Structural Condition Report

Project:	39 Marchmont Street, London, WC1N 1AP
Client:	Fortune Green Capital Ltd
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Author:	Matthew Wood (MEng, ACGI, CEng, MIstructE)
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BANFIELD WOOD LLP

Structural Engineering Services
26 Winders Road
SW11 3HB
Contact: (+44)07798808622

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Figure 1: 39 Marchmont Street. Photo showing front elevation with shop frontage at ground floor level and three levels of residential apartments above (2023)

Executive Summary

BanfieldWood LLP have been appointed by Fortune Green Capital Ltd to undertake a structural condition survey of the Grade II listed building at 39 Marchmont Street, London, WC1N 1AP. Both visual and intrusive investigations have been made to inform this study. The intrusive investigations were agreed in advance with the local authority conservation officer.

The building was likely constructed in the period 1800 to 1806. During World War II the adjacent building was demolished following bomb damage, with 39 Marchmont Street experiencing "general bomb damage". The building consists of a ground floor and basement commercial unit. A ground floor communal side corridor provides access to three apartments at level 01, 02 and 03. The top floor apartment is constructed within a roof dormer construction. At ground floor level the commercial unit extends to the rear with an enclosed courtyard and access to the basement level.

The front and rear elevations are constructed of 9inch brickwork with bonded headers. The party walls are expected to be of a similar construction. Experience suggests the floors and roof are all of timber construction. Significant historic modifications have been made to the internal layout of the residential floors. Tap tests suggest all internal walls are constructed of light weight timber partitions. Local access panels revealed modern timber studs of grade stamped timber. It is unclear whether some of the stud walls contribute as load bearing partitions. At basement level various forms of construction are present. The basement retaining walls are of traditional masonry construction, the vaulted arches which extend below the pavement are constructed as brick arches. Some modern steelwork and engineering brick piers are present. Towards the rear a melee of interventions have been made to the original structure including; modified and new openings, steel and timber lintels, steel support beams and a section of concrete filler joist floor.

Assessment of the structural condition has been broken into three parts: a) The facades, b) The residential floors and c) The ground / basement commercial floors. The front facade shows serious signs of deterioration and damage. Extensive cracks are present in the brickwork, also evidence of a local dip in the brickwork. The likely cause is the deterioration or corrosion of the support beam over the shop frontage. Replacement of the beam and strengthening of the support piers may be required to shore up the front elevation. Temporary support works will be required to facilitate beam replacement.

At the rear elevation further signs of deterioration and defect are present. Cracking, dipping brickwork, spalling render, water and frost damage are all common to both facades. The cause of the extensive cracking and settlement of the rear brickwork is likely due to poorly executed structural interventions at the ground floor below the rear façade. The interventions at ground floor have likely caused the masonry above to move and crack. The existing openings are to be shored up and re-supported using suitable new structural lintels or steel members. Robust support at the lower level is expected to mitigate ongoing settlement of the façade. In addition, both front and rear elevations require general repair and maintenance to the brickwork, lintels, rainwater goods, window reveals and parapets.

The residential levels show signs of sagging timber floors at all levels. Following our investigations, the expected cause of the sagging is due to; badly notched timber joists, additional weight of modern timber partitions and the long-term creep effects of 100+ year old timbers. No signs of rotten or deteriorated joists were found during our local investigations, however this cannot be ruled out. Joist replacement or

strengthening works are likely required to level the floors and bring the floors back to a serviceable condition.

The basement level contains significant and extensive damp ingress. In addition, there is negligible ventilation to the space resulting in high humidity which provides a low-quality internal environment. The damp and humidity have contributed to accelerated deterioration of the structural steel in this space. Badly corroded steel lintels and filler joist floors are present. In some places temporary works have been introduced to make the structure safe whilst repairs are agreed.

Contemporary modifications to the basement and ground floor have resulted in poorly executed structural works. These have changed the load path in the structure and caused walls or floors to become overloaded leading to settlement, deformation and cracking. Nearly every opening in these spaces requires intervention to provide adequate structural support in the form of a replacement lintel, new steel beam and crack repairs.

In summary visual and intrusive survey works have been undertaken to inform this condition study. Whilst the structure is over 200 years old, recent modern interventions and lack of maintenance have led to an accelerated deterioration of the structure and the prevalence of defects within the structural fabric. Interventions are now required to bring the structure back to a serviceable condition.

Introduction

BanfieldWood LLP have been instructed by Fortune Green Capital Ltd to undertake a structural condition survey of the Grade II listed building at 39 Marchmont Street, London, WC1N 1AP. The survey was undertaken on the following dates by a chartered structural engineer experienced in the assessment of historic and listed buildings:

24th July 2023 (non – intrusive survey)

11th September 2023 (non – intrusive survey)

23rd October 2023 (non – intrusive survey)

22nd November 2023 (local intrusive works)

The aim of this report is twofold. Firstly, to catalogue the structural defects in the building. Secondly, to advise the likely remedial measures required to bring the building back to a safe and serviceable condition. The findings of the report shall be shared with the local authority conservation officer as part of a listed building application.

Survey Limitations

At this time, no access equipment is provided and the use of drones for aerial surveillance is prohibited in this central London location. As such it has not been possible to assess the roof or high-level areas of parapet and chimneys. During the construction process, a scaffold will need to be installed, and the engineer invited to inspect the roof. Further, only local intrusive works have been completed, as such our conclusions are limited to those areas where the structure has been physically exposed. Additional defects may be present in other areas. Sufficient contingency shall be allowed in the development cost plan to account for unknown defects in other areas of the building. Further investigations may be required to develop a full and complete picture of the existing building condition.

Existing Building Context

The building and surrounding area of Marchmont Street have a diverse history. A fuller description of the building's history is provided within the heritage consultant's report:

Jon Lowe Heritage, "Pre-Application Heritage Statement", September 2023.

The building was likely constructed somewhere in the period 1800 to 1806 as part of the wider Foundling Estate development by architect Samuel Pepys Cockerell. During World War II Marchmont Street sustained heavy bomb damage. The adjacent 37 Marchmont Street was bombed and later demolished due to being beyond repair. 39 Marchmont street experienced "general bomb damage". Towards the 20th century there is evidence the upper levels of the building became occupied by multiple tenants with possible reorganisation of the building layout occurring at this time.

The building is a four-storey terrace building, the upper three levels consisting of residential apartments accessed from a ground floor communal side corridor. The ground floor and basement contain a commercial unit with a ground floor rear storeroom and enclosed courtyard. Originally the building was mid terrace within a row of identical townhouses, however due to the bomb damage and subsequent demolition of the adjacent structure, the building is now effectively end of terrace.

The front and rear facades are constructed in typical 9inch brickwork with bonded headers. Some historic replacement of brickwork has taken place, this is especially evident at the rear of the property where the brickwork adjacent to 41 Marchmont Street sits proud of the adjacent building by approximately 20-30mm. The lintels to the front façade are formed as gauged brick flat lintels, at the rear common brick arch lintels are used.

The party walls are assumed to be constructed as solid 9inch brick walls but likely with a lower quality of brickwork than that used on the front façade. The floor and roof structures are assumed to be constructed in timber. The top floor apartment is constructed within the dormer roof structure. Tap tests on the internal partitions of the upper residential levels indicate they are all constructed as light weight timber partitions. It is unclear whether some of the partitions are contributing to the structural support of the floor joists. During the survey a small access panel was removed from a partition wall, this exposed a timber stud with a grade stamp indicating the partitions are of a modern construction and not original to the fabric of the building. This further supports that modern reconfigurations of the layout have been made by previous owners.

Based on experience of similar structures of this age, the historic arrangement was for a central spine wall to be present from ground to roof level. Whilst this spine wall would have contained openings for circulation, the wall contributed significantly to the lateral stability of the building and the local buttressing of the party walls. The spine wall appears to have been fully removed at all levels to create a large open plan ground floor shop and alternative apartment arrangements above. At ground floor there is evidence of a downstand steel beam in the ceiling supporting first floor joists over. It is likely that similar interventions have been made at the upper storeys.

Condition Record

For reporting purposes, the building has been split into three sections as follows:

a) The front and rear facades
b) The residential floors
c) The ground and basement commercial floor

See following sections for a detailed summary of structural condition.

Front and Rear Facades

This section to be read in conjunction with drawing 20076-S-100. The front elevation shows some areas of bricks are lighter in colour and of a different format to the rest of the façade. Figure 2 below shows a photograph of the façade in 1930 and later in1956, extensive parts of the façade have been repaired and

the party wall has been rendered where the adjacent building was demolished. This is likely because of the bomb damage sustained during World War II.

Figure 2: Credit Jon Lowe Heritage Report. Left: Picture of 39Marchmont Street elevation dated 1930 (pre WWII) the adjacent building is still present and the façade brickwork is uniform. Right: Picture taken 1956, façade brickwork has been extensively replaced and the party wall has been rendered, the adjacent building has been demolished

In both photographs the brickwork above the shop signage appears uniform and level. In our modern assessment the brickwork is cracked and visibly dipping towards the centre of the building. Settlement of the façade is evident. Removal of the shop front signage reveals a supporting RSJ spanning across the full width of the building frontage. The RSJ is corroded in places, has limited bearing and the brickwork above the RSJ is of poor condition with areas of local loose or missing mortar. The support packing between the top of the RSJ and the brickwork above is also of poor condition. We speculate that the beam itself may not be the original, for a building of this age it may have been more conventional to use a large timber section for support. The RSJ may have historically been introduced to replace the timber. Part of the distress to the front façade may have been caused when the RSJ was installed. It is not uncommon for these RSJ beam to be unprotected and exposed to the elements, thus suffering serious corrosion over the life span of the structure. Corrosion and loss of steel section can lead to reduction in stiffness and subsequent deflection of the beam. This can manifest in ongoing settlement of the façade brickwork.

Drawing S-100 catalogues the visible cracks across the front façade. These generally extend from the corners of window openings, lintels or cills. As a point of stress concentration in the brickwork, it is common for cracks to develop from these locations when the brickwork is subject to additional stress or settlement. Further cracks and damaged brickwork are present behind the rainwater goods, this is assumed to be due to poor maintenance of the gutters and downpipes. Evidence of cracks, missing bricks and loose mortar behind the rainwater goods is likely due to historic water and frost damage.

At the rear façade, similar extents of cracking and dipping of brickwork are visible. A full record is provided in drawing S-100. Investigations of the structure at ground floor below the façade show that many historical and poorly executed modifications have been made to the load bearing structure. In one case a ground floor opening has been made with inadequate lintels, requiring to be propped up on timber supports. The movement induced by these poorly executed works is likely a contributing factor in the deterioration of the rear façade.

Sections of the brickwork on the rear facade have similarly been replaced. This is most evident by the protrusion of the brickwork face by approximately 20-30mm compared to the adjacent terrace building. A cement-based render has been applied at the first floor level to the rear façade and the adjacent terrace walls. Spalling of the render is evident in several places. Cement based coverings should be avoided in historic buildings as they trap moisture and prevent the building “breathing” through the porous brick and lime fabric.

At roof level, the parapet coping stones are weather damaged, with signs of missing or loose mortar below the stones. The party wall parapet and chimney stack have a visible lean into the building. This is likely caused by frost and sulphur damage.

Residential and Communal Access Areas

This section to be read in conjunction with drawing 20076-S-101. The internal face of the front and rear façade contains cracks in similar locations to those experienced externally. Namely from the corner of window openings, it is assumed these cracks are linked with the defects caused by the poor support of the external facades.

The floor structure at all upper floors experiences a significant sagging, the worst case is experienced at the top floor. The floor is assumed to be constructed of original timber floor joists; however, it is possible that a central steel beam has been installed as described earlier. It is therefore plausible that a combination of steel beam and timber joist deflection under load has caused the significant sag in the floors. Irrespective of whether a steel beam is present; because of the age, long term creep effects and possible deterioration of the timber, sagging of the floor structure is considered common in a building of this age. Our intrusive investigations revealed the joists to have frequent notching in the tops to allow services to run through the floor zone. The ends of the joists at the wall locations are generally in good condition however they have similarly been notched at the wall support location. These notches are likely reducing the effective section depth of the floor joists leading to deflection / sagging of the timbers. Lastly the modern timber partitions have been introduced at each floor level to subdivide the space into flats. The partitions are relatively closely spaced and as such the loading on the floor joists is much larger than the original floor plan. The additional load will increase the tendency for the joists to sag / deflect. Overall it is expected that joist strengthening will be required with new modern timber joists to a) relevel the floor and b) provide additional strength to carry the weight of the partitions and the modern floor finishes.

Some cracking was observed vertically between the party wall and the facades on the inside corners of the building. A common defect in this age of building is for the façade brickwork to be pulling away from the party wall. The brickwork is often poorly tied together, over time and cyclic wind loading the mortar bond between the front and side walls can deteriorate. Further investigations will be made to confirm the extent of the defect and propose suitable remedial actions.

Ground Floor and Basement Commercial

This section to be read in conjunction with drawing 20076-S-101. The basement contains significant damp. In some locations there are visible damp patches, and or water pooling in the basement. Due to the age and method of construction of the building, no significant waterproofing is expected to be present, as such the brick retaining walls and concrete ground floor slab are the only barrier to moisture entry. Furthermore, there is no active ventilation to the basement space, leading to high humidity levels. The combination of damp ingress and high humidity has created an environment in which corrosion of steelwork is extensive. The steel lintels, including those partially embedded in concrete are highly corroded and need to be replaced. In some locations temporary acro props have been introduced to make safe openings and support the floor above. It is recommended that all plasterboard and other finishes are removed to fully investigate the extent of corroded structural steelwork. If the basement space is to be let as a commercial or storage space, significant damproofing measures will be required, and ventilation should be considered to improve the internal environment. At ground floor level damp is similarly present to the rear walls of the property, however this damp is likely caused by water ingress from the faulty roofs above. Renovating the roofs and providing adequate ventilation will likely improve the ground floor internal environment.

At ground floor within the commercial unit, a concrete block partition wall is present that separates the commercial space from the adjacent residential corridor. The wall has significant vertical cracks at several locations. These cracks manifest through the plaster and into the blockwork itself. The cracks measure between 3 and 5mm. The partition does not continue down into the basement, and investigations suggest the wall is supported by only the timber floor boards and timber joists. Insufficient support of the heavy concrete block wall has led to settlement of the timber ground floor. This is evident from the obvious drop

/ unevenness of the corridor side flooring. The movement has resulted in the brittle concrete block partition cracking. Works will be required to provide new suitable support at basement ceiling level before the wall can be repaired. It may be prudent to demolish and replace the wall with a new lighter weight partition in modern materials with adequate fire separation.

At the rear of the ground floor retail unit, the load bearing spine wall is constructed of brickwork and intersects with the party wall. The spine wall and party walls have separated. In addition the small brick pier between the doorway and the party wall carries a lintel above. The pier brickwork is in poor condition and requires to be rebuilt and tied into the party wall.

It is likely that many of the openings within the basement and ground floor space are not original, but instead modern interventions to reorganise the spaces suitable for contemporary commercial use. The openings in places have been poorly executed. At one location a small timber joist has been introduced as a lintel supporting several metres of brickwork over. In other locations the steel lintels have become badly corroded because of extensive damp. One immediate safety concern was identified, whereby the bearing of a lintel has completely corroded and caused the lintel to fail. Subsequent temporary works have been introduced by the client to make safe the structure. Lintel replacements and or further investigations are required at practically every opening.

A filler joist floor (*historic concrete flooring system comprising steel joists at regular centres encased in concrete*) is present above the stairs down to the basement space. The floor is likely not part of the original fabric but introduced to form the external toilet space. Due to damp, and possible leaks caused by the toilet plumbing above, the steel joists embedded within the concrete floor are highly corroded. The concrete soffit has spalled and the joist is exposed. Again temporary works have been introduced to make safe. The floor will likely need to be fully replaced, this will involve temporarily propping the walls over which are currently supported on the floor.

Extensive cracks are present in several of the basement walls, these are documented on drawing 20076-S-101. The likely cause of the cracks is a combination of inadequate support of new structural openings, change of load paths, and likely local settlement of the foundations to accommodate the additional load caused by the structural modifications.

At the front of the property, the basement continues under the public pavement forming two vaulted storage areas. The structure in this area is a traditional brick arch vault. The front wall of the northern vault has partially collapsed exposing the earth behind. The brick arch ceiling in one area of the vaults has collapsed exposing the subbase to the pavement above and some utilities. It is assumed the brick arch was damaged when new fibre (or other) utilities were installed. Temporary works have been introduced to temporarily support the brick arch.

Lastly trial pits were conducted at two locations (see drawings for information). The footings to the internal walls were found to be relatively shallow but founded on a concrete strip over aggregate / coke breeze blinding. The trial pit adjacent the party wall was found to be deeper and similarly founded on a concrete strip. The base depth nor plan extent of the concrete strip was not found due to limitations of space for trial pitting. The foundations generally appeared to be in good condition with no obvious signs of cracks or fractures. The ground conditions are predominantly made ground consisting of silty, clayey sand, aggregates, fractured brick remains and other demolition waste.

Schedule of Proposed Works

The following works are likely required to bring the building back to a serviceable condition. It is recommended that structural enabling works such as steel beam replacements are fully completed before any cosmetic work is undertaken to repair cracks.

Front Elevation:

- Steel beam over shop frontage to be replaced with a new modern steel beam with adequate corrosion protection, bearing and packing to support wall above. All existing signage and decoration to be locally removed. Historic features to be retained if possible or otherwise recorded for later reinstatement. The masonry façade above shall be propped using temporary works including needles and props through the masonry above the existing beam. Once the façade is safely supported, the beam is to be removed and replaced with a new steel beam with suitable corrosion protection. The beam to be sited on new padstones or structural steel columns at each end. Brickwork, signage and decoration to be reinstated.
- Remove the rainwater pipe fully and repair damaged brickwork behind. Replace bricks if required using reclaimed bricks to closely match existing. Mortar repairs to be made in lime-based mortar. Replace rainwater goods with conservation style cast iron to match existing.
- Repair the cracks to the facades (internally and externally) using proprietary crack bonding stainless steel ties and lime based replacement mortars (by helifix or similarly approved)
- Replace or repair existing coping stones ensuring the stones are well seated on a new bed of lime grade mortar with DPC below

Rear Elevation:

Note: Historic structural interventions at the ground and lower ground floor below the façade are to be fully repaired with new suitable structural supports to ensure the ongoing stability of the rear of the property.

- Repair the cracks to the facades (internally and externally) using proprietary crack bonding steel ties and lime-based replacement mortars
- Remove soil pipes and repair damaged brickwork behind
- Temporarily support and repair failed lintels using new reclaimed masonry and lime mortar to reinstate cracked bricks and failed supports
- Remove all cementitious renders and replace with new lime based complimentary / breathable render systems. Alternatively no render to be applied and brickwork locally repaired

Roof and Chimneys:

(subject to a full roof investigation)

- It is likely that extensive replacement / and or repair of the timber roof and dormer structure will be required. Subject to intrusive investigations
- The chimney will need to be fully inspected. Worst case scenario may be to demolish and reconstruct using salvaged materials if the lean is too extensive or the damage to the brickwork is irreparable. Best case scenario, damaged bricks can be replaced with reclaimed brickwork in lime mortar, defective mortar joints to similarly be raked out and repaired

Floor Structure:

- The timber floors at the upper levels show extensive sag / deflection due to both age and historic defects such as excessive notching. The additional load applied due to partition works has also contribute to the joists becoming overstressed and hence deflecting further than expected. The existing floor boards are to be removed. New joists are to be introduced adjacent to the existing joists or at 600mm ctrs (whichever greater), supported on the external walls at one end and the central spine structure at the other end of the joist. They shall be through bolted to the existing joists at regular centres. The new joists shall be installed to be level across the entire floor plate. Subject to agreement with the conservation officer the floor boards shall be replaced with new plywood floor boards as a measure to further shore up the floors and improve their in plane stiffness. New floor coverings will be installed as required.
- Where joists meet the external walls, brick repairs are likely required. Investigations show the façade may reduce to one brick thickness through the zone of the floor. New reclaimed brickwork to be introduced in lime based mortars.

Basement and Ground Floor:

- The existing corroded and deteriorated steel and timber lintels will need to be fully replaced with modern lintels. This applies to both basement and ground floor level. Temporary works will be required to support the masonry walls and floors over whilst the lintels are replaced. New modern precast or galv steel lintels shall be introduced.
- Brick crack stitching will be required across the various extents of cracked brickwork walls. This will aim to bring the brickwork back into a serviceable condition
- Extensive damp exists within the basement, assuming the space is to be rented as retail storage it is likely that damp proofing measures and ventilation upgrades will be required to make the space serviceable
- The masonry arch vaults below the pavement are to be repaired using traditional masonry techniques
- The failed / corroded filler joist floor supporting the external toilet at ground floor level is to be replaced
- The concrete block wall at ground floor level between the commercial unit and communal corridor is to be re-supported from below with new steelwork. Alternatively, it may be more cost effective to demolish and replace the partition with a new lightweight timber or steel partition covered with modern materials to offer the necessary fire and acoustic separation.
- The spine wall to party wall separation will need to be retied using stainless steel bow ties and modern resin injection techniques.

Conclusion

A condition survey has been made to understand the extent of structural defects at 39 Marchmont Street. The recorded defects are extensive and appear generally to be a result of the age of the structure, lack of maintenance and poorly executed historic interventions. Structural issues relate principally to the sagging floor structure and the instability of the front and rear facades. Intrusive works have been undertaken to better understand the underlying causes of the structural defects. A suite of remedial works are proposed.

Appendix A: Survey Drawings

Appendix B: Photo Record