FEBRUARY 3, 2022

UPPER HOUSE FARM
WORMELOW
HEREFORDSHIRE
HR2 8EL

KYTEX LTD.
2021063-P1
info@kytex.co.uk

1. Introduction

1.1 KYTEX LTD. were instructed by Richard Dean to undertake a structural inspection of an agricultural shed at Upper House Farm, Wormelow, Herefordshire, HR2 8EL.

1.2 This report is limited to structural aspects only. All other building aspects are outside the scope of this report.

1.3 No intrusive work was undertaken, all comments are based solely on visual evidence noted during the survey.

1.4 This report is for use by Richard Dean only and shall not be used or relied upon by any third parties without specific written consent from KYTEX LTD.

Figure 1: Aerial photograph of the site.

2. Survey

2.1 KYTEX LTD. visited site 26th January 2022 during the midmorning. The weather was sunny with no rainfall occurring while on site.

2.2 Access was granted to the shed and adjacent shed allowing most of the buildings elevations and internal space to be surveyed from the ground.

2.3 The site topography slopes gently from the North to the South, with a sharp drop off on the building's southern boundary of approximately 2.0m.

2.4 Sketch plans and elevations of the structure can be found in Appendix I.

3. Structural Description and Observations

3.1 The shed is a single storey, duo pitched concrete portal frame with a large lean-to concrete frame attached to the South.

3.2 Roof:

3.2.1 Cement based profiled sheeting form the roof. It is unknown if they contain asbestos.

3.2.2 200 deep concrete purlins span between portal frame bays and the lean-to frames at 1300cc, supporting the roof sheets. Only 1 concrete purlin was noted as having been replaced with a timber purlin.

3.2.3 Precast reinforced concrete rafters are supported by reinforced precast concrete columns totalling 7 portal frames and lean-to's.

3.2.4 The internal portal frames consist of tapered rafters, approximately 180mm wide x 600mm deep at the haunch reducing to 200mm at the apex.

3.2.5 The lean-to rafters are circa. 450 x 80 'T' beams spanning between columns.

3.2.6 No roof plan bracing is present.

Photo 1: (Left) Portal frame Photo 2 (Right) Lean to

3.3 Columns:

3.3.1 The portal columns were dimensioned as 180mm x 300mm.

3.3.2 The lean-to columns (the South elevation) were dimensioned as 250mm x 150mm.

3.3.3 Columns appeared relatively plumb with no signs of bowing.

3.3.4 Minor spalling was noted to the concrete.

3.3.5 No clear signs of rust staining were observed to the concrete surfaces.

3.4 Foundations:

3.4.1 The existing foundations are unknown. They are assumed mass concrete.

3.5 Floor:

3.5.1 An existing concrete slab is present. The build-up and thickness is unknown.

3.5.2 Isolated cracks in the slabs were noted. Parked vehicles prohibited a full inspection of the cracks.

3.5.3 It could not be confirmed whether the slab is ground bearing or is suspended between foundations.

3.6 Stability:

3.6.1 The structure is stabilised across the bays by portal action from the North to the South. In the orthogonal direction, no bracing or rigid jointing was observed.

3.6.2 The partial height blockwork walls are jointed into the columns with reinforcement providing stability via partial shear wall action in the East-to-West direction along the southern elevation.

3.6.3 The East-to-West direction of the North elevation is believed to be stabilised by cantilever action of the columns from the foundations.

3.6.4 The current roof arrangement will be acting as a diaphragm.

3.7 Façade:

3.8 Cladding is present on all sides to varying heights.

3.9 The North elevation is partly clad with profiled fibre sheeting, spanning from the eaves down to a valley line formed at the junction with the adjacent shed. Below this, the elevation is fully exposed providing open access to the adjacent shed.

3.10 The East elevation is partly clad with profiled fibre and metal sheeting, along with a small length of blockwork at low level to the South corner. Part of the gable is fully exposed with a steel gate for access.

3.11 The South elevation is clad with hit and miss vertical timbers from the eaves down to mid height. Below this, a blockwork wall spans down to floor level and continues down to the low ground as part of a retaining wall.

3.12 The blockwork wall is joined to the columns via reinforcement located within the bed joints. The reinforced wall will contribute to stiffening the column and providing stability to the frames.

3.13 A length of blockwork has been removed and infilled with timbers. This damage to wall is likely to have been due to vehicle or machinery impact.

3.14 The West elevation is partly clad from the ridge downwards with profiled fibre sheeting. Part of the gable is fully exposed with a steel gate for access.

Photo 3 (Left): West elevation, Photo 4 (Right): South elevation

Photo 5: North boundary (internal)

3.15 Guttering and drainage

3.15.1 Guttering is present to both eaves roof edges.

3.15.2 Downpipes are located on each of the 4 corners (the Southeast is partly damaged) and discharges to the land.

3.16 Retaining wall

3.16.1 The South end of the shed is retained at the high level.

3.16.2 The construction of the retaining wall could not be confirmed. Externally blockwork is visible however a more substantial wall is assumed behind.

4. Structural Comments

4.1 An analysis of the portal shed should be undertaken to confirm its capacity for any proposed loadings.

4.2 Roof:

4.2.1 The current roof is relatively lightweight and new build ups may add additional weight to the current structure. Allowance should therefore be made for the strengthening of the existing sections to accommodate the heavier loads if required.

4.2.2 The primary structure (reinforced concrete) appeared in a relatively good condition. Spalling and rusting was minimal to the majority of sections.

4.2.3 High level connections should be closely checked with an allowance for localised repairs and connection replacement if highly corroded.

4.3 Concrete Frame:

4.3.1 The superstructure is entirely constructed from precast concrete. To undertake a back analysis would first require confirmation of the reinforcement size and quantity along with the concrete grade. To confirm this, either radar scanning or an intrusive investigation would be required.

4.3.2 An alternative approach to justifying the structure for new loadings would require comparing the existing loadings against the proposed loadings. This along with considerations such as calculating the minimum percentage of reinforcement (originally required based on historic design codes) can be combined to calculate a quantitative structural analysis of the frames. It is expected that where lightweight cladding and roofing materials are used, the frame will be suitable for conversion with minimal strengthening works.

4.3.3 The carbonation of concrete structures is a degradative affect that will need to be considered for the structures design life. Time dependent carbonation of the concrete can lead to corrosion of the reinforcement and consequential popping of the concrete. From a visual assessment, there was little sign of corrosion (via popping or rust staining) however it would be prudent to undertake insitu testing to approximate the current depth of carbonation. This can be used as a basis to predict the future rate of carbonation and whether any treatment is required.

4.3.4 High Alumina Cement (HAC) was historically used in precast concrete production up until the 1970's. The rapid strength gain was advantageous and so HAC was widely used in the mixes. However, the later understood reduction in strength over time eventually led to its banned use as part of concrete mixes in structural elements. Therefore, to undertake the structural design, samples of the concrete should be tested to allow for the relevant reduced strength values to be used if found.

4.4 Foundations:

4.4.1 Foundations should be confirmed for adequacy as their sizes could not be ascertained onsite. As there was little sign of movement to the frame via the foundation they are expected to be sufficient for load bearing. However, they will require size confirmation prior to construction.

4.5 Floor:

4.5.1 The existing ground floor slab will need to consider the necessary damp proof membranes, insulation, and finishes required for conversion.

4.5.2 Due to the adjacent retaining wall the slab is expected to have been built either off extensive compacted fill or suspended between foundations.

4.5.3 If the floor slab is found to be suspended, confirmation of the existing reinforcement will be required to confirm structural capacity. However, currently housing parked vehicles with an accepted loading of 2.5kN/m^2, A comparative domestic requirement of 1.5kN/m^2 is expected to be achievable with an additional allowance for partitions and finishes.

4.5.4 If the slab is found to be ground bearing, an assessment on the settlement of the fill should be considered. However, due to the long term existence of the current slab and historic loading, domestic reuse is expected to be acceptable.

4.5.5 The floor slab may be contributing to the stability of the retaining wall. Any removal of the slab would need to consider the effect on the retaining wall.

4.6 Stability:

4.6.1 The existing portal haunches need to remain in whole along with the southern run of block work unless replacement bracing is used.

4.6.2 Justification for the vertical cantilever action of the columns on the North elevation should be justified or an additional vertical bracing run added.

4.6.3 Roof bracing should be added to definitively provide plan bracing.

4.7 Façade:

4.7.1 New walls or cladding will also need to consider the appropriate build-ups and details to achieve a domestic standard. The fixing detail to the existing walls and frame will need to be developed.

4.7.2 Repairs to the blockwork wall should be undertaken with consideration to the walls providing stability to the frame unless bracing is added.

4.8 Guttering and drainage

4.8.1 New below ground drainage will need to be addressed for foul and surface water.

4.9 Retaining Wall:

4.9.1 While there were no concerning signs of large cracking or movement to the blockwork wall below the floor level, the retaining wall build up and construction details should be confirmed to ensure the required factors of safety can be achieved.

4.9.2 Allowance for strengthening of the wall should be considered.

5. Conclusion

5.1 Based on the visual assessment and subject to the points outlined within this report, we judge that the existing structures are suitable for conversion but allowing for minor structural strengthening works and repairs along with the recommended testing.

5.2 An engineer should review the proposed loadings and alterations of the final proposed designs prior to any construction.

Report prepared by Alexander J D Kyte MEng (Hons), CEng MICE

[redacted]

On behalf of KYTEX LTD.

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APPENDIX I

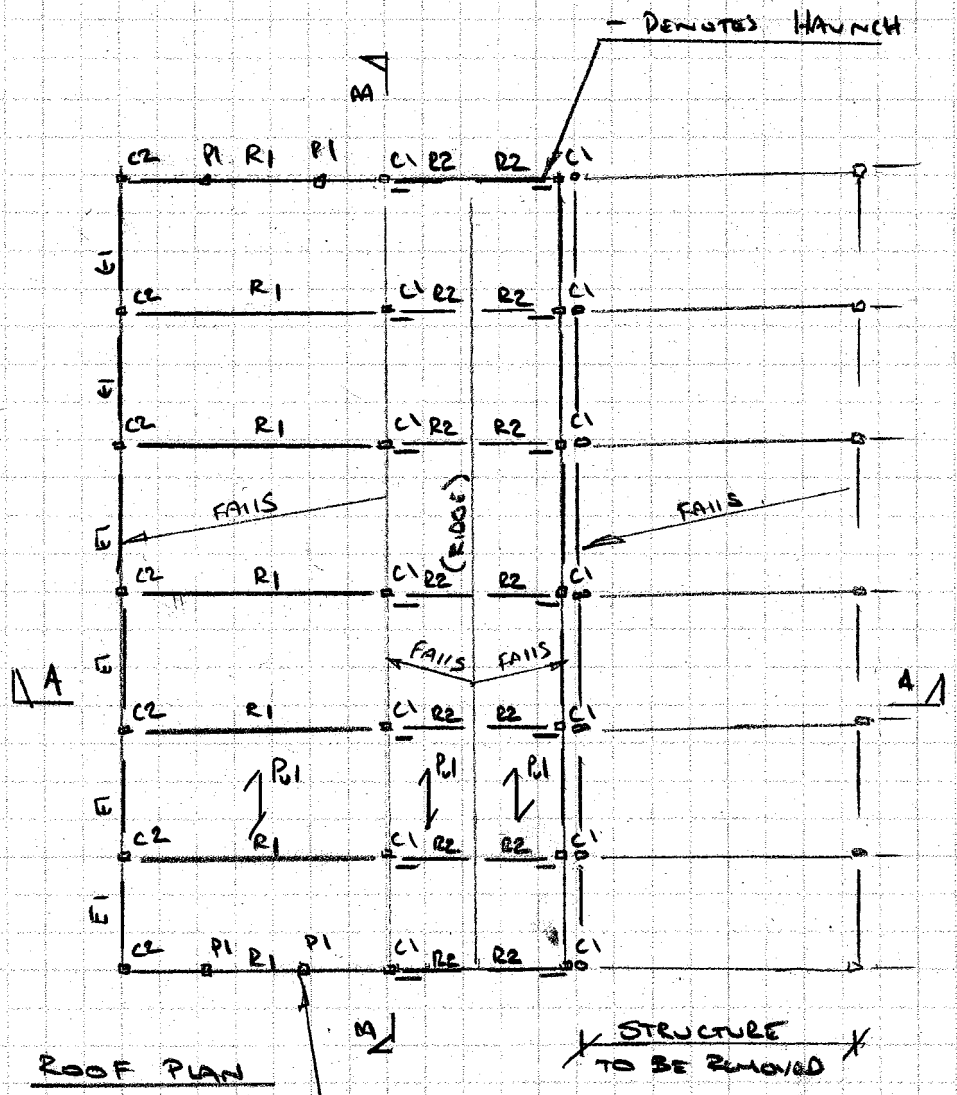
KYTEX LTD

CIVIL AND STRUCTURAL DESIGN CONSULTANTS

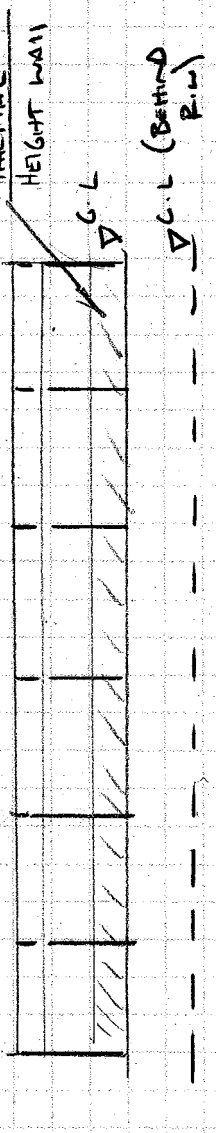
KYTEX LTD.
CIVIL & STRUCTURAL DESIGN CONSULTANTS

PROJECT TITLE:	UPPERHOUSE FARM
PROJECT NO.:	2021065
DATE:	02/02/2022
BY:	XK
CHECK:	[redacted]

STRUCTURAL G.A.



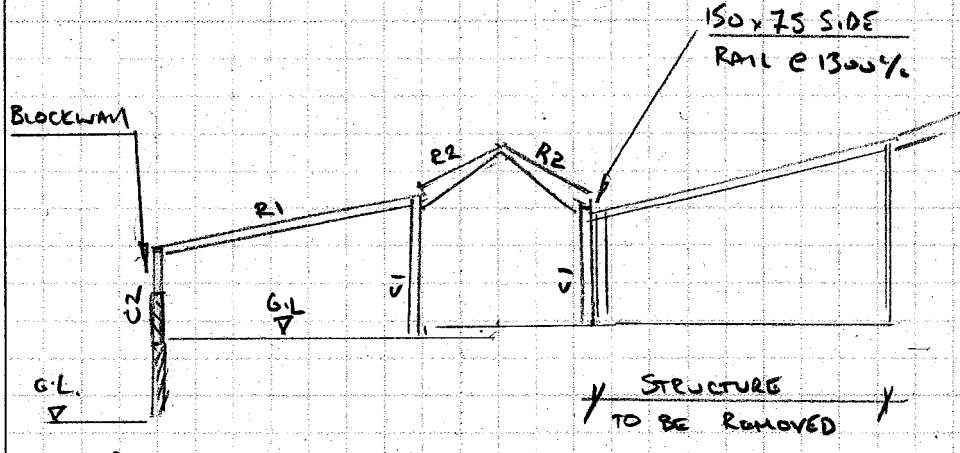
ROOF PLAN



TYPICAL SECTION (B-B)

KEY

C1: 180 x 300
C2: 250 x 150
R1: 450 x 80 'T' BEAM
E1: 200 x 250 EAVES BEAM
P1: 150 x 150
P1: 200 Dp CONC. PURLIN @ 1300 c/c.



TYPICAL SECTION (A-A)

6. Addendum

6.1 Following receipt of the proposed alteration drawings RRA4049 P(0)102REV A–JAN22, KYTEX LTD. have been able to review the drawings in respect to confirming whether the structural aspect of the proposal resembles a conversion.

6.2 The existing façade, roof and primary structure are largely remaining. Considering the North boundary is already enclosed (within a building) then the cladding infill is only required to the 2 partially filled gables. The existing clad or enclosed elevations equates to 275m^2 where the new infill is less than 50m^2. This approximates to an increase in coverage of the overall façade of 15 to 20% (excluding the pitched roof faces).

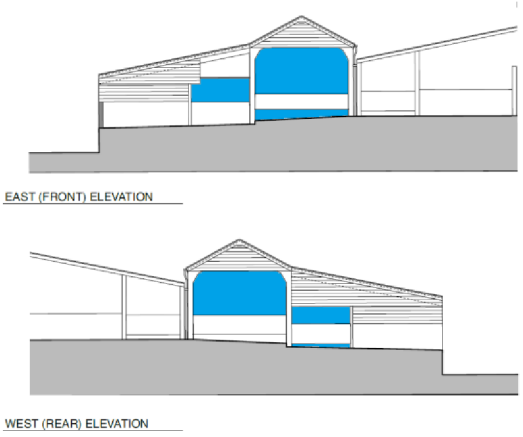


Figure 2: Infill area to the gables in blue

6.3 New secondary supports and trims will be required for the new openings; however, this is expected to be supported off the existing primary structure.

6.4 Restraint and tie details still will need to be developed as the architectural details are progressed.

6.5 Connections and supports will need to be considered for partitions, insulated walls, ceiling etc. but this will be internal works only. This is highly unlikely to affect the integrity of the frame and where lightweight construction options are used, it unlikely to add any significant loading that will cause sections to exceed their current stresses.

6.6 The existing structural load path will remain the same, utilising the existing portal rafter and columns.

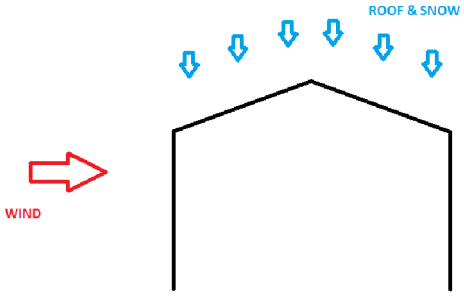


Figure 3: Load to Portal frame (typical section)

6.7 In summary, KYTEX perceives the proposal as a converted structure as opposed to a new structure.