

Job N°: SLP/23/003

1st March 2023

**STRUCTURAL REPORT
FOLLOWING
A
VISUAL INSPECTION
OF
2 N° STEEL FRAMED BARNs
AT
OAK FARM
GREEN BARNs LANE
LITTLE HAY
LICHFIELD
WS14 0QN**

**Prepared by:
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For SLP Consultants**

1.0 Introduction

SLP Consultants were instructed via an email from Ms Maisie Birch, Operations Manager for Mercia Design & Build on 23rd February 2023, to carry out a visual inspection of the structural condition of 2 steel framed barns at Oak Farm, Green Barn Lane, Little Hay, Lichfield, WS14 0QN. I understand that the owners of the barns, Mr & Mrs Haynes would like to convert them to 5 N° single storey domestic houses and hence they would like to know if any structural works will be required to do so. I have received details of the proposed conversion works in the form of planning application drawings prepared by architects Brownhill Hayward Brown as follows:

- 1) Drawing 3552/001 – Location Plan
- 2) Drawing 3552/002 – Existing Site Plan
- 3) Drawing 3552/003 – Proposed Site Plan & Site Sections
- 4) Drawing 3552/100 – Existing Plans & Elevations
- 5) Drawing 3552/ 101 – Proposed Plan & Elevations
- 6) Drawing 3552/ 102 – Plots 2 – 5 Proposed Plans & Elevations
- 7) Drawing 3552/ 104 – Double Car Barn Plans & Elevations
- 8) Drawing 3552/105 – Single Barn Plans & Elevations
- 9) Photograph Precedent Sheets 1 &2

A copy of drawing 3552/002 is included in Appendix A to this report and it should be noted that the two barns, which were inspected are referred to as Barn A and Barn B on this drawing. Based upon the above the purpose of my inspection of the two barns was to assess their current structural condition and advise upon any structural work, which may be necessary to facilitate their proposed conversion to domestic houses. My inspection of the barns was carried out on Friday 24th February at 9.00am and this report has been written to convey my findings.

During my inspection I took a number of photographs of parts of the existing barns. Copies of some of these photographs are included at the rear of this report in Appendix B to assist in clarifying some of the points mentioned. Please note that I have not inspected parts of the barns, which were covered, hidden or otherwise unexposed and therefore I am unable to confirm that such parts are free from defect. Also, this report is on parts of the structure only and is not intended to give or imply any form of financial valuation of the property.

2.0 Description of the Two Barns

2.1 Barn A

Barn A is a single storey, steel portal framed structure with masonry infill panels and an eaves height of approximately 3.0 metres. (*Photographs 1 & 2*) It is approximately 27 metres long x 9 metres wide on plan and is located close to the south boundary of the site adjacent to Green Barns Lane. It is currently used as stables and tack storage for approximately 4 to 6 horses. The roof of the building is duo pitched across the narrower width at an angle of approximately 15° to the

horizontal and is covered with deep profile corrugated fibre cement roof sheets. The steel portal frames are located at approximately 4.5 metre centres using 178 x 102 x 19 UB rafters supporting 220 x 75 timber rafters at approximately 1200mm centres. *(Photographs 3 & 4)* It was not possible to see the steel column sections to the portal frames due to the fact that they are fully encased within 460mm square face brickwork piers. *(Photograph 5)* However, I anticipate that these members are most probably either 203 x 102 UB or 203 x 133UB sections. The west gable wall of Barn A is constructed as an infill masonry panel beneath the last steel portal frame. This wall appeared to be constructed using solid 190mm wide blocks incorporating a 460mm square vertical blockwork pier at the mid-point. *(Photographs 6 & 7)* At the opposite east end of the building there appeared to be no steel portal frame. Instead, this wall appeared to be constructed as a load bearing cavity wall with an outer leaf of face brickwork and an inner leaf of 190mm wide blockwork. The internal division walls between and at the front and back of the stable units were all found to be constructed using 190mm solid blocks to a height of approximately 1600mm above the finished ground floor level.

2.2 **Barn B**

Barn B is again a single storey steel portal framed structure with masonry infill panels and an eaves height of approximately 3 metres. However, it is much larger than Barn A, being approximately 33 metres square on plan and is formed by 3 bays of portal frames again at approximately 4.5 metre centres. *(Photographs 8 & 9)* As shown on the Location Plan, (drawing 3552/01), Barn B is located to the north of Barn A, with an approximately 10 metres wide, concrete surfaced yard in between the two buildings. The barn is currently used as workshops, garage and storerooms to house and maintain farm vehicles, equipment, machinery and cars. Each of the three bays of the portal frames are again duo-pitched at angles of approximately 15° to the horizontal with two large galvanised steel valley box gutters located along the junction lines. The roofs are again covered with deep profile, corrugated, fibre cement roof sheets, which are supported on mainly 175 x 63 timber purlins at maximum 1200mm centres. However, in some small areas cold rolled galvanised steel, zed shaped purlins were also found, particularly adjacent to the valley gutters. *(Photographs 10 & 11)* Using a tape measure I established that the steel rafters of the portal frames are 178 x 102 x 19 UB sections and the columns are 203 x 133 x 25 UB sections. Internally, beneath the ridge portal frame located nearest to the east side of the building I noted that four steel columns had been installed directly beneath the portal frames. *(Photograph 12)* These columns are located along the line of one of the internal blockwork walls separating different parts of the barn and were not found to be located in any other parts of it. The external walls of Barn B were noted to be constructed using varying height, masonry infill panels, mainly using blockwork. In some areas these walls extend to full height to the underside of the portal frame members and in other areas they stop short with various forms of cladding located above the blockwork.

3.0 Details of Inspection

The following are lists of the main points noted during my visual inspection of the two barns.

3.1 Barn A

- 3.1a During my inspection I noted that the roof cladding to Barn A was in good condition with no obvious signs of rainwater ingress, localised damage or sagging of the roof sheets or timber purlins at mid-span. Also, no obvious signs of insect infestation or wet/dry rot was found to the timber purlins. The roof sheets were noted to have a relatively deep sinusoidal profile and hence are most probably "Big Six" fibre cement possibly containing asbestos fibres.
- 3.1b All of the portal frame rafters were found to be in very good condition with very little surface rusting present and no signs of buckling of the members either locally or within their length. The ridge connections to the rafters were noted to be made using end plates approximately 350mm x 120mm x 10mm thick, incorporating triangular stiffened plates, all fillet welded to the ends of the rafters and bolted together using 4N° approximately 20mm diameter bolts. (*Photograph 13*) As mentioned previously, I was unable to inspect the tops of the steel columns of the portal frames. However, from the presence of similar triangular stiffener plates projecting out of the face brickwork column surrounds, I anticipate that similar bolted connections are present at the rafter to column interfaces. (*Photograph 14*)
- 3.1c No diagonal bracing was found within the plane of the roof or within the walls of the long sides of the barn. However, no signs of horizontal longitudinal movement were present.
- 3.1d By excavating trial holes adjacent to the brick piers surrounding the portal frame columns on both sides of the building it was established that there are no pad foundations at these locations. Instead, I was able to confirm that both the masonry walls and the steel portal frames are supported on the concrete ground floor slab, which is approximately 180mm to 200mm thick. Despite the relatively shallow foundation depth I was unable to identify any signs of subsidence movement in the form of cracking within the masonry panels.

3.2 Barn B

- 3.2a As with Barn A, I noted that the roof cladding to Barn B was in good condition with no obvious signs of rainwater ingress, localised damage, sagging of the roof sheets or timber purlins. As mentioned previously some cold rolled, galvanised steel purlins were noted, particularly in areas close to the valley gutters. Some light surface rusting of these members and the valley gutter support straps was noted. (*Photograph 15*) No obvious signs of insect infestation or dry/wet rot of the

timber purlins was identified and the roof sheets were noted to be very similar to those found on Barn A.

- 3.2b As with Barn A all of the portal frame rafters were found to be in very good condition. In addition, the steel columns of the portal frames also showed very little signs of surface rusting and no signs of localised or overall buckling. The portal frame rafter connections were found to be very similar to those used in Barn A. However, in this instance 6N° bolts have been used rather than 4N°. (*Photograph 16*) Similar, 6N° bolt connections were also noted at the rafter to column interfaces. (*Photograph 17*)
- 3.2c Tubular circular hollow section diagonal wind bracing members were found to be present within the plane roof at both ends of the building. (*Photographs 18 & 19*) In addition, steel knee bracing members were noted to both internal and external columns. (*Photographs 20 & 21*)
- 3.2d By excavating a trial hole adjacent to one of the portal frame columns it was established that a concrete pad foundation, approximately 1.2m x 0.8m was present and founded at a depth of approximately 850mm beneath external ground level. Inspecting the masonry infill panels between the portal frame columns and the internal masonry walls I was again unable to find any signs of subsidence or differential settlement.

4.0 Conclusions and Recommendations

For ease of cross reference, the following conclusions/recommendations will be listed in the same sequence as the items mentioned in Section 3.0 of this report:

4.1 Barn A

- 4.1a In my opinion, from the lack of evidence or localised damage or sagging of the roof, it is clear that the existing timber purlins and steel portal frame members are providing adequate support to the existing fibre cement roof sheets. The “Big Six” profile of fibre cement roof sheets, which I believe are currently in place are known to weigh approximately 15.3kg/sqm when installed on sloping roofs. In my opinion, these roof sheets could easily be replaced with a composite metal roof sheet such as Kingspan KS1000. These roof sheets incorporate sufficient thermal insulation material to satisfy the ‘U’ value requirements of the current Building Regulations. This would result in composite roof sheets approximately 145mm thick, which would weigh less than the existing roof sheets. (i.e., approximately 14kg/sqm). Therefore, I am of the opinion that no strengthening works will be required to the existing portal frame members to facilitate this change.
- 4.1b As can be seen from *Photograph 13*, the welded and bolted ridge connections to the portal frame rafters, have been fabricated and erected to a very good standard with no localised or overall distortions to the members present. I also believe that similar quality connections are present at the rafter to column positions.

Therefore, I am of the opinion that all of the portal frame connections are working satisfactorily to support the applied loads and will continue to do so.

- 4.1c Bearing in mind the relatively small span of the portal frames to Barn A, (approximately 9m), and the presence of a large number of masonry infill panels I believe that the infill panels are providing a suitable amount of longitudinal stability to the building. Therefore, providing the proposal to convert the barn to a domestic property does not require the removal of any of the infill panels. I do not believe that it will be necessary to install any form of longitudinal bracing.
- 4.1d Based upon the lack of evidence of any signs of subsidence movement of the masonry wall panels, I believe that the ground floor slab, which is currently supporting the panels and portal frames is most probably reinforced and acting as a raft foundation. However, I believe that the existing foundations would not be considered suitable by current Building Regulations for a new domestic house. Therefore, I believe that underpinning of the existing foundations will most probably be necessary to enable the conversion to be approved. I also recommend that consideration should be given to raising the existing finished ground floor level to enable thermal insulation and a sand/cement screed to be installed on top of the existing ground floor slab.

4.2 **Barn B**

- 4.2a My conclusions for Barn B regarding its roof structure are identical to those given for Barn A in item 4.1a with the exception that I believe the reason a small number of galvanised steel zed purlins have been installed is most probably due to localised replacement of rotten timber purlins, particularly if the valley gutters have leaked in the past.
- 4.2b In my opinion the use of 6N° bolts at both the rafter to rafter and rafter to column connections on Barn B compared with 4N° bolts in Barn A is most probably as a result of the slightly larger span of the portal frames of Barn B. (i.e., 11 metres compared to 9 metres). Otherwise, the steel portal rafter sizes and spacings appear to be the same or very similar on both Barn A and Barn B. Also, from past design experience, I am aware that the rafter and column section sizes used on Barn B are satisfactory for the span and spacing of the frames. Therefore, I am of the opinion that all of the portal frame members and connections for Barn B are again working satisfactorily and will continue to do so.
- 4.2c In my opinion the larger plan size and more open nature of Barn B dictates that suitable wind bracing be installed. As mentioned in item 3.2c, in plane diagonal circular hollow section roof bracing and column to purlin knee bracings have been installed. Therefore, providing that these members are retained when the conversion to domestic properties takes place, I believe that there will be no requirement to install additional longitudinal bracing.
- 4.2d From the evidence gained from the single trial hole, which was excavated, I believe that all of the portal frame columns are most probably supported on mass

concrete foundations and founded at an adequate depth to satisfy current Building Regulations. Therefore, I do not consider underpinning of these existing foundations to be a necessary part of the proposed conversion works. However, as with Barn A I recommend that consideration should be given to raising the existing finished ground floor level in order to enable thermal insulation and sand/cement screed layer to be installed

5.0 Summary

With the exception of a small amount of underpinning of the existing foundations I believe that the proposed conversion of Barn A to a detached house is entirely feasible without the need for any further structural work to be carried out. I am also of the opinion that Barn B can be converted to 4No domestic houses without the need for any significant structural work to be undertaken

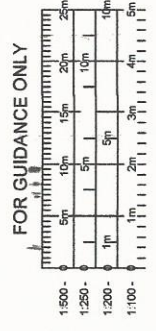
Prepared by:



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APPENDIX A

EXISTING SITE PLAN – DRAWING 3552/002



REV		DATE	CHECKED
DRAWN		INCU	MC
CHECKED		INCU	MC
SCALE		1:500 @ A3	
DATE		JUN 2022	
REV		3552 - 002	
DRAWING NO. 3552 - 002			
Oak Farm, Little Hay			
Existing Site Plan			
Mr & Mrs Haynes			
PLANNING			
01643 264357 - mail@hbrarchitect.co.uk			
brownhill hayward brown chartered architects			
bhb			

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APPENDIX B
PHOTOGRAPHS 1 to 21



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