

STRUCTURAL APPRAISAL REPORT

For

Mr W. Brearley (CT Planning)

At

**Barn Farm,
Cranebrook Lane,
Hilton,
Lichfield,
Staffordshire.
WS14 0EZ**



**Unit A,
Racecourse Business Park,
Dovefields,
Uttoxeter,
Staffordshire.
ST14 8GB**

T: 01889 569856


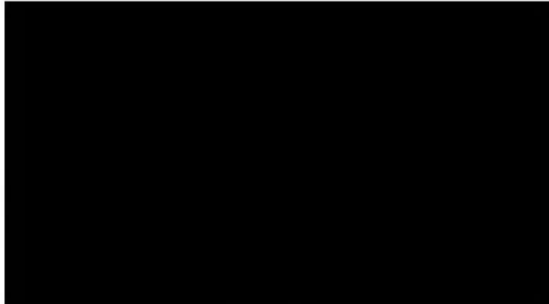
E: info@aba-consulting.co.uk

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Document Control:

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Report prepared by			
	Lawrence Taylor MEng (Hons) [Design Engineer]		
Report checked & approved by			
	Alex Payne BEng (Hons) [Associate Director]		
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1.0 Introduction

- 1.1 ABA Consulting were appointed by CT Planning to carry out a visual structural appraisal of two existing barns at Barn Farm, Cranebrook Lane, Hilton, Lichfield, Staffordshire.
- 1.2 The visual structural appraisal was carried out on Wednesday the 30th of September 2020.
- 1.3 For the purpose of the report, 'Barn 1' refers to the duo pitch portal frame barn to the North of the yard, and 'Barn 2' refers to the duo pitch barn with lean to extension to the West of the site.
- 1.4 Included in Appendix A of the report are ABA Consulting's 'Standard Scope and Limitations of Survey' statement. Appendix B includes relevant photographs taken at the time of the inspection. All Figure references not included in the main report can be found in Appendix B.

2.0 Brief

- 2.1 To visually inspect the buildings to assess the general structural condition and suitability for conversion.
- 2.2 This report has been prepared to provide advice on the overall condition of the structure of the buildings. The report is based upon a visual inspection of those areas of the property that were readily accessible at the time of inspection. It is not normal practice to remove internal finishes. As such, comments cannot be made on those parts of the structure that were inaccessible or hidden from view.
- 2.3 The report does not provide a checklist of all repairs and improvements that might be desirable or necessary.
- 2.4 Our instructions did not include:
 - a. The excavation of trial holes to establish the depth of foundations and bearing strata.
 - b. The inspection of non-structural items such as doors, windows, and internal decoration other than where they are relevant in relation to structural movement.
 - c. We have not inspected services such as electric, gas and water or below ground drainage.
 - d. We have not inspected parts of the structure which were covered, unexposed or inaccessible and we are therefore unable to report that such parts are free from defect.
- 2.5 Measurements referred to in the report are approximate and are recorded for the purpose of the report only and should not be used where accurate dimensions are required or are otherwise to be relied upon.

3.0 Form of Construction

3.1 Barn 1

- 3.1.1 The barn is comprised of a single span steel portal frame with a building footprint of approximately 20m by 18.5m. The height to the underside of the ridge apex is approximately 6.25m from SSL.
- 3.1.2 Portal stanchions are at approximately 5m centres.
- 3.1.3 Hot-rolled gable end stanchions are at third points to both elevations.
- 3.1.4 Steel purlins support the roof cladding at approximately 1m centres with timber rails supporting the vertical cladding to the perimeter at approximately third points.
- 3.1.5 The external envelope of the building is clad in vertical spanning metal sheeting with profiled metal sheeting to the roof.

3.2 Barn 2

- 3.2.1 The barn comprises a main duo-pitch roof barn with steel king post trusses. Supporting stanchions are located at third points.
- 3.2.2 To the side of the Dutch barn is a steel lean-to mono-pitch extension taking support from the main barn.
- 3.2.3 The main barn has a hot-rolled steel purlin to the perimeter supporting metal cladding. Hot-rolled purlins to the roof split the sheeting span into thirds either side of the main ridge.
- 3.2.4 The lean-to is clad with metal sheeting with timber cladding rails to sides and the roof.

4.0 Observations

4.1 Barn 1

- 4.1.1 The existing barn appears to have been extended or built using reused steelwork evidenced by the differing paint specifications (Figure 1). The main internal frame rafters are longer to the Northern end of the building, making an asymmetric duo-pitch roof.
- 4.1.2 The gable portal frames are constructed using a symmetric portal; however, they have been supplemented with a lean-to extension to match the internal portal frames (Figure 2). The extension to the gables appear to be formed using a bolted connection between the bottom flange of the steel lean-to and the top of the main portal frame.

- 4.1.3 One of the internal portal frames has three intermediate stanchion posts spaced between 5 and 6.5m centres supporting the underside of the portal frame.
- 4.1.4 The intermediate stanchions are bolted into the top of the ground bearing slab (Figure 3). One of the stanchions does not have all bolts required into the partial base plate. The base plates do not cover the entire plan area of the columns, and instead the column flanges project beyond the plates.
- 4.1.5 Significant distortion was noted to one of the three intermediate stanchions (Figure 4).
- 4.1.6 Unused hot-rolled cleats were noted to the intermediate stanchions.
- 4.1.7 Superficial rusting was generally noted to all the steelwork internally.
- 4.1.8 Knee bracing was noted to the eaves to the Northern elevation of the building; however, no bracing was observed to the Southern end incorporating the main barn doors (Figure 5).
- 4.1.9 The timber cladding rails to the perimeter were all noted to be exhibiting excessive sagging.
- 4.1.10 Roof bracing to the Eastern end of the barn was observed to not be complete, with large gaps between bracing nodes and end column nodes. A large gap was also noted at the apex. (Figure 6).
- 4.1.11 The concrete ground bearing slab appears to be in sound condition with movement joints noted at regular centres.
- 4.1.12 Surface rusting was noted to the base of columns that are not protected externally (Figure 7). No external protection measures were noted (e.g. bituminous paint, column surround etc.).

4.2 Barn 2

- 4.2.1 Metal cladding to the main barn was observed to be in poor condition (Figure 8).
- 4.2.2 The single skin brick sleeper wall to the barn perimeter was observed to be in poor condition with loss of jointing evident.
- 4.2.3 The condition of the ground bearing slab could not be determined due to existing items obscuring the view.
- 4.2.4 Evidence of paint loss, corrosion and pitting to the structural steelwork was noted throughout the main barn. No significant loss of section was noted at the lower level. High level steelwork could not be adequately inspected for corrosion.
- 4.2.5 No horizontal or vertical bracing was observed.

- 4.2.6 Internal columns are rolled steel joist sections with retrofitted 152UBs welded to the internal flange (Figure 9).
- 4.2.7 Internal columns were generally observed to be leaning towards the barn doors at 25mm per metre. Columns supporting the associated lean to were observed to lean outwards 10mm per metre.
- 4.2.8 King post steel trusses supporting the pitch roof constructed from angle sections were observed to be in reasonable condition.
- 4.2.9 Gable posts to the front and rear of the barn are not sufficiently restrained at the head.
- 4.2.10 Steel beams to the roof of the lean to are supported by the rolled steel joist columns of the main barn via a gusset plate shelf angle (Figure 10).
- 4.2.11 Timber cladding rails to the perimeter appeared to generally be in sound condition with no immediate signs of infestation and/or fungal decay.
- 4.2.12 Capping plates to the top of columns are not angled to match the roof pitch leaving a visible gap between plate and bottom flange of columns (Figure 11).
- 4.2.13 The ground bearing slab was observed to be in a good condition where visible.

5.0 Conclusions & Recommendations

5.1 Barn 1

- 5.1.1 Barn 1 appears to have been constructed using reused steelwork or retrofitted during its working life to extend the plan width of the building. This has resulted in an unusual arrangement for the gable ends with a 'lean-to' section of frame supported off the gable portal frames. In principle this arrangement is acceptable if the intersecting beam is adequately fixed to the top of the main gable portal. At the time of the inspection, this could not be determined, and it is recommended that this detail is investigated further.
- 5.1.2 It is unknown as to the purpose of the internal column arrangement, as the size of the portal rafter steels compared with the other internal portals appeared similar. The columns may have been constructed to form an internal wall (unused cleats were noted to the column faces). It is recommended that a detailed analysis is carried out to determine any requirement for these columns to remain.
- 5.1.3 One of the internal columns shows signs of significant distortion. Should it be concluded that the column should be retained, it is strongly advised that this column is replaced. Bolts to the

ground bearing slab from the columns mentioned were found to be missing. It is advised that these bolts are introduced.

- 5.1.4 Knee bracing was noted to the Northern elevation, however similar bracing was not noted to the Southern elevation. It is recommended that bracing is introduced to the Southern Elevation.
- 5.1.5 Roof bracing was observed to be incomplete. It is recommended that further CHS bracing is installed to ensure the stability of the frame is not compromised.
- 5.1.6 Columns to the perimeter were observed to be showing early signs of corrosion. It is advised that the base of all columns to the perimeter have a protection system installed to avoid further decay.
- 5.1.7 It is understood that the proposal is to convert the barn into two separate single storey ground floor dwellings. Based on the findings of this report, the barn is suitable for conversion. Detailed analysis of the frame will be required along with the implementation of the above notes for it to be sufficiently safe for habitation.
- 5.1.8 Should the conversion proposals include a significant extent of glazing; additional framing is likely to be necessary to adequately reduce structural deflections, subject to undertaking detailed analysis and design.

5.2 Barn 2

- 5.2.1 The lean-to section of the barn does not include any visible bracing system or moment connections. The stability of the lean-to is dependent on the stability and rigidity of the main barn. No observable bracing or stability system was noted to the main duo-pitch barn. It is highly recommended that a bracing system is designed and installed to ensure the long-term stability of the overall building and to restrain the columns to the main barn from further spread.
- 5.2.2 The gable posts were noted to be unrestrained at their head. Steelwork should be introduced to restrain the posts.
- 5.2.3 Excessive sagging was noted to the timber roof purlins of the lean-to. It is recommended that these purlins are replaced.
- 5.2.4 Although it is likely that the existing steel king post trusses are structurally adequate in terms of strength to support a comparable weight roof covering, detailed calculations would be necessary to prove deflections would be within acceptable limits.

- 5.2.5 It is understood that it is proposed to convert Barn 2 into a single single-storey dwelling. Based on the findings of the survey, the barn is suitable for conversion subject to the implementation of the above items, and a thorough analysis is conducted on the existing frame.

- 5.2.6 Should the conversion proposals include a significant extent of glazing; additional framing is likely to be necessary to adequately reduce structural deflections subject to undertaking detailed analysis and design.

Appendix A – ABA Standard Scope & Limitations of Survey

ABA Scope and Limitations of Survey

This report has been prepared to provide guidance on structural defects to the property only.

The report is based on a visual inspection of those areas of the property that were readily accessible at the time of the inspection. As such, comments cannot be made on those parts of the building that were inaccessible or hidden from view.

The report does not provide a checklist of all repairs and improvements that might be desirable or necessary.

We have not inspected parts of the structure which were unexposed or inaccessible. We are therefore unable to report that such parts of the property are free from defect.

This report is for the private and confidential use of the client for whom it was undertaken, and it should not be reproduced in whole, in part or relied upon by third parties for any use without the express written authority of ABA Consulting.

Appendix B – Photographs



Figure 1: Differing paint specification noted to both sides of the portal frame.



Figure 2: Steel connection to gable portal frame.



Figure 3: Internal column baseplate.



Figure 4: Flange distortion to internal column.



Figure 5: Knee bracing to Northern elevation.



Figure 6: Incomplete roof bracing.



Figure 7: External column corrosion.



Figure 8: Metal cladding corrosion.



Figure 9: Rolled steel joist columns with retrofitted 152UBs.



Figure 10: Lean-to support angle.



Figure 11: Column capping plate detail.