Barrett Mahony Consulting Engineers
Civil . Structural . Project Management
London: 12 Mill Street London, SE1 2AY, UK.
Tel: 020 3750 3530
Email: bmce@bmceuk.com Web: www.bmceuk.com

PROJECT: **1A HIGHGATE ROAD, LONDON NW5 1JY**

PROJECT NO. **16745**

DOCUMENT TITLE: **STRUCTURAL APPRAISAL OF EXISTING ROOF STRUCTURE AT 1A HIGHGATE ROAD**

DOCUMENT NO: **16745-RP-02**

Issue	Date	Description	Orig.	PE	PD	Issue Check
P1	08.08.2016	Issued for Information	PP	OC	VB	

STRUCTURAL APPRAISAL
OF
EXISTING ROOF STRUCTURE
AT
1A HIGHGATE ROAD,
LONDON NW5 1JY

barrett mahony

CONTENTS

Prepared By: Philip Penco
BSc ME

Reviewed By: Owen Carroll
BE MSc DIC CEng MIEI MIStructE

Approved By: Vincent Barrett
BSc MSc DipStructEng DIC MIEI CEng MIStructE FConsEI

1.0 INTRODUCTION

1.1 General

The subject site is located at No. 1A Highgate Road, London NW5 1JY in the London Borough of Camden. The site is occupied by an existing single-storey building. The existing building had previously been used as a warehouse with ancillary garage, but is presently unoccupied.

Planning permission has been granted for the conversion of the existing warehouse building to a residential usage.

1.2 Brief

Barrett Mahony Consulting Engineers UK Ltd. (BMCEUK) have been appointed by the client, IDM Properties LLP, to carry out a structural inspection of the existing roof structure at the above site.

The purpose of this report is to provide advice on the structural condition of the existing roof.

1.3 Scope

An initial site walkover was carried out by Vincent Barrett and Philip Penco of BMCEUK on 06/07/2016, accompanied by Matthew Savage of IDM Properties LLP. This initial site walkover comprised a non-intrusive visual inspection of the existing building.

A further site inspection to appraise the existing roof was carried out by Owen Carroll and Philip Penco of BMCEUK on 28/07/2016.

The roof structure was inspected internally from ground level. At the time of inspection, the internal roof structure was fully exposed as there was no ceiling present.

The external roof fabric was inspected from ladders only. An initial inspection had identified that the roof was in fragile condition, with evidence of structural collapse noted. It was therefore deemed unsafe to walk on the roof.

Photographs from the above inspections are included in Appendix I of this report and are referenced in Section 2.2.

This report was prepared by Philip Penco of BMCEUK and reviewed by Owen Carroll of BMCEUK.

2.0 OBSERVATIONS

2.1 Site Description

The existing site at 1A Highgate Road is located off the south west side of Highgate Road, near its junction with Kentish Town Road and Fortress Road. The site is set back from the main road behind the Bull and Gate public house. The site location is indicated in Figure 1 below:

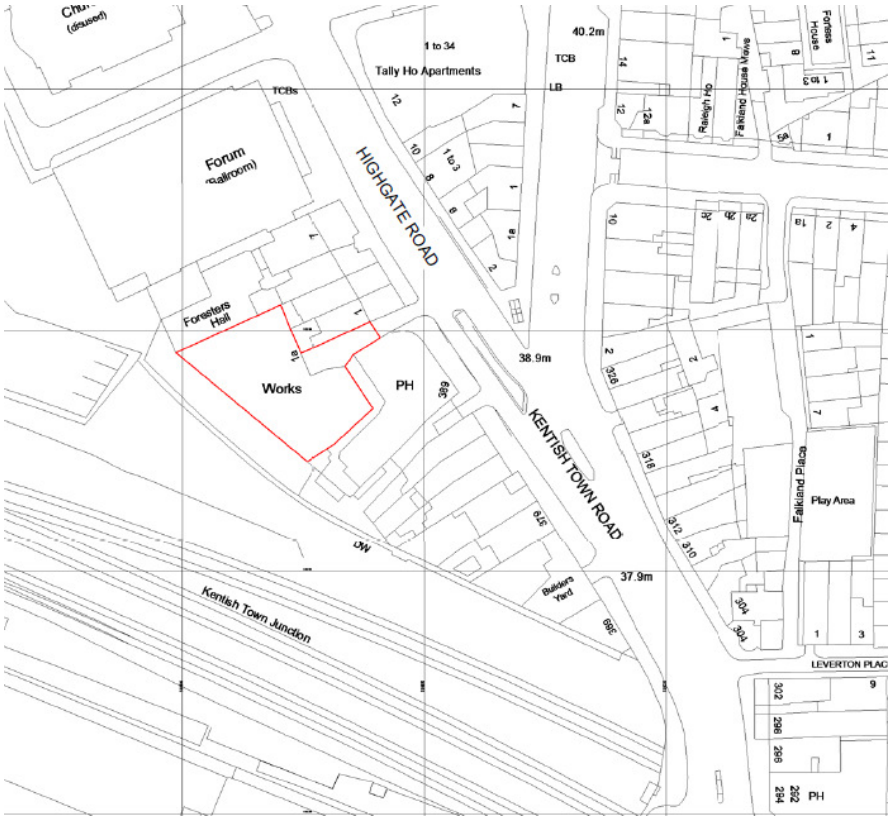

Figure 1: Site Location

The site is occupied by an existing single-storey double-height warehouse building. The building is accessed via a narrow cobbled access road from Highgate Road between adjoining buildings and is shared with rear access to the Bull and Gate public house.

The existing building is understood to be of late 19th / early 20th Century construction. A review of historical maps indicates that the existing building was constructed between 1896 and 1915. The building is understood to have had a number of uses uses over its lifetime. Originally used as a welding works, the building was subsequently used for clock face manufacture; piano manufacture and assembly; piano distribution and storage. The building is presently vacant and is understood to have been most recently used as a piano store.

The existing building comprises two distinct sections, both of which are irregular trapezoidal-shaped on plan. The main part of the building comprises a storage area with a pedestrian door entrance. This part of the building is roofed with a series of parallel pitched roof structures containing clerestory elements. There is an adjacent garage with roller shutter door vehicular entrance. The garage is roofed with a duo-pitched roof. The two sections of the building elements are interconnected by internal door access. Both sections of the building are enclosed by perimeter masonry walls.

The structure is of traditional load-bearing masonry construction. The principal vertical elements of structure are solid brickwork walls, which support the existing roof structure. The roof structure generally comprises large queen post trusses, which support the roof rafters and purlins. The trusses span onto internal and external load-bearing masonry walls. At some locations the trusses are supported on existing beams, which span onto masonry piers.

The ground floor structure comprises a mass concrete ground-bearing slab, of variable thickness. The load-bearing walls and piers are founded on traditional spread footings. Trial pit investigations have indicated that these bear on the underlying London Clay stratum at shallow depth.

The existing roof plan layout is indicated on Figure 2 below:

Figure 2: Existing Roof Layout

2.2 Existing Roof Structure

The existing roof structure is in two discrete parts, reflecting the two distinct sections of the building. The roof over the main warehouse structure comprises a series of four parallel pitched roofs. Three of these roofs feature clerestory elements at ridge level. The individual pitched roofs are separated by valley gutters. There is a duo-pitched roof over the ancillary garage space, which is perpendicular to the roofs over the main warehouse structure. The duo-pitched garage roof is abutted by a small section of mono-pitched and flat lean-to roof.

The existing roof structure generally comprises large timber queen post trusses which span laterally across the building (Ref. Photograph P29). The principal trusses support timber purlins, which in turn support timber rafters. The roof is predominantly clad externally in clay tiles, although portions of the roof are clad in assumed imitation slate tiles (Ref. Photograph P04). The tiles are attached to the roof boards, which are fixed to the rafters.

The roof structure is in a severely dilapidated condition. There are a number of large open holes in the roof structure, which allow rainwater to freely enter the building (Ref. Photographs P02, P03, P06). At such locations, the structural members have been left open and are entirely unprotected from the elements. This exposure has caused unrepairable damage; the structural capacity of these members can no longer be considered adequate. In addition, several instances of displaced and slipped roof tiles were noted, which has led to further rainwater penetration (Ref. Photograph P04).

In addition to the large holes, moisture ingress was generally evident throughout the structure. This has been caused by the failure or absence of roof weathering. This has led to the deterioration of the fabric of the existing structure, particularly of the roof itself. Evidence of wet rot was noted at the underside of the existing roof boards. This was most pronounced at the location of the existing valley gutters. This has resulted in warping and distortion of the roof boards in several locations. Photographs showing the failure of the roof members are appended to this report (Ref. Photographs P07, P10, P11). The timber trusses also appear to have been subjected to moisture damage. Evidence of wet rot was noted at locations where the structural members bear onto masonry walls (Ref. Photographs P13, P14, P17).

The roof trusses appear to be inadequately braced on plan. Longitudinal bracing to the bottom chord of the trusses was noted to be insufficient generally, and was entirely absent in places (Ref. Photograph P31). Therefore, there is limited restraint to the trusses against out-of-plane movement, creating a risk of instability. It was noted that some of the main roof trusses appear to have become distorted and are significantly out of plumb. One truss in the northern trapezoid of the building was estimated to be out of plumb by circa 80 mm, further contributing to the unsafe appearance. It is considered that this out-of-alignment may be related to the lack of longitudinal bracing noted above and aggravated by timber deterioration due to moisture ingress.

The roof is considered to provide inadequate restraint to the external masonry walls. Wall restraint straps were generally absent from the structure. The external masonry walls were observed to be significantly out-of-plumb in places, suggesting that they are not tied adequately at roof level. In particular, the triangular parapets to the rear face of the clerestory elements were noted to be severely leaning (Ref. Photographs P01, P03). At one location, the parapet was measured to be out of plumb by circa 100 mm. This out-of-alignment has been caused by the lack of roof restraint.

Several of the existing timber rafters and purlins are showing deflections in excess of acceptable limits. These members are visibly sagging, which gives the roof an unsatisfactory appearance and exacerbates the moisture ingress issues. This is because the members are undersized and have been weakened due to the effects of moisture ingress.

Elements of the roof are supported on a range of different types of supports. These include direct bearing on masonry walls, bearing on steel beams, bearing on masonry piers, supported on timber posts or bearing on timber wall plates on top of the masonry walls. At some of these bearing locations cracking was noted, which has potentially been caused by an inadequacy of the supports to support the roof load (Ref. Photographs P17, P25, P30).

In places, the roof members are supported on existing mild steel beams. Corrosion was observed to such members. (Ref. Photographs P18, P24). Although a paint coating had been applied to some steel beams, this treatment appeared to be unfit for purpose as it was peeling off, leaving the steel vulnerable to further corrosion.

In one location the roof appears to have collapsed under its own weight and a remedial steel beam had crudely been installed to support the roof. This beam currently spans from a makeshift bearing pad in an external wall into the building where it is propped up by a timber stud. No connection exists between these elements; the steel simply bears precariously onto the timber stud and is reliant on friction to remain in position (Ref. Photographs P05, P08).

The existing roof drainage regime was observed to be unsatisfactory, with evidence of blocked gutters noted. In places, rainwater from the roof appears to have spilled down the face of the external brickwork walls, leading to moisture ingress and deterioration of the existing building fabric. Debris and litter was observed to have accumulated in the valley gutters, which contributes to the perception of a historic lack of maintenance (Ref. Photograph P04).

The existing clerestory elements have been boarded up and crudely covered with felt. The felt is inadequately lapped to the roof tiles and has become detached from the boarding in places, which further promotes water ingress (Ref. Photographs P02, P03, P04).

Vegetation growth was noted on the external surfaces of the roof. Lichen growth and moss growth were observed on the roof tiles and within the valley gutters

(Ref. Photograph P04). Weed growth was also present on the roof, and this appeared to be causing damage to the existing parapet walls at roof level, as well as to the roof structure (Ref. Photograph P02). Vegetation growth was also noted internally (Ref. Photographs P07, P20), which appeared to be exacerbating the wet rot to the structural members.

3.0 ASSESSMENT

The existing roof structure is structurally unsound and has partially collapsed in places. The roof is considered to have failed and is no longer considered fit for purpose. The roof failure is evidenced by the following factors:

- Evidence of wet rot to existing roof timbers.
- Large holes in roof.
- Roof tiles slipped and missing.
- Absence of adequate roof weathering.
- Excessive deflection of roof members.
- Distortion of roof trusses, caused by lack of roof bracing.
- Absence of roof restraint to external walls, causing out-of-alignment to walls.
- Corrosion of supporting steel beams.
- Rotting of embedded timbers at support points.
- Vegetation growth.
- Unsatisfactory roof drainage.

The failure of the roof structure appears to have been influenced by a number of factors, including:

- Inadequacy of structural members.
- Deficient configuration in respect of bracing and lateral restraint.
- Historic inappropriate alterations.
- Historic lack of maintenance over several years.
- Deterioration over time due to continued water ingress.

The existing roof structure is damaged beyond remediation and should be demolished on structural safety grounds. It is considered that the existing roof does not have the structural capacity to support the loads that will be applied to it, including snow loads, wind loads, imposed loads for maintenance access, and dead loads due to proposed ceilings, weathering and insulation etc. In our opinion, the roof has been damaged beyond repair and there is no possibility of repairing it to achieve compliance with Part A of the Building Regulations.

Demolition and replacement of the existing roof structure would allow for appropriate weathering details to be incorporated into the structure to prevent further water ingress. This would ensure that further deterioration of the existing building fabric could be avoided. There would also be opportunity to improve the thermal performance of the existing building by incorporating insulation details in the replacement roof structure.

Demolition and replacement of the existing roof structure would allow for appropriate restraint to be provided at roof level to the external walls, to ensure that further damage to these elements does not occur.

4.0 RECOMMENDATIONS

Based on the observations outlined in this report, we advise:

- The roof is considered to be damaged beyond remediation. Due to the extent of the existing damage, the roof cannot be repaired to achieve compliance with the Building Regulations. It is recommended that the roof should be demolished in the interests of structural safety. Such demolition works would be subject to local authority approval.

- The existing roof is not safe for access for any purpose. The roof should be temporarily propped prior to its demolition to enable it to be safely demolished.

- Temporary propping should be provided to the external walls, prior to the demolition of the existing roof. The propping should be maintained in position until a new roof structure has been constructed and permanent lateral support provided to the external walls.

APPENDIX I

Site Photographs

P01 – View of rear elevation showing damage to roof and lack of wall restraint

P02 – View from roof level of existing hole in roof and damage to parapet caused by vegetation growth

P03 & P04 – View from roof level showing damage and dilapidation of roof

P05 – Remedial steel beam support to collapsing roof

P06 – Failure of roof rafters & collapse of roof

P07 – Failure of roof rafters & collapse of roof

P08 – Failure of roof purlin support beam & failure of waterproofing to roof

P09 – Water ingress to existing roof

P10 – Rotting roof boards and rafters due to waterproofing failure

P11 - Rotting roof boards, rafters and truss end due to waterproofing failure

P12 – Wet rot to wall plate and rafters due to waterproofing failure

P13 – Deterioration of fabric of structural walls due to roof failure

P14 – Rotting of roof structure at bearing point

Photo 15 – Rotting roof boards, rafters and timber support due to water ingress

Photo 16 – Rotting roof boards, rafters, wall plate and trusses due to water ingress

Photo 17 – Rotting roof boards, rafters, wall plate and trusses due to water ingress

P18 – Cracking of masonry below caused by inappropriate bearing of roof member. Corrosion of existing steel beam

P19 – Inadequate bearing of roof truss

P20 – Internal vegetation on rafters caused by water ingress and wet rot to roof boards, rafters, and supporting timber beam

P21 – Water ingress due to failed waterproofing detail impacting masonry walls

P22 – Existing roof structure supported on steel beam

P23 – Existing roof structure supported on steel beam

P24 – Corrosion and flaking paintwork to supporting steel beam

P25 – Inadequate bearing of existing roof truss.

P26 & P27 – Inadequate restraint to existing masonry walls

P28 – Inadequate restraint to existing masonry walls

P29 – Internal view of warehouse roof

P30 – Inadequate bearing of existing roof truss.

P31 – Internal view of garage roof. No roof bracing present.