Tully De'Ath consultants

Feasibility Research

EIA, Flood Risk & Transport Assessments

Urban Planning and Design

Integrated Transport Solutions

Infrastructure Development

Structural Design

Eco and MMC Focused

The Chapel Structural Appraisal

Kidderpore Avenue Detailed Design Stage

9100-REP-016

11581

For Mount Anvil

Engineering at its Best

Report For

Scheme No: 11581

Mount Anvil

Kidderpore Avenue Detailed Design Stage 9100-REP-016

The Chapel Structural Appraisal

Main Contributors

20th June 2016

Andrew Turner

Issued By

Andrew Turner

Approved By

Tom Purchase

Tully De'Ath Consultants, Sheridan House, Forest Row, East Sussex, RH18 5EA
Tel: 01342 828000 Fax: 01342 828001 Email: info@tullydeath.com Web: **www.tullydeath.com**

Contents

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 The Chapel 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, and during March to 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-KC-FPG1 and FPG2, dated October 2014;
- Historic record drawings, received from Mount Anvil on 22nd October 2015;
- Heritage Statement by Montagu Evans dated June 2015;
- Architect's proposed layouts – drawing references 9000-DRG-03CH-LG010 and UG010;
- Report for Chapel Fabric Survey by ESG, dated 3rd May 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 – The Chapel", prepared by Hutton and Rostron dated 29th May 2015;
- "Kidderpore Avenue: Roof finishes condition investigation including leadwork at the Chapel", Site Note 6 for 11th January 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. The roof has not been inspected due to safe access not being available to date. 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-03CH-AL001 The Chapel Existing Floor Plans
- 9100-DRG-04CH-VL001 The Chapel Existing Elevations and Sections

- 9100-DRG-03CH-FN001 The Chapel Proposed Foundation Plan
- 9100-DRG-03CH-LG001 The Chapel Proposed Level LG Floor Plan
- 9100-DRG-03CH-UG001 The Chapel Proposed Level UG Floor Plan
- 9100-DRG-03CH-RF001 The Chapel Proposed Level RF Plan
- 9100-DRG-04CH-VL002 The Chapel Proposed Sections and Elevations
- 9100-DRG-04CH-VL003 The Chapel Proposed Cross Sections
- 9100-DRG-00CH-LG001 The Chapel Proposed Lower Ground Floor Details

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 The Chapel was constructed in 1928/29. It is located towards the north west corner of the site.

4.1.2 It is essentially a single storey building that creates a large open space that was used for ministry purposes. The main entrance is via the eastern end of the building which is framed by a small stone portico. This leads to a raised lobby area and steps lead down to the main space of the chapel. The western end of the chapel contains a semi-circular apse.

4.1.3 The main elevations are rendered brickwork and there are small clerestory windows below eaves level along the south and north elevations. The roof is gabled and finished using slate. The ceiling to the main space internally is panelled.

4.1.4 The ground surrounding the chapel generally falls from east to west. The fall in level is about 4.0m along the length of the building with the south west corner forming the lowest point. The fall in level across the rear west elevation is about 1.0m from north to south.

4.1.5 External steps and a pathway run along the southern side of the building. Given the fall in ground levels, the pathway becomes elevated towards the south west corner and the south perimeter wall of the walkway acts as a retaining wall. This pathway and wall were rebuilt in 1971. Below the western end of the pathway there is a small internal space which may have been a boiler house or used for storage.

4.1.6 There are a number of mature trees surrounding the Chapel.

i. Along the southern elevation there are a mature Silver Birch and two semi-mature Fig trees within 3m of the south elevation and some semi-mature Silver Birch trees slightly further away.

ii. To the north of the Chapel there are two mature Sycamores within 8m of the north elevation and a mature Ash and two semi mature Sycamore trees slightly further away.

iii. On the western boundary there is a mature Lombardy Poplar within 20m of the west elevation

4.1.7 From previous discussions with college staff, it is understood the building has not been used as a chapel for many years. More recently the space has been used as a small sports hall but over the past 10 years or so, the building has been disused.

4.2 Description of Existing Structure – A Summary

4.2.1 The existing structure is summarized on drawings 9100-DRG-03CH-AL001 and 9100-DRG-03CH-VL001.

4.2.2 The building has a cellular load bearing masonry structure. This supports the roof structure. The building relies on the cellular layout for overall stability.

4.3 Wall Construction

4.3.1 The load bearing external walls appear to be of solid brick masonry construction. It is not clear how the windows have been formed but probably have lintels throughout the width of the wall. They may be either concrete encased steel joists or of reinforced concrete construction. The main entrance is formed with a solid stone or reconstituted stone lintel.

4.4 Existing Floor Construction

4.4.1 The main floor has been explored through an internal trial pit. This showed it to be of mass concrete construction. This appears to be a ground bearing slab. The slab supports a timber Parquet floor finish across the main part of the internal space and stone finishes within the apse.

4.5 Existing Roof and Ceiling Structure Structure

4.5.1 The roof is formed from steel trusses spanning between the main external walls supporting timber purlins and common rafters. The roof is boarded above the rafters. The rafters and ceiling joists take support off the main external walls. In some locations a timber wall plate was observed.

4.5.2 The ceiling is expected to be formed using ceiling joists spanning between the bottom chord of the roof trusses and the end walls.

4.6 Existing Foundations

4.6.1 Trial pit investigations by Soiltechnics have exposed the foundations at four locations – with one trial pit along each elevation. ESG have also excavated a trial pit internally along the south elevation.

4.6.2 The external trial pits showed the building is founded on concrete strip foundations at varying depths below ground level. Tree roots were visible within the bearing stratum, as noted below:

i. The trial pit along the east elevation is by the south east corner of the building close to the Silver Birch tree. It has revealed the elevation is founded on a concrete strip foundation which bears on to natural silty clay of the Claygate Member at 1.1m below ground level. The description of the soils indicates no tree roots were noted.

ii. The trail pit along the south elevation is towards the eastern end of the building close to the mature Silver Birch tree. It has revealed the elevation is founded on a concrete strip foundation which bears on to natural gravelly sandy clay of the Claygate Member at 0.65m below ground level. The description of the soils indicates tree roots were visible within the bearing stratum.

iii. The trial pit on the west elevation is by the north west corner of the building. It has revealed the elevation is founded on a concrete strip foundation which bears on to natural gravelly silty sandy clay of the Claygate Member at 1.34m below ground level. The description of the soils indicate tree roots were visible within the bearing stratum.

iv. The trial pit on the north elevation is roughly midway along the building. It has revealed the elevation is founded on a thin concrete strip foundation which bears on to made ground at 1.41m below ground level. The description of the soils indicates no tree roots were noted.

4.6.3 The findings from the internal trial pit by ESG is reasonably consistent with the external trial pits. The concrete foundation was recorded 2.1m below floor level. This approximates to about 1.2m below external ground (outside the pathway).

4.7 East Entrance Portico

4.7.1 The portico is of stone construction. It has four columns rising from ground level that support stone lintels and an entablature course above which appears to be formed from a thinner stone section. The foundations have not been confirmed but are expected to be traditional pad footings.

4.7.2 This basic structure supports a flat roof which has separate roof and ceiling joists spanning on to timber wall plates.

4.8 External pathway and wall

4.8.1 This feature was rebuilt in 1972. The perimeter wall acts as a retaining wall and is of solid brick masonry construction. It is enhanced with a mass concrete infill that was cast against the back face of the wall. The historic drawings suggest the wall is founded on shallow concrete strip footings.

4.8.2 The pathway itself is formed using pavers laid on the raised ground.

5.0 Imposed Floor Loads

5.1 Based on the understanding of how the existing building has evolved over time, the existing floor appears to date from 1928/29.

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 Institution of Structural Engineers Report 1927:

	Pounds Per Square Foot (lbs per sq ft)	**kN/m²**
Assembly Halls etc. including churches ad chapels, colleges	100	4.7

5.4 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

5.5 In addition to these loads, a provisional allowance of 1.0kN/m² should be provided on the floors for lightweight partitions.

5.6 The floor is ground bearing and therefore should be able to support domestic imposed loads as noted above. The proposals allow for replacing the existing floor slab and so the new floor will be designed in accordance with current recommendations, as noted in section 5.4.

6.0 Observations on the Condition of the Existing Structure

6.1 This section of the report summarizes issues that 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 a poor condition for its age and type. It has suffered from differential settlement and water ingress associated with years of neglect. These observations are set out below.

6.3 <u>External Observations – Cracking to the Elevations</u>

6.3.1 Along the southern elevation, there are a series of vertical and diagonal cracks in the elevation. The width of these cracks increases as they extend up the elevation and are up to 15mm wide. The pattern suggests the elevation has rotated about its foundations at two locations along its length.

6.3.2 Along the northern elevation there is a similar – although less widespread pattern of cracks. This pattern of cracking is consistent with differential settlement of the foundations.

6.3.3 The pattern of the cracking appears to be linked with tree root activity from nearby trees. As the trees have grown they have removed moisture from the ground on which the foundations bear, causing consolidating of the ground. The trial pits support this view as they show the foundations are relatively shallow, are founded on a silty clay, and tree roots have been recorded below the level of the foundations.

6.3.4 Reviewing the theoretical tree root influence zones, based on guidance provided by the NHBC, shows the trees affecting the foundations are most likely to be the Silver Birches by the south elevation and the Lombardy Poplar just beyond the western boundary.

6.3.5 Given the cause of the movements and the shallow depth of some of the foundations, further ground movements can be expected to occur. This would be associated with seasonal moisture changes in the silty clay and roots continuing to remove water from the ground causing further desiccation of the clay to occur.

6.4 <u>East Entrance Portico</u>

6.4.1 The stone lintels and / or entablature to the entrance portico are cracked in places. This is most noticeable on the south face of the portico.

6.4.2 There are signs of green algae across some of the surfaces and vegetation is growing from some parts of the guttering. This suggests water ingress has been prevalent for a considerable period of time, encouraging water ingress to occur. The issues have been compounded by a lack of maintenance.

6.4.3 The ceiling finishes to the portico have also fallen away locally revealing some areas of decay to the ceiling and roof joists above. Again, these issues reflect water ingress has occurred for a considerable period of time.

6.4.4 The cracking suggests there are probably embedded iron cramps or ties within the stonework. This will have been encouraged by the water ingress. Iron cramps and ties tend to have limited protection from water ingress and are vulnerable to corrosion. This is an expansive reaction and leads to spalling and cracking of the surrounding stonework. The effects are then exacerbated as further water ingress can occur, leading to an accelerated process of deterioration in the structure. Freeze thaw action can compound the issue further.

6.4.5 A radar survey of the stonework should be carried out to assess the extent and condition of embedded ironwork in more detail as part of the strategy for repairing the portico. It is possible that the more significantly damaged sections of stonework may need to be replaced with new stone sections.

6.5 External Observations – other issues

6.5.1 The gutters and downpipes are blocked in places. This is most noticeable on the south east corner of the building. This has allowed water to overflow the gutters on to the eaves below.

6.6 Internal Observations

6.6.1 The H&R preliminary report from May 2015 highlights sections of the elevations have been affected by damp providing the conditions for decay of timbers built into the wall. These damp sections of wall exist across the whole of east elevation, the western half of the south elevation and to local lengths along the west and north elevations.

6.6.2 Evidence of noticeable water ingress is visible in the ceilings above the apse. A large section of the ceiling finishes has dropped out and the wall finishes on the curved walls in this area have suffered from damp and water ingress.

6.6.3 At roof level, there are signs of surface corrosion to the roof trusses. This is related to water ingress and damp possibly combined with a lack of effective ventilation within the roof space. The corrosion seen to date is not significant but this is based on the limited access that has been possible. Each roof truss needs to be assessed in more detail once safe access can be provided, so they can be properly inspected throughout their length.

6.6.4 Local areas of timber decay have been noted within the main roof close to the east end of the building.

7.0 Proposed Strategy for Structural Engineering Works

7.1 Given the existing structure is in a poor condition for its age and type, it needs a sympathetic conservation-led approach to address the concerns which have been identified. These relate mainly to the differential settlement – where the cracking in the main side elevations has reduced the structural integrity and robustness of the building structure. There are also issues associated with water ingress that need to be addressed. Provided these aspects are dealt with, the building should then respond well to the proposed refurbishment. Essentially the building was designed as a chapel within a college campus. The proposed refurbishment will convert the building to residential flats. This use is compatible with the existing structure.

7.2 In summary, the main structural repairs involve works to address the cracking in the elevations and to underpin the existing foundations. Timber repairs will also be necessary where water ingress has caused significant decay. The portico requires a conservation-led approach to restore its structure.

7.3 The proposed refurbishment will involve a number of structural alterations. The existing ground floor structure is to be replaced with a new floor and a new lightweight steel framed mezzanine floor is to be added. A new rear extension is proposed to the north of the existing building. New openings will be formed through the existing north and south elevations.

7.4 These aspects are discussed in more detail below.

7.5 <u>Building Regulations and Extending the Useful Life of the Existing Structure</u>

7.5.1 In accordance with the Building regulations, The Chapel 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.

7.5.2 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 residential use. The existing floor is to be replaced in any case and this will be designed in accordance with current Eurocodes and British Standards. This will also be the case with all new structural elements.

7.6 <u>Conservation Engineering Approach</u>

7.6.1 Given the Chapel is listed Grade II, it has additional importance linked with its historic and architectural interest.

7.6.2 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.

7.7 Building Warranty Provider

7.7.1 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.

7.7.2 Examples of work they may require are noted below:

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

ii. Where 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.

iii. 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.

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

7.8 Differential Settlement of Existing Foundations

7.8.1 As discussed in Section 6.0 above, the existing foundations have suffered differential settlement. This is the result of tree root activity and seasonal moisture changes on the silty clay below the shallow foundations. Given the cause of the movements, further ground movements can be expected to occur.

7.8.2 It is therefore proposed to underpin the existing foundations. This will enable the foundations to be extended to a depth where seasonal moisture changes and tree root activity will not affect the foundations. Whilst these works will potentially be disruptive to the historic fabric, the alternative of leaving the foundations as they are would not be sensible in conservation terms as further movement and damage to the historic fabric can be expected.

7.8.3 Traditional mass concrete underpinning has been chosen instead of piles & reinforced concrete needles, as this limits the impact of the works on the existing listed structure.

7.8.4 Given the structural integrity of the elevations has been undermined by the widespread cracking, it is important that the walls are made good prior to the underpinning commencing. Concrete bonding lintels or stainless steel stitches will also be incorporated. This will improve the robustness of the existing structure and allow the masonry to arch over each area where the soil is to be removed to form the underpinning.

7.8.5 Given the nature of underpinning, it will naturally cause some adjustment to existing load paths and some disturbance to the existing structure can therefore be expected. Allowance should therefore be made for making good slight cracks that occur as part of the works.

7.8.6 The underpinning works will also need to be coordinated with the formation of the basement to the new townhouse which is situated nearby. Vibrations may be generated during the formation of this basement and this may impact on the structure of the Chapel. It will therefore be necessary for the structural repairs to the existing cracked elevations to be made good prior to the basement works commencing so that the chapel has sufficient robustness.

7.9 Structural Issues associated with Water Ingress

7.9.1 One aspect which has affected the condition of the existing structure is 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. The Chapel is especially vulnerable to this given it is surrounded by large trees.

7.9.2 Buildings of this age and type require good cross ventilation within the structure – and especially the roof space - 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.

7.9.3 As such, the most vulnerable areas of the structure are where the gutters and rain water pipes exist.

7.9.4 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 timbers such as wall plates and common rafters to be either cut back and re-supported where effected. 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.

7.10 The Stone Portico

7.10.1 Stone structures of this nature are susceptible to the effects of water ingress. Embedded iron cramps and ties are vulnerable to corrosion. This is naturally an expansive reaction which tends to cause cracking and spalling of the stonework. The effects of water ingress are then accelerated – only to be exacerbated further by freeze thaw action where water becomes trapped.

7.10.2 To better understand the potential for embedded ironwork corroding, a non-destructive radar survey of the stonework should be carried out. This can establish where iron exists, the condition of the embedded iron, and to help establish the potential for further problems occurring. A strategy for the repair of the portico can then be established.

7.10.3 At this stage, allowance should be made for dismantling and re-erecting the portico. The existing foundations can then be extended down, to below the level of tree root activity, before the portico is rebuilt. This can be done by re-erecting the existing stonework where it is in a reasonable condition – such as the existing pillars and most of the lintels and entablature, but incorporating stainless steel ties to replace ironwork where it has corroded or is practical. New sections of stone may be necessary to replace damaged stonework which is beyond sensible repair and conservation. An allowance should also be made for a new timber roof and ceiling structure. This strategy will need to be assessed when the results of the radar survey are available so that the potential damage caused to the structure if it is dismantled is limited. The works will require a specialist Stone Restorer to carry out.

7.11 Proposed Structural Repairs

7.11.1 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.

7.11.2 The outline scope of structural repairs are as follows:

i. Making good of cracked masonry to elevations. Allowance also to be made for reinforced concrete bonding lintels or stainless steel stiches to be placed across cracked areas of the brickwork.

ii. Underpinning of existing foundations to be carried out using mass concrete underpins.

iii. Splice repairs to decayed ends of rafters where decayed. Timber wall plates in affected areas will probably need to be replaced too. Ceiling joists to be replaced or have splice connections added where decayed.

iv. Removal of decayed timber lintels, where they exist.

v. It is anticipated the stone portico will need to be dismantled and rebuilt. As part of the repairs existing iron cramps will be replaced with stainless steel ties and cramps. New sections of stone may be necessary to replace damaged stonework which is beyond sensible repair and conservation.

7.11.3 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. The programme for the construction works needs to 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.

7.12 Proposed Structural Alterations

7.12.1 As highlighted above, the proposed refurbishment will involve a number of structural alterations. The existing ground floor structure is to be replaced with a new floor and a new lightweight steel framed mezzanine floor is to be added. New openings will be formed through the existing north and south elevations.

7.12.2 The ground floor is to be replaced with a new suspended reinforced concrete slab. This will be supported off new strip foundation. A suspended slab has been chosen over a ground bearing slab as the existing made ground will be heavily disturbed as a result of the excavations required to carry out the underpinning.

7.12.3 The new mezzanine floor is to be constructed as a lightweight steel frame, with columns and beams supporting a timber joisted floor. The stability of the structure will be provided by tying the new steel frame back to the existing elevations, incorporating ply sheeting in to the floor to provide diaphragm action and through cross bracing which will sit within a new partition.

7.12.4 The door openings through the load bearing masonry walls at the lower floor levels are to be formed using concrete lintels.

7.12.5 Given the nature of these alterations there will naturally be some adjustment to existing load paths. Some disturbance to the existing structure over where new openings are to be formed may also adjust slightly as new supporting beams deflect under the loads. This may generate some slight movements in plaster finishes and brickwork. Allowance should therefore be made for making good slight cracks that occur as part of the works.

7.13 New Extension

7.13.1 A new rear extension is proposed to the north of the existing building. This will be a two storey structure which will be formed using a reinforced concrete frame. Stability will be provided through shear walls in the structure.

7.13.2 The ground floor will be a suspended reinforced concrete slab.

7.13.3 Piled foundations are proposed to limit the potential for differential settlement between the new and existing 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. Safe high level access is required to inspect the roof structure in detail. This is to allow the condition of the structure to be assessed and the scope of structural repairs to be established.

ii. A non-destructive radar survey of the stone portico is required. This will help establish the position of embedded iron cramps and ties within the stonework. Opening up works will probably then be required to confirm the detail and condition of some of the ties so that a conservation led approach to the restoration of the portico can be established.

iii. The existing lintels above the window openings need to be exposed to confirm their construction and condition.

8.2 The programme for the construction works needs to 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.

Feasibility Research

EIA, Flood Risk &
Transportation
Assessment

Urban Planning and
Design

Integrated Transport
Solutions

Infrastructure
Development

Structural Design

Eco and MMC
Focused

Tully De'Ath offers a range of excellent design services to a wide client base. If you want to find out more about the services we offer, please contact your nearest office on the details below.

Sheridan House, Forest Row, East Sussex, RH18 5EA
01342 828000 ph
01342 828001 fax

Unit 4, St Saviours Wharf, Mill Street, London, SE1 2BE
0845 850 8280 ph
0845 850 8281 fax
www.tullydeath.com