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RIBA Stage 2 Report

For

Suitability of Conversion of Existing Agricultural Building into Residential Dwelling

At

Gardeners Farm
Flowers Lane
Plaitford SO51 6HH

Client:	Clydesdale Group Ltd.
Architect:	Trinity Rose Architecture
Job Ref:	23811
Document Number:	23811-GAP-ZZ-XX-RP-S-0001
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Revision History:

Rev	Date	Issued	Checked	Description
P01	19.01.24	JB	JR	First Issue for review/comment.
P02	26.01.24	JB	JR	Updated to further arboricultural information.
P03	21.03.24	JB	JR	Updated to further arboricultural comment regarding RPA for tree T10.

1.0 Brief

Godsell Arnold Partnership Ltd. (GAP Ltd.) were instructed to carry out a structural assessment of an existing agricultural structure at Gardeners Farm, Flowers Lane, Plaitford. The client, Clydesdale Group, intends to convert the building into new residential dwellings. The purpose of this report is to assess the suitability of the existing structure for reuse, and to provide outline details of any remediation/strengthening works deemed necessary to facilitate the conversion. It is not intended as a detailed condition survey; work has been undertaken in this respect by a chartered surveyor (ref: Trinity Rose report B23-1305 v1 dated 28th July 2023).

2.0 Extent and Limitations of Report

Our observations have been limited to a visual examination of the readily accessible surfaces of specific areas of the structure on which our opinion has been sought. No inspection was made of parts of the structure which were covered, unexposed or inaccessible. Accordingly, GAP Ltd. are unable to report that any such part of the structure is free from defects. No testing or detailed calculations have been carried out and so no definitive comments are made as to the adequacy of the structure. This report corresponds to Stage 2 as outlined in the Institution of Structural Engineers modified version of the RIBA Plan of Work (Concept Design) and is not intended to represent a final detailed design suitable for construction.

3.0 Building History & Records

At the time of writing no engineering or survey drawings for the original structure were available from the client. The information regarding the existing structure has therefore been taken from site observations and from associated surveyor's reports made available to GAP Ltd.

4.0 Structural Inspection

An engineer from GAP Ltd. visited the site on 9th November 2023 to carry out a visual inspection of the existing structure and surrounds. Some elements of the structure were also measured using a laser distance measure and digital inclinometer.

5.0 Outline Description of Structure

5.1 The structure is a cart barn, rectangular on plan, with approximate dimensions of 14.0m in length and 7.0m in width. It is currently being used as general agricultural storage and is partially overgrown with vegetation. There are walls on 3 sides constructed from a single leaf of 100mm aggregate blockwork laid in sand/cement mortar, with the front being fully open. The walls include stiffening piers at regular intervals on the outer face.

5.2 The roof is mono-pitched, sloping from front down to back, and is constructed from shallow profiled-metal decking sheets, spanning between timber purlins. The timber purlins span between the side walls and two timber frames, formed from twin-timber members supported on two circular timber columns, splitting the structure into 3-bays of approximately 3m bays.

5.3 The floor is constructed from a rough concrete slab of unknown thickness.

5.4 A more thorough description of the existing building and its condition is given in the surveyor's report produced by Trinity Rose reference B23-1305 v1 (dated 28.07.2023).

5.5 The foundations are understood to be 450mm wide mass concrete strip footings, the top of which is 250mm below ground level, as logged through trial pits undertaken by the surveyor.

6.0 Site/Ground Conditions

6.1 The site where the barn is located is roughly flat and level, and grass covered. To the side there is a hedgerow, and there is significant vegetation and several large trees within the vicinity.

6.2 No site-specific geotechnical testing has been undertaken however from geological mapping the site is expected to be underlain with the Whitecliffe and Nursling Sands formation. This formation is described as 'sand' however the nearest borehole record available within the same stratum records the top layer of soil as 'stiff buff coloured clay'. It is reasonable to assume, until further information can be ascertained, that there is the potential for shrinkable soils to be present at the site.

6.3 An initial arboricultural assessment has been carried out by Eco Urban Arboricultural which has identified trees of a category suitable for retention in the vicinity of the structure. There is one Root Protection Area (RPAs) that will be established which marginally interacts with the existing foundations and ground floor (refer ECO 1 – 231594 Tree Constraints Plan, EcoUrban Arboricultural).

7.0 Architectural Proposals

7.1 Proposals for the new dwelling are detailed on Trinity Rose Architecture drawing B23-1305-P-102 – 'Building 2 Existing & Proposed Floor Plan & Elevations'. The proposals show the front of the barn enclosed with glazed windows, doors, and cladding. Interior space has been divided into rooms using partition walls. The two internal timber posts are retained and incorporated into the partitions, and the two posts on the exterior line are outside, in front of the new envelope.

7.2 New windows are provided to the South side elevation and the North side elevation.

Figure 1: Extract from Architectural proposal drawings

8.0 Structural Recommendations (Roof)

8.1 The existing roof covering is formed from profiled metal deck sheeting. The sheeting condition is good with no signs of corrosion or damage/deformation. It is considered that the sheeting is still fully

serviceable and, structurally, may be retained as part of the proposals. The arrangement of the sheeting is currently in 6 approximately equal spans of around 1.2m each. A calculation should be made to prove the decking is suitable at this span to carry the required roof imposed, snow and wind loadings to satisfy the building regulations and the requirements of BS EN1991 part 1. If the roof decking is found to be unable to support the final loading, additional supported in the form of additional timber members below would be required to reduce the span lengths, or a different roofing system would be needed in replacement. If a different roofing system was used the impact of any weight change would need to be allowed for in design checks of the roof timbers.

8.2 The fixings of the sheets to the purlins have not been surveyed but if they are intended to be retained, they should be checked to ensure that they are of suitable type and frequency to secure the sheeting during the case of wind uplift. Sheeting laps may need to be checked to ensure they are in accordance with manufacturer recommendations to mitigate against blown rainwater ingress.

8.3 The roof purlins are timber members, nominally 150mm deep, and spanning about 4.5m between walls/support beams. While these appear in reasonably condition and have been serviceable in an agricultural application, they are unlikely to have sufficient capacity to carry the roof loadings associated with the conversion, and strengthening will likely be required. In its simplest form this could be by providing additional timber purlins to reduce the amount of roof that each purlin is required to carry. Alternatively an additional line of support in the form of beams and additional frames at midpoints could be provided to reduce the span of the purlins to 2.25m.

8.4 Initial calculations (with assumptions as to final roof weight) suggest that, over the required span of 4.5m, for the first option a deeper member than 150mm is likely to be needed, therefore it is anticipated that new timber purlins would need to be installed alongside (and to replace) the existing.

8.5 The timber frames are constructed from circular timber posts and twin timber crossmembers, also of approximately 150mm depth. The maximum span of these beams between points of support is roughly 3.6m, and they carry (at maximum) approximately a 2.25m width of roof (per one member of each twin beam). Initial calculations show that these are unlikely to be of sufficient strength to support the new roof and would need to be replaced with deeper/wider timber members or strengthened by fixing additional timber members to increase the section size.

8.6 The timber columns are considered to be of sufficient strength to carry the new roof loads. The condition of the columns was found to be generally reasonable, and therefore they should be suitable for retention in the proposed scheme. The posts appear to be repurposed utility poles and as such are likely to have received a preservative wood treatment. As some of the posts are planned to be incorporate in internal spaces consideration may need to be given to any measures needed to mitigate any negative effects on human health. Retreatment to ensure the longevity of the timber would also be appropriate as suggested in the Trinity Rose report.

8.7 The final roof build up will need to be altered to include for ventilation, insulation, weatherproofing etc. Strapping of the roof structure to the external walls will need to be included/enhanced to meet the requirements of the Building Regulations Approved Document A.

9.0 Structural Recommendations (Walls)

9.1 The existing blockwork masonry walls are of sound construction and in good condition generally.

9.2 The proposals would involve the creation of an inner leaf (likely structural timber/metal studwork) which would be tied to the existing walls which would act as the outer leaf. Additionally the front of the structure, which is currently open, would be closed with a new external wall. Both of these factors will act to enhance the stability and restraint of the existing masonry, without appreciable increasing the loading on the walls. It is therefore considered that that the existing masonry walls are suitable for retention and reuse in the new scheme.

9.3 Some minor cracking has been noted by the building surveyor and this was visible during our visit. We agree that these can be locally repaired, as per the recommendations, and do not represent an issue to the structural performance of the walls. The inclusion of movement joints, also as suggested, is a prudent step. This would be particularly beneficial if the external walls are to be covered in sensitive finishes like render.

9.4 New window openings are intended to be cut into the side elevations of blockwork, and suitable lintels will be required. While the formation of openings will weaken the panel with respect to lateral wind forces, the new inner leaf structure can be suitably design/specified to ensure sufficient strength in the final condition.

10.0 Structural Recommendations (Foundations)

10.1 The existing structural foundations are strip footings of approximately 450mm wide mass concrete, as recorded by Trinity Rose in an excavated trial pit. The top of the footing was noted as being 250mm below existing ground level, but the underside of footing (founding depth) was not recorded. It is anticipated that, due to the use of the structure as an agricultural building, that the footings are shallow and are consistent size under all walls. The timber posts are assumed to sit on mass concrete pad foundations; however this has not been proven.

10.2 Further investigation, through trial-pitting, would be needed to confirm the presence and size of foundations to the timber posts, and to confirm the founding depth of the pads and the perimeter strip footings.

10.3 An assessment of the soils beneath the structure would also be needed, ascertained through basic Ground Investigation and testing, to provide information about the volume-change potential of the soils (if cohesive) and to determine a suitable bearing capacity value.

10.4 The applied bearing pressures based on the calculated weight of the converted structure and the size of the existing footings would need to be compared to the allowable value to confirm that the proposed final structure would not overstress the ground.

10.5 Based on the soil types identified a minimum founding level can be established based on the requirements of Approved Document A, to ensure that the structure will not be negatively affected by frost heave.

10.6 If shrinkable soils are present the founding depth will need to be increased to the increased minimum requirements of Approved Document A. Additionally, as trees are present nearby, an assessment would be required to determine if the founding depth would need to be further increased, and whether any heave protection is needed.

10.7 Based on the above it is likely that some enhancement of the foundations will be required to achieve the intended conversion. If the calculated minimum footing depths and allowable bearing pressures

are not achieved by the existing footings then these would need to be deepened and/or enlarged by underpinning new mass concrete strip footings under the existing, in sequence.

10.8 An additional strip footing (if not already present as is assumed) would be needed along the front of the building, to support the new façade and to ensure minimum footing depths are achieve adjacent the floor slab.

10.9 In the event that the footing depth calculated is required to be so deep as to make excavation impractical, an alternative approach would be to introduce piling to support the structure. This would likely take the form of a grid of low/moderate capacity piles, onto which a reinforced insitu concrete suspended slab could be cast. The slab would be pocketed into the blockwork walls at intervals, effectively supporting the existing structure on the piles. The connection between the walls and the existing footings would then be removed to isolate the structure from any heave potential from the surrounding ground. Heave protection would be required beneath the slab to prevent against uplift. The pile type could be either helical screw piles, driven tubular mini-piles, or other suitable system. Advice from a specialist installer would be needed, with pile capacities likely confirmed through insitu testing at time of installation (avoiding need for comprehensive ground testing).

10.10 As previously mentioned, there is a root protection area which marginally interacts with the corner of the footprint of the building (tree T10). The arboricultural specialist has confirmed that this small incursion into the RPA, based on a moderate increase in footing width and a working zone allowance, is acceptable and will not cause any significant damage to the tree. Any works within this zone would need to be undertaken carefully and in accordance with the method statement provided by the arboricultural consultant. In the event that foundation enhancement is required such that more extensive excavations are needed, the piled solution outlined above may be the more suitable option.

11.0 Structural Recommendations (Floor)

11.1 If it is confirmed that there is no risk from ground heave the existing floor slab may be suitable for reuse, however the concrete thickness would need to be established to confirm suitability. The proposed new loadings associated with residential use are unlikely to be greater than the floor has been subjected to in current service. At the time of visit, the slab was partly covered with stored materials and plant, and with overgrown vegetation and debris. Should the slab be retained it would need to be cleared so a more detailed inspection can be carried out, and any defects damage addressed accordingly. Waterproofing, insulation, and a levelling screed will be needed to create a suitable internal floor.

11.2 If shrinkable soils are found to be present, a ground bearing slab would not be suitable due to the risk of heave, and a suspended floor would be required. The most suitable choice would likely be timber, to control the amount of additional load added to the structure, however pre-cast beam and block flooring or an insitu suspended slab with heave protection could also be considered if the foundations can be justified for the load. Additional sleeper walls and footings may be needed to control the span depth; however it is feasible to span a suitable flooring system front to back without additional support. The suspended floor may be able to be cast 'hovering' over the existing if final levels permit. However a ventilated void would be needed which may require the removal of the existing concrete.

11.3 If a piled slab solution is pursued, then heave protection would be needed beneath the slab if shrinkable soils are present.

12.0 Conclusions and Discussion

12.1 The existing superstructure is generally sound and of competent construction. With the discussed strengthening to the roof structure and the addition of a braced internal SFS/timber inner leaf, it is considered that the building would be suitable for the proposed conversion into a residential dwelling.

12.2 Further investigation would be needed to confirm existing foundations and to determine the soil types/strengths below the building. Calculation work (at Stage 3) would then determine the required approach to ensuring the foundations are satisfactory and meet the requirements of the building regulations for the finished dwelling. Strengthening to the foundations may be required and, depending on the presence of shrinkable soils (clay), deeper or alternative (piled) foundations may be needed.

12.3 The existing floor slab may be suitable for reuse, subject to the results of the ground testing. A suspended solution would be required if shrinkable soils (clay) are present.

12.4 If these steps are taken, we feel that the existing structure may successfully be converted as per the proposals (Class Q permitted development) and satisfy the requirements of Approved Document A of the Building Regulations.

We trust this report is clear and in accordance with your expectations. However, if you have any queries or would like to discuss any points in more detail, please do not hesitate to contact us.

Yours sincerely,

James Bohane BSc (Hons) MSc CEng MICE

Senior Project Engineer

For and on Behalf of Godsell Arnold Partnership Ltd.

Appendix A. Photographic Record

Figure 2: Existing Floor Slab

Figure 3: Internal view

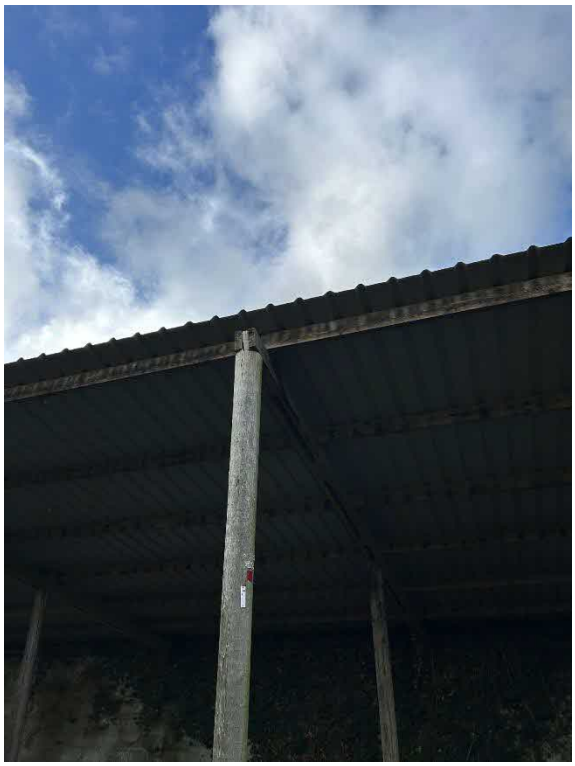

Figure 4: Timber frame (external view)

Figure 5: Post-roof connection

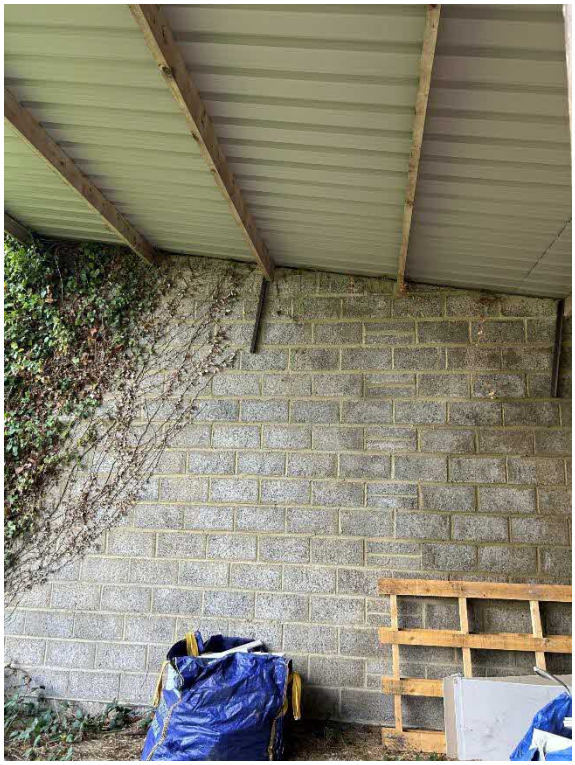

Figure 6: Side blockwork wall

Figure 7: base of blockwork wall (internal)