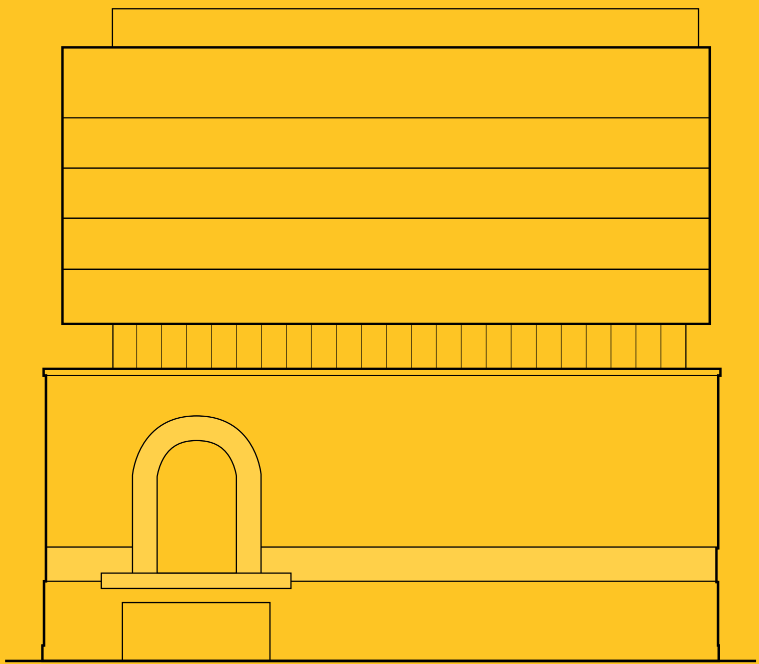

SAVILLE THEATRE

135 SHAFTESBURY AVENUE

STRUCTURAL REPORT

105465-PEF-ZZ-XX-RP-S-007-P02

PELL FRISCHMANN

Report Ref.	105465-PEF-ZZ-XX-RP-S-007-P02
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Executive Summary	
Site name	Saville Theatre
Location	135-149 Shaftesbury Avenue, London, WC2H 8AH, UK
Development proposals	Part demolition, restoration and refurbishment of the existing Grade II listed building, roof extension, and excavation of basement space, to provide a theatre at lower levels, with ancillary restaurant / bar space (Sui Generis) at ground floor level; and hotel (Class C1) at upper levels; provision of ancillary cycle parking, servicing and rooftop plant, and other associated works.
Site history	The site was occupied by terraces of commercial properties (with residential accommodation above) prior to the Theatre opening in 1931. The Grade II listed Building was developed in the early 1930s and opened as 'Saville Theatre' in 1931. The theatre was internally redeveloped in 1970 to a cinema with four screens. The multi screen cinema was subsequently altered in the early 2000's. The site remains unchanged to present day.

1 Introduction

Pell Frischmann has been commissioned by YC Saville Theatre Limited (the *client*) to prepare this Structural Report for the proposed 'Saville Theatre' redevelopment at 135-149 Shaftesbury Avenue, Camden, London, as shown in Figure 2-1.

This reports outlines a brief summary of:-

- The existing structure history
- Proposals for alterations to the existing structure including demolition, dismantling and reinstatement
- New construction work proposals

1.1 Proposed development

The Proposed Development comprises the part demolition, restoration and refurbishment of the existing Grade II listed building, roof extension, and excavation of basement space, to provide a theatre at lower levels, with ancillary restaurant / bar space (Sui Generis) at ground floor level; and hotel (Class C1) at upper levels; provision of ancillary cycle parking, servicing and rooftop plant, and other associated works."

2 The site

2.1 Site location and description

The site is bound by the following roads New Compton Street (northwest), St Giles Passage (northeast), Shaftesbury Avenue (southeast) and Stacey Street (southwest) and mainly surrounded by commercial buildings except for the park to the northwest (beyond New Compton Street). The site is in the London Borough of Camden, London.

The 'Odeon Covent Garden' cinema onsite comprises a seven-storey building (including a double storey basement) which occupies the entire site area. Ordnance Survey (OS) mapping indicates that Shaftesbury Avenue lies at an elevation of between 22.6 and 22.7mAOD (above Ordnance Datum) adjacent to the site.

Details of the history of development on this site may be found in the Land Contamination Risk Management preliminary risk assessment Report 105465-Pef-Zz-Xx-Rp-Gg-600001_P01 Saville Theatre PRA.

Details of site geo-environmental information may be found in the Land Contamination Risk Management preliminary risk assessment Report 105465-Pef-Zz-Xx-Rp-Gg-600001_P01 Saville Theatre PRA

Details of the site geotechnical information may be found in the Basement Impact Statement Report '106885-PF-ZZ-XX-RP-C-0005'.

Figure 2-1 Site location

Site location

Ordnance Survey (OS) Open Mapping

Google Satellite Image

3 Existing Building Structure

3.1 Historical Timeline

The former Saville Theatre,, at 135-149 Shaftesbury Avenue is a grade II listed building. It was built in 1930-1931 as a three-level theatre and opened in 1931. The building was designed by architect T.P Bennett & Son. The building was damaged during the blitz in 1941 but later restored.

We are in possession of a series of historical architectural drawings relating to the original 1931 building structure. Whilst architectural in nature they provide some indication of how the building was structured. The original building superstructure is a steel frame structure with an external load-bearing solid masonry façade which encases the outer steel columns and beams. The substructure comprised a two storey basement formed using large reinforced concrete retaining walls, up to 1.2m thick in some places, to the perimeter of the building footprint. These act as basement retaining structures, as well as providing vertical support to the original theatre construction.

In 1970, the Building opened as a two-screen ABC Cinema and as a consequence the interior of the building was entirely remodelled. The Site was taken over by Odeon in 2001 and reconfigured as a four-screen cinema, the layout which is visible today. This precipitated a subsequent refit, altering the cinema configuration.

This remodelling appears to be predominately formed using a steel frame. The existing staircases and floor plates to the north of the original auditorium were retained as part of the cinema refit works and currently provide back of house facilities for the cinema.

We are not in possession of structural information relating to the cinema refit works in the 1970s, nor subsequent refit in the early 2000s. As a result, we are unable to state with certainty exactly what remains of the original 1931 building structure.

Visual observations, as a result of numerous site visits, indicate that the existing cinema structure is structured using a steel frame set within the old auditorium area. It is assumed that the façade, in its current configuration following remodelling works, is tied back to the new steelwork, providing lateral stability to the retained masonry.

We do not have any details of new foundations created as a result of the cinema refits either in the 1970s or early 2000s. It is our assumption, based on visual observations, that support to the newer cinema steel frame is provided using discreet reinforced concrete pad foundations. It is unlikely, considering the magnitude of applied vertical clouds, that these foundations would have required to be piled.

As a result of these two large renovation projects our observations indicate that the majority of the original steel frame has been replaced. It is possible, however, that some minor sections of the original 1930s steel frame remain in the façade, the rear office areas and in the light well areas.

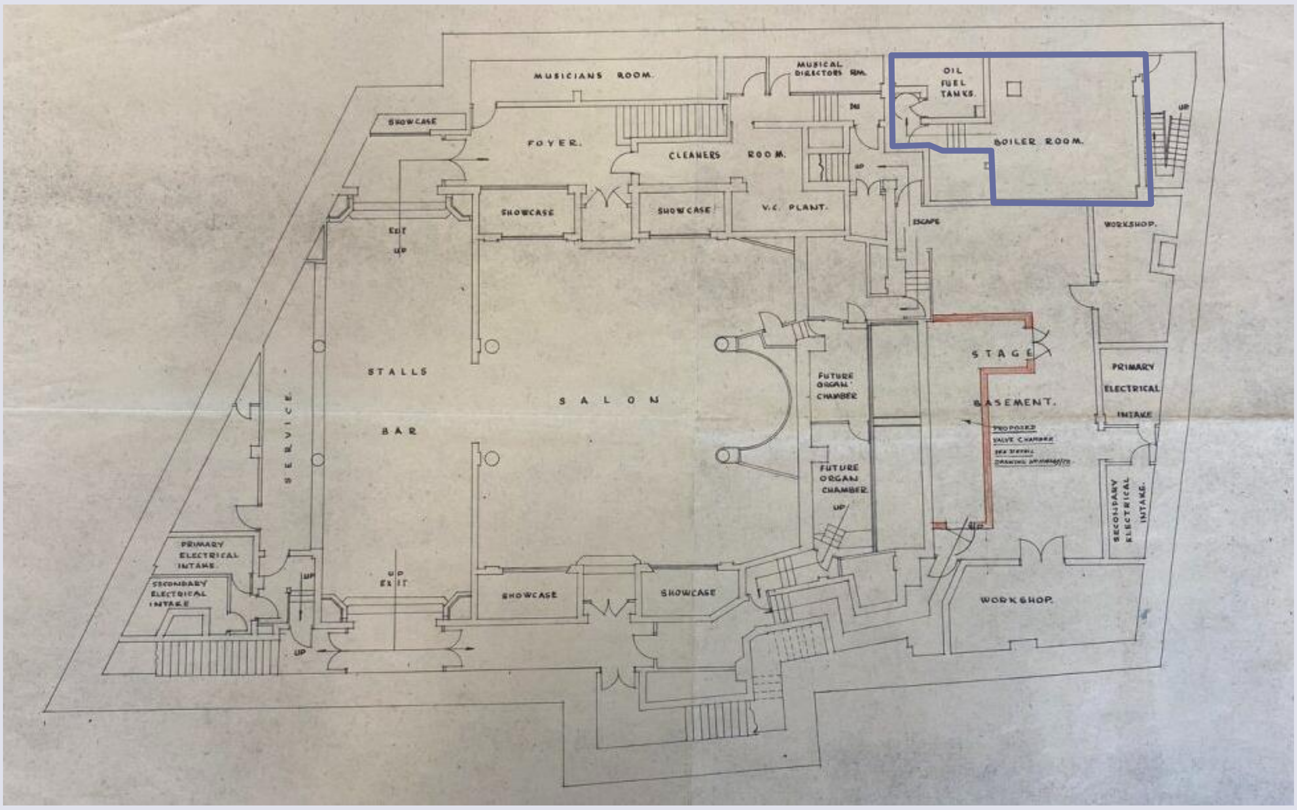
3.2 Existing structure condition

The Saville Theatre was constructed just over 90 years ago. The majority of the original internal framing was removed in the 1970's and 2000's refit or will be removed as a result of demolition to facilitate this development.

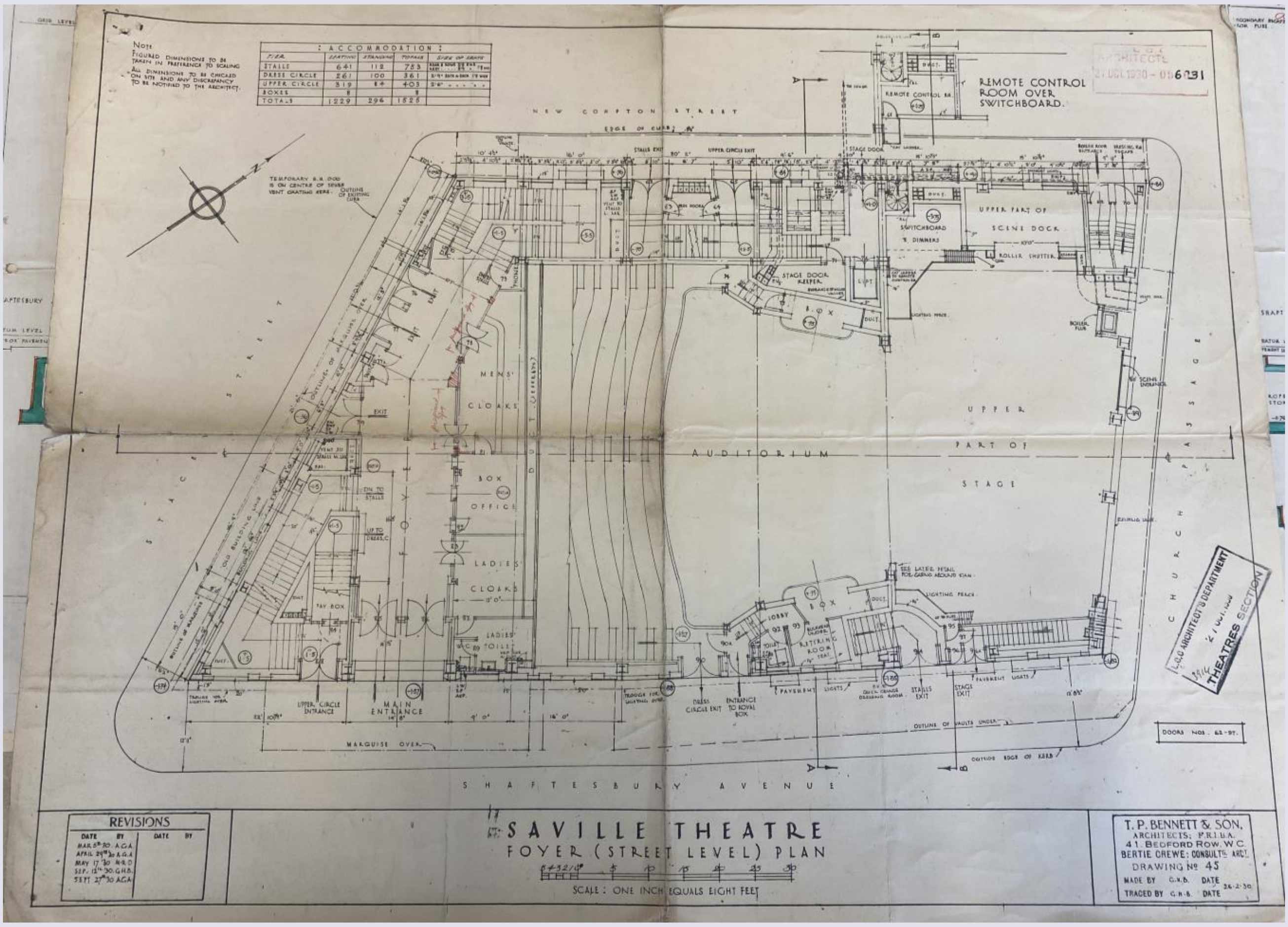
The condition of the external masonry wall and associated cladding components has been assessed as part of earlier Façade Condition Reporting. This indicates some deterioration to the façade. This will be addressed by localised repair and restoration work.

There is evidence of water ingress within the existing basement areas. It has not been ascertained as to whether this water ingress is entering the building via the perimeter wall construction or through the floor. However the new works, as well as removing the existing basement slab construction, will include the incorporation of repairs to any retained basement structures and the provision of new lining walls to meet the waterproofing requirements of the basement accommodation as outlined in Section 4.5.3 Waterproofing strategy.

Figure 3-1 A selection of 1930's archive drawings

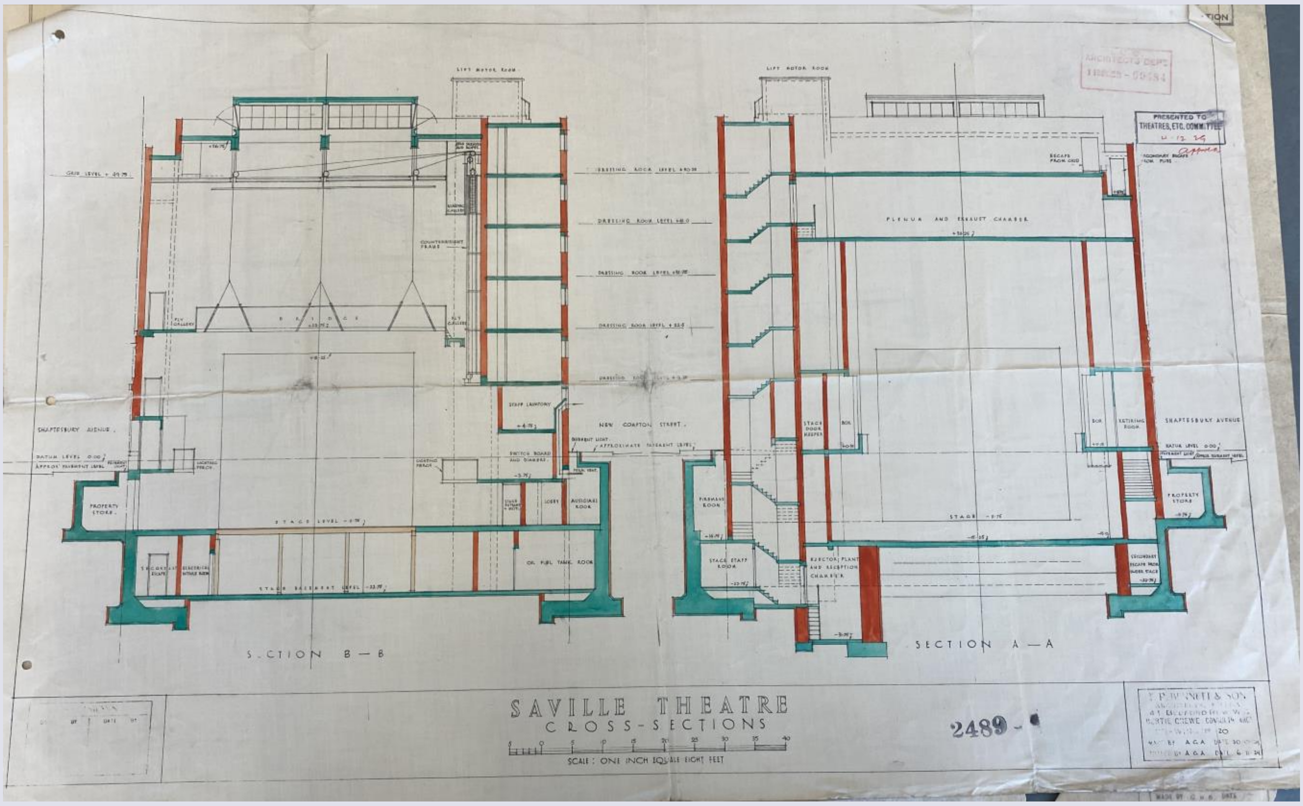


Lowest level - basement plan (May 1950) indicating Bar, Salon and back of house facilities

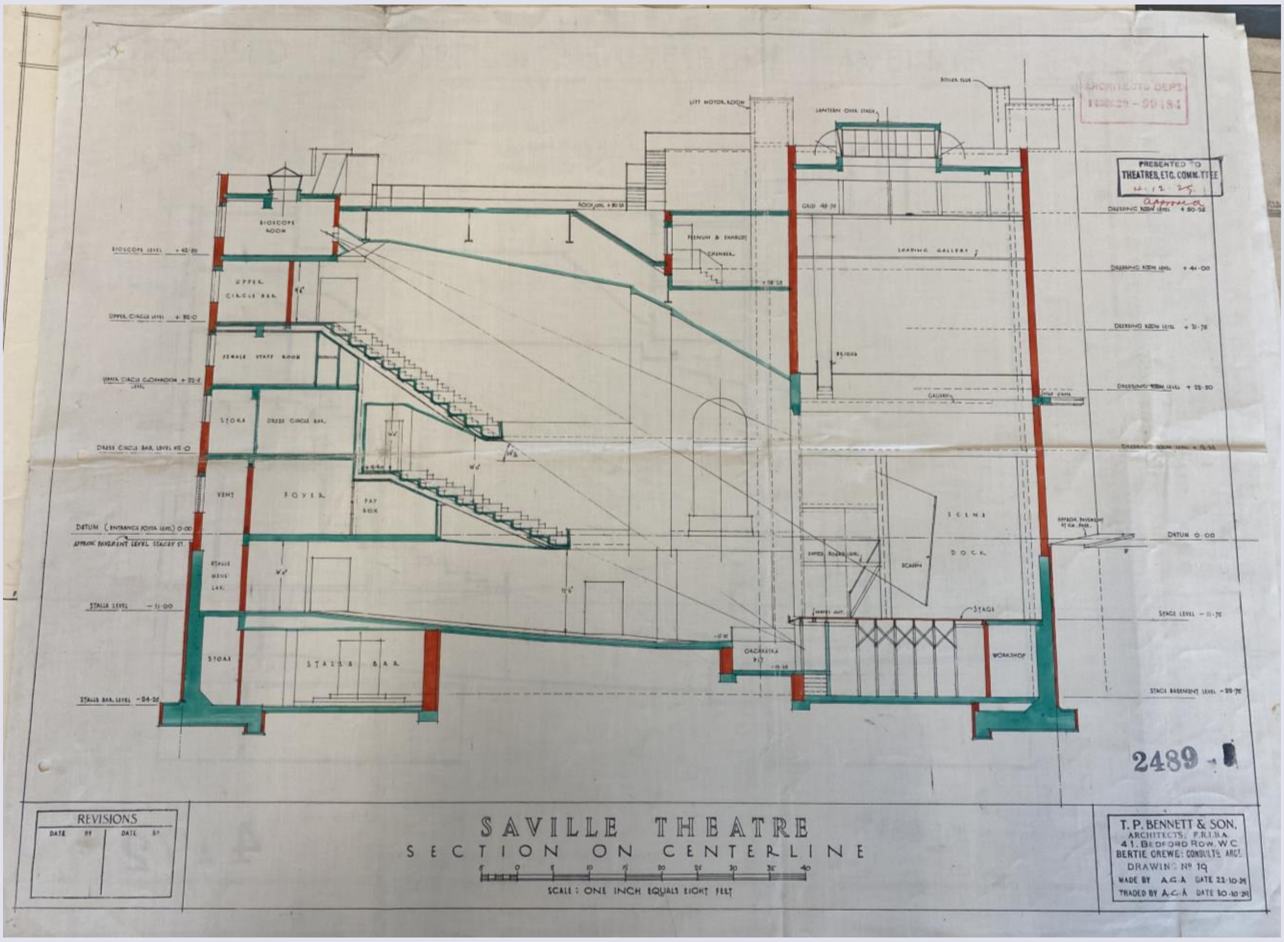


Street level plan (1930) indicating auditorium and circle

Figure 3-1 A selection of 1930's archive drawings

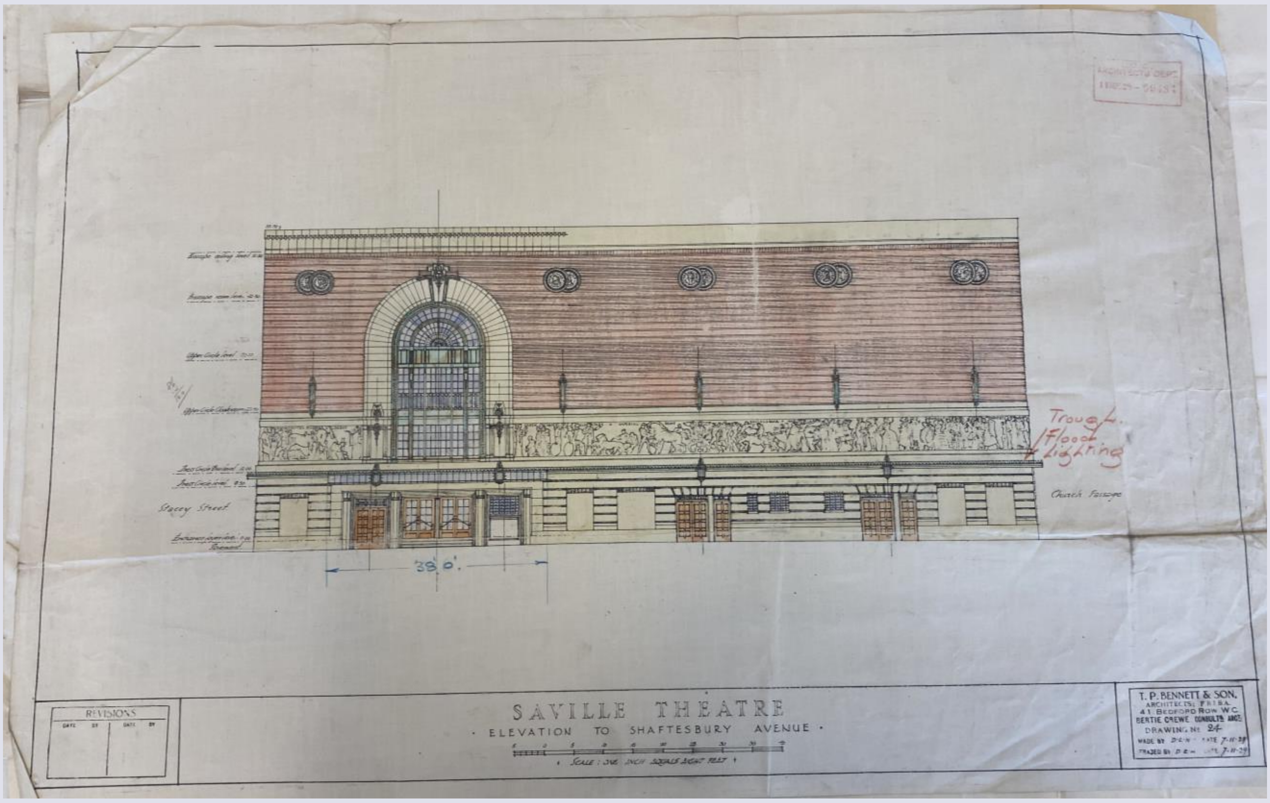


Overall west facing and east facing sections (1930)



Overall north facing sections (1930)

Figure 3-1 A selection of 1930's archive drawings



South elevation (1930)

4 Proposed development works

4.1 Introduction.

The main structural works, detailed further in the section, are as summarised below. The proposed redevelopment includes the demolition of the internal walls/structure, retaining the existing external façade and extending/deepening the existing basement (from two to four storeys) to facilitate the construction of a new multi-storey hotel and performance auditorium area with associated front of house facilities for both. Masterplan extracts are included in Figure 4-1.

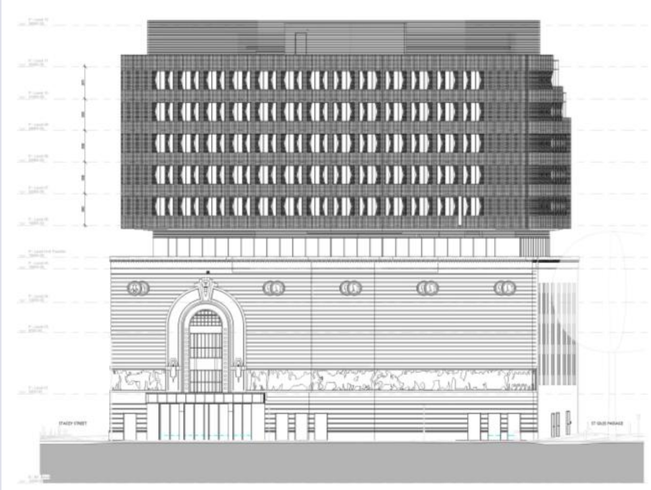
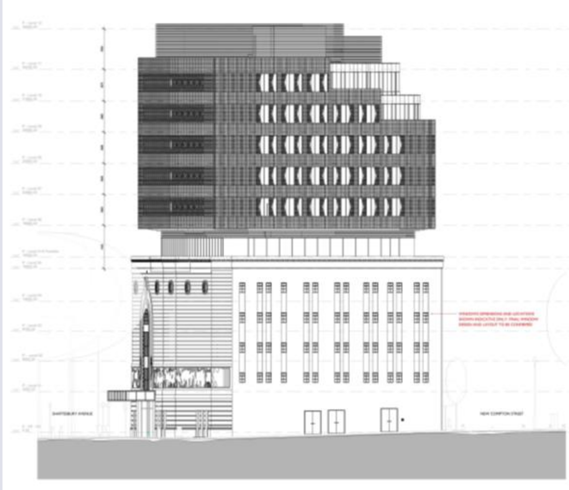
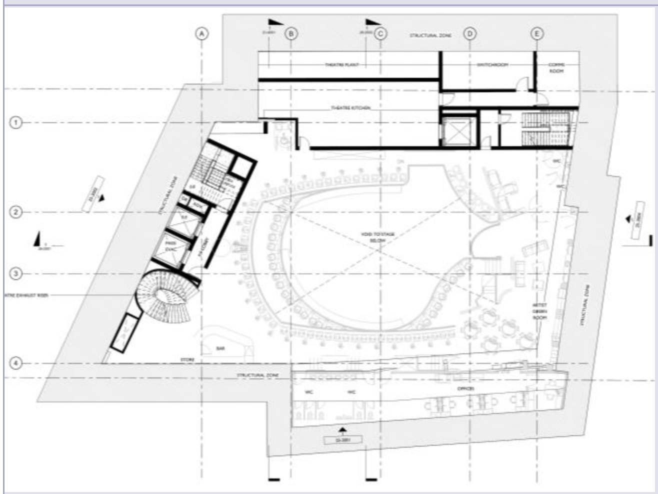
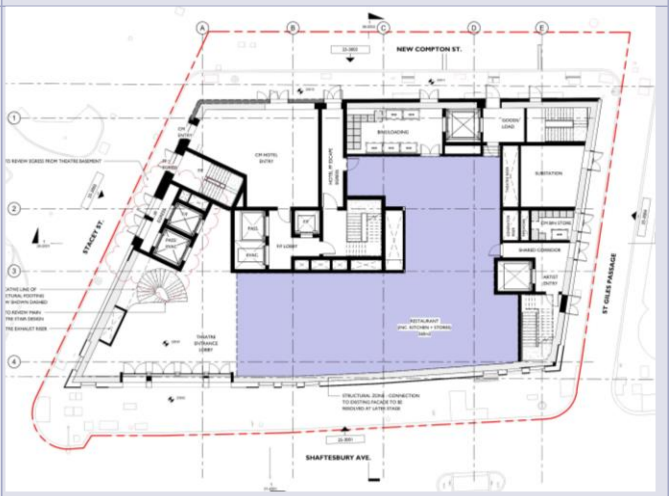
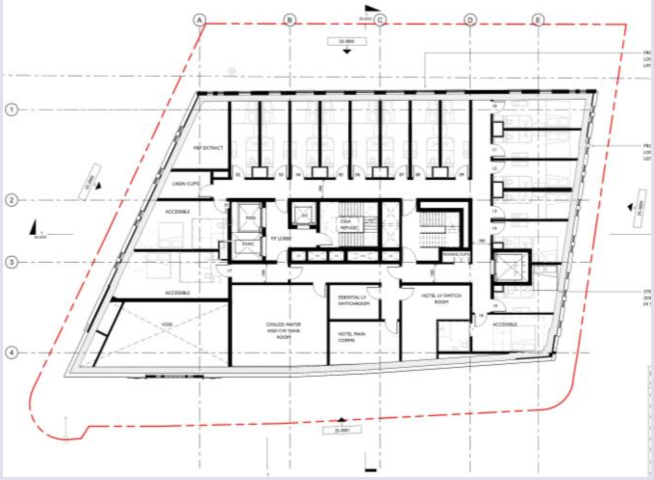
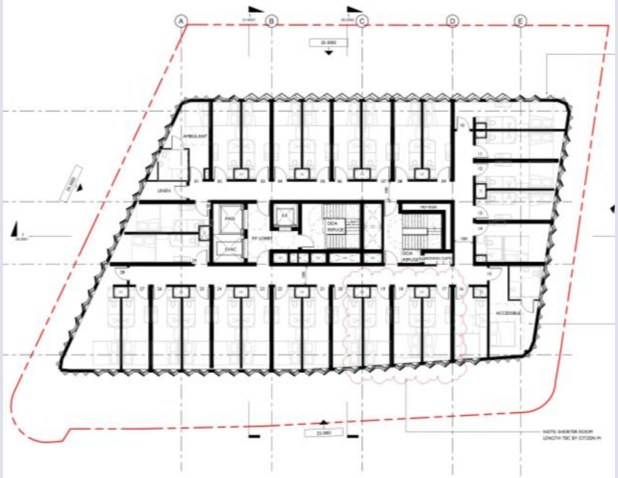
Figure 4-1 Development proposals	
	
Proposed Southeast Elevation -Shaftesbury Avenue (extracted from SPPARC drawing 2111-SPP-ST-ZZ-DR-A-25-3001- P0.01 dated January 2024).	Proposed Northeast Elevation -St Giles Passage (extracted from SPPARC drawing 2111-SPP-ST-ZZ-DR-A-25-3004- P0.01 dated January 2024).
	
Proposed basement level B1 layout (extracted from SPPARC drawing 2111-SPP-ST-B1-DR-A-20-1003- P0.02 dated January 2024). Showing largest plan extent of the basement.	Proposed ground level layout (extracted from SPPARC drawing 2111-SPP-ST-B1-DR-A-20-1004- P0.02 dated January 2024).

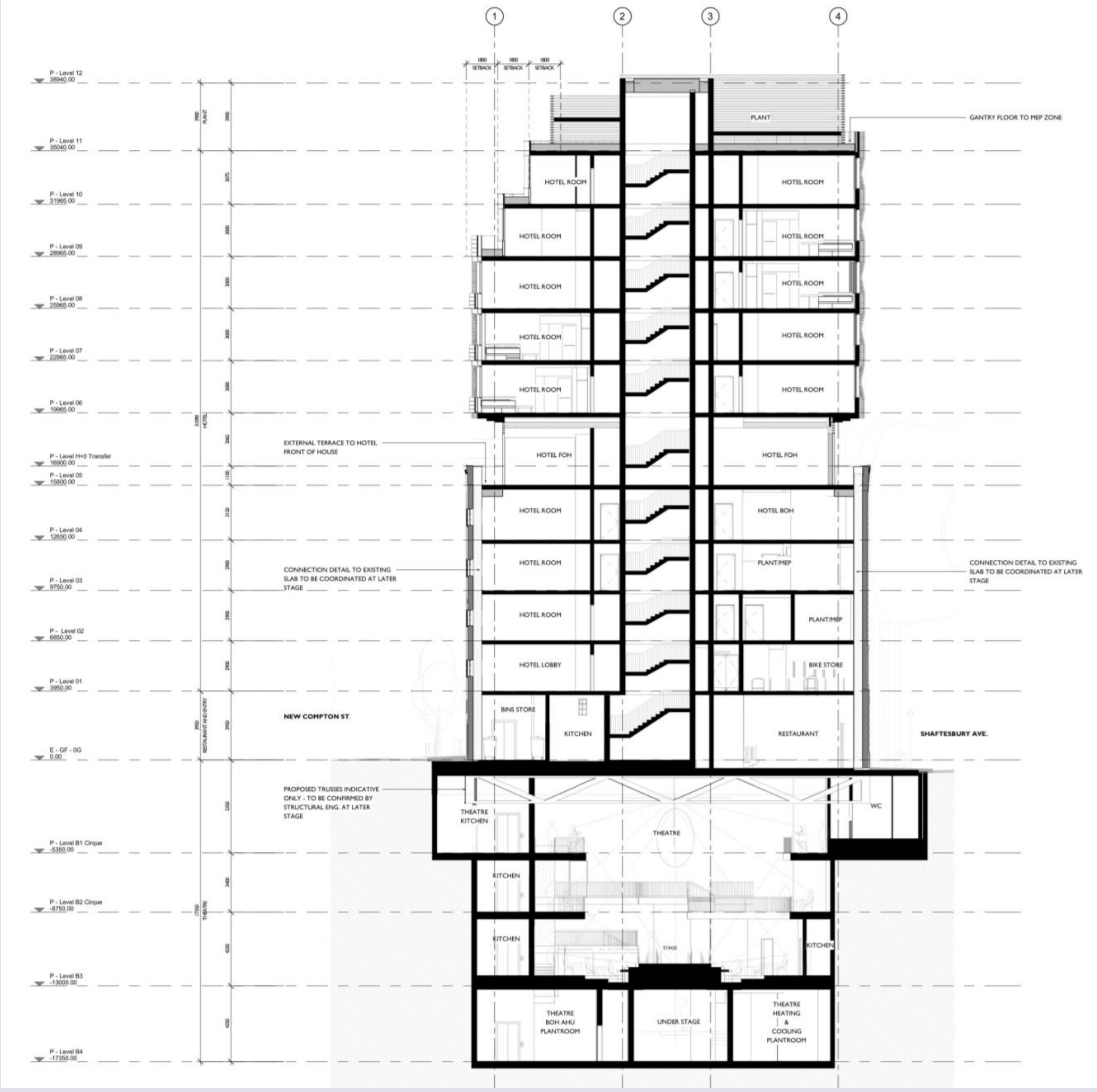
Figure 4-1 Development proposals



Proposed level 02 layout (extracted from SPPARC drawing 2111-SPP-ST-B1-DR-A-20-1006- P0.02 dated January 2024).



Proposed level 06-08 layout (extracted from SPPARC drawing 2111-SPP-ST-B1-DR-A-20-1004- P0.02 dated January 2024)



East facing section; (extracted from SPPARC drawing 2111-SPP-ST-ZZ-DR-A-26-2002- P0.02; Jan-2024)

4.2 Summary Approach

As has been outlined in Section 3 Existing Building Structure, little remains of the existing structure. However our approach has been to reuse existing structure where appropriate, reducing the extent of new works and limiting carbon impacts where appropriate. Our approach has been to work with what capacity the existing structure offers. This is evidenced through the re use of the existing masonry shell and working within the existing basement construction, using existing basement structures to facilitate an efficient design response to the brief. The retention of significant portions of the existing basement structure additionally assists in minimising the extent of any basement temporary works.

4.3 Demolition.

It is the proposed to remove the existing, internal superstructure, including roof, internal floors, retaining the existing external masonry construction. The existing masonry facade will be retained in place over the duration of the construction phase, using a facade retention system.

To better facilitate construction, reduce carbon, programme and cost impacts it is proposed that the north elevation wall is partially dismantled, stored off site and then reinstated once internal structural works have been completed.

The upper levels of the new development substructure have been designed where possible to work within the existing basement retaining walls. However, to the eastern end of the building footprint the Level B1 basement will extend north and south into areas currently occupied by existing basement vaults.

4.3 Substructure

The viability of the auditorium is predicated on maximising the number of seats. This requires the structural solution to maximise the basement footprint. Reference should be made to the Basement Impact Assessment (BIA) planning document ‘106885-PF-ZZ-XX-RP-C-0005’, with regards to new substructure proposals.

Two basement perimeter wall construction solutions have been assessed as part of the basement impact assessment.

A. The provision of underpinning to the perimeter of the basement footprint, to the underside of the existing basement retaining wall structures
B. The provision of a secant piled wall to the perimeter of the basement footprint, inside the face of the existing basement retaining wall vertical face

The Basement Impact Assessment has demonstrated that both forms of construction can be executed without impact to adjoining structures. The underpinning option is the preferred form of construction as it delivers a larger basement footprint.

New basement floorplates, formed in concrete, act as horizontal props to the basement perimeter. In locations where there are voids, immediately adjacent to the basement perimeter, the basement lining wall will stiffened through the provision of lateral propping structures and a thicker wall construction

The development will be supported on a raft foundation which forms part of the new basement box. The substructure raft is designed to balance upward heave and hydrostatic pressures resulting from the additional levels of basement.

Additional lateral stiffness will be achieved through the provision of reinforced concrete walls around points of vertical circulation such as lift shafts and staircases.

4.4 Superstructure

The development is host to a variety of occupational uses. These different uses are vertically stacked and as a result require different structural responses to different levels within the building.

This stacking is summarised below.

Location	Occupancy type	General Structural Response	Stability
Levels 06 - 11	Hotel Accom and ancillary support areas	Steel frame. Columns on short grid east to west (approx. 4.9m), concealed within partitions to every second hotel room Services and structure integrated within the beam zone within the corridor location Floor slab and support beams integrated into single structural zone to maximise floor to ceiling within rooms Floorplate formed using normal weight concrete supported on composite steel decking supported by steel beams (composite and non-composite)	Provided using bracing within the central vertical circulation core
Level 05	Hotel FOH, Hotel Accom. and ancillary support areas	As above Local transfer structures required to accommodate level 05 insets to northeast and southwest corners	As above
Levels 04 - 01	Hotel BOH, Hotel accommodation and Ancillary support areas	As above	Providing using steel bracing inset to perimeter of building footprint
Level OG	Theatre and FOH and ancillary support uses	Areas above auditorium space below, supported by five deep steel transfer structures supporting superstructure frame and ground floor insitu/precast concrete slab Where column vertical alignment is achievable and transfer elements are not required, ground floor is framed using composite steel beams supporting insitu/precast concrete slab Acoustic bearings supporting base of ground floor columns, integrated with floor structure Floor plate formed using in situ concrete supported by offsite precast concrete biscuit construction (to limit formwork and propping requirements within auditorium space below)	As above

4.4.1 Massing geometry

The superstructure grid has been driven by the need to deliver a highly efficient hotel room layout. Columns within the hotel section of the building are set within room partitions, generally to every other room (4.9m centres. The superstructure has been coordinated to ensure vertical column alignment over the majority of the building footprint thereby avoiding transfer structures, at lower levels, as far as possible.

The building massing steps in at the top of the retained masonry shell at level 05, creating an appearance of separation between the retained low massing and upper levels new construction. This set in line defines the primary vertical column line. This is inset from the outside perimeter of the building. The plans have been arranged to enable vertical alignment of these columns from ground floor to roof level location. By setting the primary columns inboard the floor plates have cantilevered slab edges from levels 01 to 11.

The superstructure sets back, to the north, at levels 09 to 11.

4.4.2 Superstructure typology

The new auditorium front of house, Hotel and associated facilities are formed using a steelwork frame.

The superstructure has been designed as a combination of offsite manufactured lightweight steel frame system and traditional steel framing. The self weight of the superstructure is critical as it has a direct impact on the tonnage and carbon of lower level steelwork components. his in order to reduce development carbon limit the magnitude of loads applied to the auditorium steel trusses. The primary driver to the superstructure has been ensuring that all floor plates meet a two hours fire performance.

The primary design driver to the superstructure floor plates is a requirement to achieve 2 hours via resistance they typically consist of normal weight concrete supported off a composite steel deck with additional reinforcement to meet fire resistance requirements these are in turn supported by a combination of composite steel beams and steel beams set within the slab zone.

The superstructure requires to be designed such that it cost effectively enables a column free space within the basement auditorium space. To facilitate this a series of deep composite steel trusses will be provided, spanning, north-south across the building footprint supporting the new building superstructure.

The ground floor slab is formed using in situ concrete supported by offsite precast concrete biscuit construction. This limits formwork and propping requirements within auditorium space below. The concrete slab is designed acting compositely with the supporting steel floor frame.

Central to the superstructure floor plate is vertical circulation provision. This is framed in steel and, above level 04, provides lateral stiffness to the overall superstructure through the provision of braced bays (see section 4.4.5 Stability).

The setbacks at levels 09 to 11 are part aligned with the primary vertical columns to minimise structural transfer requirements. Localised transfer structures are required to accommodate the setback at level 10.

4.4.3 Cladding

The cladding system to the new superstructure massing, above the retained masonry parapet, will consist of offsite fabricated panel systems designed to span from floor to floor. The cladding panel system that is likely to be adopted, will require to be vertically supported at its base by the primary structure steel. An allowance for vertical movement between adjacent floors will be provided with a horizontal movement joint at every floor level.

4.4.4 Retained masonry shell

The existing masonry external wall construction will be retained as far as is practicably possible. Local repairs will be required to address historical cracking and movement.

Currently, and in the absence of information from the 1970’s and 2000’s cinema retrofits, it has been assumed that the masonry wall is self supporting and is supported at ground level. This would be supported by historical information, visual site observation including the lack of evidence of vertical or horizontal movement joints.

The external wall will be laterally propped by the new internal steel construction. The thickness of the masonry wall construction, as evidenced by typographical survey and archive information, indicates that the wall has sufficient capacity to span vertically between floors.

There will be provision for vertical movement between the retained masonry wall and the new internal steel frame to avoid new floor loads being vertically transferred into the masonry wall.

The retained masonry shell will be internally lined to achieve the required thermal and acoustic performance criteria.

4.4.5 Stability

Superstructure

Refer to summary table in Section 4.2 Summary Approach. The building superstructure is laterally stabilised, in tow orthogonal directions, using a combination of structural systems.

To limit the magnitude of vertical loads applied to the ground level auditorium transfer trusses, as a result of lateral forces, the stability strategy is split over the vertical section of the superstructure.

Location	Stability
Levels 05 - 11	Provided using bracing within the central vertical circulation core
Levels 01 - 05	Providing using steel bracing inset to perimeter of building footprint

Within the retained masonry shell, up to level 05, steel bracing will be provided in both directions to the outside perimeter of the building footprint. This will be inset inside of the retained masonry facade.

Above the retained masonry façade, the opportunity to continue using perimeter bracing is lost due to the massing response. The lateral stability strategy switches to utilise the hotel floor plate central core vertical structure. Braced bays are provided within the vertical circulation core to provide lateral stiffness. Floor levels five and six are used as horizontal diaphragms to transfer lateral loads between the hotel central core and the perimeter of the building at the lower level.

Floor plates are designed to transmit lateral forces using concrete slabs as horizontal diaphragms.

The retained masonry facade requires to be laterally stabilised in the permanent condition. This is provided by the new internal steel frame; refer to section 4.4.4 Retained masonry shell above.

Substructure

Horizontal forces are gathered by the ground floor floorplate and are distributed into the basement perimeter walls and concrete core structures within the basement.

Vertical forces, resulting from overturning horizontal loads in the superstructure, are supported by a combination of basement concrete core structures, perimeter concrete wall structures and the deep steel transfer trusses at ground floor level.

4.5 General Design Issues

4.5.1 Design Life

The ‘design working life’ for the ‘structure’ (structural frame and main structural elements) is 50 years. This is in accordance with Eurocode ‘Category 4’ buildings – as recommended in Table NA.2.1 of the UK National Annex to BS EN 1990:2002.

‘Design working life’ is the notional figure for the statistical determination of applied loadings. The expected real life of a Category 4 building would be well in excess of 50 years, particularly if it is maintained and protected from the weather.

The substructure will be designed for the ‘Intended working life at least 100 years’ designation in the requisite substructure Eurocodes. This is likely to provide well in excess of 100 years’ real life for the predicted environmental conditions. However, where the consequence of deterioration of structural elements is deemed to be very significant, such as for perimeter retaining walls which support superstructure, those elements will be designed for the ‘Intended working life at least 100 years’ designation in the requisite substructure Eurocodes.

Some structural elements, such as those with concrete wearing surfaces and corrosion protection will require periodic inspection and maintenance.

The substructure perimeter retaining walls will be checked for design life in accordance with BS 8500-1: 2002 and satisfy this standard for the most onerous structural performance level, being a structure of long service life, (more than 100 years).

4.5.2 Fire

The building structure will be designed to meet the following fire resistance periods as defined in BS 476 fire resistance periods.

- Superstructure generally: 2.0 hours
- Substructure generally: 2.0 hours
- UKPN generally: 4.0 hours

Method of fire protection

Fire protection will be achieved in insitu concrete construction by the specification of member size and concrete cover to the main reinforcement to achieve compliance with BS EN 1992-1-2.

Structural steel beams will be fire protected using intumescent paint.

Composite slabs will achieve the required level of fire protection by adopting the additional reinforcement required by the decking manufacturer.

4.5.3 Waterproofing strategy

Reference should be made to the basement impact assessment statement with regards to the preferred basement construction forms. Two forms of basement construction have been considered, refer to section 4.3 Substructure.

The basement perimeter construction will be internally lined using a concrete wall. The concrete wall will be designed as a water retaining structure, in accordance with BS 1991–2.

The overall basement box will be designed to meet a grade three waterproofing performance level as defined in BS8102.

4.5.4 Acoustic attenuation.

A preliminary acoustic attenuation strategy has been developed by the design team.

This is important in defining, with respect to structure the impact of acoustic measures to the general building geometry. In section this particularly impacts on floor zones and on plan wall zones. This begins to define the requirements for acoustic bearings/spring support structures and their impact on plan arrangements.

The basement performance auditorium space is acoustically separated from the hotel structure at ground level. This is facilitated using a series of bearings/springs at the base of all ground floor columns, supported off the ground floor slab. This is supplemented by a floating ground floor supported off the primary ground floor slab.

Additional acoustic separation will be provided in the structural interface between the retained masonry wall and the new steel structure set internally.

4.5.5 Access and Maintenance

The roof slab will be designed to support DAVIT with sufficient load capacity to enable cleaning access and emergency access only.