# ST ANDREW'S HOUSE
# PLANNING STRUCTURAL REPORT

Project name **St Andrew's House Refurbishment**
Project no. **1620011799**
Client **Anglo American De Beers**
Version **[01]**
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## 1 Introduction

Ramboll are acting as structural engineering consultants to Anglo-American De Beers for the refurbishment of the Grade II listed St Andrews House, London.

The project brief is to bring St Andrews House up to the same standard as the adjacent Anglo-American De Beers corporate headquarters, requiring upgraded M&E systems – with associated plant additions at roof and ground floor level - material alterations, a renovated interior and heritage fabric maintenance works.

## 2 The Building

The existing Grade II listed building comprises nineteen flats over four storeys with attic, some now in office use. It was built in 1875 by Corporation of the City of London, architect Horace Jones. The structure comprises stock brick with some rendered details and a flat roof.

In plan, the building is made up of a one-bay centrepiece and two-bay end wings, with between them on each side and each floor six bays set behind galleries of cast-iron with exposed four-centred beams. All windows have glazing-bar sashes, those to centre and ends in stucco surrounds.

The block was originally known as Viaduct Buildings and is the oldest surviving public housing in London and one of the oldest in Britain. This is the survivor of two blocks built by the Corporation, whose design owes much to Sydney Waterlow's model dwellings for the Improved Industrial Dwellings Company.



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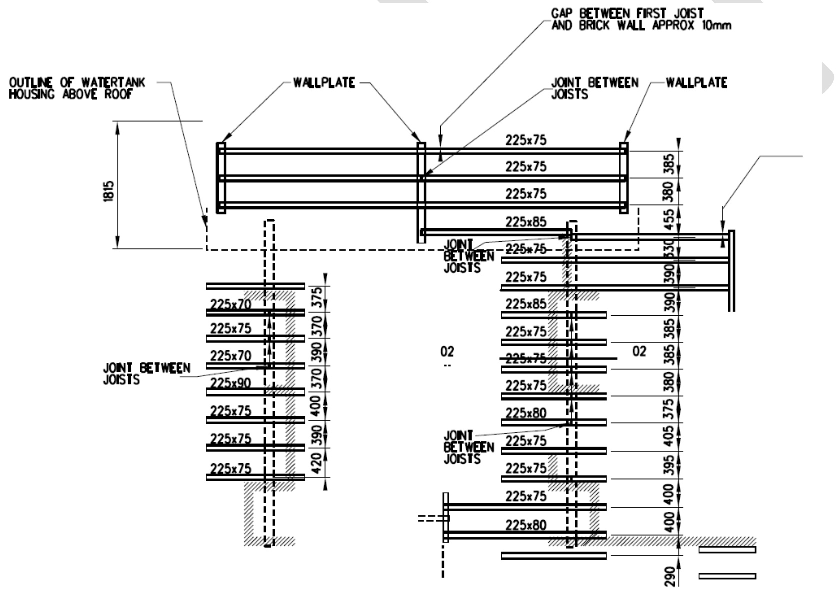
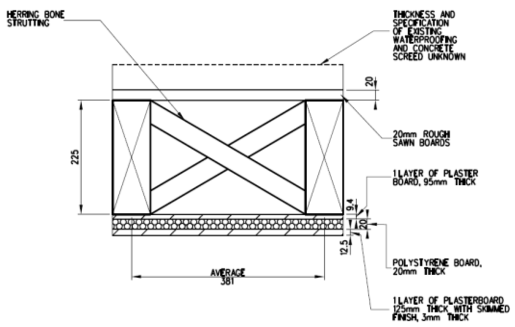
# 3 Existing Structure

## 3.1 Roof Level

The flat roof is of original timber joist construction, topped with sarking board and thought to have a 150mm concrete topping screed/slab, cast directly onto the timber sarking boards. The joists are well sized, thought to be of Baltic Pine, spanning longitudinally between transverse cross walls and occasionally steel support beams, as installed in the 2006 works. Also, as part of these works, the flat roof was upgraded with a Sarnafil layer of insulation and a single ply membrane over.

The existing roof level comprises four existing plant enclosures, housing hot water generation and distribution equipment, seated within the four bays of the rear elevation. These bays coincide with the current location of the main soil pipe and hot-water distribution risers, hard against the rear elevation. The building perimeter walls are formed in load bearing 225mm thick bonded London Stock brickwork in lime mortar, with the existing enclosures running along the line of the rear façade and around the bay returns, and projecting up from the top of the building by around 1200-1500mm in height, approximately 1 metre above the parapet.



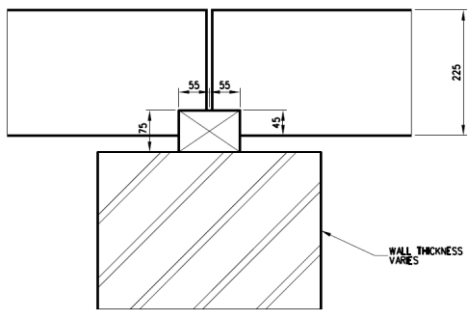




**Figure 1: Archival record from the 2006 works showing the existing roof level joist sizes, spacing and arrangement. Note the topmost 3 joists are within the rear elevation bays.**
**Figure 2: (left): The existing roof and ceiling building up. Note the herring bone strutting between joists**
**Figure 3: The joists are end notched onto wall plates centrally positioned on the transverse cross walls**

### 3.2 Ground Floor Level - Flat 4

The existing flat 4 is to be converted into a plant room and as such we have carried out investigations into the existing floor's condition and layout, locally at this area only to consider the proposed alterations.

The ground floor is suspended, with a significant sub-floor void down to uncompacted earth at oversite level. No testing for contaminants has been carried out. The ground floor comprises timber floorboards on 4" deep longitudinal spanning joists between timber wall-plates on sleeper walls within the floor void. No excavations or trial pits have been made at this stage and as such the footings of the existing sleeper walls at oversite level could not be confirmed.

There is evidence of past alterations within the floor void, including the introduction of what appears to be a fletton brick pier, but none that are in structural function currently.

At the primary masonry cross walls that run the full height of the building, the joists aren't able to have a dead bearing and as such are pocketed in. as well as onto sleeper walls, at Flat 4 the joists bear onto a wall plate running along the edge of a solid concrete chimney hearth – see Figure 5.

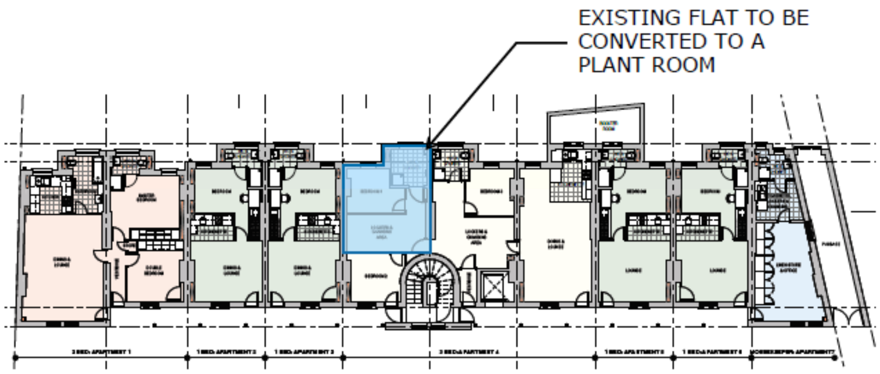



**Figure 4: Ground floor plan showing the location of flat 4, on the centreline to the rear of the property.**

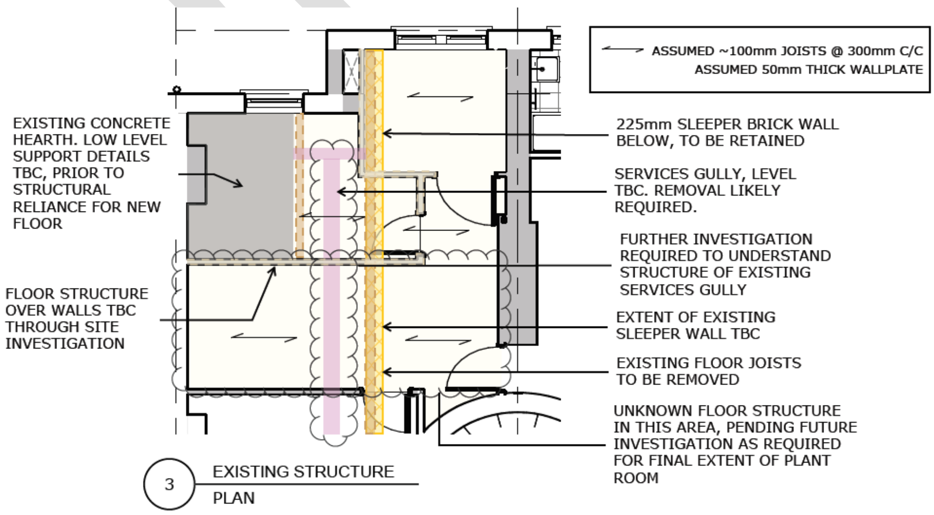



**Figure 5: The existing structure has been investigated through the lifting of floorboards to allow a visual, tactile, photographic structural survey to be carried out.**

## 4 Structural Proposals

### 4.1 Philosophy

As a Grade II listed building, our structural strategy and philosophy for repairs and alterations aligns with the principles of modern conservation:

1. Sympathetic alterations

When designing repairs or alterations to a listed building, we must consider not only structural/architectural feasibility, but the work's reversibility and integrity. Ultimately, where interventions are required, they have been designed to be appropriate and proportionate, not driven solely by the ambitions of the project and always allowing the historic value of the asset to be understood by future generations.

2. Conserve as found

A thorough desk study of the past and current usage of the building, it's materials, methods of construction and historic alterations through enquiries and archive record searches has been carried out, and this is considered a critical phase of any listed building project . This 'anamnesis' phase allows full diagnosis and an appropriate course of action to be decided on, suitable to the existing building.

3. Minimum intervention

All efforts have been made to minimise the impact of the requisite alterations. We are of the belief that adaptive works need not be to the long-term detriment of the building. Through development, controlled fabric loss can potentially be offset by the building's continued functionality and therefore upkeep.

4. Engage

Successful conservation projects typically succeed through close collaboration of the design team, client and statutory parties through to project fruition. Early engagement has allowed a clear brief to be established and shared project values developed, often bringing financial, project programme and construction phase rewards.

### 4.2 Design Standards

As is best practice for buildings of this age, the existing construction has been back-analysed from first principles and historic design codes contemporaneous to its construction. All introductions will be designed to Eurocode standards including:

Eurocode 0 (BS EN 1990) – Basis of Design
Eurocode 1 (BS EN 1991) – Actions on Structures
Eurocode 2 (BS EN 1992) – Design of Concrete Structures
Eurocode 3 (BS EN 1993) – Design of Steel Structures
Eurocode 6 (BS EN 1996) – Design of Masonry Structures
Eurocode 7 (BS EN 1997) – Geotechnical Design

## 4.3 Proposed Interventions

### 4.3.1 Re-servicing Enabling Works

A key aspect of the project is the vertical distribution of the associated pipework from the new and existing roof level enclosures downwards through the building, along the existing risers.

Th design team’s studies indicate that compared to the existing, the number of pipe-runs from roof-level is to increase and the additional pipework runs needed to be closely considered with respect to space within the risers and moving/altering of existing structural fabric – be it trimming out or coring through existing floor joists or forming of new penetrations through brickwork walls.

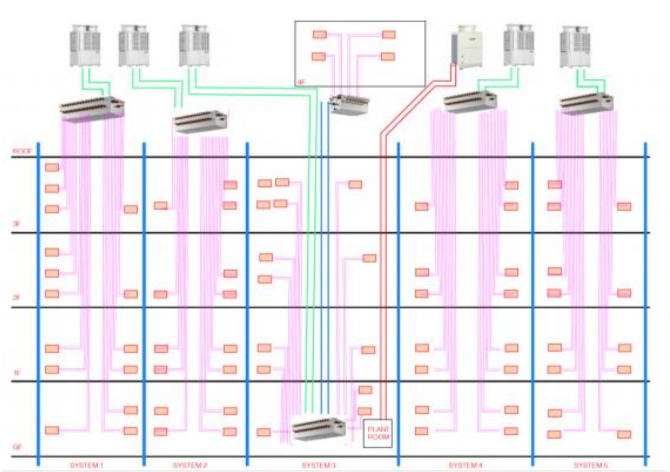


**Figure 6: The number of pipes diminishes down through the building. Additional risers away from the existing would require additional structural openings to be formed at roof level and throughout the building.**

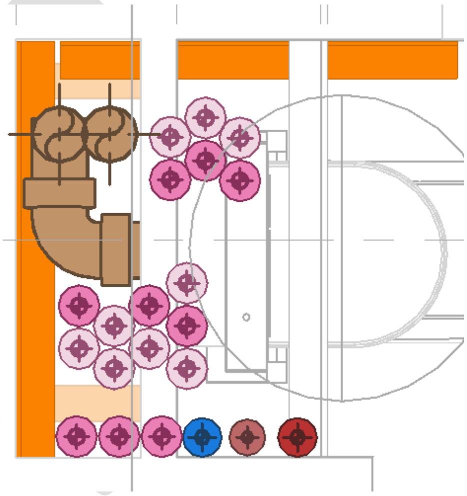


**Figure 7: Plan of corner riser in bay. Due to the number of pipes at the upper levels, close coordination of the riser size, joist size and joist placement has been made to give assurances on feasibility.**

In line with good conservation, the servicing strategy is to as far as possible allow for joists and brickwork to be left in-situ and untouched, with trimming out to be used only where absolutely necessary.

### 4.3.2 Roof Level Enclosures

Two centrally positioned enclosures are proposed, orientated longitudinally to minimise visibility from the roof level terraces. Each will be circa 3 metres tall and have a minimum internal area of 5.5m x 2.7m to house Hybrid Variable Refrigerant Flow (HVRF) Heat Recovery units, at adequate spacings.

The Hybrid Branch Controller (HBC) units for distribution are to be housed in the existing roof level enclosures, to be upgraded in line with current standards and project requirements.

The new HVRF enclosures have been designed to be of simple construction and lightweight, to avoid placing excessive additional load onto the existing brick or temporarily on the timber roof construction during erection. From a CDM perspective, by reducing the complexity of construction, we allow either pre-fabrication and lifting of enclosures (or parts of enclosures) straight into position using cranage or alternatively erection in situ at roof level. The latter approach avoids the need for large tower cranes etc, with the new central position of the enclosure reducing health and safety implications of constructing on a roof.

The low permissible load uplift in the temporary condition led us to a steel 'kit of parts' solution, fully braced in the walls in two orthogonal directions and in the roof plane. The enclosure cladding is to be lightweight pressed metal to further minimise weight whilst providing a visually honest addition to the roof of this heritage asset.

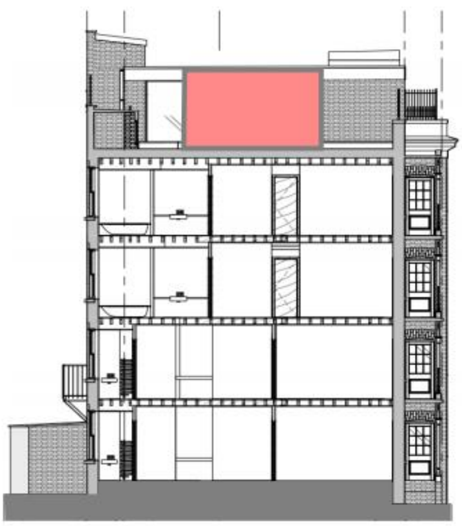


**Figure 8: The HVRF plant will be housed in longitudinally orientated, centrally positioned metal-clad lightweight steel enclosures,**

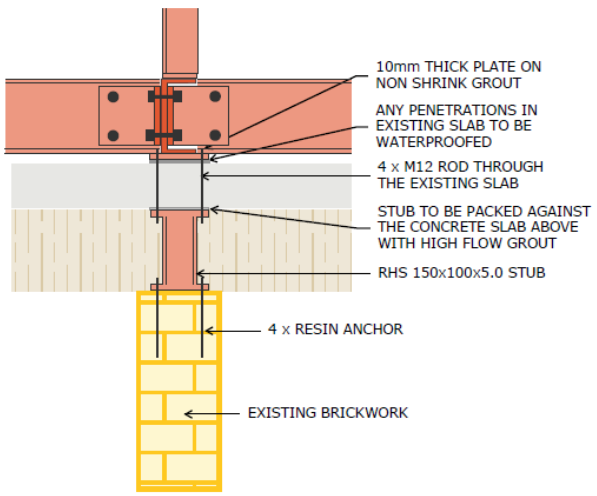
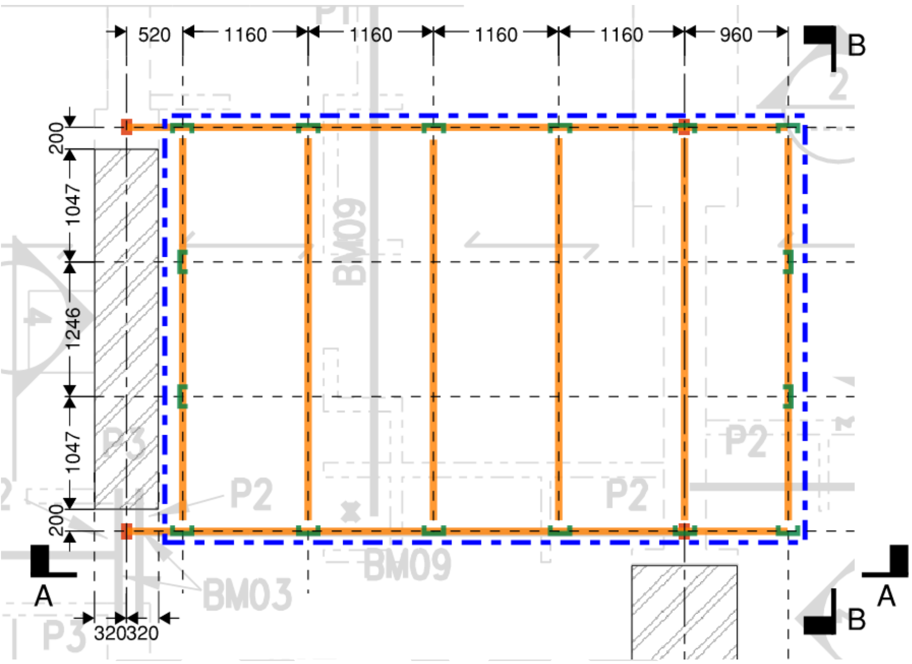



**Figure 9: Vertical load transfer from the steel frame downward onto the brickwork below, via the roof level slab and boarding.**

Further facilitating builders-work will include peeling back of the insulation and rooftopping, in order to seat the frame directly onto the screed, which will be supported beneath through the introduction of localised stud members seated on existing load bearing masonry walls, packed tight to the underside of the existing boards – see Figure 9. The studs are to be installed within the structural zone of the existing joists, between them, from below to allow retention of the existing boarding and slabs. A 15mm vertical separation is to be left between the new steel frame and existing roof slab to ensure load transfer through the studs to the brick wall *only,* even when the frame deflects under load.

Once the base frame is seated, new insulation and membrane is to be installed, including falls, allowing for a lapped interface over the new enclosure base.



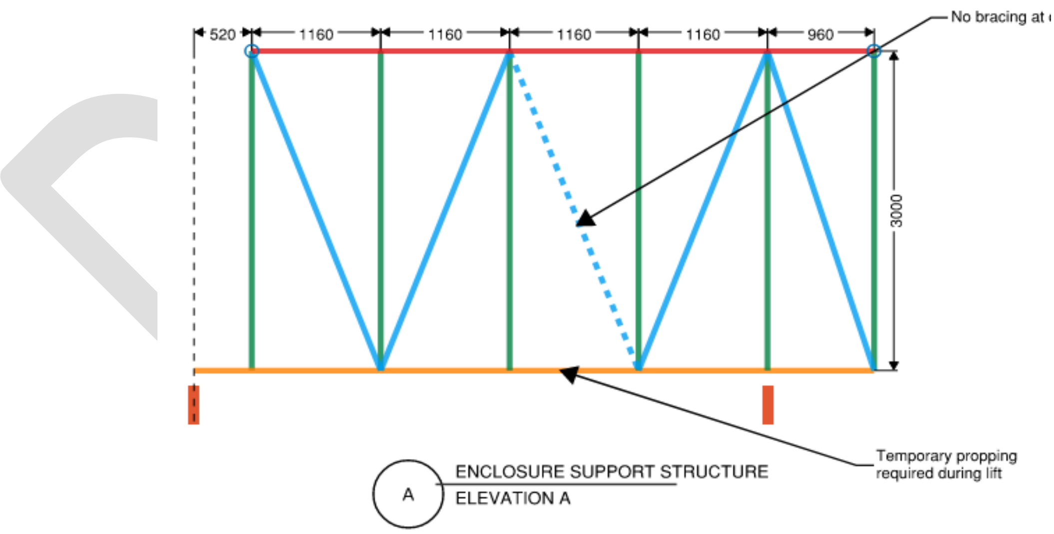




**Figure 10: Proposed base frame structural arrangement and setting out, allowing for studs (red) to transfer load to the brick walls under. In this orientation, the frame must cantilever beyond the rightmost brick wall (under)**

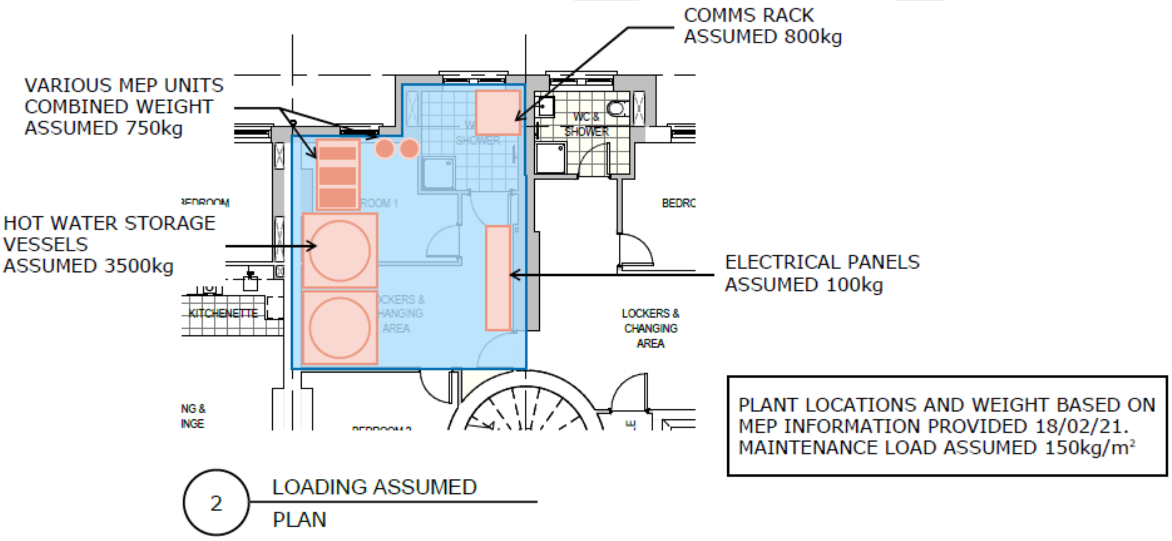
**Figure11: Longitudinal elevation A of the proposed enclosure, showing the traditional cross bracing within the walls.**

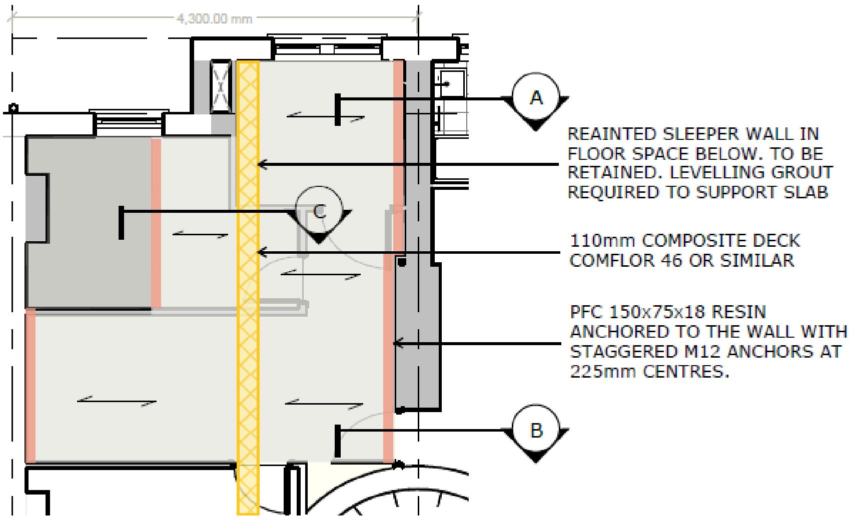
### 4.3.3 Flat 4 Plant Room

In order to convert the existing Flat 4 into a plant room, the timber floor is to be replaced with a concrete slab to support significant localised point loads associated with hot water storage vessels, as well as allowing waterproofing and bunding of the floor.

To minimise the structural zone depth and allow the surrounding thresholds to remain (see Figure 14), a composite steel Slimflor concrete deck construction is proposed. This uses a 110mm deep insitu concrete slab on deep composite steel decking which is supported by bearing onto grout beds on the existing sleeper walls and at the room edges, onto newly introduced PFC walls plates, chem anchored into the brickwork.

This form of construction has the benefit of avoiding downstand beams in the interior of the room, reducing the likelihood of clash with existing sub-floor structure and allowing optimum services distribution. By utilising a concrete solution, an edge upstand bunds can be formed as a plant room requirement.



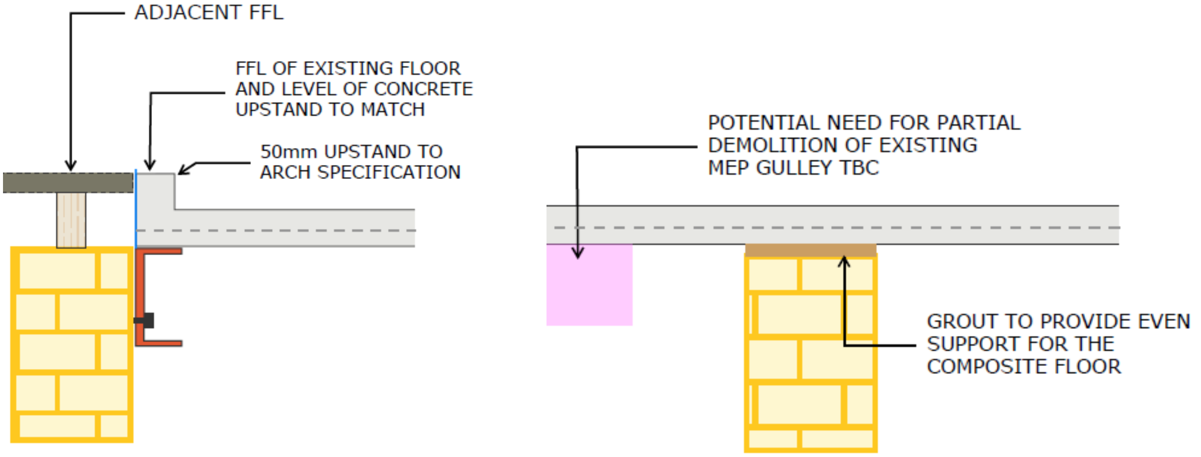



**Figure 12: The MEP loading has determined the floor thickness and support arrangement.**
**Figure 13: The proposed replacement floor in Flat 4 has been designed for peak point load.**
**Figure 14 (left): By reducing the structural floor depth and leaving the surface with no finishes, we can create an edge bunding that meets the existing door threshold level, without lowering the existing sleeper wall onto which the slab will sit.**
**Figure 15 (right): The composite deck will be seated on the sleeper walls, with levelling grout under**

The existing stud walls within Flat 4 will be removed – they are thought to serve no structural function in supporting the 1st floor over – further intrusive investigations required to confirm.

To maximise fabric retention, any conversion of existing windows in the perimeter walls to doorways would involve the retention of the existing brick lintel and vertical saw cutting from cill level to floor level. There would be no change in load case or pathway.