Hydrock

39-47 Gordon Square, London

Structural Statement in support of Listed Building Consent Application

For Birkbeck, University of London

Date: *10 September 2020*

Doc ref: *BGS-HYD-XX-XX-RP-S-002*

DOCUMENT CONTROL SHEET

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Appendices

1. INTRODUCTION

Hydrock have been engaged by client Birkbeck University of London with AHR to provide civil, structural, M&E, fire and acoustic design consultancy services in respect of the proposed refurbishment and remodelling of 39-47 Gordon Square. The basement level of building 46 is a residential unit and is outside the property demise and scope of the scheme.

This report constitutes a Structural Statement in support of the Listed Building Consent Application.

The report has been based on visual inspections, intrusive opening-up works and documents prepared or provided by the client and on our site surveys. Please see below the list of relevant documents that this report has been based on:

- Structural Survey Report Rev. P3 dated September 2019 by Campbell Reith;
- Existing Building Layout and Proposed Office Allocation Drawings by Birkbeck University of London;
- Site Visit Overview – J3397 Ceiling Collapse Report dated November 2017 by Webb Yates Engineers;
- Intrusive Inspection Summary – J3397 Ceiling Collapse Report dated January 2018 by Webb Yates Engineers;
- Initial Design Report dated October 2018 by Tate Hindle Architects;
- A number of historic building plans provided by Donald Insall Associates;
- Opening-up Works Report dated August 2019 by Chelmer Global Ltd.

The report describes the existing building's structure, identifying its sensitive Heritage aspects and structural condition. It should be read in conjunction with the Heritage Consultant's and Architect's reports and drawings. The report goes on to describe the proposed works comprising alterations, upgrades and repairs where they are relevant to Heritage fabric. The report identifies how proposed works have been mitigated in terms of reversibility, intrusiveness and sensitivity.

The details on drawings and specifications have been developed in conjunction with the following design team:

- Client: Birkbeck University of London
- Project Management: AHR Architects
- Architect: AHR Architects
- Heritage Consultant: Alan Baxter & Associates
- Services engineer: Hydrock Consultants
- Structural and civil engineer: Hydrock Consultants
- Quantity Surveyor: Fulkers Bailey Russell

2. HERITAGE OVERVIEW

2.1 Heritage assessment

The Grade II Listed building in the Bloomsbury Conservation Area was originally a speculative residential development mostly constructed around 1825, with number 47 constructed in a later phase around 1850. The building was designed as a terrace of individual houses, responding to the economic boom in the Bloomsbury area at the time. It is understood that the buildings were not occupied for some years after completion and it has been hypothesised that developer's cost cutting could reflect in the latent condition of the buildings.

The key heritage assets of the buildings have been identified by the Heritage Consultant as follows:

- The external appearance of the front elevation and its context and contribution to the overall appearance of Gordon Square and wider Conservation Area. The elevation is largely unaltered since construction apart from some small insensitive repairs and additions.
- The retention of the building's original individual residential houses arrangement.
- The building's association with the academic luminaries of the Bloomsbury Group, notably Virginia Woolf and John Maynard Keynes who both lived and worked there. Moreover, the continued academic legacy afforded by current owners, Birkbeck.
- Many important architectural heritage features within the building, in particular ornate and individual cornicing, rails, roses, cantilever stone staircases, balustrading, sash windows, stonework.

It is further noted that the building has been subject to many alterations over the years. Some of these additions and alterations are of architectural interest, particularly the cinema auditorium which won a RIBA design award in 2007. However other alterations have sometimes been ill-conceived, unplanned and generally detrimental to the building in terms of heritage. Particular areas that are considered unimportant or ever detrimental to the building's heritage assets and where removal or reversal may be considered beneficial are as follows:

- Alterations in 20th Century associated with change of use from individual houses to apartments.
- Post-war tenement extensions to the rear.

2.2 Primary structural heritage objectives of the scheme

2.2.1 Structural upgrade

The building was designed as terraced residential properties assuming a design loading significantly less structurally onerous than its current use. Although the original design predates even the London Building Act (the precursor to current design codes) it is clear that modern design loadings way exceed the structural capacity of spanning floor elements. This is especially so in the context of academic users who carry large personal libraries which have been overloading floor structure.

The alterations respond to modern usages but in a sensitive way that encompasses a pragmatic approach to what can be achieved. Importantly the proposals extend to management of building users to allow them to go about their business without compromising the building's capacities.

It is acknowledged that some lenience on Building Regulations will need to be sought to agree these changes, however given the heritage sensitivities and the pragmatic structural approach this is not considered to be contentious.

2.2.2 *Structural repair*

A number of structural defects have been encountered at the building as identified in the RIBA 2 report by Campbell Reith and inspections carried in RIBA 3. Most notably are the ceiling collapses which precipitated the wider review of the building's use and onward sustainability. Defects are also characterised by the following issues:

- Insensitive repairs or alterations
- Overloading of the structure
- General age / decay

A more detailed description of the building's structural condition is given below, with further sections on repairs.

2.2.3 *University operation*

The continued academic function of the building is important to its heritage legacy. For that to be sustainable the architecture of the building needs to respond to the changing needs of Birkbeck's educational operations. This is particularly significant against the backdrop of different methods of teaching their portfolio of subjects, remote learning, Covid response and other functions of the building such as the gallery and hired out spaces.

The structural scheme proposals respond to the architectural proposals. They have been developed in coordination with the architect and heritage consultant to focus intrusions on areas least heritage-sensitive to enable the building to be altered with the long-term sustainability of its education function at the forefront. It should be noted that some of the operation drivers overlap with issues of structural repair and upgrade, e.g. dense storage units.

2.2.4 *Circulation*

A particular difficulty of the architectural design is circulation around the building that is legible, fully accessible to all users and crucially safe in terms of emergency escape. The regular "party" walls, narrow corridors and stone staircases associated with the original residential design all significantly complicate the circulation design. However, they are of course of prime heritage concern and of defining characterisation to the building.

The scheme proposals therefore limit intrusion and alteration to these elements, but rather focus on creating new enabling circulation functions that allow sensitive areas to remain unaltered.

2.2.5 *Heritage features*

There are many architectural features such as cornices, roses, rails etc which are key heritage assets and cannot be damaged. Structural proposals have been contrived so that they can be implemented without needing to intrude on these features. Floor strengthening has been designed within the floor structure zone and detailed where required to be installed from above rather than disturbing ceiling finishes and decorations. New openings in walls have been designed with sufficient bulkhead to accommodate a downstanding beam and needle supports all below the level of any cornicing. New openings between party walls have also been contrived with supporting piers to minimise the intrusion on the party walls and leave clear relic of the original structural layout.

3. EXISTING SITE INFORMATION

3.1 Existing site

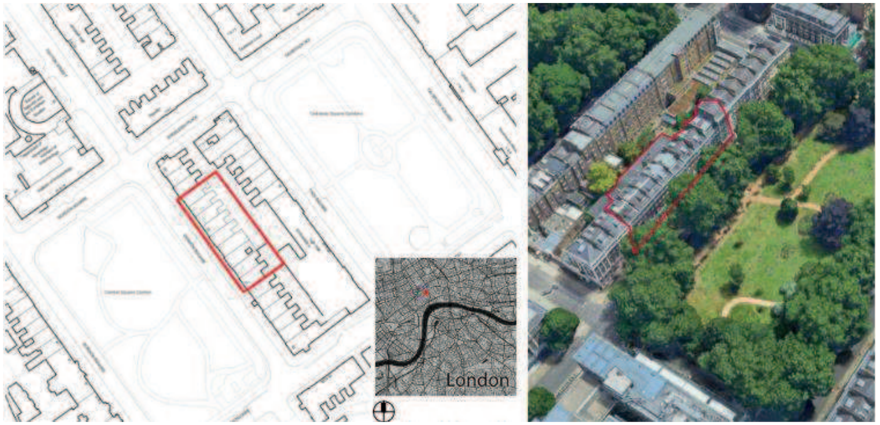


Figure 1: Site Location Plan and Birds Eye View

The site comprises of nine town houses to the east side of Gordon Square, standing centrally within a terrace of residential properties, latterly used for education purposes. It is located to the north east of Gordon Square. Adjoining to the north-west and south-east of the building are No. 38 Gordon Square and No. 48 Gordon Square respectively.

The buildings were originally constructed as private houses and have been adapted and linked over time to suit their current use. However, the original residential floor loadings have not been upgraded to suit the building's current use. The floors are now exhibiting signs of sagging and structural distress; many areas of the original lath and plaster ceilings are cracking and there have been several small ceiling collapses in recent years. As a result, restrictions have had to be placed on the number of books and other material kept within academic offices and on the occupation levels of some of the teaching spaces.

3.2 Ground conditions and site information

- The site is not in a flood risk area according to the EA website
- The site is likely to be in a UXO high risk area.
- The site is underlain by competent sands and gravels at about 2m below ground, then stiff London Clay at about 4m.
- The nearest below ground watercourse is the River Thames at 1.3 miles away.
- The site is not in an area recorded at significant risk of radon.

3.3 Underground Utilities

Existing underground services information to be provided. The gas mains are believed to all enter in the vaults and run above ground from there while the HV terminates at the substation in 42 by the site boundary.

London Underground map showing abandoned tunnel as well, shows that the site does not sit above any underground tunnels.

Figure 2: London underground map

4. EXISTING BUILDING INFORMATION

4.1 Building listing

Nos. 39-47 Gordon Square are Grade II-listed buildings located in the Bloomsbury Conservation Area in the London Borough of Camden. They form part of the wider setting of other listed buildings on Gordon Square including Nos. 1-5, 14-15, 16-25, 26, 36, 46 and 47-53.

Structural works have been developed alongside the heritage consultant and conservation officer in order to focus interventions to areas of least significance, minimise disruption and provide sympathetic insertions.

4.2 Existing building form and condition

4.2.1 General structural form

39-47 Gordon Square comprises 9 inter-connected Georgian terrace houses built on the north-east side of Gordon Square in two phases. Nos. 39-46 were built in 1825, and has 4 storeys (plus basement) while no.47 was erected in 1850 and comprises of 5 storeys (plus basement). The nine houses were all intended to be used as single-family occupation and they are all load bearing masonry with timber floors.

The earliest drawings that show the structure with no alterations are from 1926 and relate to building no. 43, shown on the next page on figures 3 and 4.

Alterations to the drainage were made in the 1930s when all the terraced houses were converted into flats. It would appear that at the same time, the basement and ground floors were combined to form duplex units (such as the third and fourth floor) and some internal partitions were amended.

From the late 1950s to the late 1960s the University of London undertook a series of alterations that include:

- The connection of the buildings through a sequence of lateral penetrations and the insertion of corridors;
- The removal of the principal staircase in Nos. 42 and 43, the basement-to-ground floor staircase flight within No. 45, and the secondary staircase in No. 43. A new principal staircase was erected in No. 43 to the south of its original location, resulting in the eradication of the original plan form at every level
- A full-width, two-storey extension with associated lightwells was erected to the rear of all four building (figure 5 below indicates);
- A single-storey extension was erected at first-floor level to the rears of No. 43-44, while an associated cooling tower rose to the third floor behind No. 43;
- A single-storey basement extension was added to the rear of No. 41 (figure 6 below refers).

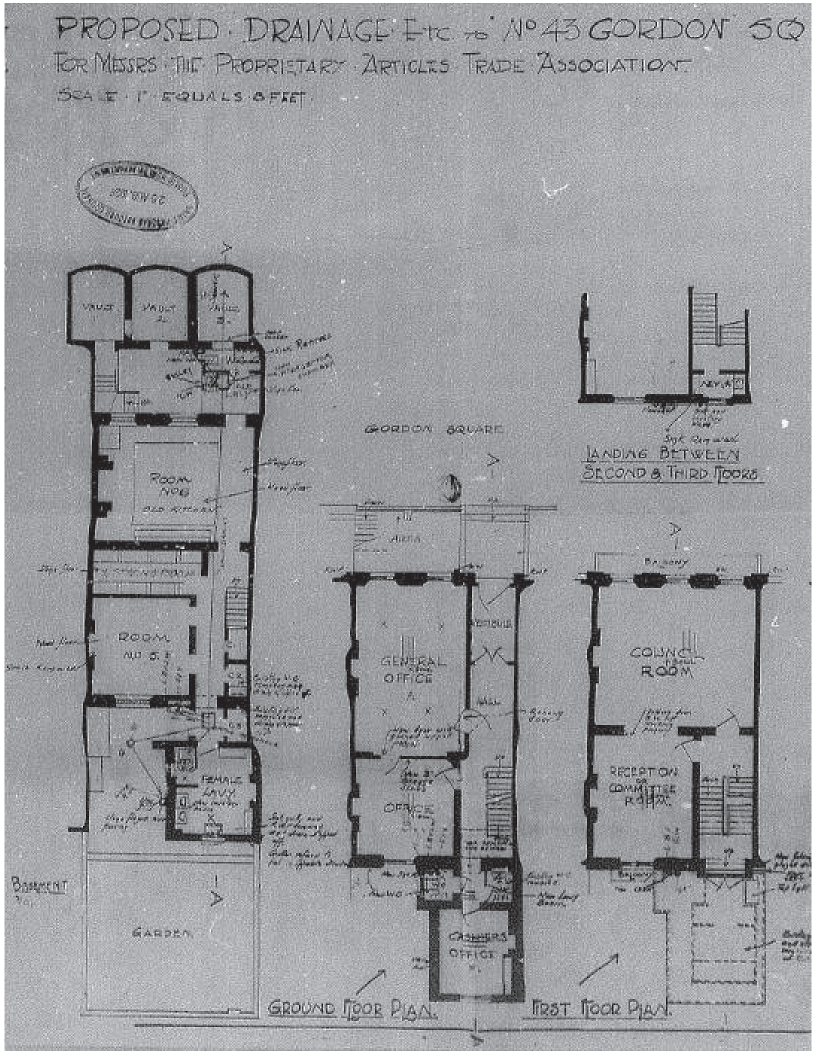


Figure 3: Building 43 structure with no alterations from 1926

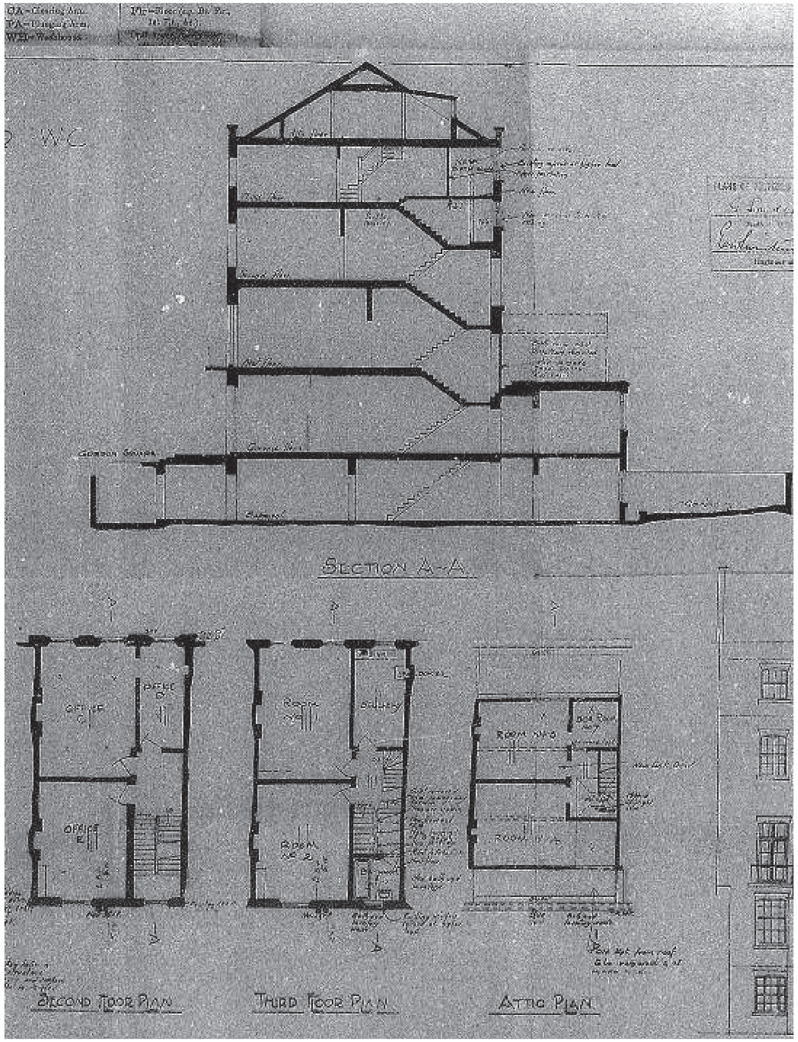


Figure 4: Building 43 structure with no alterations from 1926

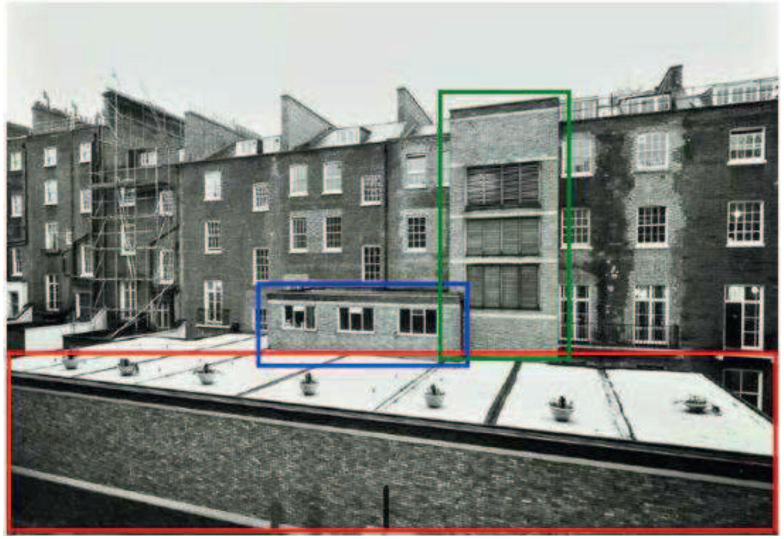


Figure 5: Full-width, two-storey extension (in red), single-storey extension at first-floor level to the rears of No. 43-44 (in blue), cooling tower to the third floor behind No. 43 (In green)

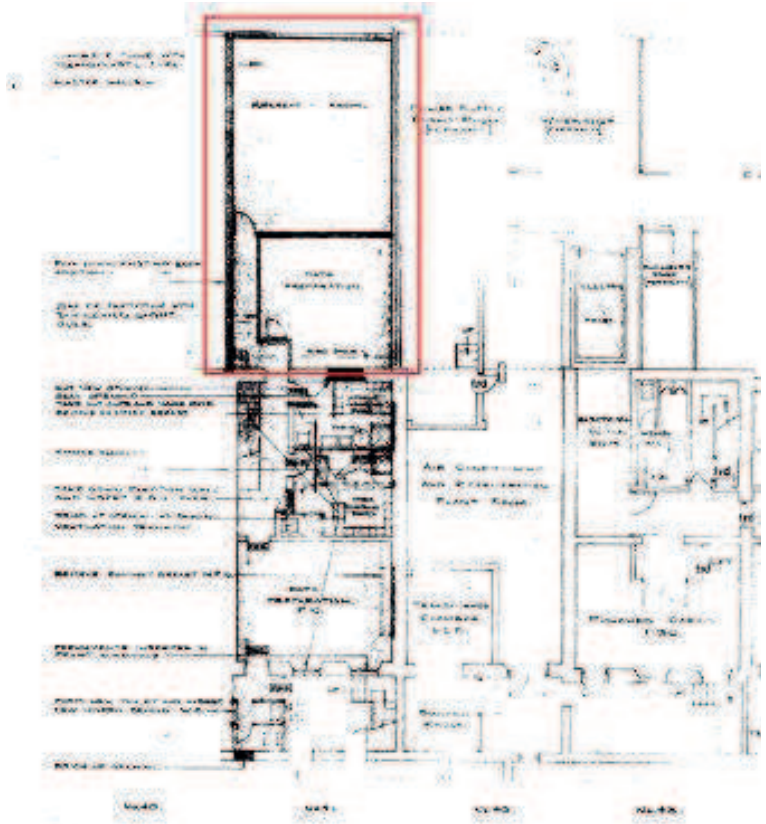


Figure 6: Single-storey basement extension to the rear of No. 41

4.2.2 Structural alterations

Recent alterations include as follows.

- new partition walls were added, while others were removed, and additional openings through party walls were formed;
- Conversion of the ground floor in the rear extension of 39-41 Gordon Square into an auditorium by Surface Architect;
- A seminar room, plant room and break-out space were included at basement level. The roof of the extension was also adapted to include a metal-framed skylight with clear glazing to improve lighting;
- The section of the modern principal staircase that provided access to the basement and the first floor was removed and a glazed screen installed to create a lobby space at the very front of the building.

The current building structure is described in recent opening up works by Chelmer Global Ltd, archive documents and visual inspections. It can be described and summarised as follows:

» Roof – timber purlins spanning between trusses that bear onto external walls. The external walls from fourth floor to roof are stepping back and it`s unclear how they are supported. A second round of opening up works have been proposed to find out if they are trussed walls or if they are supported by timber/steel beams.

» Floor – traditional timber joist and boarded floors are original to the building`s construction in 1825. They usually span between party walls and load bearing walls although their directions are not consistent throughout the building. At ground floor, opening up works revealed the presence of steel/timber beams and concrete slabs which indicates historic strengthening works. Basement floor is believed to be a ground bearing concrete slab. Proposed opening up works will investigate its depth.

» Walls – External walls are original solid masonry walls while internal partitions are typically formed by timber truss studs. Internal load bearing walls are formed by timber truss studs or masonry.

» Foundations – Foundations are believed to be strip footing under load bearing walls.

» Rear Extension – The rear extension is believed to comprise of concrete floors on steel frame (highlighted in the image below). During the visual inspections, concrete columns and beams have been noted in the basement but they are believed to be made of steel with concrete encasement rather than reinforced concrete structure

Figure 7: Level 00 - Existing Significance Plan with extension highlighted in red

4.2.3 Structural condition

The buildings have been subjected to overloading of the floors when the use was changed from residential to offices/classrooms. The worst cases of this are the academic staff's offices who retain personal libraries, the extent of which way exceed the notion of domestic book shelves and are thus severely overloading the floor joists. As a result of this, together with a normal deterioration of the materials and water ingress, there are structural defects present as listed below:

- The ceiling of no.42 in room 218 collapsed in 2017 on 27th October as reported and detailed in the "Site Visit Overview" by Webb Yates (Ref: J3397-S-RP-000). The collapse is believed to be caused by overloading of the floor joists with possible water ingress along with temperature change weakening the ceiling's plaster.
- A bulge in the ceiling and cracks were observed in Room 122 on 31st October of the same year;
- Inadequately supported partition walls, changes in ambient temperature occurring in rooms, and possible saturation of the plaster are also believed to be the cause of cracks within the building;
- The capacity of some timber floor joists may have been compromised by water ingress;
- Balconies on the rear have been reported to be in need of structural repairs to the balustrade, balcony support and waterproofing;

- Some chimneys have been reported to be leaning and/or present some cracking.

4.2.4 Further investigations

Proposed further investigations have been identified as being required due to perceived defects not understood and to inform on design proposals. Necessity for investigations have been classified as follows:

Most necessary:

- Existing construction has not been confirmed and it cannot reliably be predicted from experience or precedent; AND,
- Not knowing the structural form will leave significant risk in design due to structural significance or extent of work that impinges on it.

Necessary:

- Existing construction has not been confirmed and it cannot reliably be predicted from experience or precedent; OR,
- Not knowing the structural form will leave significant risk in design due to structural significance or extent of work that impinges on it.

Least necessary:

- Existing construction not confirmed but can be reasonably predicted; AND/OR,
- There is little structural significance or extent of work that impinges on it; AND/OR,
- The investigation is easy and not disruptive achieve.

The opening up strategy, after detailed discussion with multiple stakeholders during Stage 2, is to avoid opening up and investigate the ground floor structure from above and rather access it from the basement floor ceiling level below.

Proposed strategy for investigating ceilings and floor zones generally will be via careful lifting of floorboards in the floor above rather than cutting holes (thus damaging) through the existing ceiling. The only exception is for the fourth floor as none of the ceilings are decorative or of heritage note and there is no other way to access it i.e. from roof void above.

Proposed further investigation works are shown in Appendix A.

5. STRUCTURAL ENGINEERING PROPOSALS

5.1 Scheme overview - Loadings

It is proposed to upgrade the building structure from original residential use loading to that of mixed-use comprising office space, teaching classes and café. A small single storey extension to the back is also planned.

While the dead load will remain the same, the live load will change.

Typical dead load:

- Finishes 0.25 KN/m2
- Timber joists 0.30 KN/m2
- Ceiling and services 0.15 KN/m2
- Total Dead Load 0.70 KN/m2

Mindful of the limitations posed by the historic building, we have proposed and agreed with the client a pragmatic loading strategy as the single occupancy offices will unlikely ever be subject to office load as set out in modern design codes.

Project loading proposals:

- Office live load: 1.5 KN/m2 (no allowance for future partitions or large storage areas);
- Classroom live load: 3 KN/m2 (no allowance for future partitions);
- Dedicated dense storage units: As per Stage 2 report, pending updated drawings and information

Current Eurocode standard for modern buildings:

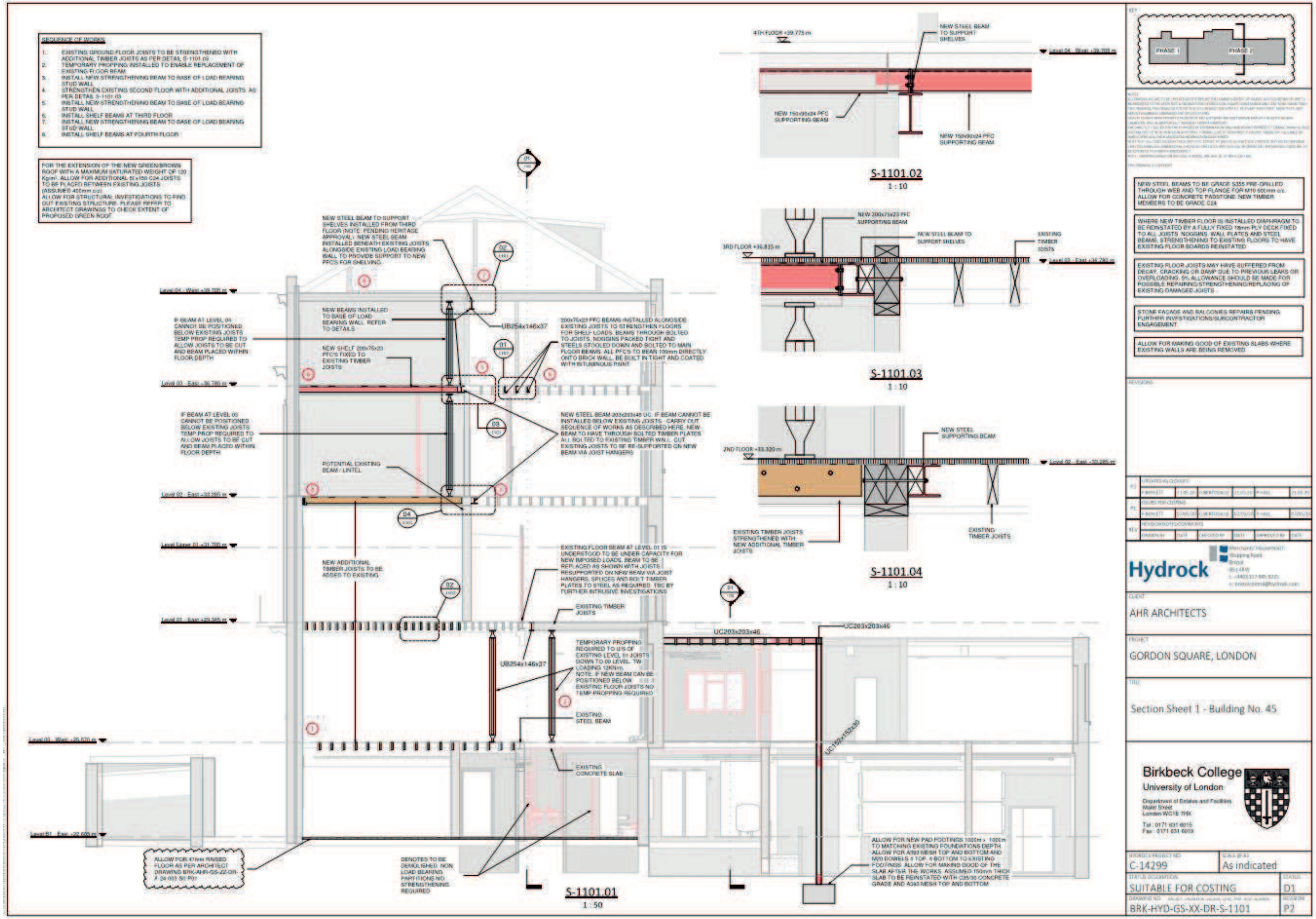
- Office live load: 2.5 KN/m2 + partitions;
- Classroom live load: 3 KN/m2 + partitions;

See Appendix B for images which explain live load allowances and typical plans to explain our proposal for applied loads to floors to suit their usage. This is based on Stage 2 drawings as new storage layout and requirements are still in progress although the principles remain the same. The detailed arrangement of dedicated storage units will be reviewed at the next stage.

5.2 Strengthening works

Due to the Live Load increase in certain areas (classrooms, storage units, communal spaces etc), there are several locations where the floor structures need strengthening works.

As noted above many academic staff members carry significant personal libraries. These have been stored in uncontrolled fashion that has led to overloading the floor structure for many years. Conventional free standing or cantilevering shelving will not meet the needs of staff, is not feasible in practice and will perpetuate this structurally adverse situation. Therefore, dedicated structural provision has been contrived to be coordinated with architectural layouts which will both accommodate local areas of dense book storage units and ensure


SEQUENCE OF WORKS
1. EXISTING GROUND FLOOR JOISTS TO BE STRENGTHENED WITH ADDITIONAL TIMBER JOISTS AS PER DETAIL S-1101.03
2. TEMPORARY PROPPING INSTALLED TO ENABLE REPLACEMENT OF EXISTING FLOOR BEAM
3. INSTALL NEW STRENGTHENING BEAM TO BASE OF LOAD BEARING STUD WALL
4. STRENGTHEN EXISTING SECOND FLOOR WITH ADDITIONAL JOISTS AS PER DETAIL S-1101.03
5. INSTALL NEW STRENGTHENING BEAM TO BASE OF LOAD BEARING STUD WALL
6. INSTALL SHELF BEAMS AT THIRD FLOOR
7. INSTALL NEW STRENGTHENING BEAM TO BASE OF LOAD BEARING STUD WALL
8. INSTALL SHELF BEAMS AT FOURTH FLOOR
FOR THE EXTENSION OF THE NEW GREEN/BROWN ROOF WITH A MAXIMUM SATURATED WEIGHT OF 120 Kg/m². ALLOW FOR ADDITIONAL 50x150 C24 JOISTS TO BE PLACED BETWEEN EXISTING JOISTS (ASSUMED 400mm c/c).
ALLOW FOR STRUCTURAL INVESTIGATIONS TO FIND OUT EXISTING STRUCTURE. PLEASE REFER TO ARCHITECT DRAWINGS TO CHECK EXTENT OF PROPOSED GREEN ROOF
S-1101.01
1 : 50
S-1101.02
1 : 10
S-1101.03
1 : 10
S-1101.04
1 : 10
NEW STEEL BEAMS TO BE GRADE S355 PRE-DRILLED THROUGH WEB AND TOP FLANGE FOR M10 500mm c/c. ALLOW FOR CONCRETE PADSTONE. NEW TIMBER MEMBERS TO BE GRADE C24
WHERE NEW TIMBER FLOOR IS INSTALLED DIAPHRAGM TO BE REINSTATED BY A FULLY FIXED 18mm PLY DECK FIXED TO ALL JOISTS, NOGGINS, WALL PLATES AND STEEL BEAMS. STRENGTHENING TO EXISTING FLOORS TO HAVE EXISTING FLOOR BOARDS REINSTATED
EXISTING FLOOR JOISTS MAY HAVE SUFFERED FROM DECAY, CRACKING OR DAMP DUE TO PREVIOUS LEAKS OR OVERLOADING. 5% ALLOWANCE SHOULD BE MADE FOR POSSIBLE REPAIRING/STRENGTHENING/REPLACING OF EXISTING DAMAGED JOISTS
STONE FACADE AND BALCONIES REPAIRS PENDING FURTHER INVESTIGATIONS/SUBCONTRACTOR ENGAGEMENT
ALLOW FOR MAKING GOOD OF EXISTING SLABS WHERE EXISTING WALLS ARE BEING REMOVED
REVISIONS
Hydrock
CLIENT
AHR ARCHITECTS
PROJECT
GORDON SQUARE, LONDON
TITLE
Section Sheet 1 - Building No. 45
Birkbeck College
University of London
HYDROCK PROJECT NO
C-14299
SCALE @ A3
As indicated
STATUS DESCRIPTION
SUITABLE FOR COSTING
STATUS
D1
DRAWING NO
BRK-HYD-GS-XX-DR-S-1101
REVISION
P2

relief of excessive floor loading from the rest of the floor plate to a level that is in line with the building's originally conceived design limitations.

A relatively complex sequence of works for this structural upgrade has been developed to mitigate the intrusion on the building fabric. Where possible new steel beams are proposed to be installed beneath existing timber joists and packed tight, however, where this is not possible temporary work systems are required to facilitate installation of steel beams within the joist depth. This involves propping then cutting the existing joists, installing beams and re-supporting the joists on the newly installed beam. The latter will require temporary propping systems which will be designed by the contractor according to design loadings to be provided on structural drawings. See figure 8 on previous page for a typical cross section of works showing suggested sequencing.

Depending on the existing timber joists size and span, the intensity of the strengthening varies.

Generally, the proposal is to add an additional joist between the space between existing joists by either bolting it to the existing joist or supporting it via hanger concreted in existing masonry walls.

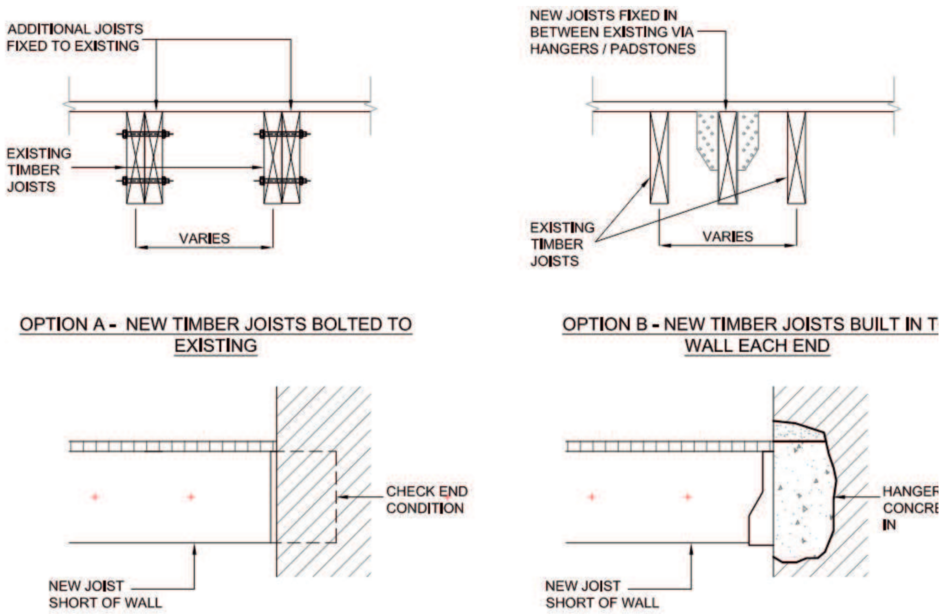


Figure 9: New timber joists details and options

Existing floor joists have in places suffered from decay, cracking or damp due to previous leaks or overloading. Allowance should be made to replace/ repair/ strengthen 5% of existing damaged joists

Storage units are too heavy to be supported on existing timber joists as noted above, even with the help of additional joists.

Given the extent of storage required conventional shelving and the high load cantilevering them out from existing masonry wall is not recommended from a structural perspective, both in terms of intrusion on fabric and structural capacity.

Therefore, the current proposal to comply with the current layout and loads is to add new steel beams running parallel to the length of the storage units as proposed below.

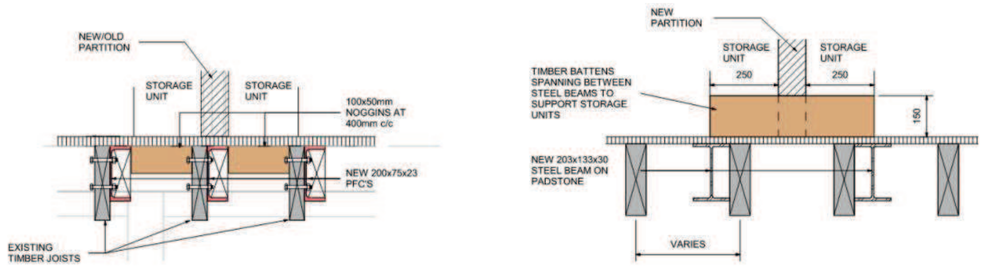


Figure 10: Floor Strengthening proposal for storage unit support

The current proposal involves the replacement of existing ground floor roof with a new green/brown roof with a maximum saturated weight of 120 Kg/m2. At this stage, the current roof structure is unknown although previous reports refer to the 1900 extension as a steel frame with concrete slab.

If the existing roof is confirmed to be a concrete slab, further checks will be undertaken to see if it can withstand the increased load.

If the existing roof consists of timber rafters, allow for additional 50 x 150 C24 rafters to be placed between existing (assumed 400mm c/c).

Structural investigations will be required to find out existing structure. Refer to architect drawings to check extent of proposed green roof.

250mm x variable length M&E services risers are required in various locations. Where timber joists are spanning onto them (perpendicular to long side), the services will be located between the joists. Where timber joists are spanning parallel to the main length of the riser, one joist will be removed and the opening trimmed with double joists.

Typical riser of 1350 x 250mm showing timber joists being kept (in orange) by spreading the services between joists:

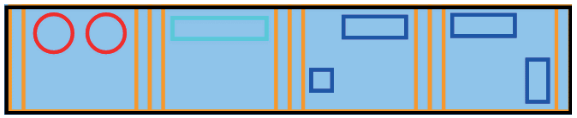


Figure 11: Typical riser coordination

Refer to M&E drawings for detailed proposals of services risers and locations.

Services through joists have been coordinated with M&E engineers to comply with the guidance from the code to avoid strengthening where possible (shown in the image below). The 250x50mm refrigerant tray at first floor that runs through notch in top of beam doesn`t follow the guidance above. Therefore, strengthening of existing joists is required. In this case allow for a 400mm steel plate 10mm thick to be through bolted onto existing joists.

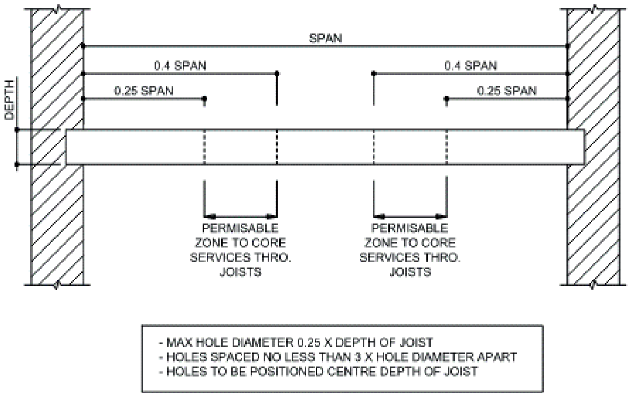


Figure 12: Services through joists

Full strengthening works are shown in the structural drawings in Appendix B.

5.3 Demolition works

Where existing walls are being removed, the following is highlighted on the proposed drawings:

- If they are load bearing or not;
- Temporary works needed with loading information so the temporary work designer can adequately design the propping requirements and give feedback on costs involved;
- Structural items that are needed to reinstate the support that the wall was given to the structure above.

Where the wall removed is supporting 1 or 2 storeys, a steel beam has been designed to take the load and to span between masonry walls via padstones.

Where the wall removed is supporting more than 2 floors and the adjacent walls cannot take this high load, a new steel box frame has been proposed.

In building no. 43, there are major demolition works as the current stairs are to be removed. In this case, structural works consist of a new timber floor supported on steel beams at 1st, 2nd and 3rd floor.

New floor/roof openings will be trimmed with double joists with the exception of the void next to the staircase in building no. 43 that will be trimmed with steel beams due to its size.

New opening through existing load bearing walls will be possible by the installation of 1 or more precast concrete lintels depending on the thickness of the wall.

Where necessary allow for breaking out and reinstatement of existing slab to new run locations as detailed in the image below:

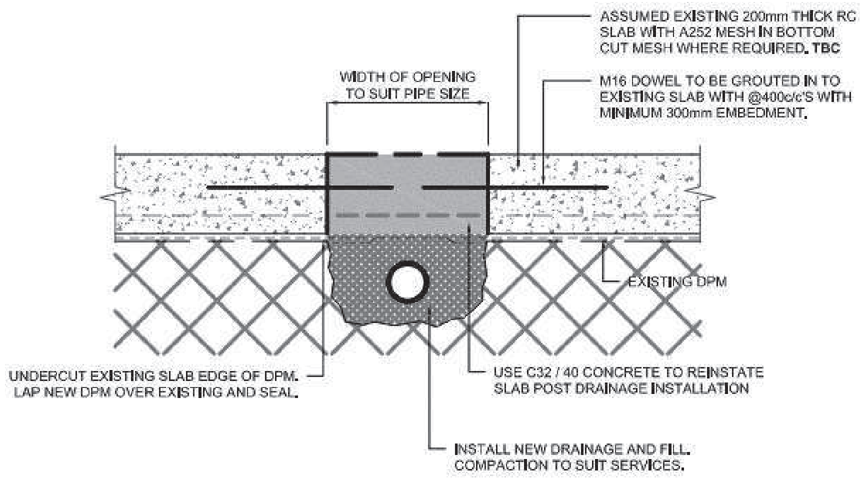


Figure 13: Drainage coordination

For below ground drainage alterations and related works please refer to civil drawing BRK-HYD-GS-ZZ-DR-C-7010.

Refer to structural drawings in Appendix B for further information and details.

5.4 Proposed Rear Extension works

The proposed extension at the back of building no. 43 and 44 is a single storey extension starting from the first floor. See figure 14 on next page.

Load bearing masonry walls are not suitable for this extension as the ground floor and basement extend beneath it.

The new extension will consist of a steel frame structure and timber joist floor and roof. The current architect proposal for the external wall is to have a masonry cavity wall. Therefore, two steel beams or a steel beam with a plate welded on top is needed.

However, timber cladding will be preferable as lighter and thinner to a cavity wall so the structure can be reduced to a single steel beam.

Figure 14: Proposed extension highlighted in red

Steel columns will need to go down to basement. They will be spliced with moment connection to avoid large/heavy steel elements and assist construction. Allow for trimming of floor joists with double joists at column location.

Temporary propping to underside of existing first floor are needed to install the steel beams and extend the floor.

Significant primary structural works are required to remove part of the existing stair core. New steel beams (with padstones if bearing onto existing masonry walls) at ceiling level and temporary propping to allow removal of load bearing wall are required at this location.

Pending geotechnical investigations, the new foundations consists of new pad footings 1m x 1m reinforced with 1 layer of A393 mesh top and bottom matching existing foundations depth to avoid underpinning. New footings will be dowelled into existing footings via M20 dowels 4 top and 4 bottom.

6. CIVIL ENGINEERING PROPOSALS

6.1 Drainage Strategy - Surface

It is not anticipated that any of the surface water network will be altered, therefore the design will maintain as per the existing situation.

6.2 Drainage Strategy - Foul

6.2.1 Pre-Development Foul Water

The existing development is served by a dedicated below ground foul water drainage system which discharges from the existing building into the wider foul drainage network in Gordon Square.

Foul flows from the existing building are considered to be domestic. It is understood that the foul drainage system which serves the building is maintained privately by the owner / occupier.

Existing drainage CCTV works were undertaken by WJ Shirley, who assessed the condition and location of the existing assets. Numerous 'moderate' defects along with one 'severe' defect were identified within the building extents.

The capacity and condition of the existing downstream foul drainage system beyond the development boundary has not been assessed as part of the scope of these works.

Drainage defects are indicated on the layout shown in Appendix D.

6.2.2 Post Development Foul Water Drainage

New foul stacks serving refurbished areas / new areas will be utilised as much as possible in the above ground drainage system. Where this is not considered achievable, a new dedicated below ground drainage system will be designed in the basement which will connect from the new stack locations and into the existing drainage network.

Foul flows from the new stack locations are anticipated to be 'domestic' in nature i.e. from WC's, sinks, wash basins etc. It is not expected there will be any trade effluent flows discharging into the wider drainage system.

The foul system also takes air conditioning condensate, flows considered to be small.

The foul drainage system will be designed in accordance with Building Regulations Approved Document H and the relevant British Standards.

Drainage Layout is shown in Appendix D.

7. STRUCTURAL DESIGN DATA

7.1 Proposed loading requirements

Client to confirm:

- What will be exhibited in the gallery at ground floor; alternatively, capacity as built to be verified to allow future exhibitions to work within that limitation;
- Usage of the top right room at ground floor (classroom or studios/stages);
- Width, height, load and layout of shelf units.

Vertical Loading:

Location	Variable Load (Live)	Permanent Load (Dead)	Permanent Load Description
Basement	Office Area 1.50kN/m2 Classroom Area 3.00 KN/m2 WC area: 2.00 KN/m2 Corridor/Stairs area: 3.00 KN/m2 Storage/Plant room area 5.00 KN/m2 Auditorium area 4 KN/m2	3.75 kN/m2	Concrete slab, assumed 150mm thick
Ground Floor	Office Area 1.50kN/m2 Classroom Area 3.00 KN/m2 WC area: 2.00 KN/m2 Corridor/Stairs area: 3.00 KN/m2 Café` Reception area 2.00 KN/m2 Storage 5.00 KN/m2	0.70 kN/m^2	Finishes, timber joists, ceiling and services
First Floor Second Floor Third Floor Fourth Floor	Office Area 1.50kN/m2 Classroom Area 3.00 KN/m2 WC area: 2.00 KN/m2 Corridor/Stairs area: 3.00 KN/m2 Shelf units line load as per stage 2 report	0.70 kN/m2	Finishes, timber joists, ceiling and services
Flat Roof	Accessible for maintenance only/Snow 0.60kN/m^2	0.90 kN/m^2	Asphalt waterproofing timber joists, ceiling and services
Pitched Roof	Accessible for maintenance only/Snow 0.60kN/m^2	0.90 kN/m^2	Slates, timber batten, felt, timber rafters, ceiling and services

Figure 15: Vertical Loading table

Minimum horizontal imposed loads for barriers, parapets and balustrades:

Example areas	Line Load	UDL on infill	Point load on infill
Areas not susceptible to overcrowding in office buildings, stairs, landings, corridors and ramps	0.74kN/m	1.0kN/m2	1.0kN
Cafes & restaurants	1.5N/m	1.5kN/m2	1.5kN

Figure 16: Horizontal load table

7.2 Movements and tolerances

The maximum allowable vertical deflection (i.e. live load deflection) for new and existing structure is as follows:

» Mid span deflection = span / 360 ≤ 25mm

» Cantilever tip deflection = span / 180 ≤ 25mm

Due allowance must be made in the detailing of finishes and non-structural partitions.

Total deflection (dead + superimposed dead + live) is limited to span /250. Long span steel beams will require vertical upwards camber to achieve this limit. The camber value for structural steel elements represents approximately 2/3 of the final dead load deflection.

7.3 Disproportionate Collapse

Clearly the building was designed and built before there were any formal requirements in respect of Disproportionate Collapse. Under current Building Regulations Part A3 the building would be classified as 2B which dictates that effective vertical and horizontal ties should be provided.

The building cannot be justified to satisfy this tying requirement, particularly in respect of vertical ties. Such strengthening works would be extremely difficult and intrusive to effect.

However, given the perceived low level of risk of an extreme event, the sensitive nature of the historic fabric and relatively minor proposed alteration works it is considered that retro-tying works are not appropriate. This has been proposed to the building Approved Inspector for agreement.

8. CONTRACTOR ITEMS

8.1 Contractors structural design items

A number of parts of the structural design will require detailed design by a specialist subcontractor to the main contractor during the construction works. Hence, they will not be developed in detail until then, and tender details will include only performance specification.

Such items are listed as follows.

» Curtain walling;

» Roof decking, including diaphragm action;

» Proprietary staircases (precast, architectural metalwork);

» Steel to steel connection designs;

» Balustrading and barriers, including glazed elements;

» Secondary structure associated with glazing or cladding;

» Any Temporary works including propping, formwork or any other temporary systems required;

» Proprietary lintels.