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STRUCTURAL APPRAISAL REPORT,

Maple Tree Farm Buildings
Lutton Garnsgate,
Long Sutton,
Lincolnshire



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Property;-	**Maple Tree Farm Buildings** Lutton Garnsgate, Long Sutton, Lincolnshire	**Instructed**;- Jan 2016
Client:-	**Mr and Mrs L Russell** By email;- Lee.russell01@btinternet.com	**Survey & Report by**;- J. Ellington BSc. CEng MIStructE J. Hicks BEng(Hons) MSc
Reference:-	JC/15/08/2602	**Issued**:- Feb 2016

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The Institution of Structural Engineers

STRUCTURAL APPRAISAL REPORT,

Maple Tree Farm Buildings
Lutton Garnsgate,
Long Sutton,
Lincolnshire

Our Ref;- JC/15/08/2602

SYNOPSIS

The report provides commentary of observations made during a structural appraisal survey, and identifies the defects witnessed within the fabric of the building.

The report concludes that the buildings are in various stages of condition, but are felt to be suitable for sensitive restoration and conversion into habitable dwelling space.

The report recommends and describes various strengthening and remedial details to the roofs, walls, floors and foundations that should be conducted as part of any conversion process.

CONTENTS

1.0 BRIEF

2.0 INTRODUCTION & SCOPE

3.0 GENERAL DESCRIPTION

4.0 OBSERVATIONS AND DEFECTS LOG.

5.0 CONCLUSIONS & RECOMMENDATIONS

6.0 PHOTOGRAPHS

1.0 BRIEF

1.1 JC Consultancy Limited was requested by Mr and Mrs Russell, to assess and comment on the structural condition of the existing buildings including the two storey barn and potting shed, adjacent to Maple Tree House, Lutton Garnsgate, Long Sutton, Lincolnshire.

2.0 INTRODUCTION & SCOPE

2.1 The barn is located in a rural location directly off Lutton Garnsgate, Long Sutton.

2.2 The client 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 via email correspondence dated 20th January 2016.

2.3 This report is solely for the purposes of the client and no other third parties.

2.4 JC Consultancy Limited visited the properties on several occasions during February 2016 in order to carry out a structural appraisal survey.

2.5 The weather condition at the time of the visits was dry and bright.

2.6 This report is limited to elements of the structural fabric of the properties, i.e roofs, walls and floors, and comments only upon their structural condition and performance.

2.7 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.

2.8 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.

2.9 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 tiles or carpets where applicable have not been removed or lifted during the inspection.

2.10 Any part of the structures that were hidden, covered or otherwise inaccessible, either by permanent finishes such as, but not limited to wallpaper, decorative plasters, suspended ceilings, or carpets, or by items of furniture, either fitted or freestanding, have not been inspected or commented upon. We therefore cannot guarantee that any such parts are free from defect. It should be noted that the barn and potting shed have been previously used for the housing of agricultural equipment, therefore machinery and other associated items were present. As such some of the internal fabric was hidden, covered or otherwise inaccessible.

2.11 The performance of the existing ground strata, general ground conditions and foundations may be referred to within this report; however the ground conditions and foundations have not been fully inspected or investigated as part of this survey. 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.

2.12 The observations and defects noted within this report should not be read as a comprehensive inventory of each and every single item witnessed during our survey. Instead the records should be taken as an indication of the condition of the barns 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.

3.0 GENERAL DESCRIPTION

3.1 The property consists of a two storey barn, a single storey potting shed, cart shed and former piggery, located on a predominantly level site. The buildings are predominantly surrounded by open fields to the rear and are located directly off Lutton Garnsgate.

3.2 The construction date of the buildings are unknown, but it is likely that they were constructed during the 1800's

3.3 The general construction of the buildings consist of;-

3.3.1 **Two Storey Barn**

Duo-pitched Roof

A corrugated sheet roof covering over a timber cut roof, consisting of timber trusses, rafters, collars, and purlins.

External Walls

A combination of 330 / 215 / 102.5mm wide, traditional solid wall construction consisting of clay masonry units laid in a lime based mortar mainly in an English Garden Wall style bond.

Internal walls

There are no internal cross walls present.

First Floor

There is evidence of a previously removed timber first floor over part of the barn. The floor would have consisted of timber floor boards over suspended timber floor joists that span between loadbearing walls. Only stubs of previously cut floor joists and beams remain within the walls.

Ground Floor

The ground floor was predominately a ground bearing concrete slab system, the specification of which is unknown.

3.3.2 **Single Storey Potting Shed**

Duo-pitched Roof

A corrugated sheet roof covering over a raised collar tied cut roof consisting of timber rafters, collars, purlins and ties.

External Walls

Predominantly 330 / 215mm wide, traditional solid wall construction consisting of clay masonry units laid in a lime based mortar mainly in an English Garden Wall style bond. Various internal piers and wall thickenings are present.

Internal walls

Predominantly 215mm wide, traditional solid wall construction consisting of clay masonry units laid in a lime based mortar mainly in an English Garden Wall style bond.

A cold store area is present between the internal cross wall and the gable elevation wall. This has been lined in an 'Iso-wall' style white wall system

Ground Floor

The ground floor was predominately a ground bearing concrete slab system, the specification of which is unknown.

3.3.3 **Cart Shed**

Roof

A corrugated sheet roof covering over a cut roof consisting of timber rafters spanning between loadbearing timber posts.

External Walls

The cart shed has a lapped boarded rear elevation, with 2No openings for machinery / carts, and internal timber support posts that are located in line with the rear elevation of the two storey barn and potting shed.

A traditional solid wall, consisting of clay masonry units laid in a lime based mortar spans between the potting shed and the two storey barn forms the front elevation of the Cart Shed.

Ground Floor

The ground floor was predominately a ground bearing concrete slab system, the specification of which is unknown.

3.4 Published Geological records show the buildings to be within an area where the soil sequence consists of a solid formation of Ampthill Clay Formation (Mudstone) overlain by Tidal Flat Deposits (Clays & Silts).

3.5 There are no large mature trees in close proximity to the buildings; however there are several small trees, shrubs and vegetation growing adjacent to the masonry elevations.

. Ivy growth is prevalent over the roofs and walls of both barns.

4.0 OBSERVATIONS AND DEFECTS LOG

(Read in conjunction with Section 2.12 of this report)

4.1 Two Storey Barn

4.1.1 Roof

- A corrugated roof covering is present. Significant amounts of Ivy growth cover the roof finish.
- The purlins are deflecting between their supports.
- Localised areas of significant water ingress was noted to a number of the timbers.
- The trusses are formed using un-regularised, untied, slender timbers. The trusses are distorted.
- Rainwater goods are missing throughout.
- Evidence of roof spread can be seen on the walls.

4.1.2 Walls - Generally

- Numerous minor cracks were noted above and below window openings and at mid length of masonry panels.
- Localised areas of defaced / weathered brick units are present.
- Externally, lower levels of masonry adjacent ground level were weathered in parts, presumably from continued wetting and splash back from surface water.
- Hard cement mortars have been used in crack repair.
- Timber backing lintels to the majority of the openings have failed.

4.1.2.1 Walls – Front Elevation

- The front elevation wall is generally free from major structural defects. The upper wall does lean outwards slightly towards the road.
- A vertical joint is present at the corner with the South facing gable elevation / party wall.
- Displacement of masonry has occurred within the upper panel over the Passageway.

4.1.2.2 Walls – Rear Elevation

- The rear elevation wall leans outwards considerably for its full height.
- A degree of foundation rotation has occurred.
- Externally, considerable Ivy growth is present across the elevation.
- Displacement and high levels of movement has occurred within the upper panel over the Passageway.

4.1.2.3 **Walls – North Facing Gable Elevation**

- The North facing gable elevation wall is generally free from major structural defects.
- An in-filled opening is present at lower level.
- Minor cracking and displacement of masonry was noted at the verge and corner eaves adjacent the front elevation.

4.1.2.4 **Walls – South Facing Gable Elevation**

- The South facing gable elevation wall forms the side walls to the passage at lower level. At upper level the gable is formed via the party wall to the adjoining ruin.
- Major cracking and distortion of masonry was noted within the lower gable at the corner adjacent the Rear Elevation, within the Passageway.
- The remaining party-wall which forms the part demolished side elevation of the adjoining ruin is in extremely poor condition, with part demolished chimney stacks and loose brickwork remaining.

4.1.3 **First Floor**

- The first floor arrangement has been previously removed.
- Remaining cut joist and beam ends remain in their pockets.

4.1.4 **Ground Floors**

- The concrete floor has been rough cast, is uneven and has been used for the storage of goods and as such the condition of the floors reflects this.
- The specification of the concrete floor slab is unknown.

4.1.5 **Foundations**

- The foundations consist of a shallow corbelled system that is typical of a building of this age and use.
- The superstructure to the front and gable elevation is not displaying any signs that would suggest the foundation system is under excessive stress.
- The superstructure to the rear elevation suggests that the foundation has rotated and is not performing satisfactorily.
- A number of small trees and vegetation are growing in close proximity to the base of the walls.

4.2 Single Storey Potting Shed

4.2.1 Roof

- A corrugated roof covering is present. Significant amounts of Ivy growth cover the roof finish.
- The purlins are deflecting between their supports.
- Localised areas of significant water ingress was noted to a number of the timbers.
- The trusses are formed using un-regularised, untied, slender timbers. The trusses are distorted.
- Rainwater goods are missing throughout.
- Evidence of roof spread can be seen on the walls.

4.2.2 Walls

- The walls are generally in a good condition and are free from major structural defects.
- A number of internal piers are present.
- Numerous minor cracks were noted above and below window openings..
- Localised areas of defaced / weathered brick units are present.
- Softer brick units have been used in the infilling of former openings. These units are heavily defaced, especially noticeable on the Front elevation.
- Externally, lower levels of masonry adjacent ground level were weathered in parts.
- Hard cement mortars have been used in crack repair.
- Timber backing lintels to the majority of the openings have failed.
- A cold store area is present between the internal cross wall and the gable elevation wall. This has been lined in an ‘Iso-wall’ style white wall system

4.2.3 Ground Floors

- The floor is uneven and has been used for the storage of goods and as such the condition of the floors reflects this.
- The specification of the concrete floor slab is unknown.

4.2.4 Foundations

- It is likely that the foundations consist of a corbelled system that is typical of a building of this age and use. The superstructure is not displaying any signs that would suggest the foundation system is under excessive stress. The foundations appear to be performing satisfactorily and as expected.

5.0 CONCLUSIONS AND RECOMMENDATIONS.

5.1 General

The Barns have survived reasonably well considering their age and previous use and are ideal for sensitive restoration and conversion into habitable dwelling space.

The Two Storey Barn has survived reasonably well considering its age and previous use. The barn as a whole has obviously suffered from a degree of movement during its lifetime, and its open plan arrangement does make it vulnerable to further progressive movement in the future.

However, with suitable intervention, and by increasing its overall structural robustness, it is viable for restoration and conversion into a habitable dwelling.

Some loss of original fabric will be required to the rear and gable elevation; however this sacrifice will result in the remaining areas of original fabric being retained. As a percentage of the whole range of buildings, the demolition and rebuild element is minimal, and is estimated to be in the order of between 5-10% of the whole site.

The Single Storey Potting Shed has survived reasonably well is ideal for sensitive restoration and conversion into a habitable dwelling. The loss of original fabric during conversion is likely to be low.

The open plan Cart Shed gives opportunity for various conversion schemes. The remaining loadbearing elements within are principally sound.

In structural terms many of the defects which have been highlighted within the Observations and Defects Log have little or no significance to the overall robustness of the buildings. The majority of loss of original fabric to date is due to the materials being subjected to the elements. Ensuring the Barn is 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.

5.2 **Two Storey Barn**

5.2.1 The buildings open plan, double height arrangement and lack of cross walls, has led to its vulnerability to a degree of lateral (outward) movement of walls. This has been exacerbated by forces resulting from an untied roof / roof spread and also the removal of the first floor structure at some time during the lifetime of the building. Whilst various repairs have been made it can be seen that the barn has only lost a small amount of original fabric during its lifetime. A small degree of foundation movement / settlement has occurred within the barn, the majority of which can be seen on the rear elevation wall where a degree of foundation rotation can be seen within the supported walls.

5.2.2 The roof structure of the building is in a reasonable condition to act as a simple weatherproof membrane, but is not suitable to be utilised in any conversion. The roof timbers are slender, and their lack of strength has contributed to its spread. A replacement roof structure is essential to enhance the overall structural robustness of the building. The roof should be engineer designed in such a way that thrust is not placed upon the supporting walls in order to reduce its susceptibility to future stress. This can be achieved by introducing a raised tie style roof truss system or by introducing a cut roof supported by principal trusses and ties.

5.2.3 The front elevation and North facing gable elevation walls of this barn are predominantly sound but as discussed elsewhere in the report, they have accommodated a degree of movement in the past.

The rear elevation wall of the barn has rotated and deformed considerably. In its current arrangement it is only remaining stable by a small amount of restraint and its own self weight. Its lean over the two storey height is significantly beyond its centre axis. The movement and subsequent lean has caused significant forces at its restraint points, i.e the gable walls, and the resultant stresses can be seen in large fractures on the South facing gable wall. In our opinion the rear elevation wall is beyond sensible repair and will be at significant risk of collapse during any proposed conversion. Therefore we strongly recommend that in order to reduce stresses and potential loss of fabric elsewhere on the barn, provision is made to carefully demolish and rebuild the rear elevation wall. Due to the soft mortars used, it is likely that a high percentage of demolished brick units can be re-used in the rebuilding of the wall.

The lower south facing gable wall is inset from the ‘flying’ first floor over, in order to from a passage between the barn and the adjoining building. There is not an upper gable wall present to the barn, as the side elevation of the adjoining building forms a party wall at this point.

The adjoining building is a ruin, which is understood to be the remains of ‘Garnsgate House’. At present the front elevation wall of the barn is not joined to the party wall and as such there is a reasonable open vertical joint between itself and the party wall.

The rear elevation over the passage is located slightly inset from the remainder of the rear elevation of the barn and is partially tied into the party wall. Significant movement of this panel over the passage has occurred.

The remaining party-wall that is shared with the adjoining ruin is in extremely poor condition, with part demolished chimney stacks and loose brickwork remaining. The long term stability and performance of the party wall cannot be guaranteed, and we feel it would be unwise to utilise this as a structural element as part of any conversion. As an alternative, we strongly recommend that a new independent gable wall is constructed adjacent to the existing party wall, which can then be tied into the rear and front elevations of the barn. This will increases the performance of the front and rear elevations considerably as it will ensure that the masonry acts as a tied four sided box as opposed to a untied, three sided, open ended arrangement.

The lower level of the party wall is in a reasonable condition, so if desired the flying arrangement over the passage could remain, with the new independent gable wall being constructed at first and upper gable levels only. If this arrangement is utilised then we envisage a low key steel support frame will be required at ground floor in order to retain the open plan walk through arrangement of the passage.

Due to the extent of movement noted within the barn, together with the general vulnerability of the existing foundations, we do feel that the introduction of a new inner leaf of blockwork to the perimeter walls is required. The new inner leaf of blockwork to the perimeter would greatly enhance the structural robustness of the building as a whole. The blockwork can be used to support the new roof and a first floor structure if applicable, and will enable the existing masonry walls to essentially become a non-loadbearing cladding system. Using remedial wall ties, the existing masonry walls can be tied to the new blockwork in order to reduce any further bulging and lean that may occur under their own self weight.

If a double height, two storey arrangement is to remain as part of the scheme, then provisions should be made to introduce tie bars (approx. 4No) with pattress plates across the barn between the existing front and rebuilt rear elevation walls. The tie bars can be positioned within the floor zone so that they are not intrusive to layouts.

Once the new structural inner leaf blockwork has been installed as above, the remainder of the existing walls can be repaired in order to provide protection from the elements only. This will involve low key repointing and crack stitching using the Helifix system.

Repointing used soft mortars should be carried out to ensure that walls provide a weathertight arrangement. Localised brick units that are heavily defaced will need cutting out and replacing or turning if possible. The introduction of damp proofing should be carried out in accordance with a damp specialist's recommendations.

Ideally any proposed layout by the architect should either introduce cross walls at ground floor level or, if this isn't possible, the re- introduction of a first floor structure. Both of these items would significantly increase restraint of the front elevation which would minimise the potential for further lateral movement.

Any timber lintels should be replaced. Any timber wall plates that are present within the thickness of the walls should be removed and replaced with remedial brickwork infill.

5.2.4 The re- introduction of a first floor can be simply done via the installation of either traditional timber floor joists or modern 'eco-style' joists spanning between the new perimeter blockwork.

5.2.5 It is assumed that the ground floor will be replaced with a ground bearing, concrete ground floor slab as part of any development. We recommend that the slab should be engineered to ensure that it is suitable to accommodate loadings from the proposed use, including the earlier recommended blockwork inner leaf and any partitions. Once installed, the slab will act as a 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 put into the walls.

5.2.6 Existing foundations appear to be vulnerable as witnessed within the rotation of the rear elevation foundation. However, if the installation of an engineered slab is introduced as discussed in 5.2.5, there should not be the requirement for any strengthening to existing foundations as part of the proposed works. The re-constructed rear elevation wall can either be constructed off a new concrete strip style foundation designed to suit the prevailing ground conditions, or constructed off a thickened toe edge that can be cast integrally with new floor slab.

5.2.7 Rainwater guttering replacement and the installation of 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.

5.3 Single Storey Potting Shed

5.3.1 The Single Storey Barn is in reasonable structural state considering its exposure and former use.

5.3.2 The roof structure of the building is in a reasonable condition to act as a simple weatherproof membrane, but similar to the two storey barn, it is not suitable to be utilised in any conversion. The roof timbers are not original, are slender and sporadic, and have been installed to support a lightweight corrugated roof system only.

A replacement roof structure is essential to enhance the overall structural robustness of the building. The roof should be engineer designed in such a way that thrust is not placed upon the supporting walls in order to reduce its susceptibility to future stress. This can be achieved by introducing a raised tie style roof truss system or by introducing a cut roof supported by principal trusses and ties.

5.3.3 The walls of the barn appear in good condition, although it must be appreciated that large areas were hidden from inspection from ivy growth. In addition, one end of the barn has been lined to form a cold store area, and as such the walls here were not able to be inspected.

However in general, the presence of various internal piers and the fact that the walls are only single storey appear to have prolonged their performance. The existing timber framed covered implement storage areas that surround the rear and gable of the barn will have also protected it from the elements during its lifetime.

It is envisaged that only small localised areas of repair will be required. This will involve low key repointing and crack stitching using the Helifix system. Localised brick units that are heavily defaced, especially the softer units than have been used to infill existing openings will need cutting out and replacing or turning if the openings are to remain in-filled.. The introduction of damp proofing should be carried out in accordance with a damp specialist's recommendations.

Once again it would be Ideal if any proposed layout by the architect could introduce a cross wall at ground floor level or leave in-situ the one existing cross wall that remains.
Unless following full removal of the Ivy growth significant defects are noted, we do feel that the introduction of a new inner leaf of blockwork to the perimeter walls is required in this instance. The existing masonry walls should be adequate to accommodate and support the replacement roof structure.

The existing cold store area that is located at one end of the barn should be removed. Lintels and arch backing timbers should be replaced throughout.

5.3.4 Similarly to the two storey barn, the ground floor will need to be replaced with a ground bearing, reinforced concrete ground floor slab that is suitable to accommodate loadings from the proposed use, including any partitions.

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 put into the walls.

5.3.5 Whilst existing foundations may have accommodated slight movement in the past, any future movement is likely to be minimal. Proposed loadings being placed on the foundations are unlikely to be significantly greater than those imposed in the past. With this in mind there should not be the requirement for any strengthening to existing foundations as part of the proposed works.

5.4 Cart Shed

5.4.1 The open plan cart shed gives opportunity for various conversion schemes. The remaining loadbearing elements within are principally sound.

5.4.2 The masonry wall forming the front wall of the Cart Shed appears in reasonable condition and can be utilised within any schemes proposed for this area with only minor repairs. Repointing used soft mortars should be carried out to ensure that wall provides a weathertight arrangement. Localised brick units that are heavily defaced will need cutting out and replacing or turning if possible.

5.4.3 A replacement roof structure can be installed to accommodate any proposed scheme. Existing internal timber support posts can be retained subject to it being confirmed that they do not currently accommodate any timber decay.

5.4.4 The ground floor will need to be replaced with a ground bearing, reinforced concrete ground floor slab that is suitable to accommodate loadings from the proposed use, including any partitions.

As per the other buildings within the site, 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 put into the walls.

5.5 Whilst references to damp may have been mentioned in this report, it should be noted that any recommendations for repair and control of damp and decay is outside the scope of this report (see 2.8). It is clear that all the structures have suffered from a degree of water penetration over the years. This will have been encouraged by both the exposure to the elements, and previous use, possibly by livestock. In addition, due to the large quantities of timbers within the buildings, the likely hood of insect / beetle attack on the timbers is high.

Therefore it is essential that further surveys and advice from specialists in the field of damp and timber decay should be carried out prior to commencement of works in order to ensure that damp and timber decay are not trapped within the fabric following conversion. Any repairs recommended by the third party reports should be carried out accordingly.

5.6 We recommend that all repair details and designs are produced and submitted by a suitable Architect and Engineer who appreciate the sensitive nature of the existing buildings. In addition we recommend that all works are carried out by contractors who have experience dealing with repairs to properties of this nature.

JC Consultancy Limited
Consulting Structural & Civil Engineers

February 2016

6.0 PHOTOGRAPHS – TWO STOREY BARN



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



Photograph # 15



Photograph # 16



Photograph # 17



Photograph # 18



Photograph # 19



Photograph # 20



Photograph # 21

6.1 PHOTOGRAPHS – SINGLE STOREY POTTING SHED & CART SHED



Photograph # 22



Photograph # 23



Photograph # 24



Photograph # 25



Photograph # 26



Photograph # 27



Photograph # 28



Photograph # 29



Photograph # 30



Photograph # 31



Photograph # 32



Photograph # 33



Photograph # 34



Photograph # 35



Photograph # 36



Photograph # 37



Photograph # 38



Photograph # 39



Photograph # 40



Photograph # 41

END OF REPORT