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## STRUCTURAL APPRAISAL

PROPOSED CONVERSION OF BARN TO A DWELLING AT  
SOUTHOLT HALL BARN, SOUTHOLT, EYE, IP23 7TN


On behalf of Mark and Trudie Beckham


Version V1 – 18<sup>th</sup> December 2020

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## Quality Assurance

Report Title: Structural Appraisal – Version 1  
Project: Proposed Conversion of Southolt Hall Barn  
Client: Mark and Trudie Beckham  
Date: 18<sup>th</sup> December 2020

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## 1 Introduction

Frith Blake Consulting Ltd were instructed by Mark and Trudie Beckham (The client) to undertake a structural appraisal of Southolt Hall Barn, Southolt Road, Southolt, Eye, IP23 7TN. The barn is located north of Southolt Hall and comprises a double height timber framed Suffolk Barn with a central entrance porch to the north elevation, a single storey monopitch annex to the north west corner and two single storey masonry wings to the south elevation forming a traditional farmyard. The barn complex is highlighted below:



Figure 1.1: Southolt Hall Barn Reference Plan

The survey has been undertaken with a view to conserving the heritage of the barns as an integral part of the proposed development.

The purpose of this report is to comment on the condition of the structural fabric of the barn and to determine whether it is structurally viable to convert the building for the proposed use, as well as to provide commentary on how the significant historic elements will be retained during the works, whilst maintaining the structural stability.

This report does not make detailed comments on structural modifications, as details of the proposed conversions are at an outline stage only at the time of writing this report. There are general comments on the viability of the proposals.

The report will make reference to the setting of the building and its' heritage, however, it is not intended to provide a Heritage Appraisal.

## 2 Limitations

This report is based on an appraisal of elements visible from ground level externally and ground floor level internally, with the exception of access to the mezzanine floor. Some areas of the frame were concealed by internal ply sheathing. We can therefore not accept responsibility for items which were not seen at the time of the inspection, nor made aware of. No intrusive investigation works to determine the extent and condition of foundations or concealed structures have been undertaken at this stage.

This report is based on conditions which were apparent at the time of our inspection in December 2020. Some of the defects noted are considered progressive and we cannot therefore accept conditions which may occur at other times. The appraisal is not intended to form a detailed schedule of all required repairs at this stage, but to highlight the overall condition of principal structural members and the viability of the proposed works.

The appraisal covers structural aspects of the building only and comments made on any other aspects are noted for information only and should be verified by a specialist in that particular field. Any other issues noted within the report are for information only and should not be relied upon.

This information is provided as sole use for the named client and is confidential to them and their professional advisors. No responsibility to other parties will be accepted.

Recommendations made within this report represent the views of Frith Blake Consulting Ltd acting as Chartered Structural Engineers with 20 years relevant experience in Conservation Engineering and the Assessment of Historic Buildings.

## 3 Site Description

### 3.1 Location

- The site is located approximately 1km North East of Southolt. The site address is Southolt Hall, Southolt Road, Southolt, Eye, IP23 7TN.
- The location is indicated on the below map extract and aerial photograph included below.

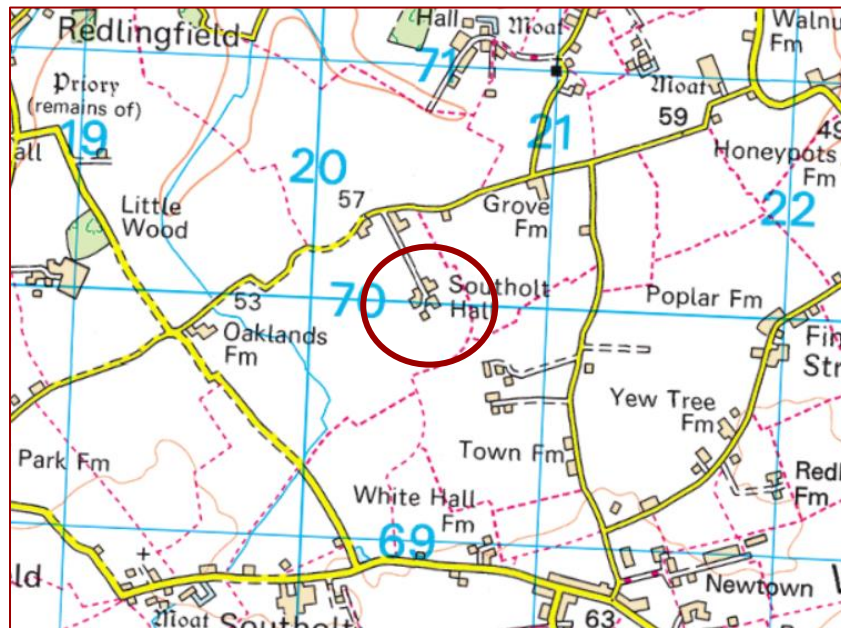


Figure 3.1: Site Location Plan



Figure 3.2: Aerial photograph

### 3.2 Site Description

To the South of the barn are a cluster of single storey barns separating the site from Southolt Hall. To the east of the barn are paddocks separating the site from agricultural land. To the north is agricultural land and an access track separating the site from Southolt Road to the north. To the west are paddocks separating the site from agricultural land.

The site is accessed via an unmade track to the north from Southolt Road. The site is broadly flat with no significant falls.

### 3.3 Proposed Development

Planning Permission is being sought to convert the existing agricultural barns into a single residential dwelling. The proposals include the demolition of the existing canopy between the east and west wings. The proposals also include the addition of a new detached cartlodge, a new single storey annex to the north east corner and the addition of first floor mezzanine floors linked by a bridge.

The proposed conversion is at an outline stage and therefore the proposals are discussed in general terms throughout the report. The below plan indicates the proposed development:

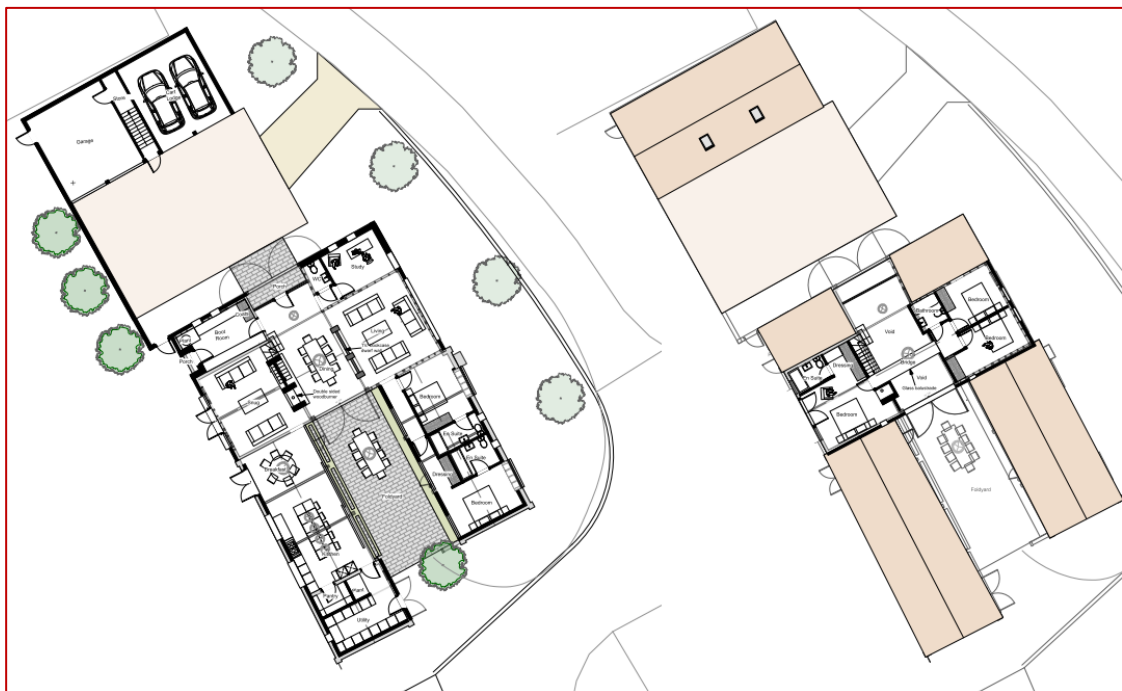


Figure 3.3: Proposed Development

## 4 Site Observations

### 4.1 Introduction

The following descriptions of the building structures are intended to highlight any significant defects and any constraints that may impact on the technical viability of converting the barns. It is not intended to provide a detailed schedule of repairs that would be required as the scheme progresses beyond planning.

No intrusive investigation works were undertaken, and the extent and depth of foundations were not determined. Observations on historic or progressive movement based on the settlement or rotation of foundations are based on our experience with other similar buildings and will need to be verified through investigation works.

All repairs are discussed below and as the scheme progresses beyond planning, these will be scheduled in detail and agreed with all relevant parties.

### 4.2 General

There are typical defects present throughout the barn complex, which are too frequent to identify on each building.

Typical repairs that would be required throughout are summarised as follows:

- Replace missing, loose, cracked or badly spalled brickwork with matching masonry and mortar.
- Repair minor cracking using helibar reinforcement and repointing.
- Clear vegetation and clean moss and algae growth from brickwork, repair masonry and repoint as necessary.
- Repoint using lime mortar, where pointing is loose or missing, or has been unsympathetically repointed in the past.
- Repair rotten timber with like for like sections spliced to existing or replace elements with significant section loss.

#### **Main Barn:**

The barn comprises as two-story timber framed barn built off a soft red brick plinth with a main central entrance porch to the north elevation and a single-story lean-to to the north west corner.

### 4.3 Main Barn External Elevations:

The west elevation comprises the double storey timber barn built off a soft red brick plinth. To the north end a single-story annex has been added. This appears to be more recent as the



weather boarding and brick plinth are in better condition. The masonry plinth to the main barn has bowed outwards in the centre which is reflected in the displacement of the timber frame above. Locally the masonry plinth is displaying cracking indicative of the rotation and movement noted. The plinth has been historically painted with bituminous paint which is spoiled and peeling off in some areas. At either end of the plinth where the movement is less apparent, the plinth is in reasonable condition. There has been some more modern repairs and repointing using cement-based mortar which would need to be removed as part of the proposed conversion.

Where the plinth has rotated it is still structurally sound and through stabilisation of the frame above is still considered to be adequate for use within the proposed conversion. The requirement for local stabilisation of the foundations would need to be investigated further.

The timber frame above has windows and hayloft access. The weatherboarding appears to be in reasonable condition indicating that the movement of the underlying frame is not progressive. The rainwater goods to the principal roof are still operational. There is a single access door to the northern annex.

The western end of the north elevation is formed from the single-story annex. This comprises timber frame with weatherboard cladding over the soft red brick plinth. The plinth has been rendered using a cement-based render which would be removed as part of the proposed conversion. Central to the elevation are cart access doors with a lean-to mono pitch roof above. There is no apparent sign of displacement to the frame. The eastern end of the elevation comprises the side wall of the main barn.

The elevation has timber weatherboard cladding to the timber frame, which is built off a soft red brick masonry plinth. The plinth is displaying spalling brickwork and loss of mortar at ground level and there is some sign of minor rotation, however the plinth is generally in reasonable condition. Rainwater goods to the main corner of the principal barn are missing and should be replaced to prevent further deterioration.

The east elevation of the entrance porch comprises timber frame with timber weather boarding built off a red brick masonry plinth which has been rendered externally using a hard cement-based render. The elevation appears to be in reasonable condition. The corner post to the entrance doors is exposed externally and the foot of the post has rotted and would need to be repaired and elevated above ground level as part of the proposed conversion.

The east elevation of the principal barn comprises double height timber frame with timber weather boarding built off a soft red brick masonry plinth. The plinth has been repaired in some areas historically with cement-based mortar. The top header brick of the plinth is generally in poor condition with a loss of mortar and loose and friable brickwork. There is significant lateral displacement of the head of the plinth to the centre of the elevation. There are no significant

cracks or defects noted externally associated with this movement. This suggests that the plinth can be repaired and retained as part of the conversion, however comments made on the internal elevations should be noted.

The majority of the south elevation to the main barn is concealed by the east and west wings. Those areas that are exposed comprise timber weather board cladding to the timber frame with the timber frame built off a soft red brick plinth. The plinth is displaying some rotation and lateral movement. The eastern end of the plinth appears to have been rebuilt in the past and has subsequently moved and rotated assumed to be associated with the movement of the east wing principal wall (discussed later). The cracking and movement have been historically repaired with cement-based mortar which has cracked again, displaying progressive movement. The remaining section of the plinth has had some adhoc unsympathetic repairs using cement-based mortar. The plinth is in reasonable condition despite the outward movement and could be reused as part of the proposed development with appropriate repairs and stabilisation of the frame above. There is significant loss of mortar at low level, particularly where the concrete slab to the east and west wings meet the wall, this would need to be repointed as part of the proposed conversion.

The section of masonry exposed under the principal entrance doors is in poor condition with significant loss of face brick work and mortar. There is a concrete plinth been added above the brick work which will have contributed to the deterioration of the brickwork below. It is assumed that this brickwork would be rebuilt as part of the proposed conversion.

To the centre of the south elevation is a double height entrance door. The original framing to the door has subsequently been strengthened with timber sections coaxed screwed to the original posts. The original timberwork is in relatively poor condition. It is soft and is displaying significant section loss and would require repair as part of the conversion. The roof structure above is no longer loading onto the lintel above the door with a new intermediate purlin added taking the loads back to the principal eaves level ties. The timber work framing the entrance doors are assumed to be replaced and repaired as part of the proposed conversion.

The western end of the south elevation is primarily concealed by the western wing, the areas exposed comprise timber weather boarding protecting the timber frame. The timber frame is built off a soft brick plinth. The plinth is in reasonable condition and is not displaying any significant signs of rotation or lateral movement. There is mortar loss throughout, particularly at low level at the abutment to the concrete slab forming the floor of the western wing. The bond of the plinth to the west wall of the west wing is difficult to define and this should be adequately tied and stitched as part of the proposed conversion.

The eastern end of the north elevation is covered by the north annex, those areas that are exposed comprise timber weather boarding over the principal timber frame built off soft red

brick plinth. The plinth is displaying significant mortar loss in some areas, and in other areas has been covered with a cement-based render. Which would need to be removed as part of proposed conversion.

There are signs of movement at the junction with the eastern plinth with separation gap of approximately 50mm, there appears to be historically some rebuilding at this part of the wall, this would need to be infilled and stitched as part of the proposed conversion.

#### **4.4 Main Barn External Roof**

The roof to the main barn has a clay pantile finish. There is some displacement of the ridge line as well as lateral displacement along sides of the barn indicative of historic movement and failure of the roof structure. The roof has been stabilised and the roof alignment could be retained as part of the proposed conversion, or the ridge line reinstated horizontal depending on the architectural detailing. The rainwater goods are generally currently intact and appear to be functioning well with the exception of the north east corner.

#### **4.5 Main Barn Internal Elevations**

The east elevation comprises a timber frame formed from principal timber posts supporting an eaves level principal tie. There are intermediate timber studs, and integral diagonal bracing. The principal timbers are in reasonable condition although there are sections that have been replaced with spliced new timber work throughout. There has clearly been historic lateral movement and separation of joints, particularly at the interface of the diagonal braces with the principal timber posts. The sole plate has been encased in concrete and therefore it is assumed to have fully rotted along with the base of the principal posts and the intermediate studs.

The internal face of the masonry plinth has been rendered in a cement-based render. The render is cracking and there is sign of lateral displacement of the plinth. The render would need to be carefully removed and the plinth repaired. The extent of repairs would be subject to investigation works. It is possible that the deterioration of the brickwork behind the render will be significant and therefore sections of plinth may need to be rebuilt.

There is a low-level timber wall plate bolted to the plinth which is assumed to be associated with preventing or limiting the lateral spread of the side walls and the plinth. The decision on whether the plinth can be retained would be made further to the removal of the render and the condition of the wall plate above.

There is a significant outward bow to the plinth and the wall plate, indicative of historic movement, however elements of the frame can be retained as part of the proposed conversion.

The eastern end of the south elevation comprises timber wall plate built off soft red brick plinth supporting the principal and intermediate timber studs with integral diagonal bracing. The timber studs support an eaves level wall plate. A significant proportion of the timbers have been

historically replaced and the framework is generally in reasonable condition. There is some outward movement of the plinth, albeit not as significant as other elevations. The sole plate is in reasonable condition and with some localised repairs could be retained as part of the proposed development. The eastern end of the plinth has cracked at the abutment to the east elevation indicative of the rotation and outward movement of the eastern plinth. The internal face of the plinth has been rendered with a hard cement-based render. This would need to be removed and the condition of the underlying brickwork assessed. Given that there is no significant cracking or outward movement, it is assumed that this section of plinth could be retained as part of the proposed conversion.

The western end of the southern elevation has a mezzanine floor at ground level. The wall has been lined with ply sheathing and therefore the condition of the original timber frame cannot be assessed. At first floor level the lower section of the wall has been lined with ply and therefore cannot be inspected. The eaves level wall plate appears to be in reasonable condition, there is some indication of outwards movement and intermediate steel lateral ties have been introduced to prevent further spread of the barn. The heads of the studs in some areas are detached from the plate and there has been some more recent strengthening to the studs installed, although this is difficult to ascertain with the ply boxing blocking the majority of the detail.

The west elevation at first floor level the eaves level tie as rotted and is no longer attached to the south elevation. This junction has been locally strengthened by a diagonal brace across the corner and ply sheathing applied to the internal face of the studs. Above the eave level wall plate a more modern stud work wall has been introduced to frame out the window. At ground floor level the internal elevation is not visible due to ply sheathing applied to the inside face of the walls.

At first floor level at the western end of the north elevation the eaves level wall plate is displaying significant lateral displacement and additional steel tie rods have been introduced to prevent further lateral movement and deterioration of the frame. The remaining studs appear to be in reasonable condition and with formalisation of the lateral ties the framing can be retained as part of a proposed conversion. There has been water ingress in both corners at high level which has resulted in deterioration of the integral diagonal brace and some movement in the timber joints. Central to the north elevation is the principal framework to the entrance porch which appears to be in reasonable condition. There are solid timber haunches forming the principal connections. There is some slippage of the joint in the wall plate above the western haunch and this has been repaired in an adhoc fashion with a modern timber coach-screwed to the face of the timberwork. There is displacement of approximately 40mm at this junction.

The eastern end of the north elevation comprises principal timber posts and infill studs with integral diagonal bracing. The majority of the infill studs and diagonal bracing have been

replaced in the past with a central and corner principal post still remaining as original. The sole plate is exposed from the porch to the central timber post and is in an acceptable condition. The sole plate towards the eastern corner has been encased in concrete and the condition is therefore assumed to be poor.

There is a loss of junction between the studs and the sole plate where the concrete encasement occurs. The framework is built off a masonry plinth which has displaced laterally and rotated. It has been rendered on the internal face with a cement-based render. This has resulted in deterioration of the brickwork below. There is cracking in the render indicative of further lateral movement, the suitability of the plinth for retention in the scheme is subject to removing the render and assessing the condition of the underlying brickwork.

There is a significant historical lateral movement at eaves level and intermediate steel tie rods have been installed to limit any further movement. There is no indication that the movement is progressive. With a formalisation of the lateral ties the existing frame can be retained as part of the conversion.

#### **4.6 Main Barn Internal Roof Structure**

The roof structure comprises principal eave ties with solid haunched connections to the principal posts. There is an adhoc arrangement of diagonal struts which support collar ties and flying purlins, which in turn support common rafters at approximately 450 mm centres.

The roof structure has been replaced in the past with diagonal bracing fitted to the underside of the rafters and intermediate steel tie rods installed to prevent lateral movement on the eaves.

The principal eave level ties appear to be in reasonable condition, there is some deterioration of the solid timber haunches, particularly at the connections with the steel rods into the eaves level ties.

There is some adhoc propping of the collar ties to the roof above the mezzanine floor although there does not appear to be any significant recent movement of the roof structure. Above the southern entrance doors, a new purlin been introduced just above eaves level to remove load from the original trimmer above the cart doors.

#### **4.7 Main Barn Floor Construction**

The central area to the principal barn comprises brick pammets with infilled patches of concrete. The east end of the barn has been overlaid or replaced with concrete slab which is displaying numerous cracks and is in relatively poor condition.

The western end of the barn comprises stores and workshops and the concrete floor slab is in reasonable condition.

It is assumed that the floor slabs will be removed and lowered to accommodate insulation as part of the proposed conversion.

#### **East Wing:**

The east wing comprises a single storey masonry structure with open front facing the original farmyard to the west.

#### **4.8 East Wing External Elevations:**

The northern end of the east elevation has rotated and separated from the main barn historically and with a gap of approximately 50mm between the soft red brick wall and the plinth to the main barn. This has been strengthened in the past using a mass masonry buttress externally which appears to have prevented any significant progressive movement. Although there is a significant lean to the wall, with adequate tying of the proposed roof structure we would consider the movement to be acceptable as part of the conversion. It is possible that some further stabilisation to the foundations and buttress may be required further to more intrusive investigation. The brickwork away from this junction is generally in reasonable condition. There have been ventilation holes punched through the wall which would need to be infilled and repaired as part of the proposed conversion. The pointing typically is in good condition.

The south elevation comprises a soft red brick gabled wall with feature brickwork to each end and forming a corbelled plinth at low level. There is some loss of face of bricks throughout the elevation which would need to be repaired. This typically appears to be associated with areas of previous repairs using hard mortar. The brickwork is generally in reasonable condition. The rainwater goods to the east wing roof are still intact and appear to be operational. The brick pier to the western end of the south gable is displaying significant mortar loss, assumed to be associated with the failure of the surface water system in the past. There is some separation of this pier from the principal wall. The head of the pier would need to be rebuilt and the remaining pier repointed as part of the proposed barn conversion.

#### **4.9 East Wing External Roof**

The roof finishes comprise corrugated metal cladding. There is no sign of vertical or lateral displacement of the eaves and ridge, indicating that the roof structure is performing well. The rainwater goods are currently intact and appear to be functioning well.

#### **4.10 East Wing Internal Elevations**

The east elevation comprises soft red brick with lime mortar. There is some deterioration of the brick work, loss of face and some loss of pointing particularly at low level. However, the elevation is generally in reasonable condition. The exception relates to the noted movement at the northern end of the wall, with significant rotation of the wall and separation from the principal barn.

There is some separation noted between the internal low level block work walls and the external wall, indicative of this rotation of movement. There is also some sign of the timber ties separating from the principal wall. There is some minor cracking in the wall at the point at which the first timber tie is built into the wall which is assumed to be associated with the rotation and outward movement of the wall. This would be to be stitch repaired as part of the proposed conversion as well as more formal lateral restraints provided to the wall.

As noted on the external elevation, further investigation would be required to determine the requirement for any stabilisation of the foundations in this area. Despite the movement, with the formalisation of the roof ties the wall is considered suitable to incorporate into the proposed conversion.

#### **4.11 East Wing Internal Roof Structure**

The roof structure comprises a slightly adhoc arrangement of collar tied trusses at approximately 1.8m centres with flying ends to the rafters supported on timber wall plate above the eastern wall, and on a timber trimmer beam on the western side. A timber wall plate on the west is supported on an adhoc arrangement of timber props supported on concrete plinths. The roof structure appears to be in reasonable condition with no significant sign of movement. There are some intermediate timber principal ties with steel restraint straps to the wall plate and to the timber trimmer beam on the west side. It is assumed that the roof arrangement will be rationalised as part of the proposed conversion to formalise the arrangement of trusses, purlins and common rafters.

##### **West Wing:**

The west wing comprises a single storey masonry structure with open front facing the original farmyard to the east. The west wing projects further to the south than the east wing with an enclosed room forming the southern bay.

#### **4.12 West Wing External Elevations:**

The south elevation comprises a soft red brick gable wall comparable detail to the east wing. There is loss of the face of bricks throughout. There are some areas where repointing has been undertaken using cement-based mortar. This primarily appears to be associated with areas where historically rainwater has run down the brickwork and washed out the mortar. The elevation is in reasonable condition despite the loss of facing brick and with some repairs can be included as part of the proposed conversion.

The west elevation comprises soft red brick work with intermediate piers. There is a vertical crack to the brickwork at the southern end indicating separation of the gable wall from the side walls. This would need to be stitch repaired as part of the proposed conversion. There is loss of face of bricks throughout as well as loss of mortar, which would need to be repaired. There

are signs that some repointing has been undertaken using cement-based mortar which would appear to have accelerated the deterioration of the brickwork. With necessary repairs to the brickwork the elevation can be incorporated into the proposed conversion. There have been ventilation holes punched through the wall which would need to be infilled and repaired. At the northern end a former opening has been infilled with fletton brick work and consideration should be given to replacing this with soft red brickwork toothed into the adjacent panels.

#### **4.13 West Wing External Roof**

The roof finishes to the west wing comprise corrugated metal cladding. The ridge line and eaves line are not displaying any sign of vertical or lateral displacement suggesting that the roof structure is performing well. The rainwater goods are currently intact and appear to be functioning well.

#### **4.14 West Wing Internal Elevations**

The south elevation comprises 215mm thick wall reducing to half brick wall above eaves height. Internal elevation below eaves level is exposed soft red brick with some loss of face to the brick but is in relatively good condition. The half brick thick panel above eaves level has been historically rebuilt using fletton bricks and is in reasonable condition. Consideration should be given to rebuilding the panel in soft red bricks to match the original.

The west elevation comprises soft red brickwork. There is loss of face of bricks throughout and particularly at low level however the elevation appears to be in reasonable condition.

#### **4.15 West Wing Internal Roof Structure**

The roof structure comprises principal eaves level ties at approximately 4m centres, with diagonal and vertical props, propping intermediate purlins and a ridge plate, which in turn supports common rafters and a corrugated metal roof.

The roof structure is supported on a timber wall plate on the west elevation and on a timber trimmer beam to the east supported on intermediate timber posts set on concrete bases.

The roof structure is an adhoc arrangement there are some local repairs and doubling up of timbers, there is no sign of any significant vertical or lateral displacement of the roof structure indicating that it is performing adequately. It is assumed that the roof arrangement will be rationalised as part of the proposed conversion to formalise the arrangement of trusses, purlins and common rafters.

The southern room to the west wing roof structure comprises intermediate eaves level tie beams with purlin spanning between the southern gable and the intermediate blockwork. The purlins support rafters at approximately 1m centres which in turn support battens and corrugated metal roof.



#### 4.16 Northern Entrance Porch

The east elevation comprises timber frame, comprising principal timber studs and corner post with intermediate timber studs. Most of which have been replaced with more modern timbers. Timber work is built off a more modern sole plate, built off a replacement soft red brick plinth. The corner post is generally in reasonable condition, albeit the foot of the post has rotted at the abutment with the concrete slab externally.

The north elevation of the entrance porch is entirely made up from the cart doors, the framework to the cart doors is a more modern timber work, supporting the cut rafters above.

The West elevation comprises soft red brick plinth supporting timber sole plate and timber plate above. The intermediate timber studs have been strengthened and replaced in some areas; timber wall plate appears to be in reasonable condition. The plinth has been repointed using a cement-based mortar in some areas.

The roof structure comprises a more modern roof with felt finish, there is an intermediate principal purlin and a new timber trimmer strengthening the original eaves level plate.

Both of these support cut rafters that have been replaced relatively recently at eaves level they span onto a more modern trimmer which is supported on the principal corner post, supporting the cart doors.

The floor structure comprises a combination of concrete slab and brick pavers. It is assumed that the floor will be removed and lowered to accommodate insulation as part of the proposed conversion.

#### 4.17 North West Annex

The internal west elevation comprises timber frame built off soft red brick. The plinth is in reasonable condition as is the sole plate.

The north elevation comprises a more modern timber frame built off a soft red brick plinth. The plinth and the frame are in good condition.

The roof structure is more modern and comprises a mid-span purlin and a high-level purlin supporting cut timber rafters. The roof is in good condition.

The floor slab comprises a concrete slab which is at lower level than the Main Barn. The slab appears to be in reasonable condition although areas of the slab were concealed with muck.

## 5 Survey Photographs



Photo 1: General view of North Elevation



Photo 2: General view of East Elevation



Photo 3: General view of South Elevation



Photo 4: General view of West Elevation



Photo 5: View of East and West Wing



Photo 6: View of West Wing East Elevation



Photo 7: View of East Wing West Elevation



Photo 8: View of Main Barn South Elevation



Photo 9: View of Main Barn South Elevation



Photo 10: General internal view looking East



Photo 11: General internal view looking South



Photo 12: General internal view looking West



Photo 13: General internal view looking towards Northern porch



Photo 14: View of East Elevation of Northern porch



Photo 15: View of West Elevation of Northern porch



Photo 16: View of Western End ground floor of principal barn



Photo 17: View of first floor at the Western end of principal barn



Photo 18: View within northern annex looking at North elevation of principal barn



Photo 19: Internal view of northern annex



Photo 20: Internal view of northern annex

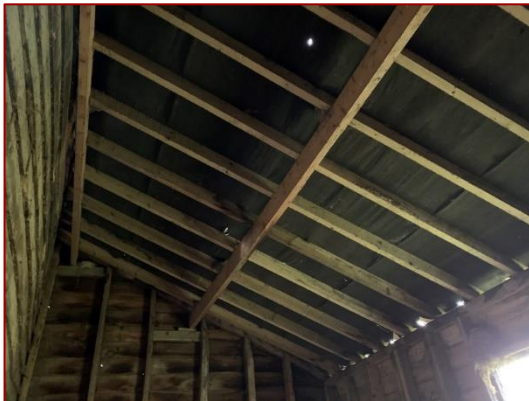


Photo 21: Roof structure to northern annex



Photo 22: Internal view to Southern end of West Wing



Photo 23: Internal view of Southern end of West Wing



Photo 24: Cracking in Masonry to East Wing



Photo 25: Cracking in masonry to East Wing



Photo 26: Cracking in Masonry to East Wing



Photo 27: Separation of Western Gable Plinth from Northern Plinth to principal barn

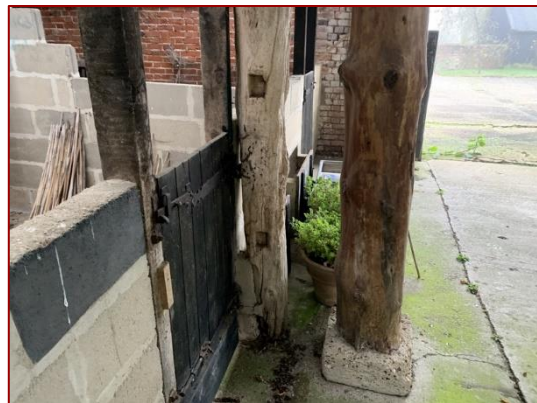


Photo 28: General view of post supporting roof structure to wings



Photo 29: General view of post supporting roof structure to wings.



Photo 30: Northern porch plinth



Photo 31: View along north elevation along principal barn showing lateral displacement



Photo 32: View of concrete encasement to timber wall plate



Photo 33: View of rendered plinth and concrete encasement to wall plate on east elevation



Photo 34: Separation of eastern plinth from southern plinth to main barn



Photo 35: View of buttress to east elevation of east wing.

## 6 Proposed Works

Details of the proposed conversion to a residential dwelling are at outline stage at the time of preparing this report and therefore comments are based on the general principles of the conversion.

Any structural works and sequences will be agreed with the contractor prior to construction and they will be detailed and sequenced recognising the importance of the buildings and the need to retain and repair the original building fabric. In particular, specific sequencing sketches and details will be agreed in relation to the temporary steel tie rods associated with the lateral displacement of the eaves of the principal barn.

Detailed schedule of repairs will be prepared as the scheme progresses towards construction. However, at this stage we would note the following comments in relation to the proposed works.



### **6.1 Lowering of ground floor slabs**

It is likely that the existing ground floor slabs and brick pavement tiles will be removed to enable the installation of below floor installation and a new structural slab. This will be subject to trial pit excavations of the existing foundations and the interface with the existing slabs where present. The removal would typically be carried out in stages so as not to undermine the existing foundations, and also to maintain a lateral stability where existing floor slabs may be providing lateral support to the existing structural walls. This also relates to external slabs which should only be removed in sequence with internal slabs, as due to the rotation and lateral movement of the masonry plinth they may be providing support to the plinth.

These will be carefully considered during the progression of the detail design and if necessary, the floor slab will cantilever beyond and internal slab thickening to allow the slab to be thinned at the perimeter and to not apply any additional loading to the existing foundations.

### **6.2 Underpinning**

The process discussed in section 6.1 may encounter shallow footings that cannot accommodate the depth of installation and new slab. Therefore, local underpinning may be necessary to ensure that either existing foundations are suitably robust or to prevent differential movement between the existing and newly installed footings. Local hard spots should be avoided using isolated underpin sections as this can lead to differential movement and cracking in the plinth. The requirement for underpinning will be subject to intrusive investigation works undertaken as part of the plinth survey during the detail design.

The survey did not identify defects within the plinth associated with the settlement of the foundations and the defects are primarily associated with lateral movement and spread of the frame above. It is therefore considered that the underlying ground conditions are suitable for the proposed conversion.

### **6.3 Overall Stability**

As part of the conversion the use of ply sheathing to the perimeter walls and roof will be considered to ensure that the overall lateral displacements are within those tolerable by brittle internal finishes. This strategy would enhance the overall stability and relieve load from the integral diagonal bracing.

During the conversion, the removal of the existing steel ties at eaves level will be carefully coordinated to ensure the lateral stability of the timber frame is maintained throughout. At this stage it is not clear whether the lateral displacement of the proposed roof structure preceded the replacement of many of the roof elements, i.e., the frame displaced, the ties installed, and the roof rebuilt accordingly. If this is the case, and the existing roof is to be retained, it would be particularly difficult to try and straighten the wall panels and therefore adequate lateral ties

will need to be incorporated into the proposed works to accommodate the out of plumbness of the walls as well as the prevention of lateral thrust from the roof structure.

During construction adequate ties will need to be installed to also tie the gable and side walls of the barns and the wings to ensure that any works to the existing frame and walls do not destabilise the existing structure. Any existing and new cross walls will be adequately tied to the existing walls to further enhance stability. It is assumed that the existing mezzanine floor structure within the main barn will be carefully removed to enable the new mezzanine to be installed at the correct level. The stability of this end of the barn has been significantly enhanced by the use of ply sheathing internally. Therefore, the removal of this section of mezzanine floor and the more modern timber wall panels should be carefully coordinated to ensure they do not destabilise the original frame and plinth.

#### **6.4 Masonry Repairs**

Where defects in the existing masonry walls are identified then repairs will be undertaken using brickwork and lime mortar to match existing. The junctions between existing masonry walls will be formalised through the installation of remedial wall ties or Helibar reinforcement where necessary where toothing in of the brickwork is not possible.

The extent and details of repairs will be agreed prior to construction works commencing.

#### **6.5 Timber Repairs**

Where defects or significant section loss are identified in timber members, repairs will be undertaken using like-for-like sections and traditional timber repair methods. The extent of repairs will be subject to detailed survey of the frame and available high-level access. It is likely that a suite of traditional repairs will be agreed prior to commencement of site works and their requirement would be determined as and when access is available, and all faces of the timber members are available for inspection.

The appropriate repair would then be selected depended on the specific condition of the member of connection. In a limited number of cases the complete replacement of the timber section may be necessary. Our initial survey suggests this will be uncommon for the principal frames members to require replacement and generally insitu repairs will be viable. A large number of timber infill studs and roof common rafters are of more modern construction and it will be agreed with the architect whether these are replaced as part of the proposed works to reinstate timber sections sizes and connections comparable with the original frame.

#### **6.6 New Openings to Existing Walls**

New openings should be kept to a minimum but where necessary would need to be carefully detailed to maintain the integrity of the remaining wall.

#### **6.7 Removal of the existing canopy between the east and west wing**

The removal of the existing canopy should be carefully coordinated to ensure that any lateral and/or vertical support provided to the east and west wing roofs and walls is maintained. It should be assumed that temporary bracing will be required until the permanent stability mechanism is reinstated.

#### **6.8 Introduction of new first floor**

Where proposed, new first floors and their load path will be carefully considered to ensure that additional vertical and lateral loads are not placed on the existing building structure. It is likely that new internal posts and walls will take additional loads to new foundations, independent of the existing barn foundations. The new first floor structure will be horizontally tied to the existing frames to enhance lateral stability, but connections will be carefully considered to ensure no vertical loads are transferred.

#### **6.9 Replacement of previous unsympathetic repairs.**

Throughout the main barn, wings and annex there are numerous historic unsympathetic repairs that have been undertaken which are not in keeping with the original building fabric. The conversion will provide an opportunity to remove these unsympathetic repairs and replace with more suitable materials. The replacement of unsympathetic repairs will be carefully thought out to ensure the existing structure is not destabilised during the works.

#### **6.10 Proposed North East Annex**

A new extension to replicate the north west annex is proposed as part of the conversion. This will be supported on independent footings and detailed to ensure that it enhances lateral support to the original frame but does not redistribute vertical loads.

#### **6.11 Proposed Cart Lodge**

The proposed cart lodge is detached from the main barn complex and will therefore have no impact on the proposed conversion.

## 7 Conclusions

A structural appraisal has been undertaken of barns north of Southolt Hall. The purpose of this report is to comment on the condition of the existing structural fabric of the buildings and to determine whether it is structurally viable to convert the buildings for the proposed use, as well as to provide a commentary on how the significant historic elements will be retained during the works, whilst maintaining structural stability.

The overall conditions of the barn complex are considered to be reasonable although there are localised defects that require repair as part of the proposed conversion. Most significantly, there has been historic significant lateral spread at eaves level of the Main Barn, assumed to be associated with the historic failure and movement of the roof structure. Repairs have been undertaken but the displacement is still evident within the timber frame and the supporting plinth.

Specific commentary on the buildings is as follows.

### **Main Barn**

The main barn is generally in reasonable condition. The principal defects relate to the horizontal spread of the frame at eaves level, assumed to be associated with the historic failure and movement of the roof structure. A significant proportion of the roof structure has been replaced in the past and steel tie rods have been introduced at eaves level to prevent any further movement. The movement and lateral displacement of the timber frame has in some areas been translated into the masonry plinth with a horizontal displacement and rotation of the plinth resulting in an out of plumbness.

Despite these defects we consider that the vast majority of plinth and frame can be retained as part of the proposed conversion and that any repairs can be undertaken in situ without the need for significant deconstruction.

The cart opening to the southern elevation requires reconstruction of the masonry plinth below the door threshold where a concrete step has resulted in the progressive failure of the brickwork below. The principal posts and lintel forming the opening have been crudely repaired and the original structural arrangement should be reintroduced as part of the proposals.

External cladding is typically timber weather boarding and this has failed in some areas allowing water to penetrate the underlying timber frame and plinth however it is generally in reasonable condition and is keeping the building weather tight. We have assumed that as part of the conversion the weatherboarding will be replaced and a ply sheathing introduced to the external walls and roof to enhance the overall stability. This strategy will enable the existing displacement of the frame to be retained.

Generally, the rainwater goods are still in place and appear to be working well, however in some areas they have failed and as a consequence water continues to penetrate parts of the building resulting in progressive deterioration of the frame and plinth. The rainwater goods should be reinstated as soon as possible to prevent further deterioration.

It is assumed that the existing mezzanine floor to the western side of the barn will be removed and replaced at a level to provide appropriate headroom at ground and first floors. The condition of the timber frame behind the existing ply sheathing could not be ascertained, however there is no indication of significant movement, suggesting that the frame is functional behind the ply sheathing. The removal of the floor and existing ply would need careful coordination to maintain lateral stability throughout the works.

The proposed first floor structure and link bridge will be supported on independent foundations and will not impose any additional loads on the existing frame and plinth.

The proposed conversion will not apply any significant increase in loads on the existing building fabric. **We can therefore conclude that the proposed conversion to residential is structurally viable.**

#### **North Annex**

The north annex comprises a single storey pitched roof structure with a timber frame walls built off masonry plinth. It appears that this element is a later addition (or has been repaired/rebuilt) to the principal barn and the timber frame is in reasonable condition. The roof structure has been replaced more recently with principal purlins supporting cut rafters. There is no sign of any lateral or vertical displacement of the roof suggesting that the roof structure and underlying frame is performing well. The masonry plinth is in reasonable condition albeit there are elements of render on the external face which may need to be removed to ascertain the condition of the underlying soft red brick work.

The proposed conversion will not apply any significant increase in loads on the existing building fabric. **We can therefore conclude that the proposed conversion to residential is structurally viable.**

#### **East Wing**

The east wing comprises a principal masonry wall to the east supporting a timber roof which has been repaired in an adhoc basis in the past. The roof structure spans between the wall and an internal row of posts forming open fronted west elevation.

The masonry is generally in reasonable condition albeit there is significant loss of face of bricks to some areas and general repointing required throughout, particularly at low level at the abutment of the concrete floor slab.

The most significant defect to the east wing is the lateral displacement and rotation of the eastern masonry wall at the northern abutment to the principal barn. Historically there has been significant movement and this has translated into cracking in the plinth of the principal barn. An external masonry buttress has been installed which would appear to have prevented the progression of the movement. This buttress should be retained as part of the proposed conversion and additional ties should be installed between the east wing wall and the plinth and frame to the principal barn. At this stage it is not clear whether any stabilisation of the foundations will be necessary but there is no indication of vertical settlement.

The existing roof structure is an adhoc arrangement of part timber trusses and eaves ties with raked props supporting purlins and cut rafters which in turn support battens and a corrugated metal roof.

It is assumed that the roof structure will be rationalised as part of the proposed conversion which will provide the opportunity to reinstate adequate lateral ties to the main wall and introduce new vertical support along the western elevation of the east wing.

As part of the proposed conversion, adequate ties should be placed between the southern gable wall and the side walls, to prevent any separation between the two.

Proposed loadings will not apply any significant increase in loads and with the repairs undertaken and the rationalisation of the roof structure and lateral ties **we would consider the conversion to residential to be structurally viable.**

### **West Wing**

The West Wing comprises of principal masonry wall to the west elevation supporting principal timber eaves level ties with raked braces supporting purlins and cut rafters, which in turn support a corrugated metal roof. The most southerly bay of the west wing has masonry walls to the east elevation enclosing this space with a more modern blockwork wall forming the northern wall of this room.

The masonry walls are generally in reasonable condition with some loss of face of bricks in some areas and repointing require throughout, particularly at low level. The southern elevation appears to have separated from the side walls with a vertical crack present in the west elevation. This should be tied and strapped as part of the proposed conversion.

The upper ten courses of the southern elevation have been rebuilt in a hard fletton brick and these should be replaced with a soft red brick as part of the proposed conversion.

The roof structure is an adhoc arrangement of eaves level ties and raked timber supports. The roof structure should be rationalised as part of the conversion to ensure that the lateral ties are in place tying the masonry walls with the new infill walls to the east elevation.

The proposed loadings will not apply any significant increase in loads and with the repairs undertaken and rationalisation of the roof structure **we would consider the conversion to residential structurally viable.**

### **Summary**

We conclude therefore, that the proposed conversion of the barn complex to residential use is structurally viable, providing the noted repairs are integrated into the conversion. We believe that the proposed conversion would enhance the building fabric and provide an opportunity to remove previous unsympathetic repairs that detract attention from the original barn structure. The conversions would therefore enhance the buildings and their setting and provide a long-term use, thus securing their long-term stability.

Limitations associated with the survey and assessment are outlined in Section 2.