

Structural Appraisal

Property: **THE BARNS LOWER FARM**
CONSALL

Client: K & J Sigley

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Authors: B.Johnson I.Eng.A.M.I.Struct.E

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1.00 Introduction

1.01	Background:
	<p>Farming development in the twentieth century has led to a gradual redundancy of many traditional agricultural buildings. To avoid dereliction and inevitable loss, alternative uses are frequently pursued. Potential uses include conversion to residential dwellings, holiday lets and commercial use.</p> <p>Generally, buildings are constructed for a specific use; to change that use requires consideration since the construction may not be suitable in its current form to readily adapt to a new purpose.</p> <p>Checking the structural adequacy of an existing building represents one such consideration. Structural adequacy refers to the 'stability' and 'durability' of the primary load bearing construction. The load bearing construction typically consists of walls, floors and roof which act to transfer applied loads safely to the ground and these elements are usually the subject of the Appraisal.</p> <p>A Structural Appraisal records and describes the visible physical condition of the existing load bearing construction interpreting this information to assess the structural adequacy of the building and its ability to readily adapt to the proposed change of use.</p> <p>Should it be reasoned that to achieve an acceptable standard of stability and durability the necessary works will involve a considerable reconstruction of existing fabric then that is declared at a stage when overall viability of the proposal is being considered. This is particularly relevant when the building is 'listed' either for reasons of historic importance or, architectural interest. Reconstruction of structural elements is only recommended where all other economical and practical solutions have been exhausted. The application of traditional techniques to restore the structural fabric is also encouraged.</p> <p>The group of Agricultural Buildings under consideration form part of the established farmstead Lower Farm set within the village of Consall sharing many similarities with regional farms in this locality. The range of buildings under consideration served a mix of farming activities.</p> <p>Reference should be made to the Heritage Statement prepared by Melanie Morris. This information adequately illustrates the buildings and their history.</p> <p>The Report addresses the building group as:</p>

Building '1A' (P2) (P3)



Buildings '1B' (P13) (P25)



Building '2A' (P26) (P36)



Building '2B' (P19) (P30)



Building '3' (P30) (P35)

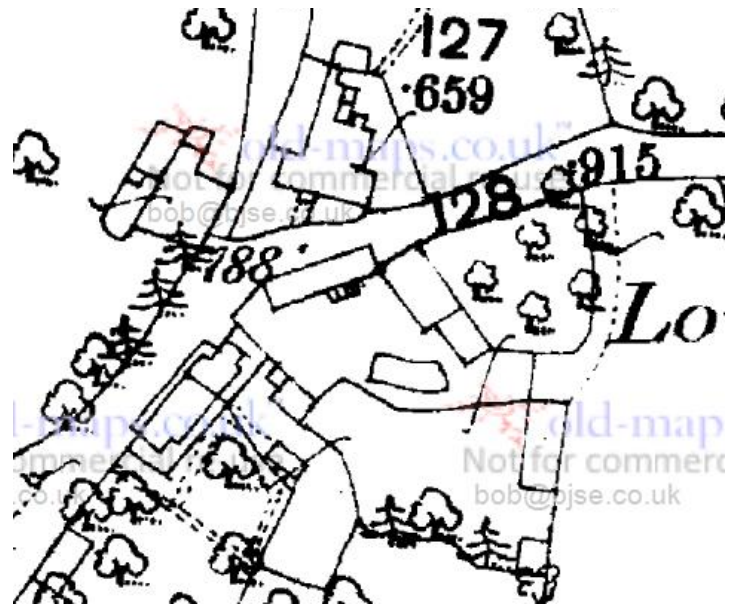


1.00 Introduction

1.02	<p>Summary of Findings</p> <p><u>Building 1A:</u> The loss of the roof structure has exposed remaining masonry walling to the elements. Despite efforts to protect the remaining construction penetration of moisture will have inevitably caused a deterioration in the materials. Examination of the brickwork revealed perished mortar to upper courses. Whilst the bricks may be salvageable the mechanical bond provided by the mortar should not be relied upon for load bearing purposes.</p> <p><u>Building 1B:</u> Walling, material condition is acceptable for load bearing purposes, Floor and roof structure whilst intact and displaying no evidence will require further investigation to confirm their condition.</p> <p><u>Building 2A:</u> No serious or significant structural defects noted.</p> <p><u>Building 2B:</u> No serious or significant structural defects noted.</p> <p><u>Building 3:</u> No serious or significant structural defects noted.</p>
1.03	<p>Aims & Objectives:</p> <p>Undertake a non-intrusive visual examination of the building construction.</p> <p>Record areas of the building construction which were visible and accessible.</p> <p>Establish physical condition of the primary loading bearing structure.</p> <p>Identify those areas of the construction that require enhancement or reconstruction to address defect/instabilities.</p>
1.04	<p>Limitations:</p> <p>The Appraisal is not a finite or exhaustive exercise and is intended to provide an overall impression of the physical condition of the visible construction. Inspection of the property took place on the November 2016. Recordings made during the survey are confined to those elements of the construction that were exposed and accessible at the time.</p>
1.05	<p>Report:</p> <p>The following Report presents and discusses the findings of a 'Structural Appraisal. The report narrative describes the building construction and with the assistance of photographs provide an outline record of the current 'physical' condition. The final section discusses the findings of the survey identifying areas of the construction that require enhancement or reconstruction to address defects/instabilities and importantly to ensure that the buildings can meet the requirements for habitable use.</p> <p>Information contained within this report is intended primarily for the Local Authority Conservation/Planning Officer and no work should take place on site until permission has been granted to proceed. Where scheme proposals are subsequently developed as part of the Building Regulation/construction phase it should be noted that recommendations in this report should be followed up and fully developed.</p>

2.00 Site

Figure 1 – 1902 map showing the location of the buildings



2.01 Location & General Arrangement

Purpose built range of agricultural buildings developed over several centuries.

2.02 Surface Geology

Geological information indicates the site to be underlain with glacial deposits – sands and clays.

3.00 Construction

BUILDING '1A'		
3.01	Construction – Primary Load Bearing	
	Masonry walling on three sides forms the perimeter shell of the building. Originally, two storey in height supporting a timber framed dual pitched roof. Walling construction is predominantly 330mm thick solid brickwork with stone included on the gable end.	P2 P3 P4 P5 P6
3.02	Structural Modifications	
	Loss of upper masonry levels and roof and floor construction.	
BUILDING '1B'		
3.03	Construction – Primary Load Bearing	
	Masonry walling: 330mm brickwork with stone work employed at lower levels.	P12 P13 P23 P25
	Ground Floor: (Circa C20) Solid concrete.	
	First Floor: suspended timber joisted floor using rectangular joists set out at regular centres and span the building width being suspended off the external walls.	P11
	Roof: Arrangement consistent with traditional practice - dual pitched timber framed construction. Common rafters set out at regular centres supported by a wall plate, single row of side purlins supported on timber trusses located along the building length and, gable masonry.	P7 P8 P9 P10
3.04	Structural Modifications	
	No significant modifications or alterations were noted.	
BUILDING '2A'		
3.05	Construction – Primary Load Bearing	
	Walling: Rectangular base plan, two storey with gabled ends. Mass stone walling (450mm + red gritstone).	P4 P5 P10 P11 P20
	Ground Floor: (C20) Solid concrete, probably mass cast.	
	First Floor: (C20) suspended timber joists spanning between steel beams along building length.	P37 P38

	Roof: Arrangement consistent with traditional practice - dual pitched timber framed construction, two rows of side purlins supported on timber trusses.	P15 P16 P17 P18
3.06	Structural Modifications	
	External road side gable wall reconstructed, suspended first floor replaced.	
BUILDING '2B'		
3.07	Construction – Primary Load Bearing	
	Walling: Rectangular base plan, storey and half in height with gabled ends. Mass stone walling (450mm + gritstone) and solid brickwork.	P19 P20 P28 P30 P31
	Ground Floor: (C20) Solid concrete, probably mass cast.	
	Roof: Arrangement consistent with traditional practice - dual pitched timber framed construction, two rows of side purlins supported on timber trusses.	P21 P22
3.08	Structural Modifications	
	C19 remodelling or reconstruction of external elevations and roof.	
BUILDING '3'		
3.09	Construction – Primary Load Bearing	
	Walling: Rectangular base plan, storey and half in height with gabled ends. Mass stone rubble walling (450mm + red gritstone) forms the external shell of the building.	P32 P34 P35
	Ground Floor: (C20) Solid concrete.	
	Roof: Lightweight metal profiled roof covering, dual pitched with timber framed construction, two rows of side purlins supported on lightweight softwood timber trusses.	P33
3.10	Structural Modifications	
	Roof construction comparatively modern, presumed a replacement.	

4.00 Observations – Material Condition

BUILDING '1A'		
4.01	Masonry (Walling)	
	Common Defects:	
	<ul style="list-style-type: none"> Inherent material defects i.e. poor firing, material selection, mixing. External environmental influences i.e. aggressive chemicals, sulphate attack, freeze thaw action, weathering. Physical damage i.e. collision, associated defects i.e. eccentric loading. Poor Repairs incorrect pointing. 	
	Observations:	
	Moisture penetration to brickwork.	P4 P5 P6
	Comment:	
	Evidence of prolonged exposure to moisture has caused a deterioration in mortar, evident to top 1.0m+ of walling.	
4.02	Timber (Lintels)	
	Common Defects:	
	<ul style="list-style-type: none"> Inherent material defects i.e. knots, splits, species selection. External environmental influences i.e. water penetration causing decay i.e. Rot insect activity. Overstressing/loading. Poor assembly/fabrication. 	
	Observations:	
	Lintels over openings in external elevations, exposure to moisture.	P4 P6
	Comment:	
	Surface softening and localised decay noted in timber.	

4.10 Observations – Material Condition

BUILDING '1B'		
4.11	Masonry (Walling)	
	Common Defects:	
	<ul style="list-style-type: none"> Inherent material defects i.e. poor firing, material selection, mixing. External environmental influences i.e. aggressive chemicals, sulphate attack, freeze thaw action, weathering. Physical damage i.e. collision, associated defects i.e. eccentric loading. Poor Repairs incorrect pointing. 	
	Observations:	
	Localised superficial degradation of brickwork noted not serious.	P13
	Comment:	
	Overall material condition of the masonry is reasonable.	
4.12	Timber (Floor & Roof)	
	Common Defects:	
	<ul style="list-style-type: none"> Inherent material defects i.e. knots, splits, species selection. External environmental influences i.e. water penetration causing decay i.e. Rot insect activity. Overstressing/loading. Poor assembly/fabrication. 	
	Observations:	
	Floor Joists, rafters. Generally, material condition is good with no obvious evidence of decay or defect.	P7 P9 P8
	Comment:	
	<p>No significant material defects noted to those components which are currently contributing to the structure.</p> <p>Timber frame components appear to be performing well significantly the roof covering has been maintained ensuring protection to the timber.</p> <p>No evidence of overloading in the floor components although closer examination of the bearings may be necessary.</p>	

4.20 Observations – Material Condition

BUILDING '2A'		
4.21	Masonry (Walling)	
	Common Defects:	
	<ul style="list-style-type: none"> Inherent material defects i.e. poor firing, material selection, mixing. External environmental influences i.e. aggressive chemicals, sulphate attack, freeze thaw action, weathering. Physical damage i.e. collision, associated defects i.e. eccentric loading. Poor Repairs incorrect pointing. 	
	Observations:	
	Stone: No significant material defects noted, localised mortar loss on external face.	P36
	Comment:	
	Two elevations have been reconstructed recently the remainder appear satisfactory localised superficial surface degradation noted in stone and brickwork.	
4.22	Timber (Floor & Roof)	
	Common Defects:	
	<ul style="list-style-type: none"> Inherent material defects i.e. knots, splits, species selection. External environmental influences i.e. water penetration causing decay i.e. Rot insect activity. Overstressing/loading. Poor assembly/fabrication. 	
	Observations:	
	Roof covering is complete, no evidence of significant material decay. Evidence of localised surface insect activity with minor surface damage.	P15 P16
	Comment:	
	Roof timbers are old and rustic but show no material issues. Floor joists are comparatively new.	

4.30 Observations – Material Condition

BUILDING '2B'		
4.31	Masonry	
	Common Defects:	
	<ul style="list-style-type: none"> Inherent material defects i.e. poor firing, material selection, mixing. External environmental influences i.e. aggressive chemicals, sulphate attack, freeze thaw action, weathering. Physical damage i.e. collision, associated defects i.e. eccentric loading. Poor Repairs incorrect pointing. 	
	Observations:	
	Stone: No significant material defects noted, localised mortar loss on external face. Brickwork: degradation and mortar perishing noted to external face of rear elevation, this refers to the infill panels and small surrounding sections.	P19
	Comment:	
	Localised disruption to the yard elevation attributed to C19 alterations/reconstruction.	
4.32	Timber (Roof)	
	Common Defects:	
	<ul style="list-style-type: none"> Inherent material defects i.e. knots, splits, species selection. External environmental influences i.e. water penetration causing decay i.e. Rot insect activity. Overstressing/loading. Poor assembly/fabrication. 	
	Observations:	
	No apparent significant material decay evident; localised issues where roof membrane is torn.	P22 P21
	Comment:	
Condition of the timber framing elements appears good.		

4.40 Observations – Material Condition

BUILDING '3'		
4.41	Masonry (Walling)	
	Common Defects:	
	<ul style="list-style-type: none"> Inherent material defects i.e. poor firing, material selection, mixing. External environmental influences i.e. aggressive chemicals, sulphate attack, freeze thaw action, weathering. Physical damage i.e. collision, associated defects i.e. eccentric loading. Poor Repairs incorrect pointing. 	
	Observations:	
	Stone: No significant material defects noted, localised mortar loss on external face.	P32 P34
	Comment:	
	No comment.	
4.42	Timber (Roof)	
	Common Defects:	
	<ul style="list-style-type: none"> Inherent material defects i.e. knots, splits, species selection. External environmental influences i.e. water penetration causing decay i.e. Rot insect activity. Overstressing/loading. Poor assembly/fabrication. 	
	Observations:	
	No apparent evidence of material defect noted.	P33
Comment:		
No comments		

5.00 Observations – Strength & Stability

BUILDING '1A'		
5.01	Masonry	
	Common Defects:	
	<ul style="list-style-type: none"> Vertical Settlement/subsidence i.e. loss of support or lack of capacity in supporting soils - deterioration in foundation construction. Loss of integrity – bond, inherent lack of cohesion. Lateral movement – insufficient strength to resist horizontal forces. 	
	Observations:	
	No discernible evidence of vertical movement noted.	P5
	Horizontal misalignment to front and rear walls, most pronounced at wall head.	P6
	Comment:	
Movement associated historic instability.		
5.02	Timber (Lintels)	
	Common Defects:	
	<ul style="list-style-type: none"> Overloading causing deformity or failure. Loss of support – inadequate bearing conditions or displacement of supporting member. Inappropriate modifications – removal of frame members 	
	Observations:	
	No discernible evidence of member distress or loss of strength.	
Comment:		
Requires further investigation, refer to 4.02.		

5.10 Observations – Strength & Stability

BUILDING '1B'		
5.11	Masonry (Walling)	
	Common Defects:	
	<ul style="list-style-type: none"> Vertical Settlement/subsidence i.e. loss of support or lack of capacity in supporting soils - deterioration in foundation construction. Loss of integrity – bond, inherent lack of cohesion. Lateral movement – insufficient strength to resist horizontal forces. 	
	Observations:	
	No discernible evidence of vertical movement noted.	P13
	Nominal movement at wall head (dentil course) over opening yard elevations.	
	Comment:	
No evidence of significant movement or misalignment.		
5.12	Timber (Roof & Floor)	
	Common Defects:	
	<ul style="list-style-type: none"> Overloading causing deformity or failure. Loss of support – inadequate bearing conditions or displacement of supporting member. Inappropriate modifications – removal of frame members 	
	Observations:	
	No discernible evidence of horizontal or vertical movement was noted.	
Comment:		
No significant structural deficiencies noted.		

5.20 Observations – Strength & Stability

BUILDING '2A'		
5.21	Masonry (Walling)	
	Common Defects:	
	<ul style="list-style-type: none"> Vertical Settlement/subsidence i.e. loss of support or lack of capacity in supporting soils - deterioration in foundation construction. Loss of integrity – bond, inherent lack of cohesion. Lateral movement – insufficient strength to resist horizontal forces. 	
	Observations:	
	Loss of strength and stability in the external elevations has been addressed in recent times. Reconstruction of the roadside gable and introduction of tie bars and pattress plates	P14 P9 P10
	Comment:	
	Stone walling has performed adequately with few notable defects. Surface undulation/irregularities can be seen but this is not necessarily evidence of a defect more a function of the methods employed to construct the wall.	
5.22	Timber (First Floor & Roof)	
	Common Defects:	
	<ul style="list-style-type: none"> Overloading causing deformity or failure. Loss of support – inadequate bearing conditions or displacement of supporting member. Inappropriate modifications – removal of frame members 	
	Observations:	
	Roof Structure: 3No. Truss Frames, two hardwood appear salvaged, third truss is amalgam. Frame Setting out not symmetrical along building length. Side purlins propped off truss rafters. Fractures and member connection/bearing defects noted in truss and purlins. First Floor: No apparent structural defects.	P15 P16 P17
	Comment:	
	Roof structure is incongruous with the building and has a number of structural deficiencies. These can be addressed, it is not displaying signs of distress and the underlying primary members conform to traditional arrangements and if the material issues are resolved it will be possible to nominally enhance the strength to enable installation of the domestic construction.	

5.30 Observations – Strength & Stability

BUILDING '2B'		
5.31	Masonry (Walling)	
	Common Defects:	
	<ul style="list-style-type: none"> Vertical Settlement/subsidence i.e. loss of support or lack of capacity in supporting soils - deterioration in foundation construction. Loss of integrity – bond, inherent lack of cohesion. Lateral movement – insufficient strength to resist horizontal forces. 	
	Observations:	
	Yard elevation; alterations to the elevations, new and infilled openings, creating vertical joints.	P28 P31 P19
	Comment:	
	Walling has performed adequately with few notable defects. Joints and irregularities can be seen but this is not necessarily evidence of a defect.	
5.32	Timber (Roof)	
	Common Defects:	
	<ul style="list-style-type: none"> Overloading causing deformity or failure. Loss of support – inadequate bearing conditions or displacement of supporting member. Inappropriate modifications – removal of frame members 	
	Observations:	
	No defects noted.	P21
	Comment:	
Roof construction; size and arrangement of members is appropriate for loads.		

5.40 Observations – Strength & Stability

BUILDING '3'		
5.41	Masonry (Walling)	
	Common Defects:	
	<ul style="list-style-type: none"> Vertical Settlement/subsidence i.e. loss of support or lack of capacity in supporting soils - deterioration in foundation construction. Loss of integrity – bond, inherent lack of cohesion. Lateral movement – insufficient strength to resist horizontal forces. 	
	Observations:	
	No notable defects.	P32 P34 P35
	Comment:	
	Stone walling has performed adequately with few notable defects.	
5.42	Timber (Roof)	
	Common Defects:	
	<ul style="list-style-type: none"> Overloading causing deformity or failure. Loss of support – inadequate bearing conditions or displacement of supporting member. Inappropriate modifications – removal of frame members 	
	Observations:	
	No notable defects.	P33
	Comment:	
	The roof structure is lightweight and modern and would not be adequate to support a tiled roof. Presumably it should be replaced.	

6.00 Conclusions & Recommendations

<p>6.01</p>	<p>Discussion:</p> <p>Located in the Staffordshire moorlands this farmstead together with other upland regional buildings are subject to aggressive weather conditions. Generally, construction of agricultural buildings generally reflects the functional purposes to which they are intended and prove quite resilient however, frequently they are not maintained to standard comparative to domestic buildings, and typically only receive attention only when urgently required.</p> <p>One particular feature of historic agricultural buildings is the inevitable physical alteration to the building fabric. These alterations are a result of periodical changes in working practise and this group is no exception, with all buildings exhibiting minor changes most notably in the external fenestration and also in Building B, where a complete first floor has been replaced. Rarely are the potential impact of these changes on the structural behaviour considered and fortunately only minor localised issues are evident in these buildings.</p> <p>Overall, with the exception of Building A there are no significant defects or instabilities. Material condition of the masonry elevations represent the key requirement when considering future durability; floors and roofs can be protected. Whilst, it is evident that the buildings have localised surface condition of facing brick elevations display evidence of degradation the width of construction is such that there is sufficient redundancy in the structural system to mitigate this and superficial repairs can be affected without significant intervention.</p> <p>Strength and stability Importantly, no evidence of vertical movement was noted, indicating no deficiency in the support at foundation level.</p> <p>Horizontal misalignment mostly occurring at eaves is long standing, where timber framed roof when initially loaded have thrust outwards at wall plate. The weakness in the system can be attributed in part to early life settlement that is when the timber is green and mortar not hardened, other factors include heavier roof coverings since the current covering is probably not the first.</p>
<p>6.02</p>	<p>Remedial Work:</p> <p>Building 1A</p> <p>Evidence as presented suggests the remaining masonry elevations will need to be partially rebuilt; full extent is difficult to measure and may only be apparent once work has commenced.</p> <p>Building 1B, 2A, 2B& 3</p> <p>Repairs and enhancements need to be concentrated on external elevations consisting of localised consolidation of the masonry walls. Truss bearings and member connections will need to be examined to check fixity/robustness.</p>
<p>6.03</p>	<p>Conversion:</p> <p>A strategy for converting these buildings is to accept that to avoid excessive scrutiny and intervention the existing construction cannot be fully relied upon to provide the support for the associated elements. By introducing supplementary support the existing structure can be relieved of some applied loads. Typically this consists of a load bearing ground slab with a new internal frame which acts to support floors and roof construction. The framework can be tied to the external masonry to enhance transfer of wind forces back into the internal structure.</p>

Appendix 'A'

Photographs can be viewed via the following link <https://www.flickr.com/gp/bobs-pcs/3D717V>



P2



P3



P4



P5



P6



P7



P8



P9



P10



P11



P12



P13



P14



P15



P16



P17



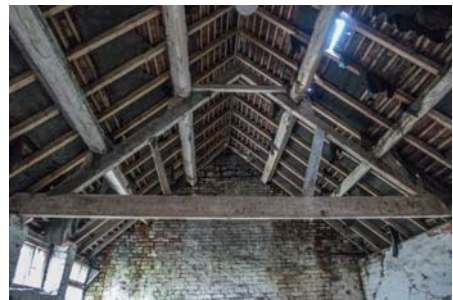
P18



P19



P20



P21



P22



P23



P24



P25



P26



P27



P28



P29



P30



P31



P32



P33



P34



P35



P36

Appendix 'B'

Explanation of the key criteria used in the assessment process.	
B1	Structural Safety
	Safety of a building structure when subject to particular service conditions is a major consideration of the Appraisal.
	Safety refers to 'Strength' and 'Stability' that is the capability of a structure to support/transfer loads to the ground. This applies to either the whole building or, a particular element. Service conditions refer to 'Applied Loads'. These loads include permanent loads (self-weight) and, temporary/transitional loads (wind, snow and intended use).
B2	Durability
	Buildings gradually and inexorably deteriorate and without routine maintenance would inevitably collapse. The rate of deterioration varies and depends on a number of factors; Age, material quality and detail of construction, service and environmental conditions.
B3	Defects & Deficiencies
	The survey identified a number of less onerous but still relevant defects and deficiencies; these are associated with routine maintenance and proposed future use.
B4	Repairs & Enhancements
	Recorded defects do not represent a serious impairment to stability or functionality of the building structure. The level of damage is currently superficial and limited and can be addressed.
B5	Maintenance
	Frequency and standard of maintenance dictates longevity of most buildings.
B6	Future Requirements
	Conclusions and repairs noted can be assessed against future management plans and maintenance costs.