Survey

On:

Barn

Laurel Farm

Pilning Street

Pilning

Bristol

BS35 4HN

For:

Mr Adam Williams

Date: 9th November 2023

Author:

Geomex ltd

Red Robin Farm

Sandlin

Leigh Sinton

Malvern

Telephone: 01886832810

Eur.Ing. **Paul Smith**, DipHI, BEng(Hons), MSc, C.Eng, C.Build E, FCABE, FCIOB, MICE, MCMI, MCIHT.

1.0 Brief

1.1 In accordance with instructions conveyed by The Rural Planning Company on behalf of Mr A Williams, we have undertaken a survey at Barn A, Laurel Farm, Pilning Street, Pilning, Bristol BS35 4HN in connection with assessing the structural adequacy of barn and condition for change of use into a habitable dwelling.

1.2 Our appraisal took the form of a single visual inspection carried out during showery weather conditions on 9th November 2023.

1.3 The object of our involvement is to make a structural appraisal of the building with particular regard to the above and therefore the scope of this report is confined accordingly and should not be construed as comprehensive survey including the survey of unrelated matters.

1.4 We have not inspected parts of the property that are covered, unexposed, or otherwise visually inaccessible and therefore cannot comment on these matters.

1.5 Our inspection was carried out from ground level and around the perimeter of the property or from adjacent public land. Any notes are made with the walls described handed facing the front but notes on a particular wall are described facing the elevation in question.

1.6 We would advise that no physical or specialist testing has been undertaken for example to determine the presence of Asbestos or High Alumina Cement.

.1.7 We include the following table for your information.

Category of damage	Approximate crack width (mm)	Definition
0	Up to 0.1	Hairline
1	0.2-2	Fine
2	2 to 5	Moderate
3	5 to 15	Serious
4	15 to 25	Severe
5	Greater than 25	Very Severe

2.0 Location

2.1 The barn is verified as a steel framed building located at Laurel Farm with an adjoining lean-to to the east elevation. To the south elevation there is a lean-to between the subject barn and adjacent steel frame barn.

3.0 Description

3.1 The main building comprises of five bays and six portal frames. The overall length of the main building is 22.860m and the width is 8.848m measured internally. Measurements to the eaves are 4.758m and to the ridge is 6.042m. The overall dimensions of the barn provide a large span with relatively low ridge height making it resistant to overturning.

3.2 The bays comprise of 178 x 102 x 19 U.B. columns with 152 x 89 x 16 U.B. principal rafters secured using a haunch detail seen in Appendix 1. The rafters are fixed using a haunch at the gable as seen in Appendix 2.

3.3 The frames are at 4.56m centres and are typical of a structure of this type. See Appendix 3. The south wall has additional lateral restraint provided by a 7N/mm2 concrete block wall between the web of the columns to a height of 1.8m. This will assist in preventing sway and afford lateral stability to the walls. The north elevation is partially exposed but has 2No 47 x 97 timber rails to which corrugated metal sheets are attached to a height of 1.93m. See photographs in Appendix 3.

3.4 The west elevation comprises of 50 x 50mm box section to which the corrugated sheets are attached which in turn are attached to two 178 x 102 x 19 U.B. extending 2.75m from the ground, see photograph in Appendix 3.

3.5 The lean-to to the east comprises of a 100 x 100mm square hollow section centre the main barn with the lean-to comprising of 3No 203 x 102 x 23 U.B. principal rafters see photographs in Appendix 3. The central rafter is supported on a 115 x 115mm diamond steel section central to the east wall and the side rafter supported on similar sized diamond shaped steel column on the northeast and southeast corner, see photographs in Appendix 3. The south elevation has the benefit of an additional diamond column mid span.

3.6 The south and east walls of the lean to have 100mm concrete blocks to a height of 1.8m adding additional lateral support to the walls, see photographs in appendix 3. The external face is clad with corrugated metal sheets attached to 100 x 100 x 5mm angle section which is in turn attached to the column on the south and east elevation.

3.7 The condition of the steel to the main barn appear to be in good condition and free from corrosion. The lean-to steel sections have suffered some corrosion but this is superficial.

4.0 Roof

4.1 The purlins to the lean-to on the east elevation comprise of 100 x 197mm timber section comprising of two joists 50 x 197mm at 1.4m spacing.

4.2 The main barn purlin comprises of 75 x 175 at 1.6m spacing spanning between the steel portal frames, see photographs in Appendix 3. These are adequately supporting the cement fibre type sheets above and are adequate to support a lightweight insulated metal panel with a deflection L/250 which are permissible deflection in the code of practice.

4.3 The condition of the timbers to the roof structure look to be in good serviceable condition.

5.0 Foundations

5.1 The lean-to barn on the east elevation have exposed foundations as ground level which extrude 320mm beyond the wall, see photographs in Appendix 3. Assuming the wall to be central to the foundation the overall width is therefore 720mm as a minimum and therefore any bearing pressure is well above the bearing capacity of the soil. It is reasonable to assume a bearing capacity for the soil at 135KN/m2 compared with 23.10 KN/m2 for the wall load even if the wall was full height. See Appendix 4.

5.2 Foundations to main building appear to the 270mm out from the wall, see photographs in Appendix 3. Hence the overall width of 600- 640mm as seen Appendix 4 these foundations are adequate to sustain the load from a full height wall. The bearing capacity is 135KN/m2 with a bearing pressure of 26.95KN/m2 since 135KN/m2 >26.95KN/m2 the foundations are adequately sized.

5.3 The foundations to the column appear to be 1.0m x 1.0m and are typically 1.0m deep which providing an overall weight of 24KN which counteracts the overturning and wind load on the building. This far outweighs the wind loads on a relatively low structure and are therefore adequate.

5.4 Steel frame barns have large foundations to each column which are typically 1x1x1m minimum to which the columns are set into or attached via a steel base plate and a bolt arrangement. This arrangement prevents overtiming due to wind loads.

6.0 Lean-To link to adjacent barn

6.1 The link to the adjacent barn comprises of block walls comprising of 7N/mm2 blocks some 100mm thick. The wall adjacent to the main barn of the north elevation comprises of a central column 300 x 450mm and extends to the height of the block work some 1720mm high, see photographs in Appendix 3.

6.2 The walls to the east and west comprise of 100mm thick walls with no piers.

6.3 The wall to the south forms a "party wall" to an adjacent steel frame barn. The blockwork is fixed in the web of the 203 x 102 x 23 U.B forming the columns to the barn.

6.4 Above the masonry walls are corrugated cement sheets which cover the south and east elevation and only approximately 75% of the north wall, see photograph in Appendix 3. No significant defects were noted.

6.5 The roof comprises of corrugated cement fibre type sheets on 75 x 175mm purlins spaced at 1.3m spanning approximately 4.5m, between steel columns 203 x 133 x 25 U.B. on the south elevation and a 178 x 102 x 19 U.B. column on the north elevation.

6.6 The principal rafter comprises of a 178 x 102 x 19 which supports the purlin spanning approximately 3.8m attached using a gusset plate welded on bolted to the column see photographs in Appendix 3.

6.7 That is some superficial corrosion to the end rafters on the east elevation but this is not a structural issue. See photographs in Appendix 3.

6.8 On the west elevation the roof is supported to a wall plate on the wall see photograph in Appendix 3.

6.9 In general the walls appear to be structurally sound and vertical in alignment with no signs of cracking or structural distress.

7.0 Conclusion

7.1 The barn does not appear to have suffered any structural distress and should be able to be converted to habitual dwelling in accordance with the plan submitted.

7.2 The steel framework would appear adequately sized and considered suitable for the proposed change to residential accommodation. Hence, we do not believe there is any problem with the structural components carrying the loads.

7.3 It is our opinion that the structure is suitable for conversion into a habitable dwelling without the need for structural improvements, albeit some thermal qualities will require improvements. The addition of floor insulation and insulation to the existing walls and roof does not afford any necessary structural improvements as the building is already able to sustain the loads imposed on it. These works only afford the necessary thermal and essential improvements to meet current day Building Regulations.

7.4 For steel frame Portal frame buildings can be used for supermarkets, warehouses, agriculture and other applications.

7.5 The dead or permanent loading on such structures is relatively light compared with the imposed/variable and wind loads. The imposed/variable and dead/permanent loads are vertical, but the wind loading is horizontal. The dead loads are relatively small and usually involve cladding and insulation. The side rails to which the cladding is attached transfer the permanent/dead loads and wind loads to the columns.

7.6 The shape of the building is a key consideration, as one can imagine. If we consider a narrow building in relation to its length, then the building could be susceptible to over-turning should high wind loads be encountered. In such circumstances the overturning will have to be overcome by the buildings dead weight or the possibility of increasing the weight of the foundation. Consequently, a building of this nature may have to be constructed using a large pad foundation to overcome the resulting wind loading.

7.7 In general, this type of structure is constructed using large widths to overcome such problems. For spans up to 15 meters, steel frame structures are primarily susceptible to deflection and it is this quality that is the usual concern to designers.

7.8 Considering the above, a short span across the gable of say up to 15 meters would normally have a frame spacing of between 3 and 5 meters. For longer spans of 45-60meters the spacing of the frames is 10-12 meters. This is based on experience and is for guidance only to emphasise the points above.

7.9 The larger building is not so susceptible to overturning due to the ratio of its length to span, and therefore the frames and transfer of load to the foundation can be less frequent.

7.10 The columns will experience the largest bending moment at the eaves or knee, where they connect to the rafters, and therefore the depth is increased to resist the moment by the use of a haunch. This also provides increased depth for the bolted joint connection between the column and rafter. This arrangement is evident in the subject building.

7.11 The bottom of the columns can be fixed or pinned. A fixed connection usually comprises anchor plates fixed into a concrete base. A pinned connection has a single pin or bolt from the column to the foundation block and there is no moment at the connection. However, if the column has two or more bolts and/or has haunches at its base, the connection is considered fixed. In this case the building is fixed to large concrete foundations to absorb movement and prevent overturning.

7.12 The foundations of the existing walls are adequately sized to sustain the walls being increased in height to the eaves.

7.13 The roof structure is capable of sustaining a similar load provided by lightweight insulated sheets.

7.14 The link to the adjacent barn to the north appears to be in good condition and suitable for conversion to a habitable annex.

Appendix 3

Photograph of east elevatkion.

Photograph of east elevation showing lean to and roof structure.

Rear south elevation with lean to link barn in the background

Rear south elevation with lean to on main barn on east elevation

Front north elevation of the lean to located to the east of the barn.

Front north elevation of main barn.

Front north elevation

West elevation

Looking towards the east elevation internally, showing the principal rafters and timber purlins which are in good condition.

Internal view towards the north elevation which is partly open at the front.

Internal photograph showing the lean-to structure to the east elevation. Also note the principal rafters which are in good condition.

Rafters and column in steel which are in good condition.

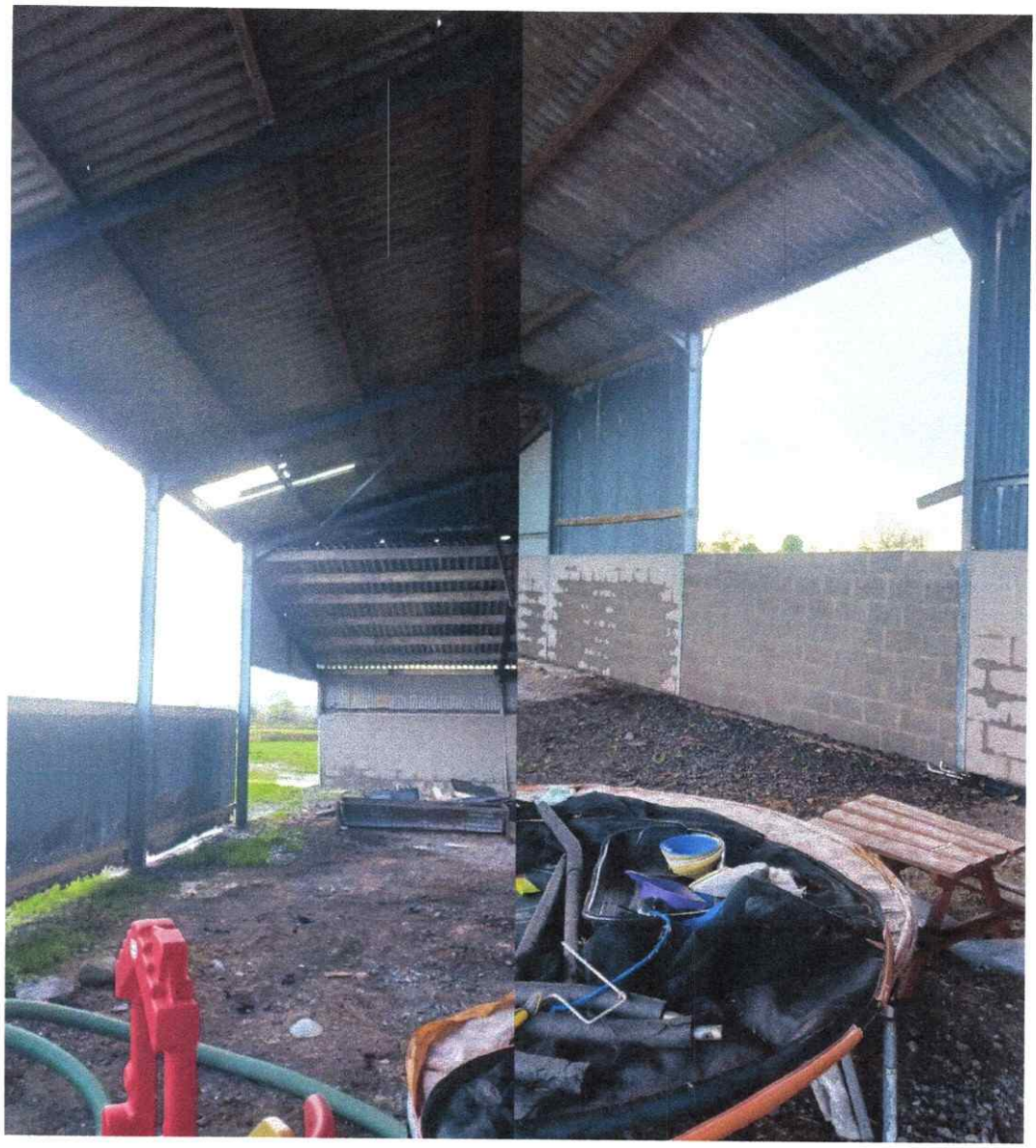
Photographs showing the internal structure and the rear south and east walls partly blocked adding lateral stability to the wall.

Lean to structure to east elevation. Roof structure in timber and steel shown to be in good condition.

Roof structure with steel members in good condition.

Rear wall to lean to and main barn.

Front elevation facing north where the steel columns are exposed but nevertheless in good condition.

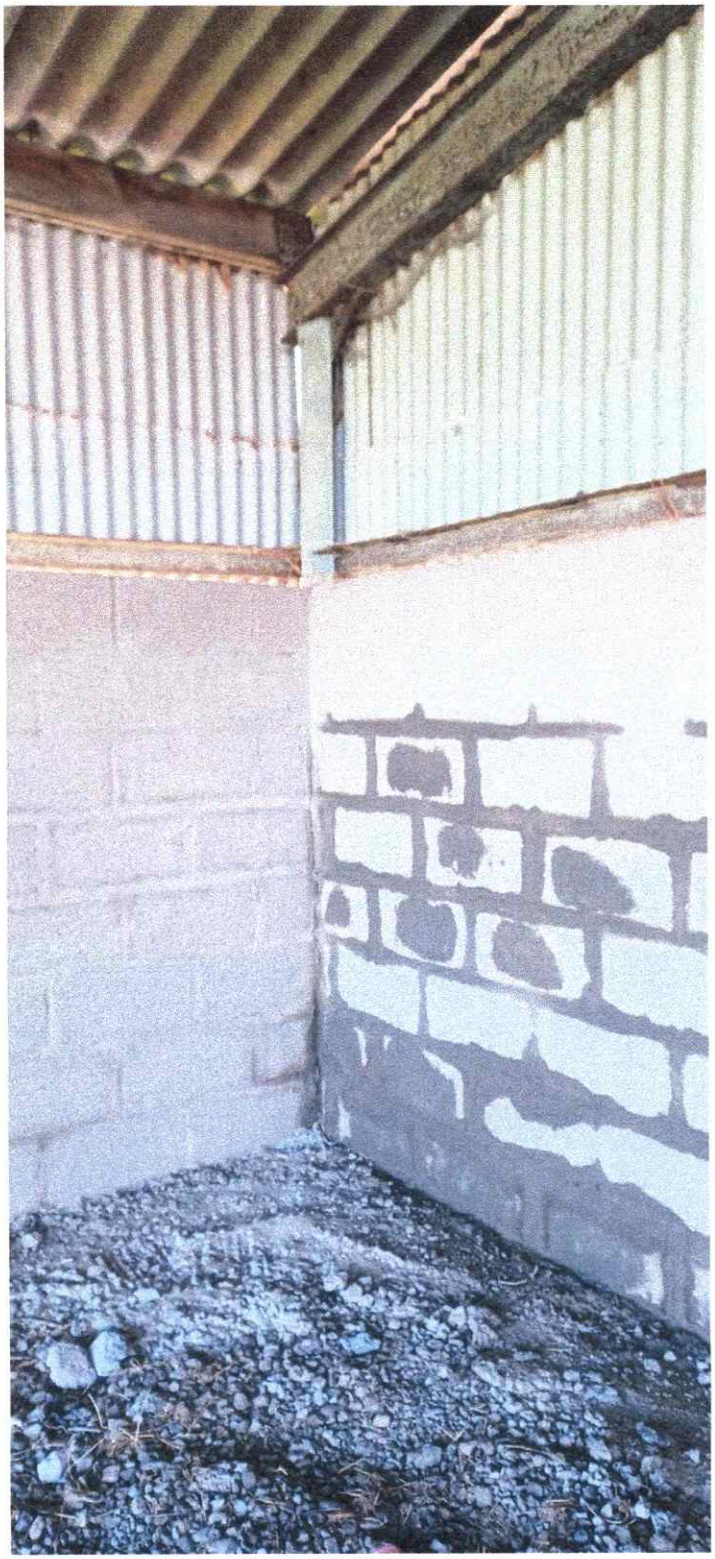


Internal photographs of the barn .

Diagonal steel sections used as columns to support the roof structure to the lean to on the east elevaton.

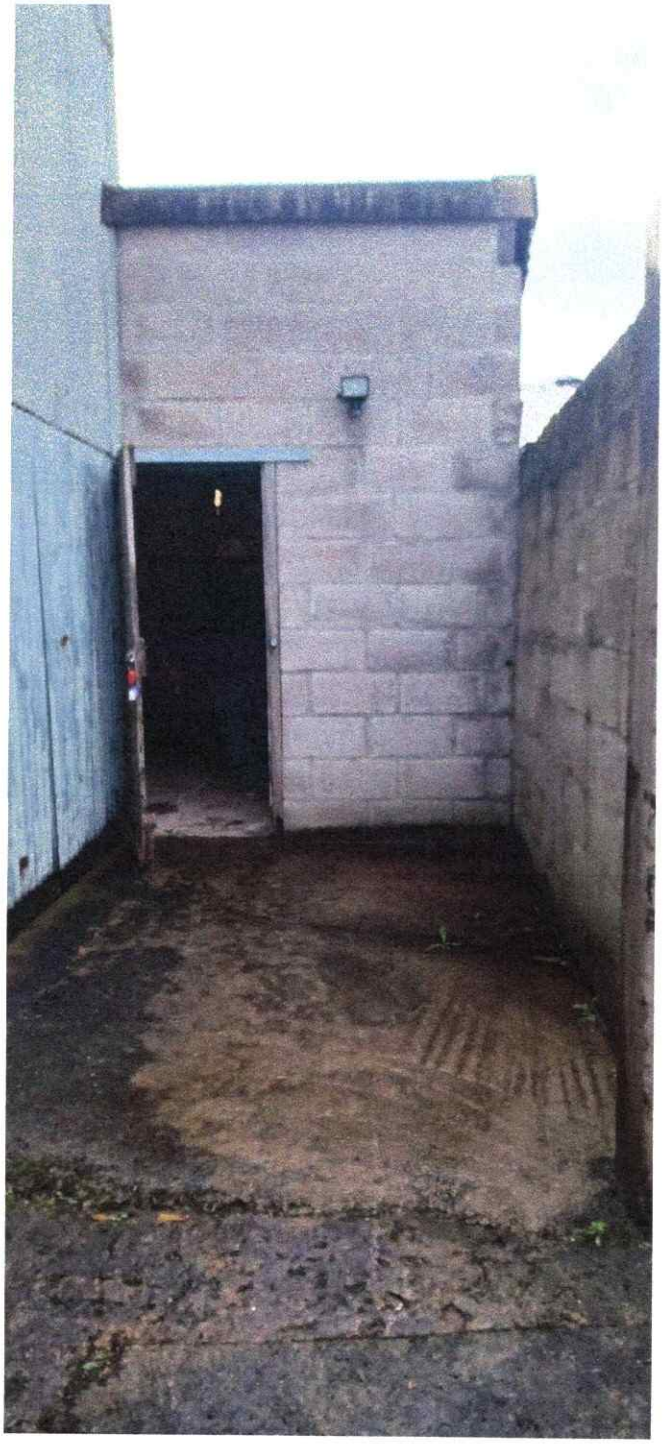
Photograph of diagonal column sections to the lean to on the east elevation supporting the principal rafters and timber purlins.

Photograph of timber purlins supporting lean to roof on east elevation which appear to be in reasonably good condition.

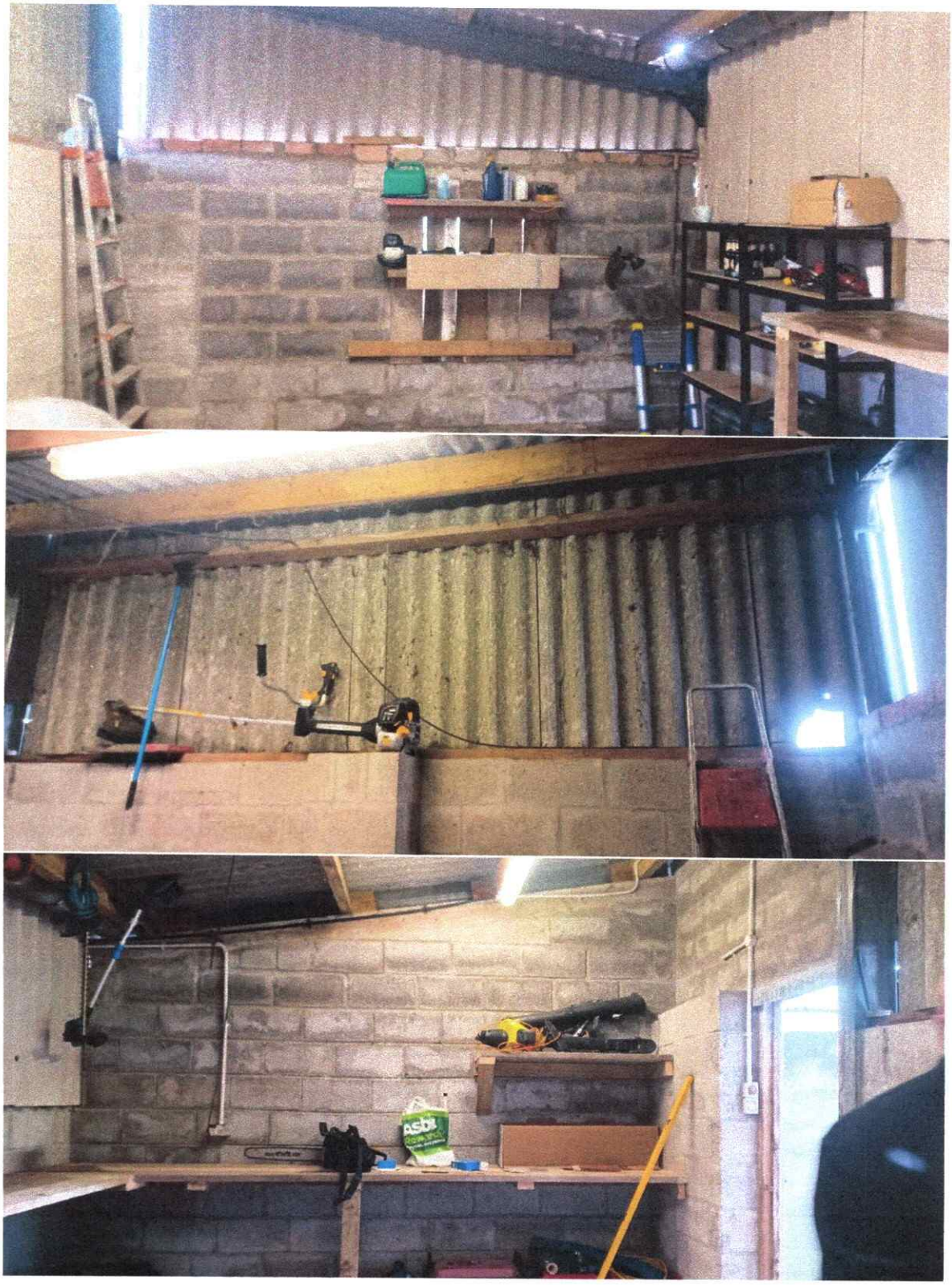


Photograph of southeast corner of lean to showing diagonal column, principal rafter and foundation which is evident at the surface.

Foundation seen on rear south wall exposed at the surface which is found to be adequately sized to support a wall full height of the elevation.



Photograph of lean to barn to south west corner and rear of main barn.



Internal photographs showing the internal area of the lean to barn to the rear and southwest corner. The photograph shows the steel members and block walls which exhibit no cracking or structural distress.