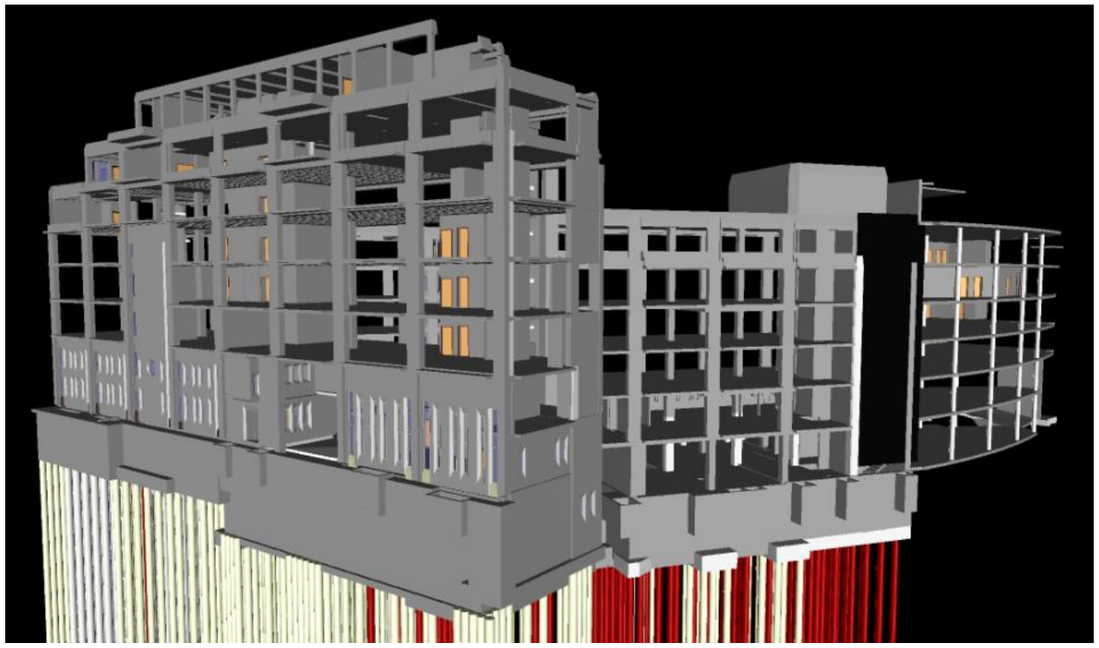
Intended for
Anglo American and De Beers

Document type
Strategy for Structural Demolition and Construction

Date
August 2017

17 CHARTERHOUSE STREET, LONDON
STRATEGY FOR STRUCTURAL DEMOLITION AND CONSTRUCTION



RAMBOLL

Revision	**01**	Ref	**1620003673**
Date	**4th August 2017**		
Made by	**Tim Roe**		
Checked by	**Martin Willis - Director**		
Approved by	**Tim Roe – Technical Director**		
Description	**Feasibility Report**		

CONTENTS

1. INTRODUCTION

1.1 Introduction

This report outlines the Structural Engineering strategy to demolition and reconstruction of the existing office buildings owned by Anglo American and De Beers (AA&DB) at 17 Charterhouse Street and Saffron Hill site.

1.2 Report Limitations

This report has been produced exclusively for the use of Anglo American and De Beers. Any other party seeking to rely on this report should seek written permission from Ramboll. This report has been produced for the purpose of the proposed office refurbishment as currently shown on architects drawings. If the refurbishment proposals change then findings of this report should be reviewed accordingly.

1.3 The Project

The 17 Charterhouse Street and Saffron Hill site is an existing complex of interconnected office spaces in central London. The site is currently largely unoccupied, with the majority of AA&DB staff having been recently relocated. The structures compromise of a two storey concrete basement/lower ground level and five to eight storeys of concrete frame above ground level. The various office spaces are arranged around a courtyard. The aim of this project is to refurbish the buildings in order to provide AA&DB with a revitalised central London office space.

1.4 Report Objectives

This report is based on the available project information at the time of writing. The aim of this report is to comment on the structural feasibility of the refurbishment options developed by MCM architects.

2. THE SITE

2.1 Site Location

The site is located in central London on Charterhouse Street, Farringdon, EC1N 6RA and is situated within the London Borough of Camden. Refer to the site location plan below. The buildings indicated in red and the enclosed courtyard are subject to redevelopment under Project 2020. The buildings indicated in blue are also owned by AA&DB but are not subject to any structural alteration.

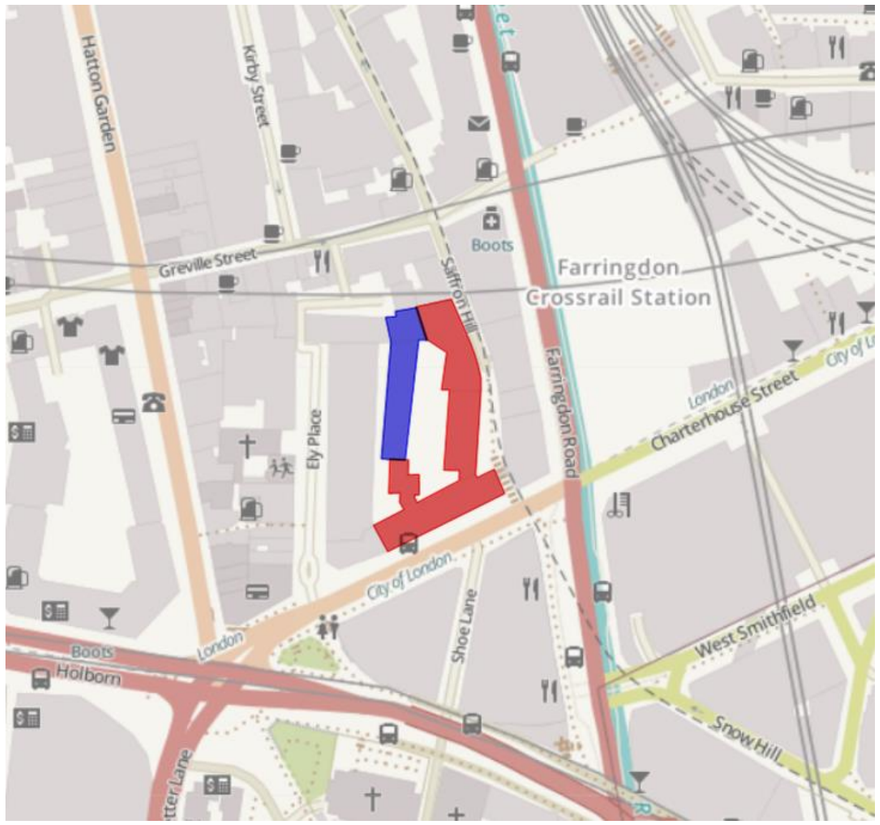


Figure 1: Site Location (Source: OpenStreetMap)

2.2 Boundaries and Surroundings

The site is bounded on the southern edge by Charterhouse Street and on the eastern edge by Saffron Hill, part of which is privately owned by AA&DB and provides vehicle and pedestrian access to the buildings and the courtyard. The northern edge of the site is connected to a group of buildings known as Bleeding Heart Yard. The western edge of the courtyard is bounded by a building known as St Andrew's House or Asfil House, the eastern façade of which is listed. The south western edge of the building is a party wall condition with the adjoining property along Charterhouse Street, as indicated by existing basement drawings.

The site lies within the Hatton Garden Conservation Area.

Figure 2: Hatton Garden Conservation Area - site indicated in red (Source: Camden Borough

2.3 History of Site

The site and surrounding area has had a variety of uses and is not associated with any particular era or architectural style. Much of the land was agricultural until the sixteenth century, although in the late thirteenth century the Bishop of Ely built a house and chapel just to the west of the existing site, giving rise to the name of Ely Place. At this point, the River Fleet still flowed openly along what is now roughly Farringdon Road. As such, ground conditions include large areas of alluvial deposits and the site slopes downwards towards Farringdon. This results in complex ground levels and a storey height difference between the entrance to 17 Charterhouse Street and that of the Saffron Hill block.

Land ownership was transferred to the Hatton family in the seventeenth century, leading to a flurry of residential developments in early attempt at town planning. It is at this point that much of the existing road layouts were set out and Bleeding Heart Yard to the north of the site was constructed. However, by the early eighteenth and well into the nineteenth century the eastern part of the site had fallen into disrepute with low quality housing and slums. The River Fleet had become an open sewer and attempt was made to revitalise the area by covering the river between 1733 and 1766.

It was not until road widening measures were introduced in the 1860s that buildings were developed, slums were cleared and businesses moved in. By the late nineteenth century the jewellery trade had established itself in the Hatton Gardens area. In 1934, De Beers established the

Diamond Trading Company on the 17 Charterhouse Street site in what was likely existing terraced housing. In the late 1970s, these were demolished and the structure as we know it today was built.

2.4 **Building History**

The Diamond Trading Company completed a new set of headquarters in 1979. This is compromised of the 17 Charterhouse Street block, the St Andrews block and the Saffron Hill block. Bleeding Heart Yard and St. Andrew's House were retained, although the courtyard was remodelled to incorporate the basements from the new blocks. The Diamond Trading Compnay previously owned the adjacent building between Saffron Hill and Farringdon Road and a bridge link structure was put in place at the same time.

In 2003, a five storey extension to the Saffron Hill block was completed, with Whitbybird (now Ramboll) acting as structural engineers. The office extension replaced a three storey sports hall that had been built between 1979 and 1981. The sports hall was a concrete and load bearing masonry structure on strip footings and a significant volume of concrete foundations were removed. The same project saw the construction of a new 4 storey bridge link from the Extension block to 19 Charterhouse Street. Around the same time the bridge link across Charterhouse Street was removed. Modifications to strong rooms throughout the 17 Charterhouse Street and Saffron Hill blocks may also have been completed. Ramboll advised on potential alterations to the helipad on the roof of 17 Charterhouse Street in 2015 but no further work was conducted.

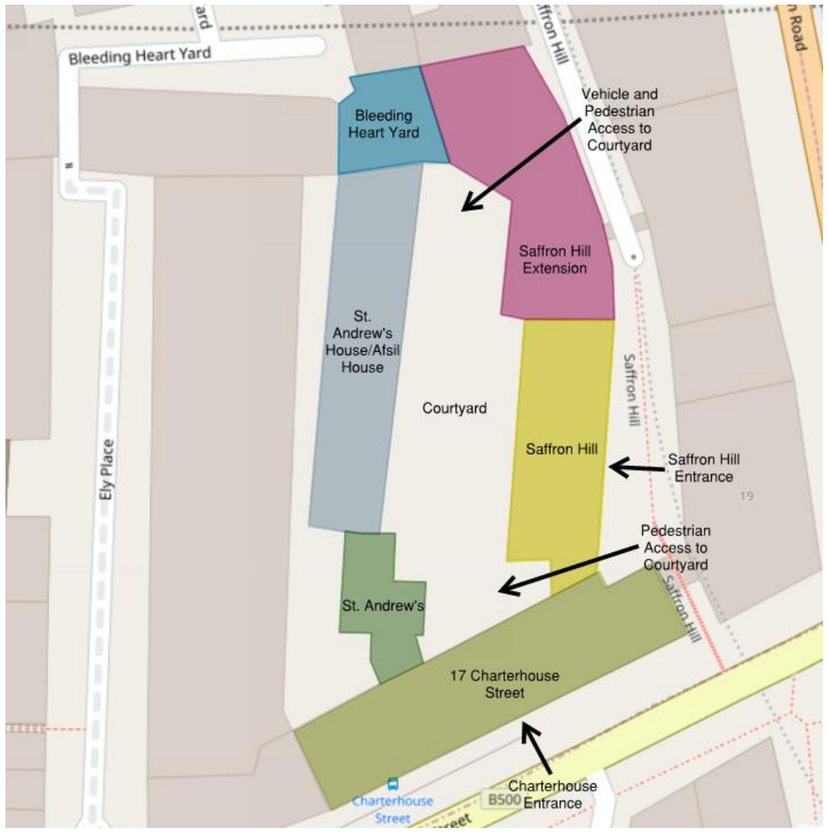


Figure 3: Site Plan and Nomenclature (Source: OpenStreetMap)

2.5 **Existing Tunnels**

A now unused Post Office tunnel (shown below in blue) runs approximately 10m below Saffron Hill. Foundations for both the 1979 redevelopment and the 2003 extension accounted for this tunnel. The 2003 extension also factored in the boring of new Crossrail tunnels for Farringdon station (shown in red) along the northern boundary, approximately 20m below ground level. Although these plans had not been finalised at the time, the tunnels have been constructed in approximately the same position as anticipated.

In addition to these tunnels, pre-existing below ground (presumably masonry) vaults line the southern edge of the Charterhouse block. These do not appear to be accessible but have probably informed the boundary of the basement wall.

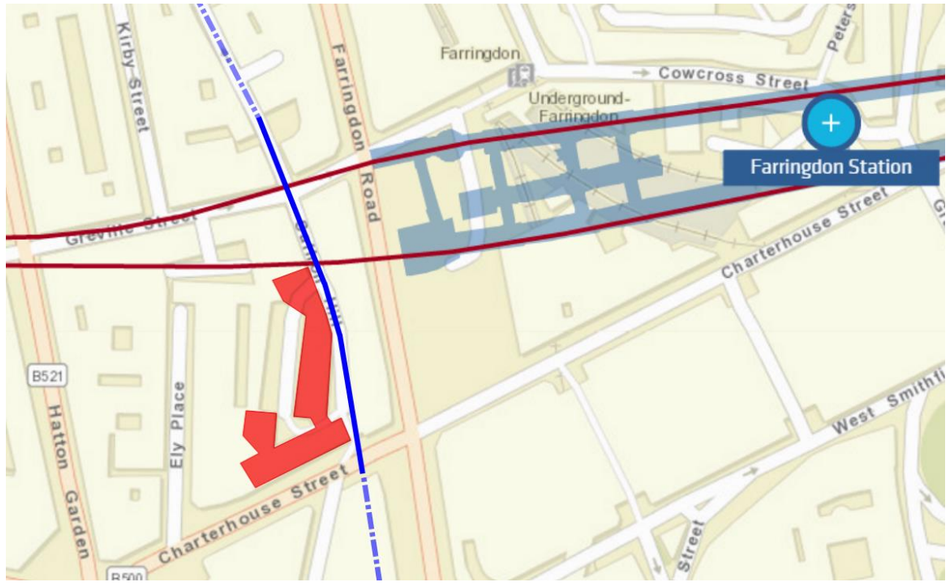


Figure 4: Tunnels Around Site (Source: Crossrail)

3. EXISTING BUILDING REVIEW

3.1 Existing Information Retrieval

127 drawings of the existing buildings have been retrieved from the AA&DB archives and have been thoroughly reviewed for the purpose of developing the concept design. These drawings include comprehensive plans and sections for all buildings subject to structural amendment. In addition, a considerable number of reinforcement drawings have been obtained, although not for the entirety of the construction.

3.2 Existing Building Structure – Charterhouse, Saffron Hill and St. Andrews Blocks

Based on a review of the record drawings, an outline description of the existing building structure is provided as follows:

3.2.1 Overview

The overall construction is bespoke in nature, being designed and detailed very specifically to suit the client requirements at the time of construction. As a result, there are a very large number of concrete walls, upstands, voids, steps in slab edges and vertical mullions of concrete in the external elevations. The bespoke nature of construction adds complexity to the refurbishment proposals due to the need to 'clean up' the structural arrangement.

3.2.2 Foundations

The three blocks are all supported by approximately 600mm diameter concrete piles of an unknown length. Pile caps transfer vertical loads from columns and stability elements into the piles.

3.2.3 Basement Construction

The two storey basements beneath the Charterhouse and Saffron Hill blocks are separate structures, with only a small tunnel connecting the lower level of the two basements. Parts of the 'Lower Ground Level' are actually above ground due to the downwards slope of the site to the north east. They are constructed using a mixture of reinforced concrete walls and contiguous bored piled walls, with reinforced concrete slabs between.

Construction of the basement required extensive underpinning of adjacent party walls and infilling of brick vault structures.

3.2.4 Superstructure

The superstructure typically consists of 300mm deep reinforced concrete waffle slabs supported by concrete columns and walls. Building stability is provided by concrete cores and shear walls around lifts and stair cases. The three blocks are independent from each other, separated by movement joints at every level.

Due to the vehicle entrance and ramp in the centre of the Charterhouse block at ground floor, Level 1 is significantly different compared to the levels above. There are numerous voids and several large transfer beams to provide clear spans for the vehicle route into the basement. These transfer beams are steel plate girders and vary from approximately 1.2 to 3.3m deep and span 14.4m, supporting up to six storeys of concrete frame at their mid-point.

3.2.5 Roof Structure

The roof of the St. Andrews and Saffron Hill blocks are generally also concrete waffle slabs and are used for plant. The roof of the Charterhouse block differs in that, at Level 7, the concrete frame steps in and provides plant area but also continues up to Level 8 to provide a helipad landing site. The helipad level consists of a 200mm thick concrete flat slab and 400x550 band beams.

3.2.6 Fire Protection

The concrete frame has generally been designed for a 2 hour fire period using the inherent fire resistance of the material and appropriate cover to reinforcement, apart from the basement and main core which was designed for a 4 hour fire period. It is unclear how the steel plate girder transfer beams are protected but they would be expected to meet the same requirements as the main concrete frame as a minimum. This could have been achieved using intumescent paint or fire board.

Figure 5: View of St. Andrews (right) and 17 Charterhouse Street (left) blocks from within courtyard

Figure 6: View of Saffron Hill block (right) and extension from within courtyard

Figure 7: View of Saffron Hill block roof plant enclosures

Figure 8: Storey height transfer beam above GF vehicle entrance in 17 Charterhouse Street

3.3 Existing Building Structure – Saffron Hill Extension Block

Based on a review of the design philosophy and piling close out report for the extension block, an outline description of the existing building structure is provided as follows:

3.3.1 Foundations

As for the 1979 development, the Saffron Hill extension is supported on piles, 110 in total. These vary from 350mm to 750mm in diameter, depending on their location and proximity to the tunnels nearby. Agreed exclusion zones for both sets of tunnels limited the use of certain pile diameters and depths. The smaller, shorter piles are generally used towards the northern edge of the site, whereas the larger piles are located under the southern portion of the extension. Where the full depth could be used, piles appear to be approximately 25m in length in order to comply with the Crossrail requirement that the toe level of the piles is below the crown level of the tunnels.

3.3.2 Basement Construction

Unlike the 1979 development, there is no basement level under the extension. The 'Lower Ground Level' is fully above ground at this end of the site and therefore does not require the installation of contiguous pile walls.

3.3.3 Superstructure

The ground floor is a suspended concrete slab with a perimeter reinforced concrete upstand. The remaining superstructure levels consist of one way spanning reinforced concrete composite steel decking (Richard Lees 'Rib-Deck') supported on steel beams. Perimeter steel columns and concrete walls support vertical loads, with the concrete walls also providing lateral stability. The extension is structurally independent from the original Saffron Hill block but the buildings abut each other and access between the floor plates is possible from Ground Floor to Level 4.

3.3.4 Roof Structure

The roof structure does not differ to the rest of the superstructure, aside from resisting a higher loading to account for plant.

3.3.5 Fire Protection

The structure has a fire resistance of 1 hour, apart from an existing sub-station which has a rating of 4 hours. It is assumed that a combination of the inherent fire resistance of the composite floor and intumescent paint or fire board is used to achieve the fire rating.

4. STRUCTURAL DEMOLITION

The primary elements of structural demolition are noted below.

4.1 St Andrews Block

The proposal is to demolish St Andrews Block in its entirety from roof level (level 5) to first floor level and in part or entirely to ground floor level. The final extent of level 1 demolition is yet to be finalised.

4.1.1 St Andrews Building Interface

St Andrews Block has an interface with St Andrews Building to the north. However, the structures are understood to be entirely separate, with the original St Andrews building constructed in 1875 and more recent St Andrews Block in 1979. Historical photographs during the 1979 construction work show St Andrews Building freestanding during the basement excavation.

Figure 9: Photograph taken during basement excavation for 1979 development

Inspection of record drawings of the 1979 construction show that the south wall of St Andrews Building was underpinned to facilitate the construction of the adjacent basement. However, no alteration to the structure below ground floor level is proposed for Project 2020 and therefore this condition remains unaffected.

Figure 10: St Andrews Building 1979 underpinning works

Above ground, the south end wall of St Andrews Building is separated from the adjacent column line of St Andrews Block and the gap between the two structures is shown as being closed by projecting concrete fins, as shown in Figure 10.

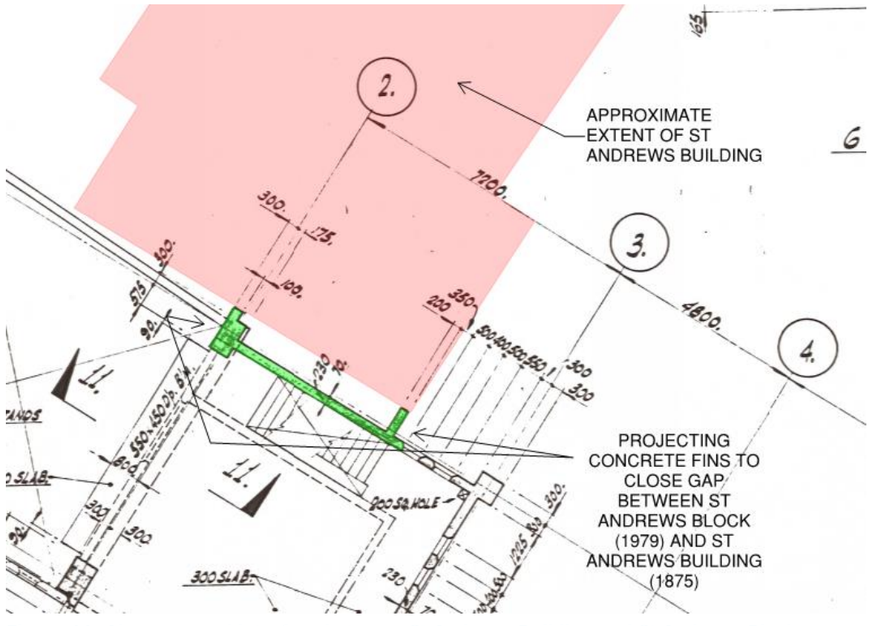


Figure 11: Above ground interface between St Andrews Building and St Andrews Block

Based on the above information, it should be possible to demolish St Andrews Block without impacting on the structure of St Andrews Building.

4.1.2 Charterhouse Block Interface

On the south side, St Andrews Block has an interface with Charterhouse Block. The intention is to demolish St Andrews Block and retain Charterhouse Block. The two structures are entirely independent above ground floor level with halving joints and movement joins at every level.

Therefore, this represents a very simple demolition interface where St Andrews Block can be removed without any impact on Charterhouse Block.

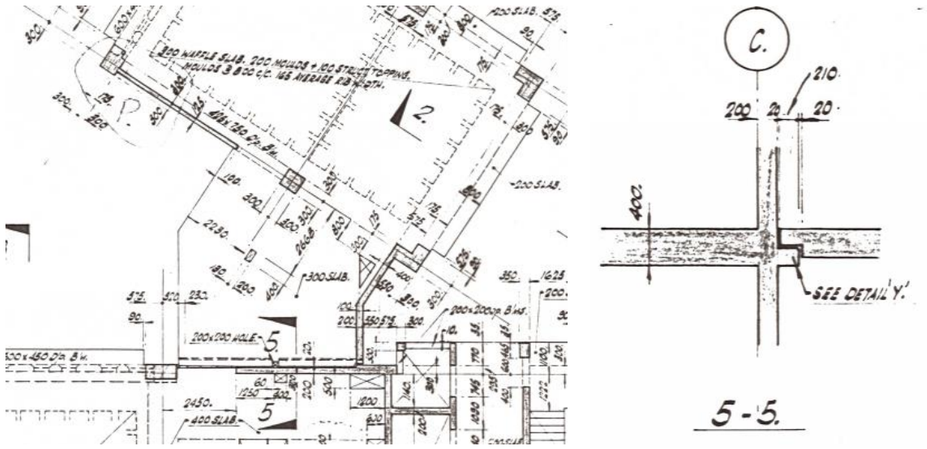


Figure 12: St Andrews Block interface with Charterhouse Block

4.2 Charterhouse Block

The main extent of demolition to Charterhouse Block involves the removal of the helipad roof structure at level 8 and the plantroom at level 7. These slabs do not interface with any other buildings and can therefore be removed without impact to adjacent structures.

Further internal alterations are proposed within Charterhouse Block, which require local demolition and alteration within the building. These changes do not significantly affect vertical load paths, but changes to building stability systems are proposed as discussed in Section 5.

4.3 Saffron Hill Block

The main extent of demolition to Charterhouse Block involves the removal of the plantroom structure above level 5 and the removal of the main roof at level 5.

The Saffron Hill Block interfaces with Extension Block to the North and Charterhouse Block to the south. All three of the structures are independently stabilised with movement joints between each structure. The interface between Saffron Hill Block and Charterhouse Block is a halving joint, similar to that described in Section 4.1.2. Therefore, the removal of the upper levels of Saffron Hill can happen without impact on adjacent structures.

Further internal alterations are proposed within Saffron Hill Block, which require local demolition and alteration within the building. These changes do not significantly affect vertical load paths, but changes to building stability systems are proposed as discussed in Section 5.

4.4 Extension Block

No structural demolition is proposed for Extension Block, with work limited to minor modifications of internal service risers only.

The link bridge between Extension Block and No.19 Charterhouse Street is proposed to be removed, which will require reinstatement of cladding systems to elevations at both ends of the bridge.

5. STRUCTURAL ADAPTATION & EXTENSION

The Project 2020 scheme focusses on the need to unify and modernise the current four distinct office spaces around the courtyard, as well as increasing the overall floor area available. There are a number of structural alterations that will need to be completed in order for the refurbishment to achieve this desired outcome, which can be summarised as follows:

- Demolition of the St. Andrews block;
- Unification and levelling of ground floor level between blocks by 'making up' level differences and infilling voids and the vehicle ramp to the basement;
- Construction of extension from Charterhouse block and Saffron Hill block into courtyard to increase floor area and link spaces;
- Reconstruction of level 7 of Charterhouse block;
- Modification of central core in Charterhouse block;
- Reconstruction of level 5 of Saffron Hill block;
- Addition of level 6 to Saffron Hill block;
- Modification of northern stability core to Saffron Hill block;
- Relocation of south stability wall to Saffron Hill block;
- Rationalisation of slab edges and replacement of external façades throughout.

Alterations to the basement and lower ground floors are anticipated to be limited in nature with major structural interventions avoided where possible. The vehicle ramp will be removed but the vault and layout in the lower levels retained. Where foundation strengthening or new foundations are required the associated pile caps will be formed above the existing lowest basement level resulting in some loss of space.

5.1 Foundation Works

The extent of new foundations will be minimised by reusing existing basement column locations and foundations to support the courtyard infill slabs wherever possible. However, new foundations and enhancement to existing foundations will be required in various locations across the project where vertical loading exceeds the limits designed for in the original buildings.

As all existing buildings are piled, all new foundations will also need to be piled. New piles will have to be carefully placed to avoid existing piles and pile caps.

5.2 Ground Floor Slab Works

Floor levels from level 1 upwards are largely consistent between blocks, however, at ground floor the existing slabs vary in level across the site. The floor levels therefore require making up to a consistent level which is likely to be approximately 13.125mOD. In addition, in several places existing voids require infilling.

Where possible, floors will be made up to a consistent level by using deep raised access floor systems as this will result in the most lightweight solution. Where this approach is not possible e.g. where solid finishes are required, the structural levels will be raised using void formers with a new slab cast above – subject to justification of the existing structure.

For one section to the west of Saffron Hill block the existing ground floor slab above the basement is too high and requires breaking out and reforming at a lower level.

Voids in the ground floor will be infilled using steel beams and angles bolted to slab edges supporting a concrete slab on composite metal decking.

5.3 Extension into Courtyard

In order to improve the connectivity between the existing spaces and unify the site, the proposal is to extend into the courtyard and over the footprint of the demolished St. Andrews block to increase floor area. It is proposed to construct the extension as a steel frame, with composite deck floors and either additional steel bracing (if sufficiently stiff to compete with concrete cores) or concrete shear walls for stability. A steel frame is proposed in order to minimise dead loads and limit the extent of new foundations.

Existing foundations will be reused where possible, but some new foundations/piles will need to be installed within the footprint of the existing basement and courtyard.

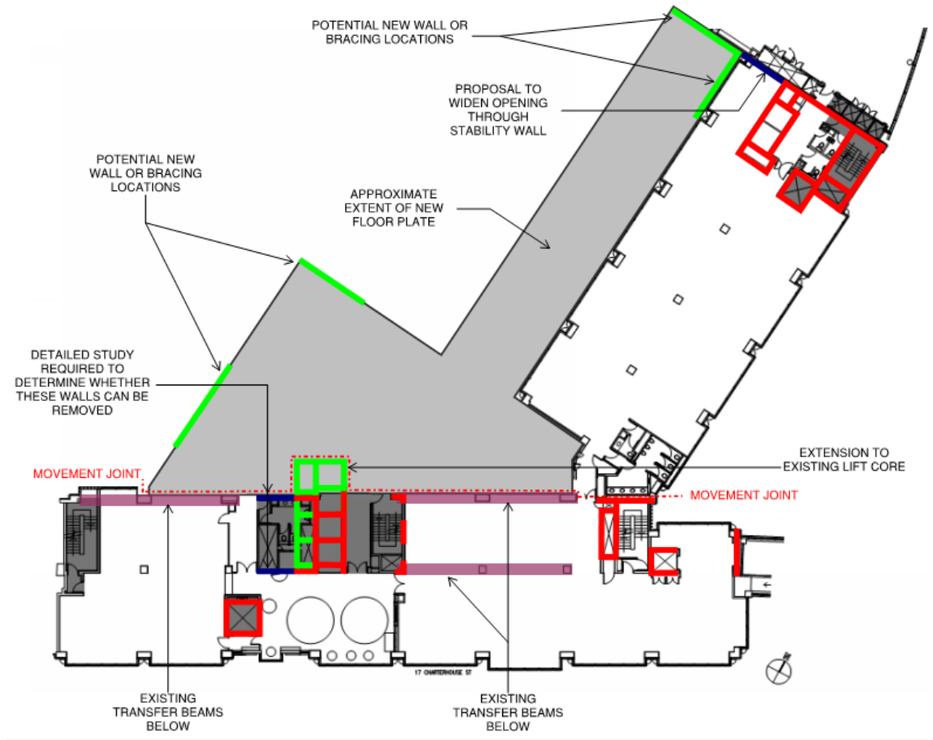


Figure 13: Extension and infill to courtyard from Charterhouse and Saffron Hill blocks

The relationship between new and existing construction is indicated in principle in the sketches in Appendix A.

5.4 Movement Joints and Stability Principles

Currently Charterhouse Street Block, Saffron Hill Block and St Andrews Block are all structurally independent with movement joints between the buildings. The provision of joints is understandable due to the relatively narrow floorplate connections between the blocks.

For building stability, the proposed approach is to avoid subjecting existing stability walls to greater forces than in the current design, thus avoiding the need for detailed back calculation by way of justification, which is not possible where record drawings are incomplete. The choice of movement joint locations in the final design is therefore subject to detailed stability analysis in order to find a solution that works in best harmony with the existing structure. The primary options currently being

investigated are to join all blocks together or join the infill slabs to Saffron Hill block and leave Charterhouse block as independent.

Where new floors are monolithically connected to existing structure, the supporting steelwork beams will be bolted to existing columns and new slabs will be dowelled into existing slabs to provide a robust continuous stability diaphragm.

5.5 Works to Charterhouse Street Block

5.5.1 Core Alterations

In order to complete the modernisation of the office space in the Charterhouse block, and to re-plan the vertical circulation around the combined blocks and extension, the central stability core in the Charterhouse block is proposed to undergo modification. As the current core arrangement supports the surrounding slabs and forms part of the building stability system, the proposed alterations are not simple to achieve. Slab areas surrounding the core will most likely need to be propped from basement to roof to allow breaking back of the slabs and demolition and reforming of the existing core area.

It is recognised that altering the large steel transfer beams over the current vehicle route into the basement would be best avoided due to the cost and programme impact of altering or removing these elements. The design has therefore been developed to retain these elements.

5.5.2 First Floor Infills

The first floor of the Charterhouse block is currently a difficult space to use efficiently due to the large number of voids, various concrete walls and shafts and the presence of two transfer beams on Grids B5-7 and C5-7. The concrete walls are typically located around the first floor slab voids and extend from ground floor to second floor and therefore potentially also provide support to some areas of the second floor slab.

Whilst the proposal is to retain the transfer beam structures, other areas of the first floor need to be 'de-cluttered' and existing voids infilled. Some strengthening of the level 2 slab may also be required where concrete walls are being removed below.

5.5.3 7th Floor & Roof Adaptations

AA&DB has advised that the helipad will not be required in the future and can be removed as part of the redevelopment proposals.

The structural arrangement at Level 7 is complex, with numerous plinths, upstands, slab steps, stairs and voids which will require removal or infilling. Given the extent of alteration that would be required to amend level 7, the proposal is to demolish down to level 6 and reconstruct above. The removal of level 7 and the roof results in a considerable reduction in dead load at the top of Charterhouse block and assists with load balancing down through the building in order to minimise strengthening of vertical structure.

5.5.4 Column Strengthening

Column strengthening may be required to some areas of Charterhouse Street block, in particular over the footprint of the courtyard infill slab and where the infill slab connects along grid C and delivers additional load along this line.

Elsewhere across the floor plate it is likely that column loads will reduce due to a reduction in live and superimposed dead loads.

5.5.5 Works to Slab Edges Associated With Façade Replacement

The existing facades are proposed to be replaced for Charterhouse block due to the presence of asbestos, and also to radically modify the external appearance of the building. It is likely that the new façade system will be a similar weight to the existing façade and the capacity of supporting beams and columns is unlikely to be a problem. However, extensive re-profiling of the slab edges is required to provide a straight and consistent cantilever slab edge that doesn't step in at column locations.

5.5.6 Removal of Concrete Façade Mullions

In several locations towards the base of the building, the existing façade incorporates perimeter concrete walls with punched windows. It is assumed that this arrangement formed part of the security provision for the original design.

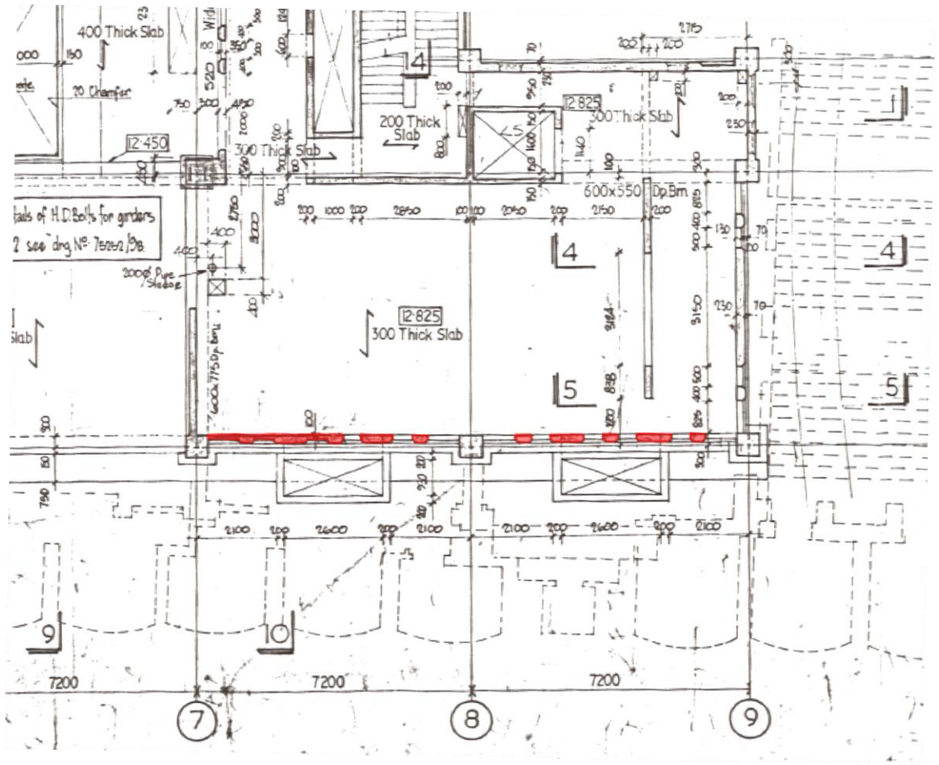


Figure 14: Typical concrete mullions in existing façade structure (shown in red)

Due to the proposed change of building cladding and the intention to open up the elevations to give better daylight and transparency, the existing concrete mullions will require removal. As the concrete walls are likely to provide some support to the connecting slab edges, strengthening to the floor edge beams may be required before the mullions are removed.

5.6 Works to Saffron Hill Block

Much of the work to Saffron Hill Block is similar in nature to that described for Charterhouse Block. The key amendments are noted below.

5.6.1 Core and Stability Wall Alterations

To facilitate the opening up of the office areas, the shear wall at the southern end of the Saffron Hill block (grid H6-H7 at ground floor and G6-G7 above) will be removed and replaced with new stability structure included within the courtyard infill structure.

The main core on the northern end of the block will also undergo some modification, though it will not be as extensive as that in the Charterhouse block. Most of the walls will be retained, although one of the longer shear walls along the interface with the Saffron Hill Extension block may have to be shortened or punched with wider openings.

5.6.2 Addition of Level 6 to Saffron Hill Block

The proposal is to demolish the existing plantroom structure to the north end of Saffron Hill block and also demolish the existing roof structure down to level 4. New slabs will then be formed at level 5 and level 6. This results in an additional floor level over most of Saffron Hill block. It is hoped that column and foundation capacity to support the additional floor can be found through reductions in superimposed dead and live loads on lower floors and via removal of the heavy existing 5th floor slab.

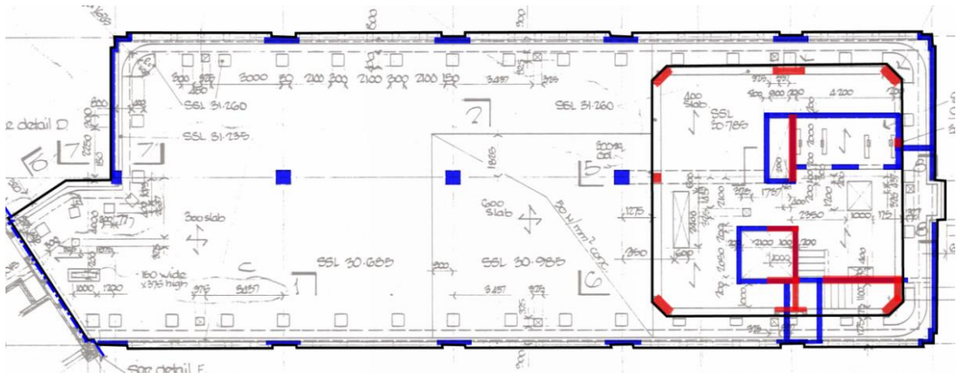


Figure 15: Existing Saffron Hill roof. Structure below in blue and structure above to upper roof in red.

5.6.3 Floor Extensions to West Side of Saffron Hill Block

A new floor extension is proposed to the west side of Saffron Hill block from first floor upwards. This floor extension is approximately 5.5m in width and is therefore too great to cantilever from the western edge of each existing floorplate. The perimeter columns for the floor extension will sit on transfer beams at second floor level, thus allowing column free space within the courtyard atrium below. Reference should be made to the sketches included in Appendix A to understand the proposed load paths.

5.6.4 Column Strengthening

Generally it is hoped that column and foundation strengthening can be avoided for Saffron Hill Block, with the building amendments being offset by load reductions elsewhere. However, along grid 6, the existing columns and foundations are likely to require strengthening or supplementing to support the floor plate extensions to the west.

5.6.5 Works to Slab Edges Associated with Façade Replacement

Works to the slab edges are anticipated to be similar to those required for Charterhouse block and outlined in Section 5.5.5.

5.6.6 Removal of Concrete Façade Mullions

Works to the slab edges are anticipated to be similar to those required for Charterhouse block and outlined in Section 5.5.6.

5.7 Works to Extension Block

Structural amendments to the Extension Block are anticipated to be minimal in comparison to the other blocks.

5.7.1 Amendments to Risers at Interface with Saffron Hill Block

In order to improve the floorplate connectivity between Saffron Hill and Extension Blocks, some amendments to the service risers are anticipated to be required at the interface between the blocks. This is likely to require infilling of existing risers and formation of new risers in alternative locations, dependent on the servicing strategy for the revised buildings (see Figure 16).

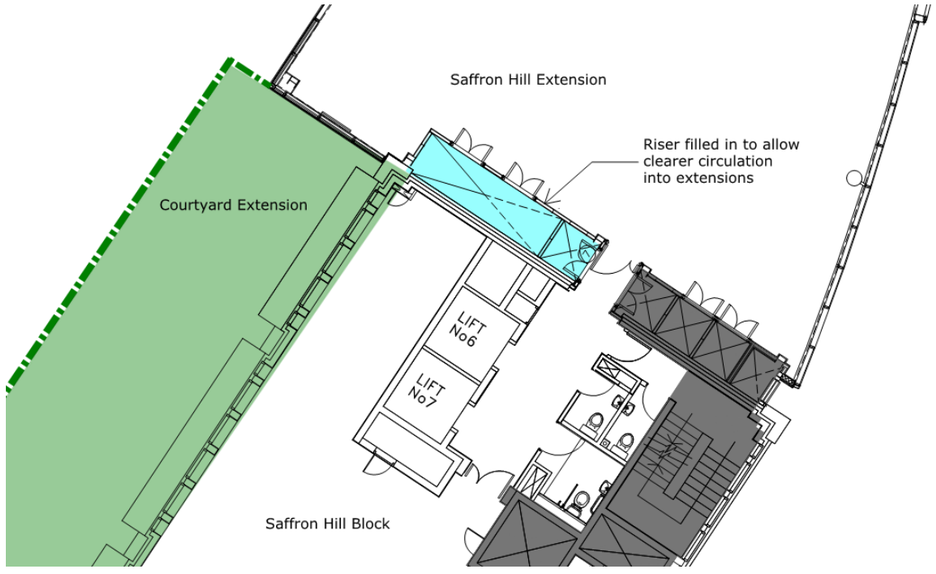


Figure 16: Alterations to core and interface between Saffron Hill and extension

5.8 Courtyard Atrium Structure

A new glazed courtyard structure is proposed to the West side of Saffron Hill Block at ground floor level. This is anticipated to be a key feature of the new building, providing a high quality, flexible recreation and events space. The primary roof and west wall structure will incorporate the transfer beams and supporting columns described in section 5.6.3.

5.9 Builders Works for Building Services Installation

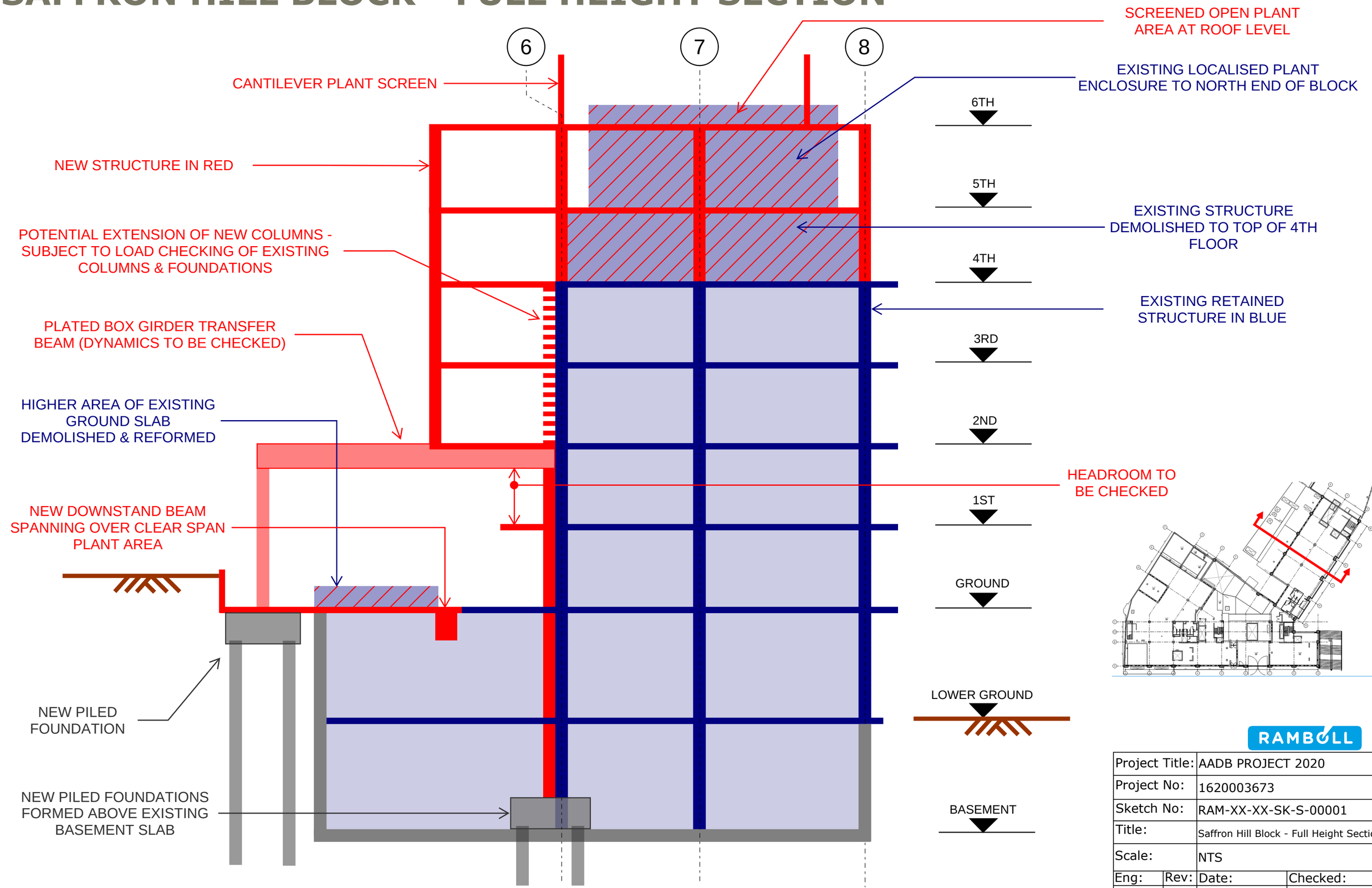
Further minor structural works are anticipated to be required to incorporate new building services installations. Full requirements will be determined as the building services design progresses.

APPENDIX A:

INTERFACES BETWEEN NEW AND EXISTING CONSTRUCTION

PROJECT 2020

SAFFRON HILL BLOCK - FULL HEIGHT SECTION



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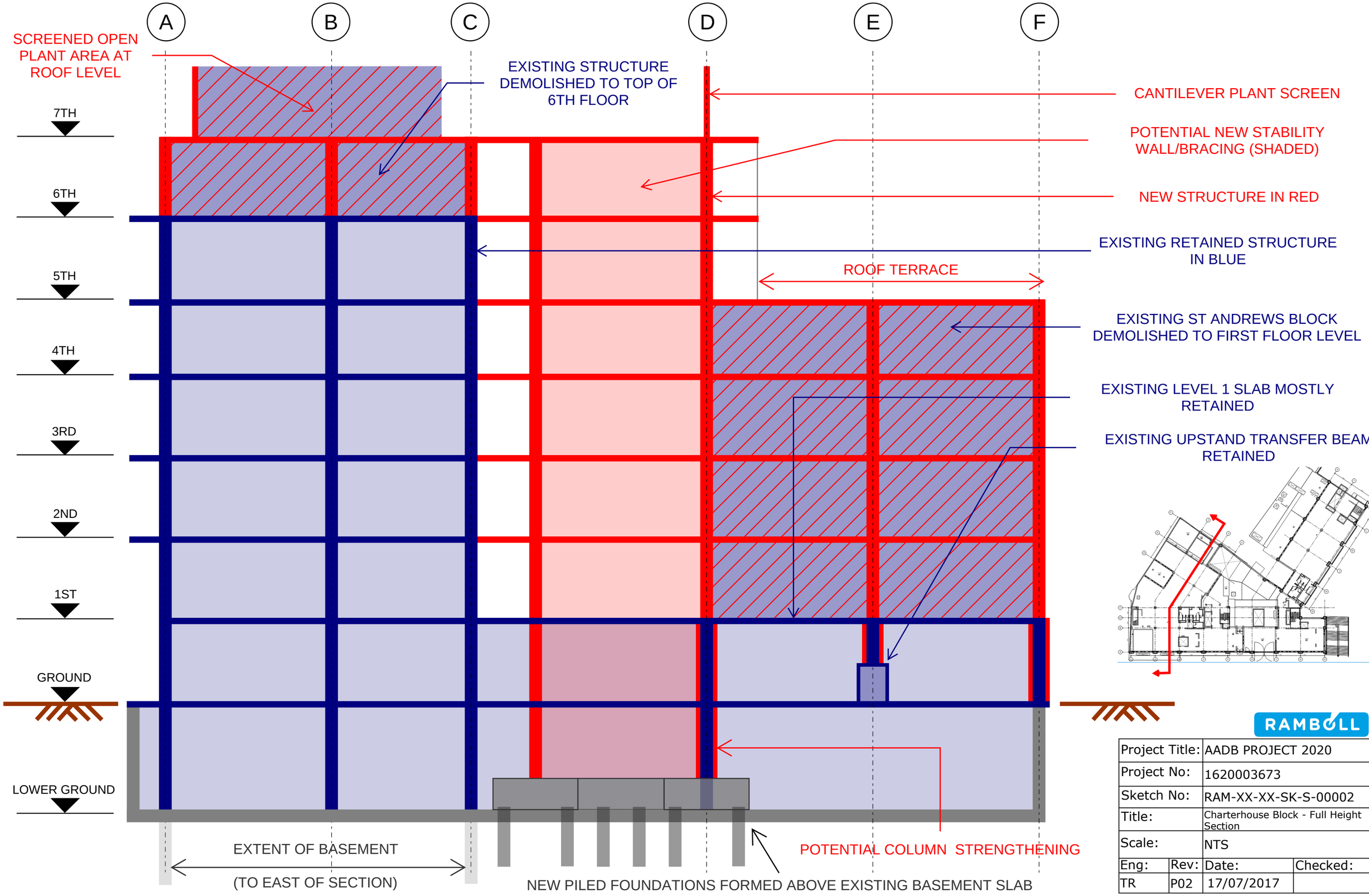
Project Title:	AADB PROJECT 2020		
Project No:	1620003673		
Sketch No:	RAM-XX-XX-SK-S-00001		
Title:	Saffron Hill Block - Full Height Section		
Scale:	NTS		
Eng:	Rev:	Date:	Checked:
TR	P02	17/07/2017	

PROJECT 2020

CHARTERHOUSE BLOCK - FULL HEIGHT SECTION



RAMBOLL

Project Title:	AADB PROJECT 2020		
Project No:	1620003673		
Sketch No:	RAM-XX-XX-SK-S-00002		
Title:	Charterhouse Block - Full Height Section		
Scale:	NTS		
Eng:	Rev:	Date:	Checked:
TR	P02	17/07/2017	