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Bay House Structural Appraisal
Kidderpore Avenue Detail Design Stage
9100-REP-012
11581
For Mount Anvil

Engineering at its Best

Report For

Mount Anvil

Scheme No: 11581

Kidderpore Avenue, Detail Design Stage
9100-REP-012

Bay House Structural Appraisal

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1.0 Introduction

1.1 This Structural Engineering Appraisal Report has been prepared for Mount Anvil. It considers the structural engineering aspects associated with the proposed refurbishment of Bay House which is being carried out as part of a redevelopment of the former Westfield College Estate in Kidderpore Avenue, for which A&Q Partnership are acting as Architect.

1.2 The observations and comments provided in this report are based on walks around the building on 19th June 2014, 30th March, 1st April and during May 2016, opening up works carried out in March and April 2016 by ESG, and the following information:

- Existing building survey drawings prepared by Murphy Surveys, reference numbers MSL9992-BH-FPB, FPG, FP1, FP2, dated September, October and November 2014;
- Historic record drawings showing refurbishment works from 1976/77, received from Mount Anvil on 22nd October 2015;
- Heritage Statement by Montagu Evans dated June 2015;
- Architect's proposed layouts – drawing references 9000-DRG-03-LG010, UG010, 01010, 02010 and RF010;
- Report for Bay House Fabric Survey by ESG, dated 25th April 2016, reference STR 642, Issue No. 001 (Draft);
- Factual Site Investigation Report prepared by Soiltechnics dated July 2015;
- Arboricultural Report prepared by Crown Consultants, dated 1st July 2015, reference 09166;
- "Preliminary timber decay and damp survey of the Kidderpore Avenue development site – Bay House", prepared by Hutton and Rostron dated 28th May 2015;
- "Kidderpore Avenue: Bay House timber condition survey", Site Note 19 for 7th to 14th April 2016, prepared by Hutton and Rostron;
- Kidderpore Avenue: Bay House lintels condition survey", Site Note 20 for 7th to 14th April 2016, prepared by Hutton and Rostron;

1.3 Observations are based on access to all internal areas where the structure was viewed from floor level. By their nature, the opening up works and other observations have been limited in their extent at this stage of the design. It is therefore possible that details of the structure that are later opened up as part of the refurbishment works will be different from that inferred to date.

1.4 The following drawings have been prepared by Tully De'Ath as part of the design development and should be referred in when reading this report:

- 9100-DRG-03BY-LG900 Bay House Existing Floor Plans Sheet 1 of 3;
- 9100-DRG-03BY-01900 Bay House Existing Floor Plans Sheet 2 of 3;
- 9100-DRG-03BY-RF900 Bay House Existing Floor Plans Sheet 3 of 3;
- 9100-DRG-03BY-LG001 Bay House Level LG Proposed Floor Plan;
- 9100-DRG-03BY-UG001 Bay House Level UG Proposed Floor Plan;
- 9100-DRG-03BY-01001 Bay House Level 01 Proposed Floor Plan;
- 9100-DRG-03BY-02001 Bay House Level 02 Proposed Floor Plan;
- 9100-DRG-03BY-RF001 Bay House Level RF Proposed Roof Plan.

2.0 Historic Development of the Site

2.1 The site forms the former Westfield College campus, associated with King's College London. It contains a number of historic buildings – some of which are listed Grade II. Immediately to the north of the site is Kidderpore Reservoir.

2.2 Kidderpore Hall forms the earliest building on the estate and dates from 1843. It was designed by T Howard for a merchant, John Teil who ran a leather concern in India. John Teil died in 1854 and following several changes of ownership, the house and two acres of ground were bought by Westfield College in 1889.

2.3 Westfield College then began a process of developing the grounds for use as a college and halls of residence. The developments included:

i. Maynard Hall was added by the college in 1889. It was designed by Robert Falconer Macdonald and provided expanded accommodation for the college on the site.

ii. Skeel House – also known as Skeel Library – was added in 1903-04 along the southern boundary of the site. It was also designed by Robert Falconer Macdonald and was built to allow Westfield College to be admitted as a teaching school of the University of London. A further building, Dudin Brown House, was added to the east of Skeel Library about the same time. The construction of these two buildings began to define the Quadrangle – a landscaped space to the north of these buildings and to the east of Maynard Hall.

iii. The Chapel was added in 1928/29 towards the north west corner of the site.

iv. Bay House was developed to the east of Kidderpore Hall. The original structure probably dates back to 1889 when it formed the southern end of Maynard Hall. Historic records indicate it was later altered and extended around 1921 and later about 1935. This included works along the main southern elevation and to the rear facing the Principal's Lawn.

v. Lady Chapman was added on the north side of the Quadrangle in c.1927.

vi. Lord Cameron Hall was then added along the eastern boundary of the site in c.1935. The north eastern corner of the site was then developed with the construction of Rosalind Franklin Hall in c.1965. This building abutted the eastern end of Lady Chapman Hall and completed the Quadrangle which exists today.

vii. Queen Mother Hall was constructed to the west of Kidderpore Hall in 1982.

2.4 There is also a timber-framed summerhouse on the site, which is located by the northern boundary by the reservoir.

2.5 Of the 11 existing buildings on the site, five are Grade II listed. This consist of Kidderpore Hall, Maynard House, Skeel Library, the Chapel and the summerhouse.

3.0 Summary of Ground Conditions Generally on the Site

3.1 A site investigation has been carried out by Soiltechnics and is summarized in a Factual Report dated July 2015. The report is based on 10 bore holes, 10 window samples, and 22 exploratory trial pits across the entire site.

3.2 In summary, the ground conditions have been shown to comprise top soil and made ground overlying the Claygate Member with the London Formation at depth.

Strata	**Depth (below ground level)**	**Description**
Top soil and Made Ground	0.3m to 1.8m	
The Claygate Member	4.9m and 8.7m	Slightly gravelly silty sandy clay, very sandy clay and silty sand.
London Clay Formation	Proven to 25.8m	Silty clay with occasional shelly material at depth

3.3 Groundwater levels across the site vary between 1.3m and 6.0m. The levels are subject to further monitoring.

4.0 Description of Existing Structure

4.1 The Setting

4.1.1 Bay House appears to be the most altered of all the existing buildings on the site. It is set out over four storeys extending from a basement level to second floor level and is located between Kidderpore Hall to the west and Skeel Library to the east. The basement only extends across parts of Bay House.

4.1.2 The front elevation faces Kidderpore Avenue and contains three single storey bay windows at ground floor level. A number of trees line the street between this elevation and the pavement. The eastern bay window sits above a 'drive-through' access route which runs under the ground floor of the building. The rear elevation faces on to the Principal's Lawn. The building is dominated by a main hall within the ground floor space – forms an open space roughly 24m long by 8.5m wide. This has a 'Dais' at the east end of the space, which sits above the 'drive-through'.

4.1.3 The layout of the building can be split in to three areas.

i. Area 1 covers the footprint of a main hall at ground floor level with two storeys of smaller rooms above and a local basement on the eastern side by the 'drive through'.

ii. Area 2 forms the block between the main hall and Kidderpore Hall, and contains a full basement.

iii. Area 3 forms the rear part of Bay House. This has a conservatory space at ground floor level with smaller rooms above.

4.1.4 It appears the original structure of Bay House formed part of Maynard House, when it was constructed in 1889. This structure appears to have included the two western bay windows and the façade in between on the existing front elevation. The building was later extended, first in 1921 and later in 1934. The 1921 works included an infill structure in the area towards Kidderpore Hall and an extension to the rear towards the Principal's Lawn. The 1934 works appears to have included infilling the space between the original 1889 structure and Skeel Library when the drive through and the 'Dais' were formed. A further extension was also built to the rear of Bay House at this time.

4.1.5 Historic records indicate the building underwent a refurbishment in 1976/77. Most of the works was concentrated with Area 2, the 'infill structure' between the original 1889 structure and Kidderpore Hall, when staircases were added and an old stairwell was infilled and the front elevation was altered.

4.1.6 As the different phases of construction all occurred after the site was owned by Westfield College, it appears to have been used for college use throughout its life. The main hall originally formed a Dining Hall and was later referred to as the Reading Room. The other spaces were used lecture rooms and offices.

4.2 Description of Existing Structure – A Summary

4.2.1 The existing structure is summarized on drawings 9100-DRG-03BY-LG900, 01900 and RF900.

4.2.2 The building has a cellular load bearing masonry structure. This supports the existing floors which are formed using various forms of construction of different ages, which are described in more detailed below. The building relies on the cellular layout for overall stability.

4.3 Area 1: Across footprint of Main Hall and Above

4.3.1 The existing masonry walls appear to be solid brick masonry construction. The front elevation appears to represent two phases of construction – from 1889 and 1935. The window openings in the front elevation are brick arched externally and have either timber or solid concrete backing lintels. The timber lintels coincide with the original 1889 construction at ground floor level across the south facing elevation.

4.3.2 The ground floor structure forming the main hall varies in construction. Above the 'drive through' a reinforced concrete slab appears to exist. This dates from 1934. A solid floor also exists above the basement area. This may date from 1889 and so could be a filler joist floor with clinker concrete – similar to the solid floors seen in Maynard House. Elsewhere the floor is of timber construction supported off brick and timber sleeper walls supported on shallow foundations bearing on to made ground.

4.3.3 The first and second floor structures span across the width of the hall. Both have a grillage of steel beams supporting a timber joisted floor. The second floor internal walls appear to be load bearing providing support to the roof structure above which is constructed using carpentered timber. Further safe access is necessary to review the construction of the roof in more detail and to understand how it is supported.

4.3.4 The front elevation contains a number of dormer windows and one longer section of dormer window towards the eastern end of the block. The longer dormer probably dates from 1934.

4.3.5 Based on the 1976/77 refurbishment drawings which are available, a number of partitions were altered at first and second floor level at the time but otherwise no structural alterations appear to have been carried out to this area.

4.4 Area 2: Infill Structure Between Main Hall and Kidderpore Hall

4.4.1 This section has the appearance of a town house when viewed from the south elevation. It has a central front door accessed via steps leading up from pavement level with window openings either side. The second floor is accommodated within the roof space with dormer windows projecting form the roof profile. This section of the building has a full basement. The front elevation probably dates mainly from 1921.

4.4.2 The existing masonry walls appear to be solid brick masonry construction. The window openings in the front elevation are brick arched externally and have either 'concrete' or 'solid' backing lintels, according to H&R.

4.4.3 The floor construction towards the front of the building in the rooms against Kidderpore Hall appears to be a concrete hollow pot form of construction. This suggests the floors date from either the 1921 or 1934 works, although historic maps suggest the former.

4.4.4 Based on the 1976/77 refurbishment drawings which are available, the following structural alterations were carried out at this time:

i. The front door was moved to its current location from the east side of the front elevation of this section of Bay House. The old doorway was altered to form the right hand window at ground floor level as seen from the street. The canopy to the door appears to be a steel structure cantilevering off a concrete lintel above the doorway.

ii. A new staircase and landing structure were formed towards the rear. The landings are 150mm thick reinforced concrete construction.

iii. Where the existing stairwell was infilled, this was done using a 150mm thick reinforced concrete slab. This slab connected with the new stairwell at the rear, at first floor level.

4.5 Area 3: Rear Part of Bay House

4.5.1 This area forms a two-storey section to the rear part of Bay House. The western part of this elevation is rendered to match the adjacent rendered elevation of Kidderpore Hall. This area appears to date from 1921. The adjacent eastern part of the elevation is part brick and part rendered and is set back slightly. This section appears to date from 1934.

4.5.2 The ground floor space internally is open plan. The floor structure has a ground bearing slab across the western part and a suspended clinker concrete floor across the eastern part.

4.5.3 The first floor structure appears to be a mixture of concrete hollow pot floor and timber joists dating from 1921. It is supported on the external walls and internal beams and two internal columns. Opening up works have revealed these columns to be circular, and probably steel, and are encased in concrete. The columns extend to roof level to support a flat roof.

4.6 Existing Foundations

Trial pit investigations by Soiltechnics have exposed the foundations by two of the bay windows along the front (south facing) elevation and in one location along the rear (north facing) elevation.

A window sample by the trees between the south elevation and Kidderpore Avenue showed the depth of made ground in this area to be very shallow – recorded at 300mm. This is underlain by sandy clay and very sandy clay of the Claygate Member. The two trial pits revealed the south elevation is founded on a concrete strip footing extending to 1600mm and 2130mm below ground level and bearing on silty clay of the Claygate Member. Tree roots were recorded in the trial pits but only to a depth of 680mm below ground level.

The trial pit along the northern elevation was not conclusive as to how deep the existing foundations are, by the Claygate Member was recorded below the Principal's Lawn from about 380mm below ground level. A strip foundation would be expected, bearing on to the natural ground.

A trial pits has been excavated within the basement of Area 2 – the infill structure between Kidderpore Hall and the Main Hall of Bay House. This showed this section of the building is founded on a concrete foundation extending to 770mm below basement level.

5.0 Imposed Floor Loads

5.1 Based on the understanding of how the existing building has evolved over time, the existing floors appear to date from four periods in time – 1889 when Maynard House was first constructed, 1921 and 1934 when Bay House was significantly modified and then 1976/77 when further alterations were carried out to the building.

5.2 It is very likely that the structure was designed in accordance with industry guidance that was available at the time. The key documents that existed are noted in the table below together with the classification of loads each document provided.

5.3 Encyclopaedia of Architecture 1881:

	Pounds Per Square Foot (lbs per sq ft)	**kN/m²**
Public Halls in which people only accumulate	128	6.1
Ordinary dwelling houses	100	4.7

5.4 London County Council (General Powers) Act 1909:

	Pounds Per Square Foot (lbs per sq ft)	**kN/m²**
Floor intended to be used wholly for the purpose of human habitation	70	3.3
Floor intended to be used wholly for office	100	4.7

5.5 Institution of Structural Engineers 1927

	Pounds Per Square Foot (lbs per sq ft)	**kN/m²**
Upper floors of houses, not exceeding four storeys in height	40	1.9
Private bedrooms in residential flats	60	2.8
Classrooms in schools etc. Dormitories and upper floors in offices	80	3.8
Assembly Halls	100	4.7

5.6 Institution of Structural Engineers 1933 – changes from the 1927 guidance as follows:

	Pounds Per Square Foot (lbs per sq ft)	**kN/m²**
Dormitories	40	1.9
Offices for slabs	60	2.8

5.7 British Standard Code of Practice CP3 Chapter V: Part 1: 1967 Code of Basic Data for the Design of Buildings – Dead and Imposed Loads:

	Pounds Per Square Foot (lbs per sq ft)	**kN/m²**
Colleges – classrooms	n/a	3.0
Colleges - corridors	n/a	4.0
Offices	n/a	2.5
Staircases	n/a	3.0

5.8 As a comparison, the current recommended imposed loads for residential use are as follows:

	kN/m²
Residential floors	1.5
Residential corridors and staircases	3.0

5.9 This review suggests the existing floors should be adequate for the proposed imposed loads provided the floors were designed correctly.

6.0 Observations on the Condition of the Existing Structure

6.1 This section of the report summarizes issues which have been observed on site or have been identified in H&R's reports which relate to the condition of the existing structure.

6.2 The building generally appears to be in an average condition for its age and type. Issues which have been identified are linked with the effects of water ingress in to the structure and slight movements which are visible along the south facing front elevation. These observations are set out below.

6.3 External Observations – South (Front) Elevation

6.3.1 The H&R report on the condition of the timbers highlights areas of the front elevation which have been subject to water penetration and provide the conditions for damp and timber decay.

6.3.2 There is a stone or reconstituted stone cornice feature at high level below the gutter line by the junction with Kidderpore. This has hairline cracking along part of its length and has spalled at one end. The spalling has occurred close to where the gutter drains in to a rain water pipe. This may be linked with water ingress and subsequent freeze-thaw action.

6.3.3 H&R have highlighted in their May 2015 report that the gutters are vulnerable to blockage due to the proximity of trees.

6.4 External Observations – North (Rear) Elevation

6.4.1 The rendered elevation appears to be an impermeable cementitious render. This will allow water penetration to occur where it is damaged but is likely to restrict drying. There are signs of previous patch repairs to render at first floor level.

6.4.2 The brick faced section of the rear elevation has rainwater pipes at each end. Both down pipes have overflowed in the past for a considerable period of time and staining and efflorescence are visible on the brickwork surface. Blocked down pipes will encourage water to saturate the brickwork which could affect timbers embedded in the wall behind.

6.5 Internal Observations

6.5.1 The timber floors fell reasonable stiff when walked on.

6.5.2 Timber decay has been identified locally at first and second floor levels at the far south eastern corner of Bay House.

6.5.3 Where timber lintels have been identified by H&R at first and second floor levels, they were found to be have a low moisture content which is too dry for decay to occur.

6.5.4 Within the main hall, water ingress has occurred through the roof of the bay window at the south east corner. There are further signs of water ingress further to the west along the main hall internally. The window openings at this level are formed using timber backing lintels. The majority of these lintels were examined by H&R and shown to have a high moisture content and so are susceptible to decay or have already decayed in part. In this area, cracks are also visible in the plaster finishes above the window openings. Allowance should be made for further detailed inspections of these lintels and possible replacement with new concrete or steel lintels.

7.0 Proposed Strategy for Structural Engineering Works

7.1 Given the existing structure is in an average condition for its age and type, it should respond well to the proposed refurbishment. Essentially the building was designed as a college building providing a dining hall, dormitories and offices. The proposed refurbishment will convert the building to residential flats. This use is compatible with the existing structure.

7.2 The proposed refurbishment will involve a number of structural alterations.

i. Within Area 1, much of the floor to be main hall is to be lowered and a new mezzanine floor is to be incorporated. The internal walls at second floor level above the main hall – which appear to be supporting the roof over are also to be reconfigured.

ii. Within Area 2, a number of internal load bearing walls are to be opened up and existing door openings infilled. The basement floor will be replaced.

iii. Within Area 3, the flat roof is to be converted to a roof terrace and a second floor extension is to be formed providing additional internal space. The ground floor structure is to be replaced.

7.3 Building Regulations and Extending the Useful Life of the Existing Structure

7.3.1 In accordance with the Building regulations, Bay House will undergo a material change of use. However, the Building Regulations do not identify the specific structural engineering requirements that the existing structure needs to adhere to under Part A of the Building Regulations.

7.3.2 The key structural engineering aspects however are to design all alterations to be sensible in engineering terms and to see that the floors have sufficient strength and stiffness for the proposed use as residential flats. Provided any new partitions are designed to be lightweight timber or metal stud partitions and new sound insulation and fire protection are lightweight, the provisional structural engineering assessment shows it is unlikely the existing retained floors will need to be strengthened for the intended use, provided the condition of the structural elements has not been undermined by previous ill-judged alterations. A further more detailed assessment of the existing floors is being carried out to confirm this.

7.3.3 New structural elements will be designed in accordance with current Eurocodes and British Standards.

7.4 Conservation Engineering Approach

7.4.1 Whilst Bay House is not listed, it sits adjacent to Kidderpore Hall and Maynard House which are. Part of Bay House also forms part of the original structure to Maynard House in any case and so the building will be treated as having importance linked with its historic and architectural interest and the adjacent listed buildings.

7.4.2 The engineering strategy for the structural design will therefore aim to limit the impact of the structural works on the historic fabric. Existing structure will be retained where possible and new structural elements – whether related to alterations or repairs - will be designed to be compatible with the historic fabric. They will also be reversible and interpretable for what they are, as part of a proposed 21st century refurbishment. This approach is good in conservation terms but also provides a sensible and economic engineering approach for the works.

7.5 Building Warranty Provider

7.5.1 It is understood the proposed Warranty Provider is Premier. An early meeting should be arranged with Premier to understand what measures they will expect to see implemented structurally as part of the proposed refurbishment.

Examples of work they may require are noted below:

i. The structure is required to have a life of at least 60 years.

ii. The existing foundations may need to be inspected more fully than has been carried out to date in order to demonstrate the building has satisfactory foundations, even though there are little or no signs of differential settlement. If foundations are found to be locally shallower, they may insist on the foundations being underpinned.

iii. If concrete foundations exist, Premier may insist on concrete testing being carried out to demonstrate the concrete is in a reasonable condition and will be able to perform adequately for a further 60 years.

iv. All timbers built in to external walls would need to be checked for decay or infestation. Any affected timbers would need to be replaced. Unaffected timbers will require re-support off joist hangers or removed and re-installed with additional protection from a damp proof membrane.

v. Of these examples, example iv is the most likely one to be required. It may be a requirement for all embedded timbers and not just those in vulnerable areas.

7.6 Structural Issues Associated with Water Ingress

7.6.1 The main issue which has affected the condition of the existing structure is the effects of water ingress. This is usually associated with gutters and rain water pipes not having a robust design or having been maintained effectively. This allows areas of the elevations to become saturated after periods of heavy rain.

7.6.2 Buildings of this age and type require good cross ventilation within the structure to help maintain its condition. Regular maintenance to keep gutters and rainwater pipes free of blockages and vegetation is also important. The building has also been empty for some time and unheated spaces will also have encouraged damp to migrate.

7.6.3 As such, the most vulnerable areas of the structure are where the rain water pipes exist and the balconies exist. These areas coincide with where the condition of the structure is poorest. There has been significant water ingress in these areas coupled with decay of embedded timbers.

7.6.4 Given this pattern, it is important for the timber repairs now proposed to be detailed such that timbers will not be susceptible to decay in future in the areas highlighted as being vulnerable. This will require embedded timber joists to be either cut back and re-supported off joist hangers or for the ends to be wrapped with a damp proof membrane and ventilated where retained as embedded in the external walls. Timber lintels in vulnerable areas will need to be replaced with concrete lintels and bonding timbers will need to be cut out and replaced with brickwork.

7.7 Proposed Structural Repairs

7.7.1 Based on the observations and opening up works carried out to date, the following structural repairs are expected to be necessary as part of the proposed refurbishment. This list is provisional and will be confirmed once the floors are lifted completely by the builder during the construction phase.

7.7.2 The outline scope of structural repairs to the walls, floors and roof is as follows:

i. Splice repairs to decayed ends of rafters where decayed. Timber wall plate in affected areas will probably need to be replaced too.

ii. Splice repairs to ends of floor joists where decayed. New joist ends to be supported via joist hangers are to be isolated from the external wall via a damp proof membrane.

iii. Removal of decayed timber wall plate and bonding timbers and replacement with brickwork. Embedded timber to be removed also from areas which are not decayed but are in areas highlighted as being vulnerable.

iv. Heavily notched joists will need to be strengthening and stiffened by fixing additional joists to the sides of affected joists.

v. Decayed lintels and sound lintels in vulnerable areas of the elevations will need to be replaced with new concrete lintels. Additional structural ties may be required where cracking has occurred within the bay windows. This will be confirmed following further opening up works.

7.7.3 Whilst not strictly repairs, the following enhancement works are required to the timber floors.

i. Solid timber blocking pieces needs to be added between joists. This is to enhance the stiffness of the floors by improving the 'load share' between adjacent joists.

ii. Existing floor joists are to be doubled up along the lines of new partitions to improve the stiffness of the floors on these lines.

iii. It is understood stone and other brittle finishes may be proposed on the timber floors. This approach is not recommended as timber floors and brittle finishes are not compatible with one another and there is a high risk that brittle finishes will crack. A timber joisted floor is - by its nature - lightweight and susceptible to more noticeable deflections than a heavier concrete floor. The volume of timber is also not stable as it will shrink or expand slightly as moisture levels change within the atmosphere. Whilst such issues can be controlled to some degree, they cannot be removed altogether and as such the risk of cracking will remain.

7.7.4 Other structural repairs may become necessary as the building is opened up. Examples include addressing ill-conceived structural alterations that have been carried out in the past and structural features such as openings which are currently concealed behind finishes. It is recommended the programme for the construction works leaves sufficient time to allow the structure to be thoroughly assessed once it is fully opened up so the final scope of structural repairs can be confirmed without causing delay to the works.

7.8 Proposed Structural Alterations

7.8.1 Within Area 1, much of the floor to be main hall is to be lowered and a new mezzanine floor is to be incorporated. The internal walls at second floor level above the main hall – which appear to be supporting the roof over are also to be reconfigured. The works are discussed in more detailed below.

i. The existing Main Hall floor structure is a lightweight timber floor supported off brick sleeper walls which bear on to made ground. These foundations are not suitable for supporting a new mezzanine floor. The structural design therefore consists of forming the new lowered floor as a suspended reinforced concrete floor supported off new strip foundations bearing on to the underlying natural ground.

ii. These new foundations below the Main Hall will also support the new mezzanine floor. This will be formed using a braced steel frame with columns and beams supporting a timber joisted floor. Ply sheeting is necessary to provide diaphragm action to the floor and this will need to be directly fixed to the joists.

iii. At first floor level, the internal walls are to be reconfigured. These walls are expected to be non-load bearing but further opening up works to the partitions where they run beneath the steel beams should be carried out to confirm this.

iv. At second floor level, the internal walls are also to be re-configured. These walls appear to be load bearing, supporting the roof structure over. Structural works are anticipated but at this stage the complexity of these cannot be determined at present. Further investigations are required to confirm the structural arrangement of the roof and determine which walls are structural. If the level of structural alterations becomes too complex, it may be more sensible to dismantle the roof structure and rebuild it using cranked steel roof frames with steel purlins and a timber infill structure, which can span between the main side walls of this area of the building.

7.8.2 At second floor level, the internal walls are also to be re-configured. These walls appear to be load bearing, supporting the roof structure over. Structural works are anticipated but at this stage the complexity of these cannot be determined at present. Further investigations are required to confirm the structural arrangement of the roof and determine which walls are structural. If the level of structural alterations becomes too complex, it may be more sensible to dismantle the roof structure and rebuild it using cranked steel roof frames with steel purlins and a timber infill structure, which can span between the main side walls of this are of the building.

i. At basement level, new openings are proposed within some of the internal load bearing walls and front elevation. The structure over will be re-supported off steel beams. A steel box frame is needed within the front elevation to prevent the masonry becoming overstressed.

ii. The basement floor is also to be lowered slightly and will be reformed using a reinforced concrete ground bearing slab. Further trial pits are required to confirm the depth of the existing foundations and assess whether the new floor level could undermine the existing foundations. Allowance should be made for a small length of underpinning as noted on the drawings.

iii. By the front elevation at basement level, the light well is to be extended. This will be done using a reinforced concrete wall and base slab.

iv. At ground floor level and first floor levels, some alterations are proposed to the internal walls including new openings and infilling existing openings. New lintels will be required across new openings.

v. Some of the internal walls at second floor level appear to be load bearing – supporting the roof structure over. Further opening up works is required to confirm the arrangement of the roof structure. Allowance should be made for new steel beams spanning across the width of the building to re-support the roof structure.

7.8.3 Within Area 3, the flat roof is to be converted to a roof terrace and a second floor extension is to be formed to provide additional internal space. The ground floor structure is to be replaced. The works are discussed in more detail below:

i. The ground floor is to be replaced with a new reinforced concrete ground bearing slab, at a slightly reduced level to the existing floor slab.

ii. The existing flat roof structure is to become a roof terrace. This will require increased imposed loads to be supported. Based on limited investigations to date, allowance should be made for a new roof structure constructed using steel beams and a joisted timber deck. The existing ceilings below the existing roof however should be removed to expose the existing structure to assess whether it can be retained and / or strengthened.

7.8.4 Throughout all areas, builders work will also be required associated with the integration of new services in to the structure. Existing routes for services should be re-used where possible to avoid further unnecessary alterations to the structure.

8.0 Proposed Further Investigations

8.1 The following additional opening up works and other investigations are necessary to assist with the development of the working drawings:

i. Within the basement areas, excavate further trial pits to confirm the depth of the foundations in order to confirm whether underpinning is required.

ii. Within Main Hall at ground floor level, remove plaster finishes from timber lintels around bay window openings to confirm the condition and assess whether decay has caused the cracking seen.

iii. Within Area 1 at first floor level, remove ceiling and wall finishes at junctions of internal walls with floor beams over to confirm arrangement of structure with wall build up.

iv. Within Area 2 at ground and first floor levels, remove ceiling finishes over to confirm span of concrete hollow pot floor construction. Concrete testing should also be carried out to check the quality of the concrete floor construction at these levels.

v. Within Area 3 at first floor level, carry out concrete testing on concrete hollow pot floor construction to check the quality of the concrete floor construction.

vi. Provide safe access to roof spaces across Areas 1 and 2 to permit more detailed structural assessment of existing roof structure to be carried out. Existing walls at second floor level to be removed and assessment is required to determine which walls proposed for removal are load bearing.

vii. Within Area 3, remove ceiling finishes below flat roof to expose existing roof structure. This is to help assess whether the existing roof structure can be retained.

8.2 The programme for the construction works should leave sufficient time to allow the structure to be thoroughly assessed once it is fully opened up so the final scope of structural repairs can be confirmed without causing delay to the works.

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