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STRUCTURAL APPRAISAL REPORT

**Existing Barns at;-
The Laurels,
Wood Lane,
Quadring Eaudyke,
Spalding,
Lincolnshire
PE11 4SS**



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Property;-	Existing Barns at;- The Laurels, Wood Lane, Quadring Eaudyke, Spalding, Lincolnshire PE11 4SS	Instructed;- March 2019 Surveyed;- March 2019
Client:-	Mr and Mrs Clark The Laurels, Wood Lane, Quadring Eaudyke, Spalding, Lincolnshire PE11 4SS	Survey & Report by;- J. Ellington BSc. CEng MStructE MIO D J. Hicks BEng(Hons) MSc, PgDip.CHE, MIO D
Reference:-	JC/18/09/4660	Issued:- March 2019

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1.0 BRIEF

- 1.1 JC Consultancy Limited was requested by Mr and Mrs Clark, to assess and comment on the structural condition of an existing barn located at The Laurels, Wood Lane, Quadring Eaudyke, Spalding, Lincolnshire.

2.0 INTRODUCTION & SCOPE

- 2.1 The barns are located off the highway known as Wood Lane in a rural location within the boundaries of the house and small holding known as 'The Laurels'.
- 2.2 The client owns the property and has instructed a structural appraisal report to be carried out in order to assess possible options for future development. This instruction was provided by the client on 28th February 2019.
- 2.3 This report should be read in-conjunction with documentation prepared and issued by the client's architect, JMAD Architecture.
- 2.4 This report is solely for the purposes of the client and no other third parties. Transfer of this report to a third party is not permitted.
- 2.5 JC Consultancy Limited visited the property on 18th March 2019, in order to carry out a structural appraisal survey.
- 2.6 Weather conditions at the time of the survey were cool but dry.
- 2.7 This report is limited to elements of the structural fabric of the property, i.e roof, walls and floors, and comments only upon their structural condition and performance.
- 2.8 The report does not contain observations, comments or recommendations to any non structural items including, but not limited to drainage, electrical, heating and plumbing services, timber work and decorative plasters.
- 2.9 Decay associated to damp, fungal attack, insect infestation or contamination is outside the scope of our appointment or report. Any reference to decay associated to damp, fungal attack, insect infestation or contamination to either structural or non-structural items are observations only. As such we recommend that further advice is sought from specialists in the fields of damp, fungal attack, insect infestation or contamination in order to guarantee peace of mind from these potential defects.

- 2.10 The inspection was of a visual nature only. There has been no opening up works involved in this investigation. Wall finishes or floor finishes, including carpets where applicable have not been removed or lifted during the inspection.
- 2.11 Any part of the structure that was hidden, covered or otherwise inaccessible have not been inspected or commented upon. We therefore cannot guarantee that any such parts are free from defect. It should be noted that inspection of the fabric of the barn was limited due to the presence of farm related equipment and livestock food / hay internally, together with climbing plants / overgrowth that is prevalent externally. Roof structures were partially hidden from view internally due to polythene membranes that had been placed to the underside of rafters.
- 2.12 The performance of foundations may be referred to within this report; however the existing foundation system has not been exposed as part of this report other than a single small hand dug trial hole, and as such we cannot guarantee that the foundation system is free from defect throughout.
- 2.13 The performance of the existing ground strata and general ground conditions may be referred to within this report; however the existing ground conditions have not been inspected therefore comments made will be based on analysis sought from indicative desktop sources including but not limited to the 'British Geological Society'. These sources generally provide sound interpretation, however local anomalies can occur, and as such we cannot guarantee their accuracy.
- 2.14 The observations and defects noted in order to prepare this report should not be considered as a comprehensive inventory of each and every single item witnessed during our survey. Instead the observations have been taken as an indication of the condition of the property in general, and should demonstrate the likely defects that may be present elsewhere in areas of the fabric that have not been surveyed or recorded. In order to demonstrate the condition of the original fabric, potential loss percentages have been provided in Section 4.0 of this report.

3.0 GENERAL DESCRIPTION

- 3.1 The complex comprises of two barns configured in a traditional L shape arrangement.

Barn 1 is a single storey, traditionally constructed, storage barn that is part open ended to the rear gable elevation.

Barn 2 is a double height, traditionally constructed hay barn, with a small hay loft / first floor present over part of the footprint.

There are a pair of covered areas adjacent to Barn 2, formed using timber circular 'telegraph pole' style columns and rafters, one adjacent the front elevation and one adjacent the East facing gable.

- 3.2 The construction date of the barns is unknown, but it is likely that Barn 2 pre-dates Barn 1, and may have been constructed during the 1800's to early 1900's. The layout of the buildings appears to be generally in their original format.

- 3.3 The general construction of the **Barn 1** is as follows; -

Duo-pitched Roof

A clay pantile roof covering over a timber hand cut roof consisting of timber rafters, ties and purlins.

Walls

Predominantly 215mm wide, traditional solid wall construction consisting of clay masonry units laid in a soft mortar.

Ground Floor

The ground floor consisted of a later introduced concrete floor slab of unknown specification.

Foundations

Foundations were not inspected on this barn as part of this preliminary report; however, they are likely to consist of shallow corbelled masonry foundations bearing onto the ground strata below.

- 3.4 The general construction of **Barn 2** is as follows; -

Duo-pitched Roof

A clay pantile roof covering over a timber hand cut roof consisting of timber rafters, ties and purlins.

Walls

Predominantly 330mm wide, traditional solid wall construction consisting of clay masonry units laid in a soft mortar.

First Floor

A hayloft style first floor is present over part of the barn, consisting of timber floor boards of timber floor joists that span between loadbearing walls.

Ground Floor

The ground floor consisted of a later introduced concrete floor slab of unknown specification.

Foundations

Foundations were inspected on this barn via a hand dug trial hole, which confirmed that they consist of shallow corbelled masonry foundation bearing onto the ground strata below at approximately 6 courses below existing ground level.

- 3.5 Published Geological records show the building to be within an area where the soil sequence consists of a solid formation of Oxford Clay formation (Mudstone) overlain by Tidal Flat Deposits of Silts and Silty Clays.
- 3.6 There are no mature trees in close proximity to the barn. Overgrowth and climbing plants are prevalent to a number of the elevations.

4.0 SUMMARY OF OBSERVATIONS

(Read in conjunction with Section 2.14 of this report)

Based on initial visual observations conducted during our survey, we estimate that the likely loss of original fabric during a typical conversion will be as follows; -

Barn 1

Roof Structure – 100% (Original roof structure has deflected and distorted considerably and has suffered partial collapse towards the rear facing elevation. A full replacement roof structure is deemed necessary as part of any conversion).

Masonry Walls – 15 -20% (The walls can be described as reasonable and have been assisted in their stability by the adjacent structures. As such we estimate a high percentage of the walls can be retained as part of any conversion).

Barn 2

Roof Structure – 100% (Original roof structure has deflected and distorted and has suffered significant exposure to the elements due to missing roof coverings. A full replacement roof structure should be considered as part of any conversion, although some timbers may be able to be retained following inspection from a timber specialist).

Masonry Walls – 20% (The walls can be described as reasonable and have been assisted in their stability by the adjacent structures, the presence of a cross wall and part first floor. In addition, the walls are reasonably substantial in terms of width resulting in a low height to thickness ratio. The rear facing elevation wall has suffered a degree of lateral movement and distortion and it is expected that a degree of this elevation will need to be rebuilt. However, when considering the overall areas of reasonable quality masonry present, we estimate that realistic losses will be less than 25% of all original masonry fabric during any conversion).

First Floor Structure – 25% (Existing timber joists may be able to be retained following inspection from a timber specialist. Strengthening may be required, and floor boards will need to be replaced).

5.0 DISCUSSIONS & RECOMMENDATIONS

Barn 1

5.1 Roof Structure

- 5.1.1 The current roof covering is clay pantile. Many areas of missing tiles were noted. It is envisaged that some of the original roof covering could be set-aside and reinstated as part of any proposed conversion scheme.
- 5.1.2 The roof structure could not be fully inspected due to a polythene underlining that had been placed to the underside of the roof timber, however in the areas that timbers were exposed it could be seen that the timbers were slender and predominantly untied.
- 5.1.3 The majority of the roof timbers can be seen to be accommodating significant stress with deflection and distortion noted throughout. Towards the rear of the barn, the roof incorporates a small, hipped end arrangement which can be seen to have partially collapsed.
- 5.1.4 The continued wetting and water penetration due to missing finishes has encouraged decay and the failure of timber elements.
- 5.1.5 A full replacement roof structure is deemed necessary as part of any conversion.
- 5.1.6 Any new roof structures should be engineer designed in order that they do not exert excessive lateral forces upon the supporting walls. Finishes, battens and felt membranes will need to be installed in accordance with the architect's requirements and roof specifications.

5.2 External Walls

- 5.2.1 The walls appear in a reasonable condition and are likely to have been protected to a degree by the adjacent structures and adjoining walls of Barn 2. There is little evidence of defects suggesting complete structural failure of any of the masonry panels observed.

Furthermore, a 'drier tunnel' has been constructed adjacent to the flank (West facing) elevation wall at some point during the lifetime of the building. The 'drier tunnel' is constructed to a height of approximately 1.5m and is capped with a concrete slab. This arrangement continues for the full length of the flank elevation wall and is presumably tied into the barn masonry to some degree. It is likely that this structure has provided a buttressing effect to the flank wall of the barn and therefore the wall has remained reasonably plumb even though it will have accommodated lateral thrust from the effective roof structure.

- 5.2.2 Consideration should be given to retain this 'drier tunnel, structure as part of any conversion in order that it can continue to assist with the barns overall stability.
- 5.2.3 The rear facing gable of the barn is of an open 'cart shed' style with a typical timber beam and post arrangement supporting the roof. The post and beam support timbers have suffered from being exposed to the elements and are no longer able to support the roof structure. We envisage that the repair of this gable, either as replacement timber supports or an infill masonry panel will be addressed during any conversion.
- 5.2.4 Due to their exposure, the brickwork panels are suffering from general fatigue in areas, including mortar joint delamination and brick unit deterioration, but as a whole the existing masonry can be considered as being in a reasonable and repairable condition. Continued wetting of the brickwork from defective guttering systems is likely to have accelerated any decay and deterioration, however we expect that following a more in-depth inspection by a mason, general brickwork repair is likely to be all that is required to the masonry panels as opposed to complete demolition and re-build.
- 5.2.5 Consideration should be made for further inspection of the panels following the removal of the roof structure. At planning stage, allowances should be made for various stitching of cracks and possibly a small degree of rebuild to those areas that are considered unrepairable, for instance where brick units are deemed un-repairable.
- 5.2.6 The performance of all walls that accommodate minor fractures can be improved by low key stitching using the 'Helifix' masonry repair system, which involves installing remedial 'Heli-bar' rods into the bed joint of the masonry at regular vertical centres over any open cracks. We recommend that allowance is made for the application of this system to localised areas of all retained masonry panels.
More information can be seen at www.helifix.co.uk.
- 5.2.7 Any areas of hard cement re-pointing previously carried out on any brickwork that is to be retained should be carefully removed and replaced with a sympathetic soft lime-based mortar. Other areas of weathered masonry joints should be repointed in a similar fashion.
- 5.2.8 Arches over window openings that are to be retained should be reset as deemed required and any timber lintels / backing timbers that are present over any openings should be replaced throughout. Any timber wall plates that are present within the walls should be removed and replaced with remedial brickwork infill.
- 5.2.9 Ideally, any proposed layout by the architect should introduce cross walls / partitions. This would significantly increase the stability of the barn, and partition walls can be utilised to support proposed roof structures.

Barn 2

5.3 Roof Structure

- 5.3.1 Full inspection of the roof structure was not possible due to height limited access; however, the roof structure appears to have performed reasonably well. The roof is tied in parts, however, there may have been a degree of roof spread accommodated by the roof structure in the past, evident via the distortion of masonry to the rear elevation. When viewed externally, the ridge line of the roof is sagging, and dishing on the roof slopes is apparent.
- 5.3.2 The current roof covering is pantile. As such the roof has accommodated a reasonable degree of loading throughout its lifetime without undue deflection, however we cannot guarantee the long-term continuing performance of the roof in its current form and we therefore recommend that a replacement roof structure is considered as part of any conversion.
- 5.3.3 Following a more detailed inspection of the roof timbers carried out by specialists in the field of damp and timber decay it may be deemed possible for some of the roof elements to be retained, however careful consideration will need to be given to ensure that damp and timber decay are not trapped within the fabric post completion, and significant levels of new timbers may need to be introduced in order to provide an adequate degree of strengthening. Any timber repairs, including that of any decayed rafter feet, purlin / beam ends and wall-plates as advised by the specialist should be undertaken.
- 5.3.4 Any new roof structures should be engineer designed in order that they do not exert excessive lateral forces upon the supporting walls. Finishes, battens and felt membranes will need to be installed in accordance with the architect's requirements and roof specifications.

5.4 External Walls

- 5.4.1 The front and gable elevation walls appear in a reasonable condition and are likely to have been protected to a degree by the adjacent timber covered areas in addition to the adjoining walls of Barn 1.
- 5.4.2 The walls to barn 2 have reasonable height to thickness ratio, and as such are generally robust.
- 5.4.3 The rear (North facing) elevation wall has suffered from a degree of structural movement, with lateral, outward movement and distortion present, particularly at upper levels. Therefore, consideration should be made for careful assessment of this wall, and at planning stages we would recommend that allowances are made for a high percentage of the existing wall to be carefully demolished and rebuilt as part of any conversion.

- 5.4.4 Should architectural layouts allow, the incorporation of an extension or addition off this elevation could benefit the performance of the existing wall and may reduce the extent of envisaged areas of demolition required.
- 5.4.5 Elsewhere, consideration should be made for further inspection of the panels following the removal of the roof structure. At planning stage, allowances should be made for various stitching of cracks and possibly a small degree of rebuild to those areas that are considered unrepairable, for instance where brick units are deemed un-repairable.
- 5.4.6 The performance of all walls that accommodate minor fractures can be improved by low key stitching using the 'Helifix' masonry repair system, which involves installing remedial 'Heli-bar' rods into the bed joint of the masonry at regular vertical centres over any open cracks.

Notable cracks were observed within the masonry of the East facing gable elevation, and also at the junction between the flank elevation and the cross wall that is located within the barn. Both of these areas can be assisted using the application of the Helifix system.

More information can be seen at www.helifix.co.uk.

- 5.4.7 Any areas of hard cement re-pointing previously carried out on any brickwork that is to be retained should be carefully removed and replaced with a sympathetic soft lime based mortar. Other areas of weathered masonry joints should be repointed in a similar fashion.
- 5.4.8 Arches over window openings that are to be retained should be reset as deemed required and any timber lintels / backing timbers that are present over any openings should be replaced throughout. Any timber wall plates that are present within the walls should be removed and replaced with remedial brickwork infill.
- 5.4.9 Ideally, any proposed layout by the architect should retain the existing cross wall and ideally introduce further cross walls / partitions if layout s allow.

5.5 First Floor

- 5.5.1 The part first floor that is present within barn 2 consists of floor boards over floor joists spanning between loadbearing walls. Whilst a number of the timbers were displaying signs of decay, it is expected that the majority of the floor could be retained as part of any conversion. Any strengthening required to resist undue deflection can normally be achieved via the introduction of additional joists as required.
- 5.5.2 Following a thorough inspection by an experience joiner, together with the results of a damp and timber survey conducted by a specialist it may be deemed necessary to conduct localised repair to joists, especially at the locations where they are supported on the masonry walls. Due to previous exposure and decay it is likely that all floorboards will need replacing.
- 5.5.3 The introduction of an extended first floor over the remainder of barn 2 is possible if deemed required within Architects proposals. The introduction of the floor could assist in the overall stability of the remaining barn fabric, as the floors could be tied into the existing walls however any new floor structures should be engineer designed in order that they do not exert excessive lateral forces upon the supporting walls.

5.6 Ground Floors

- 5.6.1 The existing ground floor system to both barns 1 & 2 needs to be removed and replaced with a ground bearing, concrete ground floor slab as part of any conversion. The slab should be engineered to ensure that it is suitable to accommodate loadings from the proposed use, including any inner leaf blockwork and any loadbearing partitions. Once installed, the slab will act as an internal raft type slab system, which will minimise any additional loadings placed upon the existing foundations. This should assist in improving the overall structural performance of the building. The floor should also incorporate insulation and damp proof systems as specified by the architect to meet current regulations. Damp proof membranes should be applied underneath the floor slab which should be continuous with any damp proof systems that are applied to the walls.
- 5.6.2 Care should be taken when planning finished floor levels of the barn to ensure that the existing foundations are not undermined during the excavation works in achieving the aforementioned slab build up.

5.7 Foundations

5.7.1 Based on observations made within the superstructure masonry, it appears that the existing foundations in general have suffered only small amounts of vertical movement in the past, and there should not be the requirement for significant strengthening to the existing foundations as part of the proposed works. Depending on the extent of demolition required to the rear facing wall of barn 2, this wall may require the reinstatement of a new foundation system if a full re-build is deemed sensible.

5.7.2 It should be understood that the existing foundations are reasonably shallow, and should replacement elements / extensions be added to the footprint of the existing barn, we would recommend that Reinforced Concrete 'Raft' style foundations should be utilised for these areas of re-build / extensions.

The introduction of 'Raft' style foundations will assist in keeping any proposed foundations to a similar depth as the existing, reducing the risk of future differential movement between existing and reinstated masonry walls.

5.7.3 The external ground levels should be landscaped and prepared to ensure that they do not exert pressures on the base of the walls. Controlling surface rainwater and introducing a gravelled apron / French drain around the external perimeter of the walls will assist in reducing softening of the ground and subsequent foundation movement in the future.

5.8 General

5.8.1 Whilst reference to damp is outside the scope of this report (see 2.9), it can be seen that the structure has suffered from significant amounts of water penetration over the years.

As such it is essential that advice and any required treatment from specialists in the field of damp and decay should be carried out in conjunction with the conversion, in order to ensure that damp and timber decay are not trapped within the fabric post completion.

5.8.2 There is a lack of suitable rainwater discharge downpipes throughout the barn which has resulted in the localised wetting of masonry. Rainwater goods should be installed to any conversion to allow reliable discharge of rain water.

6.0 CONCLUSIONS

- 6.1 The pair of barns have survived reasonably well considering their age and previous use and are ideal for sensitive restoration and conversion into a habitable dwelling.
- 6.2 The buildings basic, rectangular shape, together with the presence of adjacent structures and a solid wall construction results in them being a complex of robust structures which can be seen to have only lost a small amount of original fabric during its lifetime.
- 6.3 In structural terms many of the defects which have been highlighted in this report have little or no significance to the overall stability of the buildings. The majority of loss of the original fabric is due to the materials being subjected to the elements. Ensuring the outbuildings are weather-tight should be addressed even if a full conversion or restoration is not going to take place. Failure to do so will accelerate the decay and deterioration of the remaining fabric.
- 6.4 Loss of original fabric occurs in almost all conversions of this type, and generally cannot be avoided. The majority of loss is usually due to the structure being exposed to the elements during its period of non-use, or masonry walls accommodating significant levels of structural movement from defective roof structures together with the general activity of material fatigue. In order to demonstrate the condition of the original fabric, potential loss percentages have been provided in Section 4.0 of this report.

The potential losses perceived in this report are for guidance only. It is not uncommon for additional losses to occur once works commence as material fatigue and other catalysts of material failure may only present themselves following intrusive opening up works, however having considered the existing arrangements, we envisage that in this instance the overall loss of original masonry wall fabric during a standard conversion will be reasonably low.

- 6.5 Section 5.0 of this report highlights a series of recommendations including various low key strengthening and remedial details to the roof, walls and floors that should be considered as part of any conversion process. Further inspections and considerations will need to be conducted as works progress to ensure that the remaining and any proposed additions comply with Part A (Structure) of the Building Regulations.
- 6.6 Consideration of any proposals should be done only following liaison with your Architect, and guidance from, the Local Authority Planning and Building Control Departments.

JC Consultancy Limited

Consulting Structural Engineers

March 2019

7.0 PHOTOGRAPHS.



Photograph # 1 (Barn 1 - South Facing Front Elevation)



Photograph # 2 (Barn 1 – North Facing Rear Elevation)



Photograph # 3 (Barn 1 – East Facing Elevation)



Photograph # 4 (Barn 1 – West Facing Elevation)



Photograph # 5 (Barn 1 – West Facing Elevation) – Dryer Tunnel Structure visible



Photograph # 6 (Barn 1 – Roof - Internal)



Photograph # 7 (Barn 1 – Roof - External)



Photograph # 8 (Barn 1 – Roof - External)



Photograph # 9 (Barn 1 – Roof - External)



Photograph # 10 (Barn 2 – North Facing Rear Elevation)



Photograph # 11 (Barn 2 – South Facing Front Elevation)



Photograph # 12 (Barn 2 – South Facing Front Elevation)



Photograph # 13 (Barn 2 – North Facing Rear Elevation)



Photograph # 14 (Barn 2 – South Facing Front Elevation - Internal)



Photograph # 15 (Barn 2 – North Facing Rear Elevation - Internal)



Photograph # 16 (Barn 2 – East facing Gable Elevation)



Photograph # 17 (Barn 2 – East facing Gable Elevation)



Photograph # 18 – (Barn 2 – Roof - Internal)



Photograph # 19 – (Barn 2 – Roof - Internal)



Photograph # 20 – (Barn 2 – Roof - Internal)



Photograph # 21 – (Barn 2 – First Floor (underside))

END OF REPORT