



IAW Consulting Engineers Ltd. | Civil & Structural

102 Kemp House, City Road, London, EC1V 2NX

lftekhar.waseem@iaw-ce.co.uk

T: 02033270173, M: 07792450933

TY MAWR

Pontfadog, Wrexham, LL20 7AS

Structural Condition Survey of Existing Barn

	Name	Position	Signature	Date
Prepared by	Iftekhar Waseem BE, MSc, CEng MICE	Director		06/12/2021

STRUCTURAL REPORT

SR01

06 December 2021

© Copyright IAW Consulting Engineers Ltd.

Unless explicitly stated otherwise, all rights including those in copyright in the content of this document are owned by or controlled for these purposes by IAW Consulting Engineers

Except as otherwise expressly permitted under copyright law, the content of this document may not be copied, reproduced, republished, broadcast or transmitted in any way without first obtaining written permission from the copyright owner.

CONTENTS

	Page No.
1 INTRODUCTION	3
2 OBSERVATIONS	4
3 CONCLUSION AND RECOMMENDATIONS	6
4 APPENDIX	8

1.0 INTRODUCTION

- 1.1** This is a specific structural inspection report limited in its scope to the problems and/or concerns as noted below. We have not inspected parts or problems which are not relevant to these problems and/or concerns unless noted in the report.
- 1.2** This report has been prepared on the instructions of Foxall Surveying Ltd on behalf of the property owners Mr & Mrs GO & ML Jones.
- 1.3** The property was inspected by I A Waseem BE MSc CEng MICE (Chartered Civil & Structural Engineer) on 10 November 2021.
- 1.4** This report presents the findings of visual appraisal undertaken when the interior and exterior were inspected. The interior and the exterior features have been viewed during a walk-around. The weather was moist and cloudy on the day.
- 1.5** The inspection was carried out on an “as found” basis where safe access was available and without entering concealed elements. No exploratory holes or opening up was done to expose any structural elements. No design checks were carried out on the building. The building was partially vacant at the time of inspection.
- 1.6** The scope of this report is to review the structural condition and fabric of the existing structure for the safety of the future occupancy. To inspect and report on damage to external elevations, internal cracking, and structural movement.
- 1.7** For the purposes of this report, unless otherwise stated, the front elevation is considered to be that which faces the public road or path from which access to the property is given, and all references to left and right are given as if viewing a plan of the property with the front elevation located to the bottom, and the rear elevation located to the top of the plan.
- 1.8** The survey had been conducted on the existing barn, which is estimated to have been built around the late 1890's.

2.0 OBSERVATIONS (EXTERNAL & INTERNAL)

- 2.1 The existing barn is a single storey with a high and low level timber floor mezzanine structure supported on external flank masonry walls. The external walls appear to be in brickwork masonry with rendered stonework façade.
- 2.2 The primary construction of the roof structure comprises a series of timber trusses supported on external brickwork flank walls – **Photograph 1**. The timber purlins supporting the secondary pitched roof rafters are supported by the main trusses. The roof is moderately pitched.
- 2.3 The primary external walls/ cladding generally comprises brickwork masonry with stonework rendered, and patches of top coursing brickwork, timber cladding, and concrete blockwork in certain locations – **Photograph 2**. The internal partition walls appeared to be in brickwork masonry. On the South end gable wall, a lean-to structure had been identified.
- 2.4 The stability of the building in minor axis appeared to be contributing through a combination of the timber trusses with flank wall masonry buttresses, diagonal braced shoring, and the internal masonry partitioning shear walls – **Photograph 3**.
- 2.5 The last two trusses towards the South end are propped by intermediate timber posts that are supported on the ground floor load bearing wall below.
- 2.6 The extent of the high level mezzanine is between the North gable wall and the first truss. Access to it is through the external stair case located outside the gable wall.
- 2.7 The extent of the low level mezzanine is between the first and the third trusses, and is accessed through a small window located within the infill wall of the first truss.
- 2.8 The mezzanine floors appeared to have had been built within the bottom chord zone of the roof trusses. The structural condition of the floor appeared significantly weak and deflection of the floor joists was detected. The condition of some of the mezzanine floor joists above the Milk Parlour appeared rather weak – **Photograph 4**.
- 2.9 Severe degradation of timber purlins and some truss members including diagonal axial members were identified – **Photographs 5 & 6**. This would most likely be due to exposure to extreme humidity and weathering causing the timbers to decay with time.
- 2.10 Severe degradation of the timber post propping the third truss had been identified. The timber section appeared fully decayed – **Photograph 7**.

- 2.11 Some of the masonry buttresses did not appear to be fully bonded to the flank walls – this would potentially cause structural instability due to the walls being partially restrained – **Photograph 8.**
- 2.12 The ground floor construction appeared to be in stonework/ concrete tiled flooring – subgrade underneath the flooring is unknown. The flooring was found to be uneven and in significantly poor state, and in varying levels between Storage room and Milking Parlour – **Photograph 9.**
- 2.13 The bottom part of the North end gable wall appeared to be retaining the earth due to the topography beneath the building. This has caused degradation on the inside face of the wall.
- 2.14 Significant weathering damage to the internal masonry walls and inside face of external walls. Significant hair line cracks of magnitude up to 1mm were found on the internal masonry walls. They appear to be due to embrittlement as a result of age deterioration and are ‘non-structural’ – **Photograph 10.**
- 2.15 A diagonal ‘Fine’ shear crack circa 3mm was observed along the brick mortar coursing adjacent to the flank wall window which appeared to be due to a possible structural movement – **Photograph 11.**
- 2.16 Significant structural cracks had been identified on the external walls. The cracks appeared to be due to either subsidence as a result of tree influence on the foundations or a significant structural movement due to water ingress. Mortar bedding in various locations appeared dislocated and not in level.
- 2.17 The flank wall adjacent to the Storage room door opening appeared to be leaning outward. The wall appeared out of plumb, which would possibly be due to a structural movement – **Photograph 12.**
- 2.18 Extensive shear cracks of magnitude up to 8mm at the eaves of the North Gable wall and at the corner of the door opening was observed resulting in the dislocation of stonework, which appeared to be due to potential structural movement – **Photograph 13.**
- 2.19 Significant deterioration of timber lintel above the Storage room door opening was observed – **Photograph 14.**

3.0 CONCLUSION AND RECOMMENDATION

- 3.1 Unless specifically identified below requiring special attention, all 'fine' and 'hairline' structural cracks on the walls need to be repaired using a standard sealant method.
- 3.2 The high and low level mezzanine structures must be strengthened by adding intermediate floor joists. Replace all damaged timbers with new C24 grade joists.
- 3.3 The decayed timber purlins appeared to have lost structural strength and must be replaced by new C24 grade timbers – subject to structural calcs.
- 3.4 The decayed diagonal truss timber members and vertical prop appeared to have lost structural strength and must be replaced by new C24 grade timbers – subject to structural calcs.
- 3.5 All masonry buttresses must be tied back to the masonry flank walls using wall starters and masonry ties to ensure full bonding is achieved for re-establishment of structural stability.
- 3.6 The existing ground floor construction does not appear to comply with the latest building regulations for the proposed scheme and must be re-built in accordance with the mandatory specification subject to structural design.
- 3.7 The rotten timber lintel on the flank wall has clearly lost its structural integrity and must be replaced by a new C24 timber or steel/ specialist lintel subject to calcs.
- 3.8 All the internal and external masonry walls that have been damaged due to weathering must be thoroughly cleaned using specialist masonry treatment method and re-plaster as necessary.
- 3.9 All structural cracks associated with the inside face of the flank walls should be repaired using bed joint reinforcement and appropriate Helifix method – refer to section 2.0 for identification of structural cracks.
- 3.10 All 'non-structural' cracks in masonry can be repaired using proprietary sealant method.
- 3.11 The leaning flank wall and outward displacement may have been the result of a potential movement occurred in the property. Further investigation is recommended. Any displaced masonry should be repointed and repaired as necessary, but not until the movement issue is resolved.

- 3.12 With regard to the structural cracks mentioned in 2.16 & 2.18, a trail pit investigation is recommended to verify if there has been any ground movement and establish the extent/ nature of a possible subsidence. A robust structural engineering solution such as 'underpinning' or strengthening of foundation is recommended as necessary. The movement is possibly be ongoing and in our opinion would unlikely to progress significantly in the foreseeable future failing to recognise the cause.
- 3.13 The extensive structural damage at the corner of the North gable wall appeared to have compromised the structural integrity of the building due to rotational movement, and a robust repair works need to be carried out.
- 3.14 Regarding 3.12, it is further recommended that careful repointing and re-building of masonry brickwork/ stonework is carried out with new mortar bed. Moreover, Helifix masonry repair solution (in accordance with their recommendation) should be adopted to repair the cracks on the external walls. This however should not be done until the substructure is fully secured in case there has been a settlement in the ground.
- 3.15 From the previous refurbishment scheme of the main house, it had been revealed that this site is general built on a deep varying layer of fill material which would make the ground condition rather challenging. We would anticipate the same ground condition/ geology under this Barn building. The structural movement cracks/ damages identified in Section 2.0 above would most likely be due to a possible underlying foundation settlement as a result of weak ground condition. If however no fill material in the ground is present then the building would most likely been affected due to tree influence as there is presence of a few trees on site (of unknown species) provided they are HIGH WATER DEMAND and that the 'natural' soil is of HIGH SHRINKABLE CLAY. Another possibility is a blockage or leak in a below ground drain in the immediate area, which could impact the ground condition.
- 3.16 An intrusive trial hole investigation of the foundations is recommended to ascertain any impact on the foundations – they should be one under each flank wall and one under each gable wall. Considering the proposed scheme is a conversion of the barn into a Holiday Cottage, the existing foundations must be underpinned using a robust piling solution subject to structural design.
- 3.17 Furthermore, a robust structural arrangement involving necessary steelwork framing must be introduced to cater for the gravity and stability criteria of the building in the proposed refurbishment scheme subject to structural design.

APPENDIX

(PHOTOGRAPHS)



PHOTOGRAPH 1



PHOTOGRAPH 2



PHOTOGRAPH 3



PHOTOGRAPH 4



PHOTOGRAPH 5



PHOTOGRAPH 6



PHOTOGRAPH 7



PHOTOGRAPH 8



PHOTOGRAPH 9



PHOTOGRAPH 10



PHOTOGRAPH 11



PHOTOGRAPH 12



PHOTOGRAPH 13



PHOTOGRAPH 14