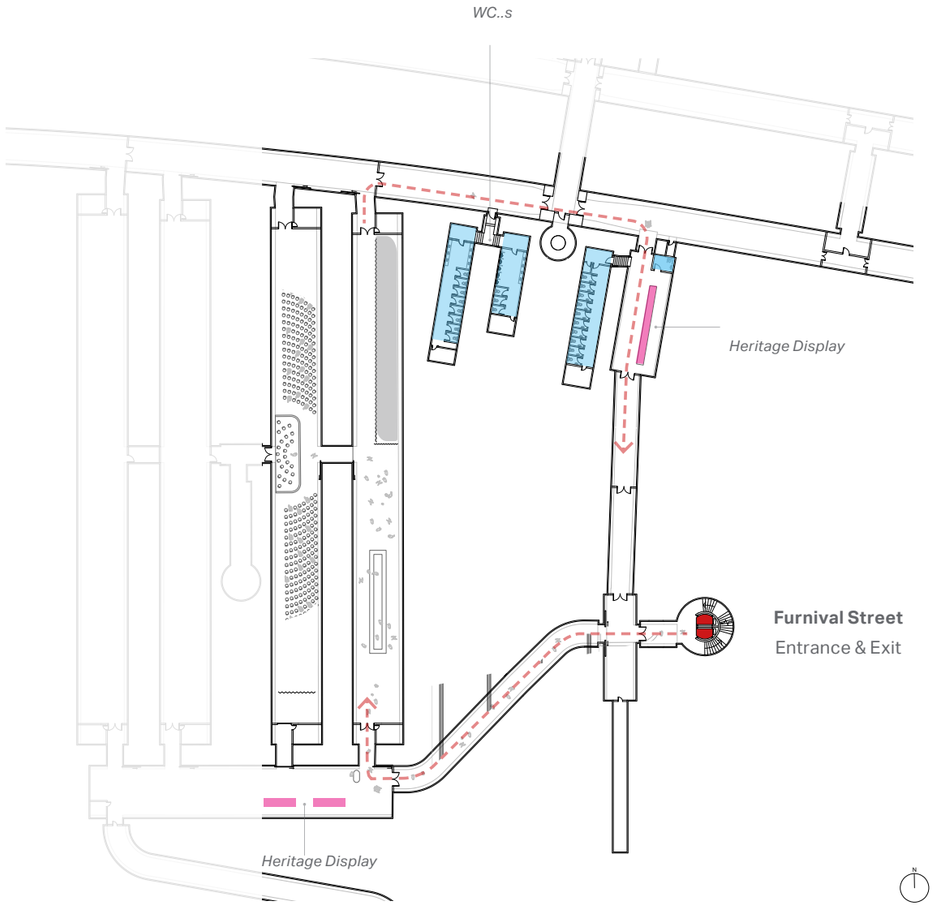
It is assumed that this would take place outside key Heritage Experience hours.

- Access assumed to be to and from Furnival Street.
- Integration of market leading AV technologies will allow for innovative and immersive installations and branding and quick set-up times.
- Assume furniture and temporary stage all stored within tunnels for ease of set up/breakdown.
- BOH area provided within Avenue for food prep. Assume this is basic reheat and plating delivered in suitable food trolleys by approved catering company.
- Beautifully lit heritage assets will complete the unique setting.
- Amenities will be upgraded and expanded to support and optimise the visitor experience.
- Indicative capacity of 250pax.



Event showing 220pax Gala Presentation (seated)

4.4.12 Other Uses - Music Event



Event showing 250 pax Music Event (seated)

This indicative layout shows the potential to host a seated musical performance.

It is assumed that this would take place outside key Heritage Experience hours.

- Access assumed to be to and from Furnival Street.
- Integration of market leading AV technologies will allow for innovative and immersive installations and branding and quick set-up times.
- Temporary bar area set up in adjacent Avenue.
- Backstage area provided within Avenue.
- Assume furniture stored within tunnels for easy of set up/breakdown.
- Beautifully lit heritage assets will complete the unique setting.
- Amenities will be upgraded and expanded to support and optimise the visitor experience.
- Indicative capacity of 250 pax.

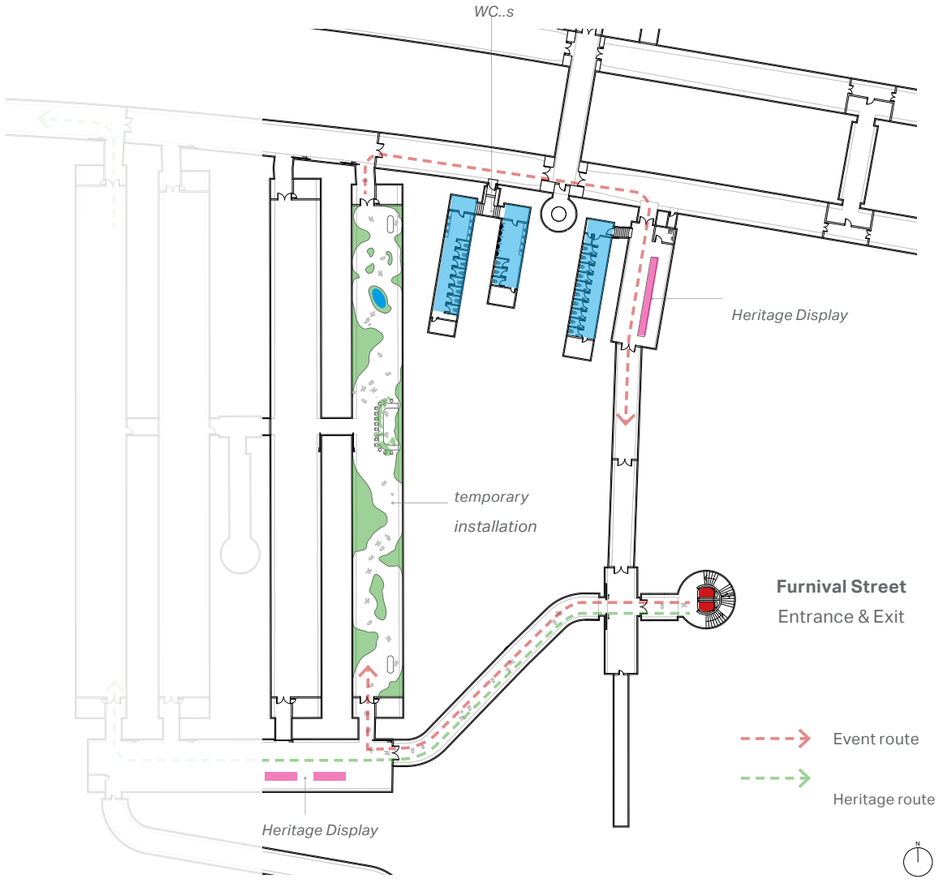
4.4.13 Other Uses - The Flower Show

This indicative layout shows the potential to host a Indoor Garden Exhibition during London the Chelsea flower Show on one Avenue.

Assumptions:

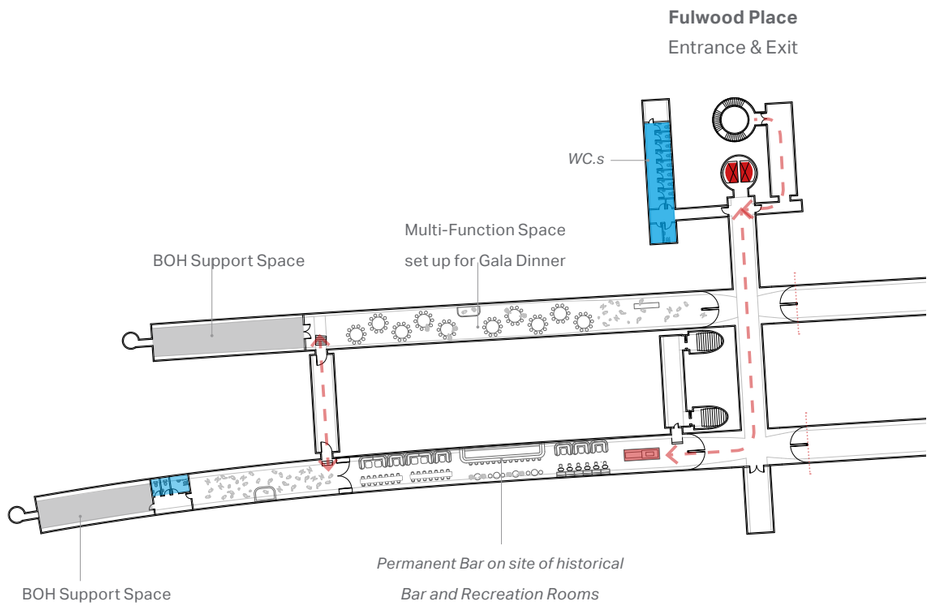
- Access assumed to be to and from Furnival Street.
- Integration of market leading AV technologies will allow for innovative and immersive installations and branding.
- Beautifully lit heritage assets will complete the unique setting.
- Amenities will be upgraded and expanded to support and optimise the visitor experience.
- Indicative capacity subject to exhibition design - max 250.

It is assumed that a launch event would take place outside key exhibition opening hours but an exhibition can run concurrently with Heritage Trails and Temporary Exhibitions in the other Avenues.



- Event showing single tunnel used for partner event with RHS Chelsea Flower Show
- Assume can be run concurrently with Heritage Trails & Temporary Exhibitions in other Avenues

4.4.14 Other Uses - Bar Corporate Gala Event



- Bar - showing 92 pax seated in eastern end plus flexible layout to western end
- Multi-Function Space showing 100 pax seated and a dance area

This indicative layout shows the potential to host a Gala Event using the Heritage Bar area in conjunction with the multi- function space in North Street West.

It is assumed that this would take place outside key Heritage Experience hours.

- Access assumed to be to and from Fulwood Place.
- Assume furniture stored within tunnels for easy of set up/breakdown.
- BOH area provided within Avenue for food prep. Assume this is basic reheat and plating delivered in suitable food trolleys by approved catering company.
- Beautifully lit heritage assets will complete the unique setting.
- Amenities will be upgraded and expanded to support and optimise the visitor experience.
- Indicative capacity of 200 pax.

4.4.15 MEP Strategy

The Streets are quite constrained in themselves so the main heritage and exhibition areas have been purposely designed to include the smallest amount of plant possible, in order to maximise the space for circulation and for the exhibition installations.

The tunnels themselves provide both the conditioned spaces and the distribution routes for the services, and therefore contain ventilation ductwork, heating and cooling pipework, electrical cables, domestic water pipework, sprinklers, and various other specialist systems such as fire alarms, communications cabling, and drainage.

Life safety systems which are also present in the tunnels include smoke extract, which uses the fresh air ventilation ductwork, and a stair and lobby pressurisation system, which serves the entrance/exit lobbies at tunnel level.

Cooling is provided by equipment located within the compartments they serve, fed with chilled water via pipework from Furnival Street.

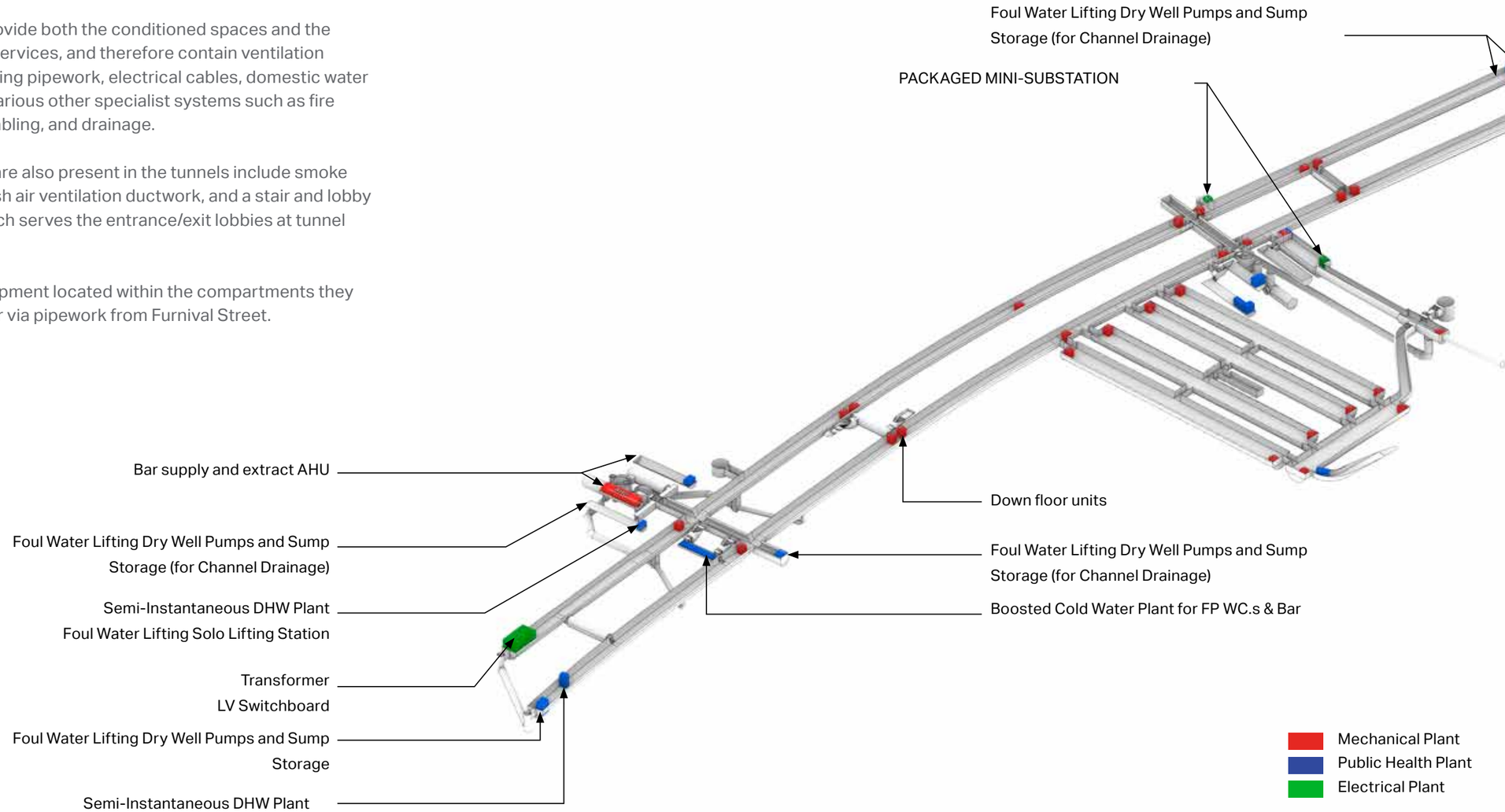


Diagram showing proposed locations of plant within tunnels

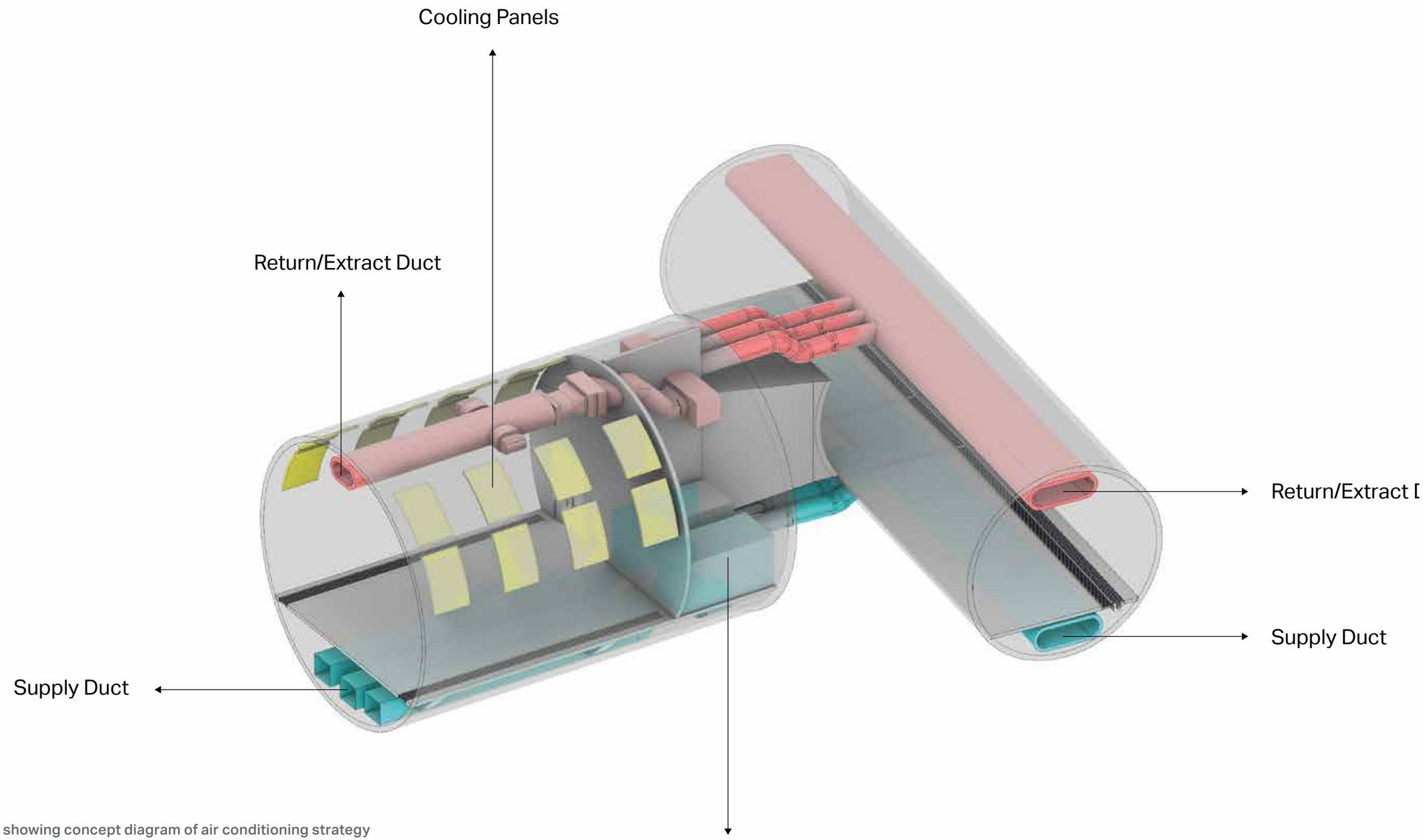


Diagram showing concept diagram of air conditioning strategy

4.4.16 Audio Visual and Technology

The temporary exhibition spaces in the Tunnels will provide a diversity of experiences for visitors described in the Cultural Strategy section of this statement.

The seamless integration of state of the art audio-visual technology will form a key element in the delivery of a successful immersive and interactive visitor experience, with a combination of LED screens, projectors and advanced sound system technology built to create best in class immersive experiences.

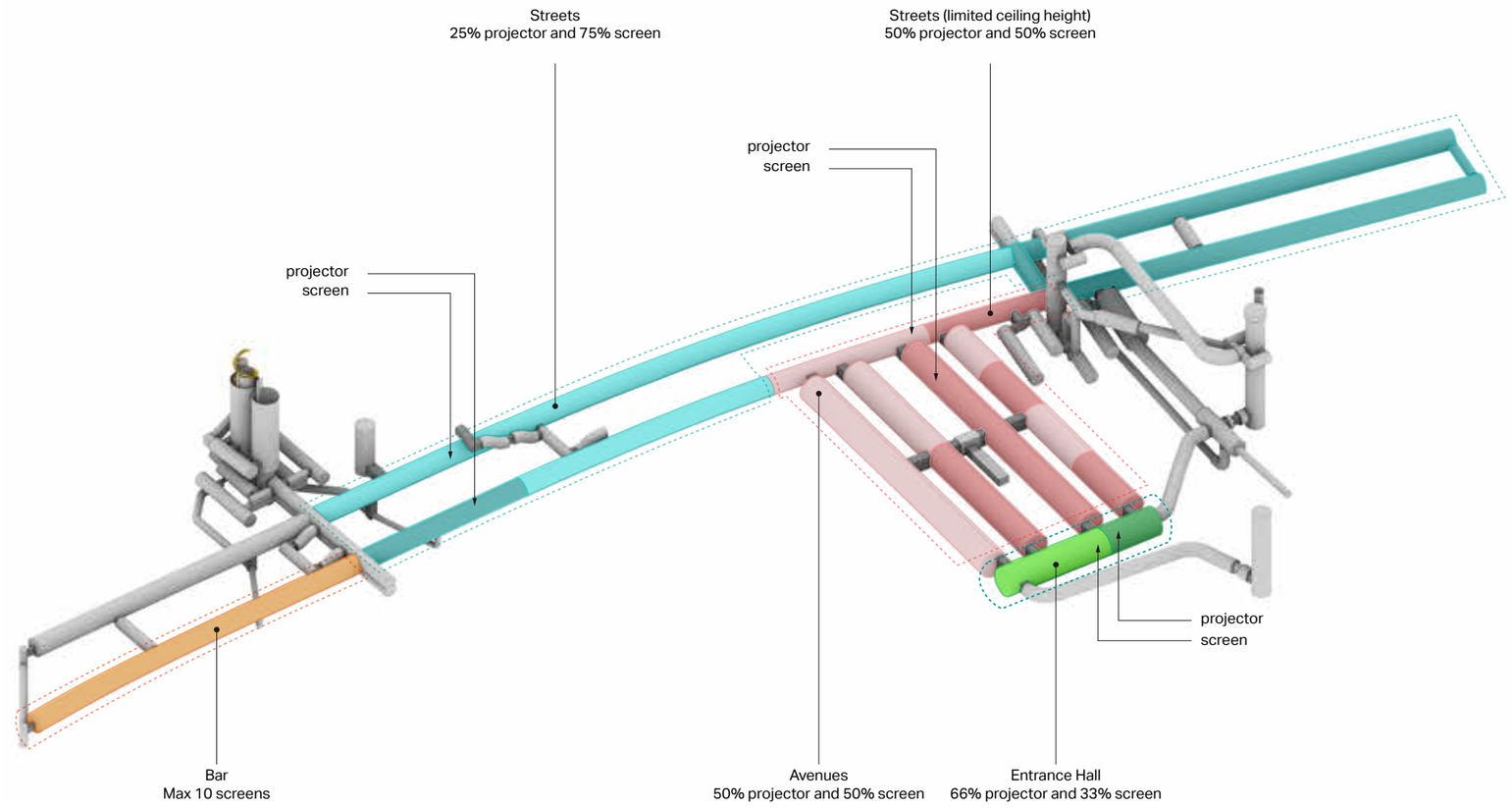
The diagram adjacent sets out how the various technologies are expected to be distributed within the Tunnels with the distribution shown representing the maximum expected provision that may be required for the immersive experiences.

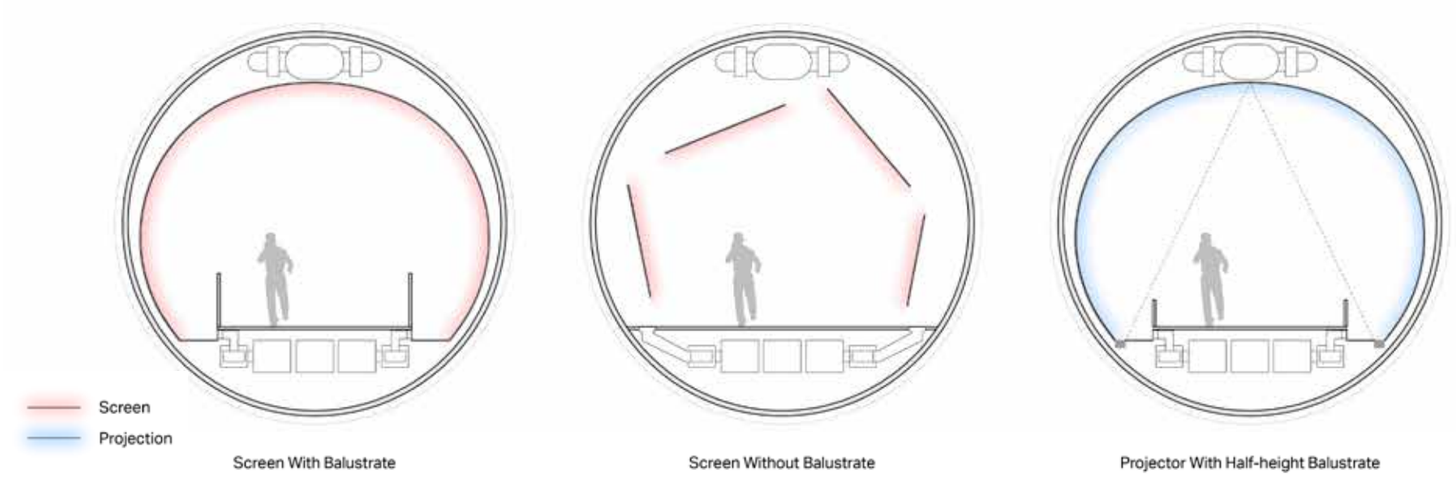
A screen management system installed on a converged information technology local area network will provide seamless management of content across the breadth of the tunnels.

The passive cabling system will use an optimal balance of fibre and copper wiring to deliver a high quality communication system while minimising embodied carbon and cable lengths.

Active equipment required for managing the communication and audio visual systems will be installed in an a Main Equipment Room (MER) adjacent to North Street.

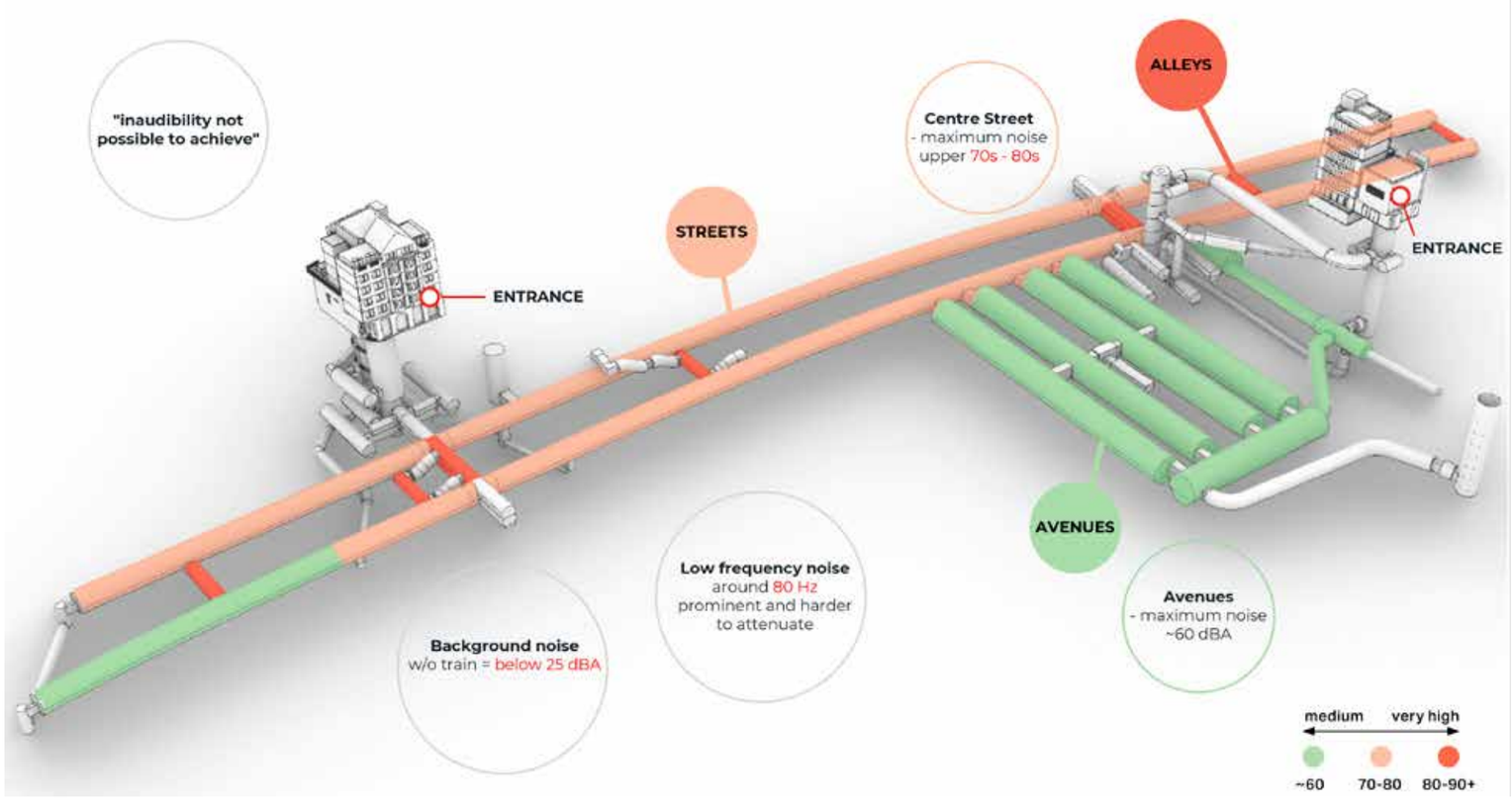
The network system will also provide WiFi connectivity throughout the Tunnel system to enable mobile phone connectivity throughout the site.





4.4.17 Noise Levels

Maximum $L_{Aeq,1sec}$ levels during short term measurements



The background noise levels within the Tunnels are typically very low (circa 25 dBA), however breakout noise from the Central Line tube trains which run above the Streets has significant noise impact within the Tunnels, particularly at lower frequencies (peak ranging between 80 –125 Hz), depending on the locations:

- 'North & South Street': maximum overall noise upper 70 – 80s dBA with lower freq noise around 95 dB.
- The 'Avenues': maximum overall noise up to around 60 dBA with lower freq noise around 75 dB.
- The proposed Bar area is slightly quieter with overall noise levels around 55 dBA.
- The 'Alleys' along the Centre Streets are the loudest parts of the Tunnel with maximum overall noise levels exceeding 90 dBA.

The overhead train frequency occurs as often as every minute and, although it does not last very long, due to the very high noise levels coupled with very low background noise levels within the Tunnels, it creates an acoustic environment that would not be suitable for uses that are particularly noise sensitive. Options for acoustic improvements are being explored and will be developed to reduce the impact of the train noise within the Tunnels, however elimination of the train noise will not be possible to achieve. It is intended to zone the heritage and cultural installations into quieter and livelier sections and where appropriate to mask the train breakout with background sound.

Vibration levels due to train pass-by within the Tunnels were measured to be insignificant.

Due to the location of the Tunnels, noise generated within the Tunnels will not cause adverse noise impact to the neighbouring above-ground premises.

Operational noise generated above ground at Fulwood Place and 39 – 40 Furnival Street (i.e. building services) will be controlled adequately to meet the City of London and London Borough of Camden's noise policies, thus minimising adverse noise impact to the neighbouring premises.

4.4.18 Structure

The Kingsway Exchange tunnels broadly comprise two long “Streets”, north and south and several “Avenues”. There are also numerous stub tunnels which were used to provide toilet and first aid facilities. The tunnels vary in diameter throughout the network and are lined with a mix of pre-cast concrete and cast-iron units. Tunnel junctions have been constructed utilising a cast-iron opening frame surrounded in a mass concrete block. Where tunnels of different diameters meet, mass concrete headwalls have been used. The design of both junctions and headwalls are currently unknown and further investigation work will be required to determine feasible repair options if required.

In general, most of both Streets are constructed from concrete linings except at areas where other tunnels intersect with the Streets and cast-iron lining is used to form the openings. All the Avenues and Alleys are constructed utilising cast-iron linings.

All of the shafts are assumed to be constructed using cast-iron linings. It appears that the openings from the shafts into the tunnels are formed from a combination of cast-iron opening sets and mass concrete although this should be confirmed with surveys.

WSP undertook a tunnel condition survey (Report - 70106185/GEO/RP-0001) using the 3D “Matterport Survey” in August 2023 and reported that the condition of the tunnel network varied, and where it was possible to see the lining, there were areas of leakage or areas of cladding which were showing evidence of leakage. Some areas of cast-iron lining were reported to be corroded potentially because of water infiltration. It was also reported that some of the concrete headwalls and junctions in the tunnel network showed cracks of varying extents.

The shafts in the tunnel network were not covered by the Matterport Survey although the condition survey noted that, due to the major corrosion of items in shaft bottoms, significant leakage in the shafts was present.

One of the major issues in relation to the tunnel network is the presence of asbestos containing materials within the system. Due to the age of the tunnels all of the cladding and partitioning materials currently in the tunnel, preventing proper access to determine the condition of the tunnel lining, may contain asbestos.

It is also known that the tunnel linings will have made use of asbestos caulking, a waterproofing material used in the joints between the segments of both pre-cast concrete and cast-iron linings.

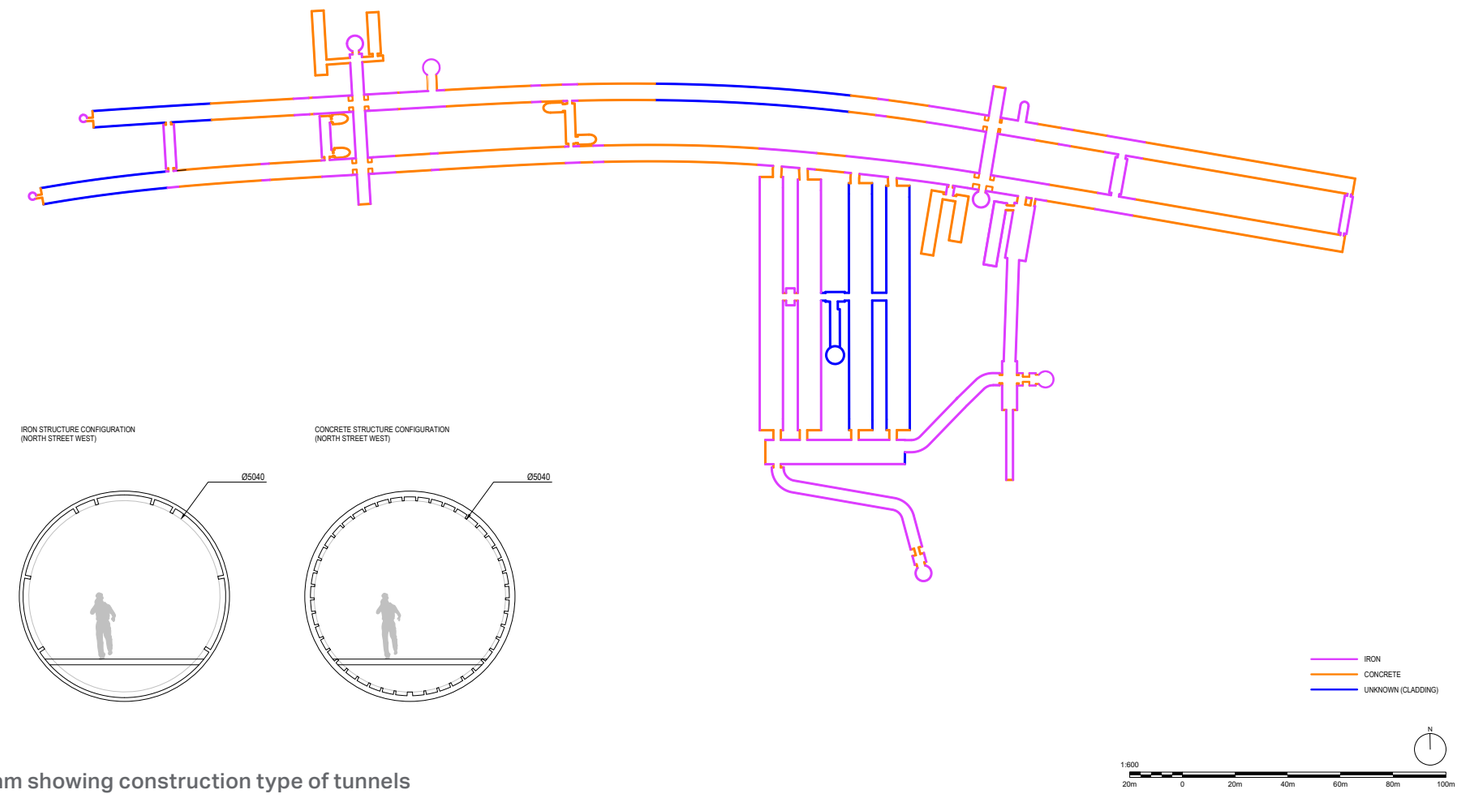


Diagram showing construction type of tunnels

Cast iron lining

Pre-cast concrete lining

Laminate lining (inside pre-cast concrete)

4.4.19 Internal linings

The tunnels were decommissioned in the late 90s. The current condition of the tunnels serves as a “time capsule,” retaining the distinctive atmosphere of the time they were decommissioned. Whilst much of the mechanical and electrical plant equipment required during the historical operation of the tunnels remains in place, much of it is no longer operational.

The absence of regular maintenance has hastened the deterioration of the structure, with significant leaks occurring, especially in the cast iron tunnels. Several sections of the tunnels still retain the original cladding, concealing the full extent of the leakage issue. The internal finishes have to provide solution to the current water infiltration problem and the presence of asbestos.

For this, the scheme proposes two solutions based on 2 finishes:

Exposed structure: - No Lining

If the intention is to expose the tunnel lining the asbestos will need to be removed and replaced.
Initial water ingress may be controlled with a campaign of grouting behind the lining. Usually, a cementitious grout is injected behind the lining reducing water paths. For wetter areas use of a material that expands in the presence of water, such

The joints in the lining will need to be sealed. This may be possible by replacing the join material or injecting sealing materials, such as Tampur into the joints.

A significant water path in both concrete and cast iron lining is through the bolt holes. Gaskets and grommets in bolt holes may need to be replaced with modern equivalents.

Cast-iron tunnel linings will need to be cleaned of all paint and loose corrosion before being coated. One of the issues with cast iron lining is the loss of section due to corrosion. The lining in this tunnel does not appear to have suffered from too much corrosion but to extend the life of the tunnel water infiltration will need to be significantly halted.

Concrete linings can be cleaned and painted in a similar way to any other tunnel structure as long as the water sealing processes described above for cast iron linings have been carried out.

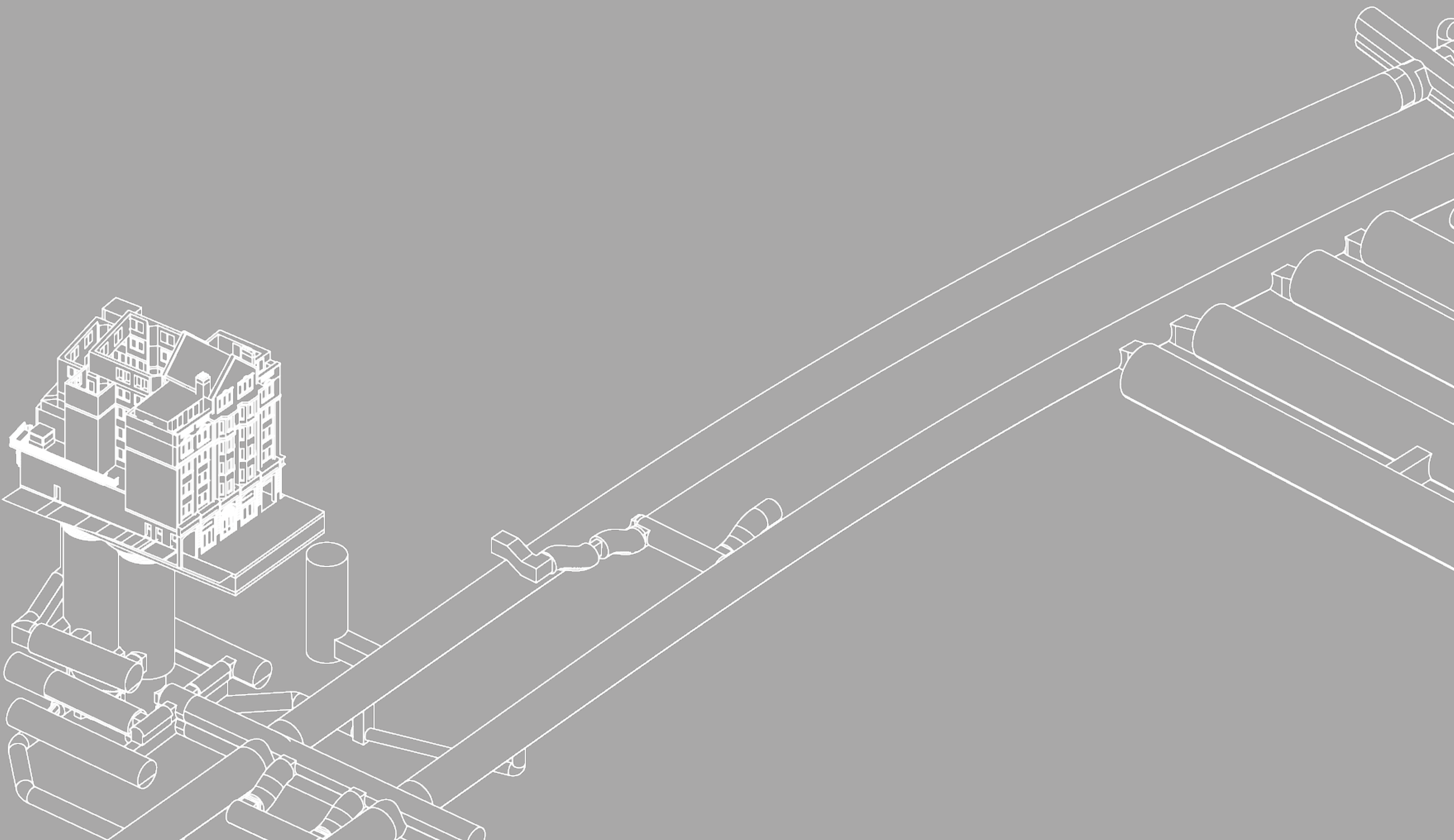
Covered Areas - Internal Lining

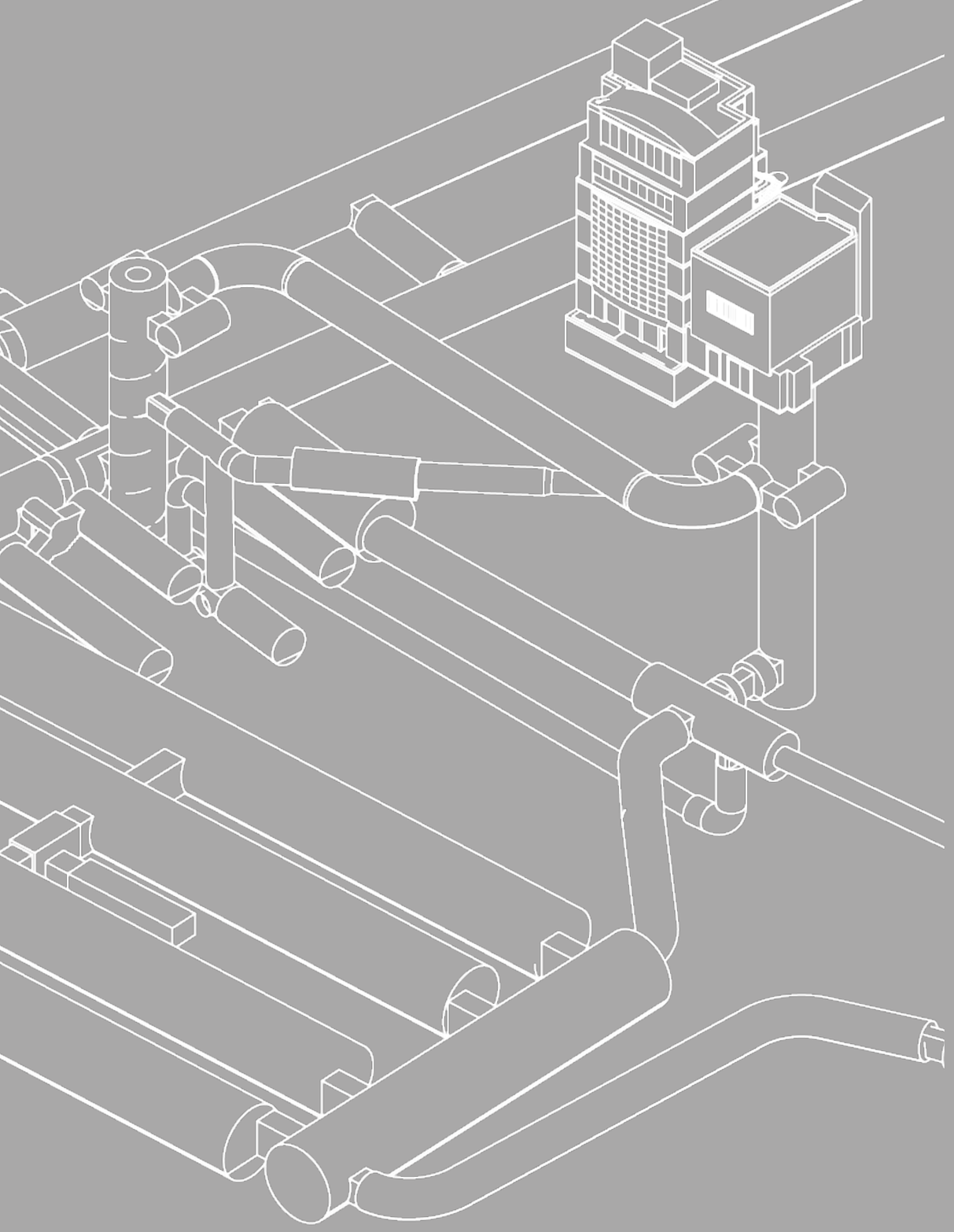
The tunnels could be internally lined using vitreous enamelled panels fixed to a stainless steel or galvanized steel frame. These frames are typically fixed to the tunnel lining although they could also be freestanding.

These panels are typically used in road tunnels and are easy to clean and corrosion resistant.

The canopy would be used to direct water infiltrating the lining down to floor level drains without impacting on any internal infrastructure. The resulting finish is clean to look at but hides the original lining. Inspection panels would be needed to allow condition surveys of the tunnel lining at regular intervals.

It is also known that the tunnel linings will have made use of asbestos caulking, a waterproofing material used in the joints between the segments of both pre-cast concrete and cast-iron linings. Joints sealed with asbestos caulking shall be cut back as far as practicable to remove asbestos near the inside face of the lining. The joints shall then be resealed with an appropriate rubber based joint sealant to prevent further asbestos exposure.





4.5 Area Schedules

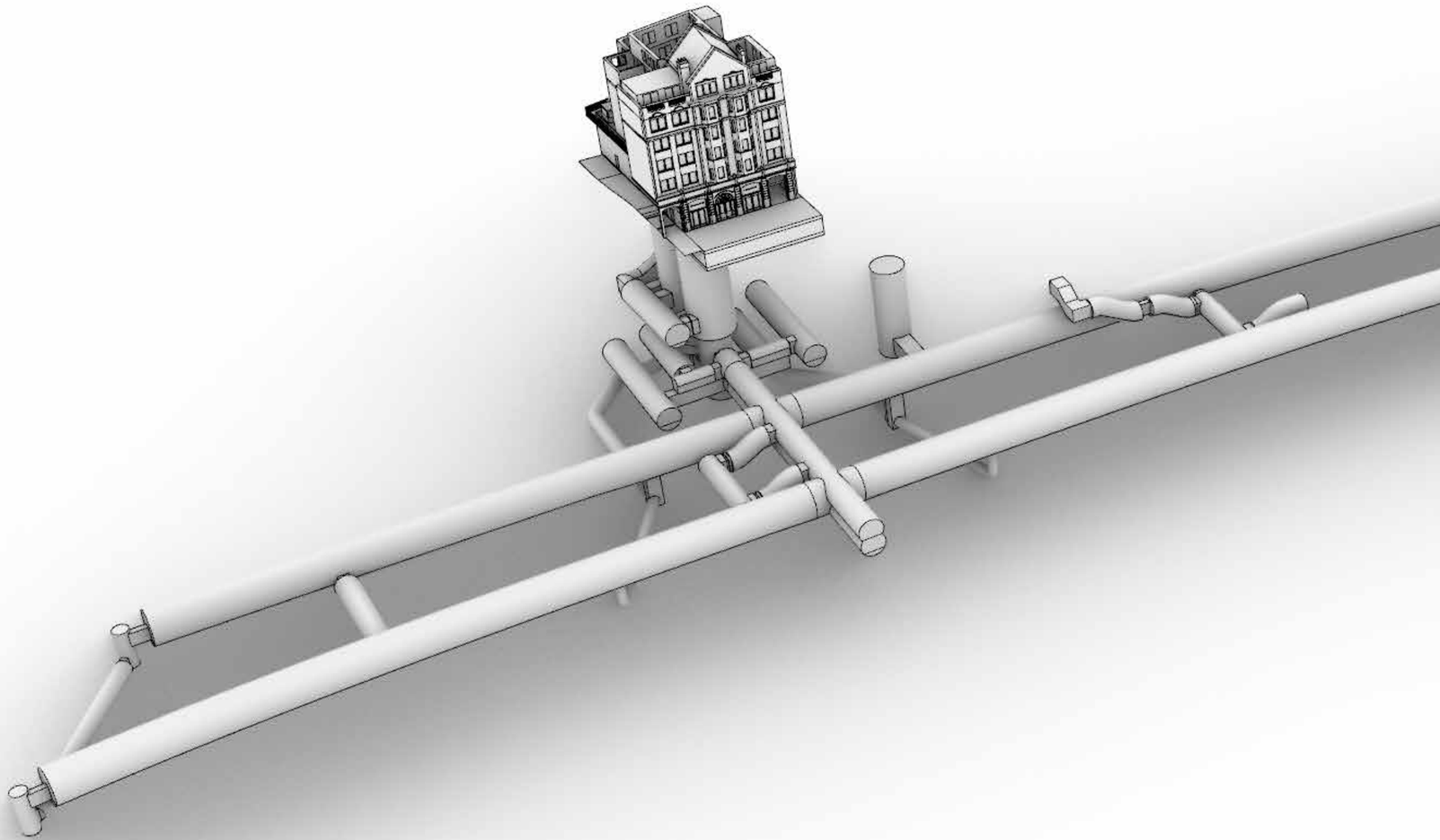
4.5.1 Area Schedules

	38-41 Furnival Street		Split Between Camden & CoL	
Level	**GEA (m2)**	**GIA (m2)**	**CoL**	**Camden**
B3	404	290	290	-
B2	404	290	290	-
B1	404	344	344	-
GF	358	309	309	-
1F	358	323	323	-
2F	358	262	262	-
3F	353	323	323	-
4F	205	164	164	-
5F	176	162	162	-
Total	**3,020**	**2,467**	**2,467**	**-**

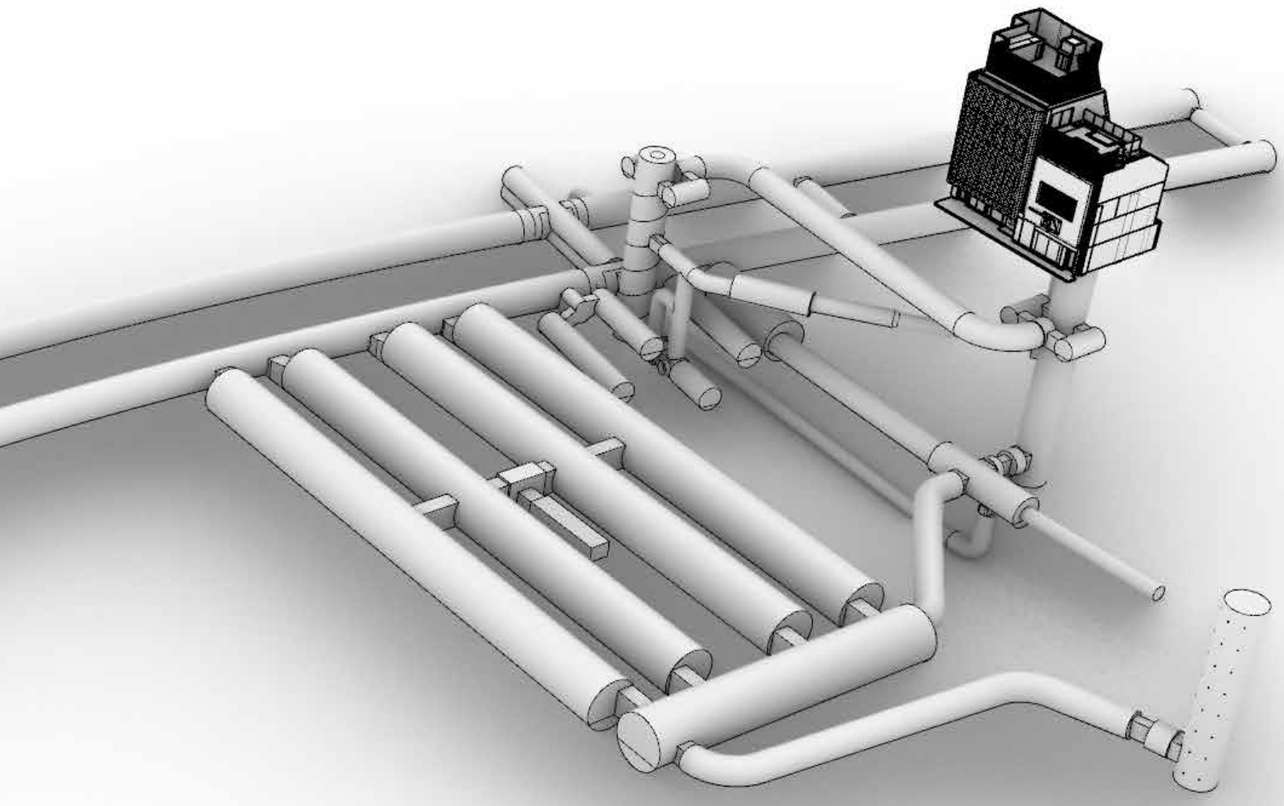
Terrace - 79m2

	Fulwood Place (31-33 High Holborn)		Split Between	
Level	**GEA (m2)**	**GIA (m2)**	**CoL**	**Camden**
B	94	82	-	82
0	292	247	-	247
Total	**386**	**329**	**-**	**329**

Fulwood Place
(31-33 High Holborn)



38-41 Furnival Street



The London Tunnels
(Tunnel Complex)

	Tunnels Complex		Split Between	
Level	**GEA (m2)**	**GIA (m2)**	**CoL**	**Camden**
Level -1	216	135	53	82
Level 0	8,299	6,707	4,350	2,357
Level +1	738	555	351	204
Level +2	196	147	72	75
Level +3	379	285	285	-
Total	**9,828**	**7,829**	**5,111**	**2,718**
Ventilation ducts (Not included in GIA)				
Level -1	760	475	475	-
Level 0	364	250	250	-
Level +1	85	64	64	-
Level +2	-	-	-	-
Level +3	21	16	16	-
Total	**1,230**	**805**	**805**	-

	Summary		Split Between	
	GEA (m2)	**GIA (m2)**	**CoL**	**Camden**
38-41 Furnival Street	3,020	2,467	2,467	-
Fulwood Place (31-33 High Holborn)	386	329	-	329
Tunnel Complex	9,828	7,829	5,111	2,718
Total	**13,234**	**10,625**	**7,578**	**3,047**