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Report 434

**BAILEY HALL BARN,
HURST GREEN,
CLITHEROE
LANCASHIRE**

REPORT

on an appraisal of the structural condition of the Barn and
surrounding outbuildings at Bailey Hall, Hurst Green on behalf of:

Mr J.Holt

20th April 2012

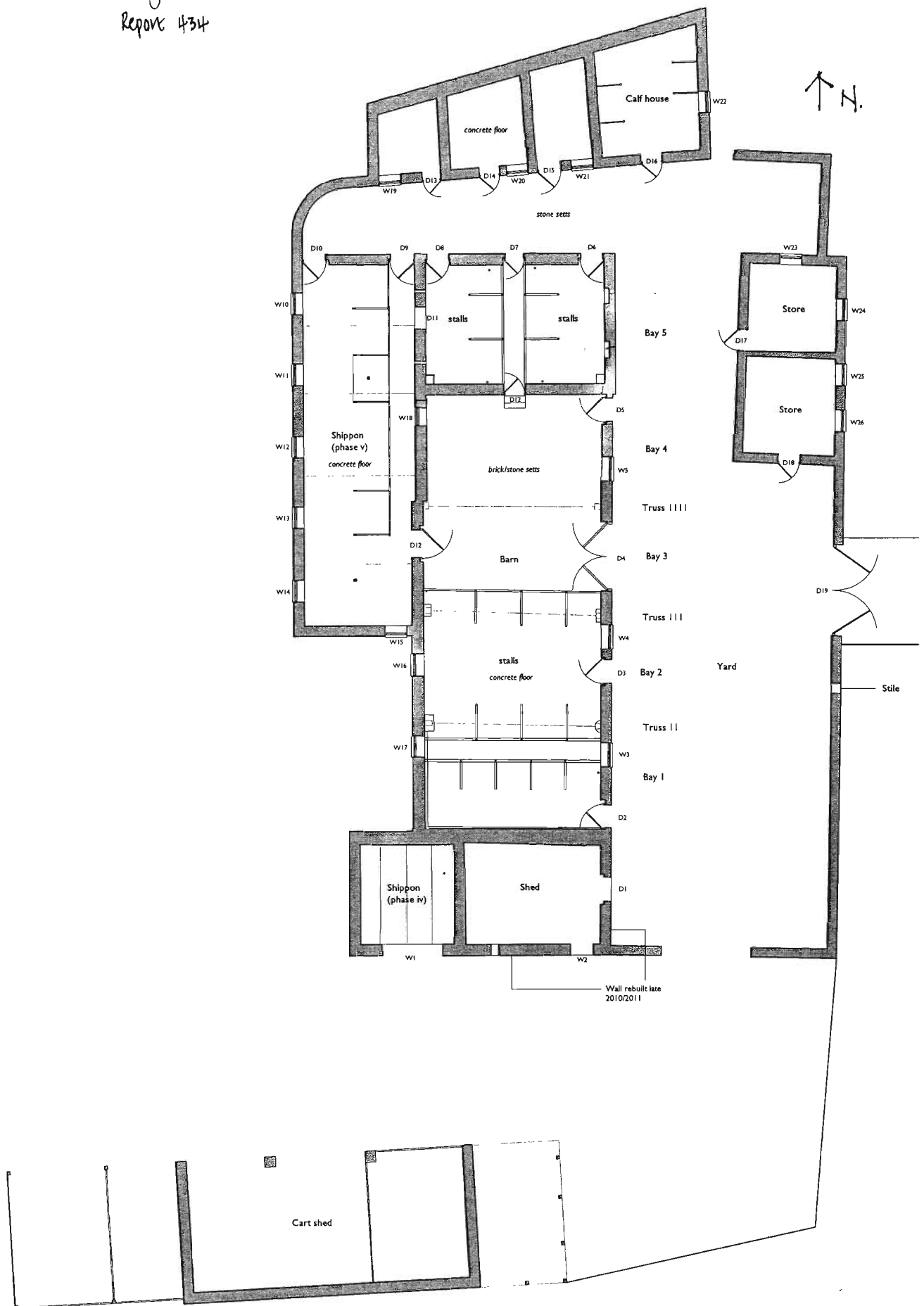
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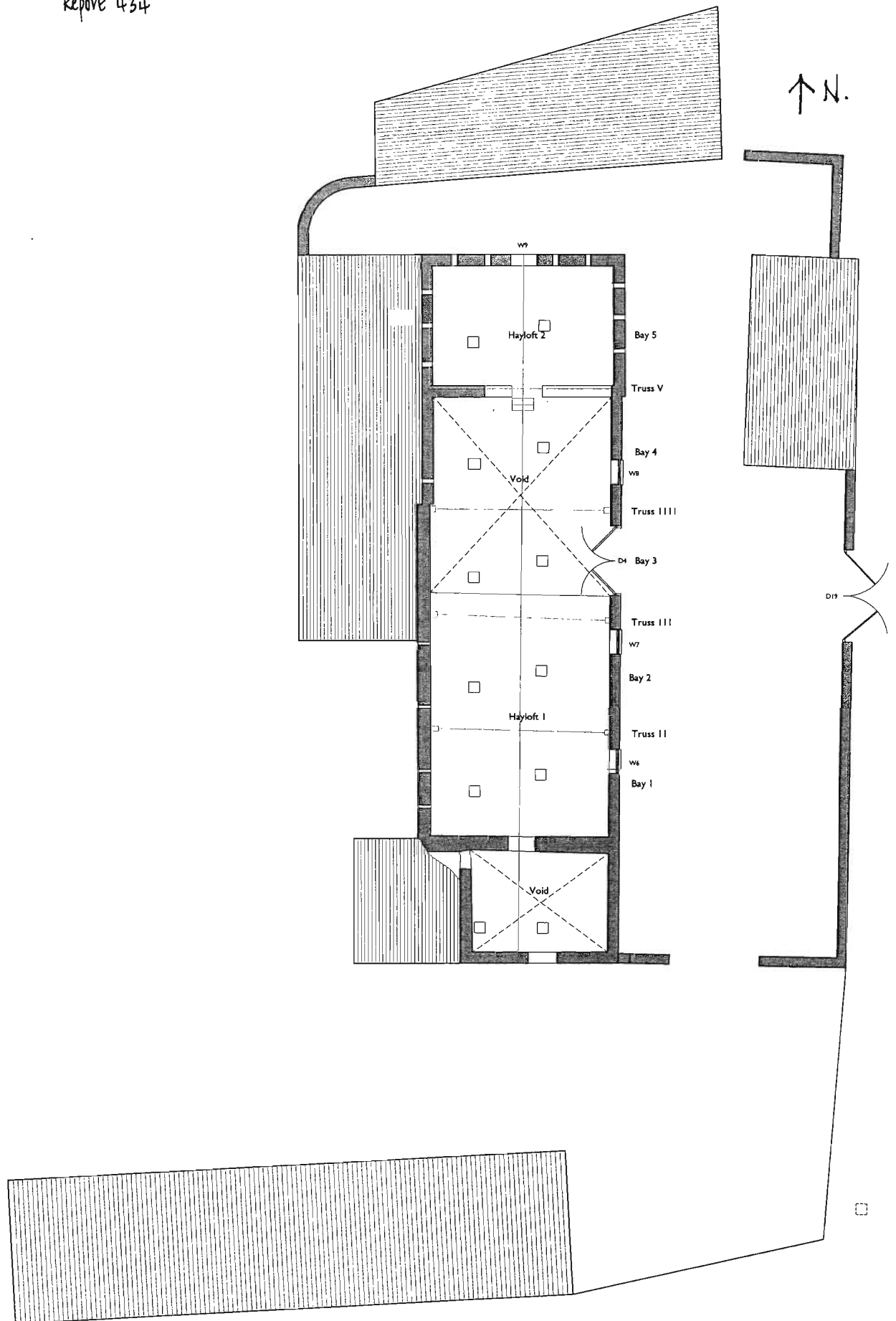
on an appraisal of the structural condition of the Barn and surrounding outbuildings at Bailey Hall, Hurst Green:

1.0 INTRODUCTION

- 1.1 The Barn and surrounding outbuildings at Bailey Hall are to be converted to form housing. My instructions, given to me by Susan Amaku of Woodhall Planning and Conservation on behalf of Mr. Holt, were to visit the site, make investigations as necessary, assess the general structural condition of the buildings, advise on the feasibility of the proposed alterations and prepare a structural report recording my findings and making recommendations for any remedial works required, to be included in the application for Planning Permission.
- 1.2 This report deals with the Barn, a grade II listed building, the two adjoining shippens, the calf house, the store and cart shed. The existing buildings are shown on Woodhall Planning and Conservation's drawings nos.2647.01.100a, & .01.101 - .01.105, and the proposed alterations on drawing 2647.01.sk3. I have seen copies of these drawings and make reference where appropriate to them in this report. Reduced copies of the ground and first floor layouts (drawing 2647.01.100a) are included on sheets 3 & 4 of this report.
- 1.3 The buildings are generally empty at present, except for some limited storage. A single visit was made on the 20th March to inspect the buildings from wherever safe access was possible. The weather was dry, bright and cold and had been dry for some time. This inspection was thorough enough to establish the general character and state of the structure of the buildings, so that an assessment of the overall structural condition could be made. However detailed investigations into the precise condition of individual structural elements were not made and I cannot comment on the structural adequacy of those parts of the structure that are covered or otherwise hidden from view.
- 1.4 The Barn and outbuildings stand on land sloping down to the east, to the southwest of Hurst Green, at about 90m above sea level. There is a band of trees in the valley to the northeast but the buildings are surrounded by pastureland and there are no trees or shrubs of any significance nearby.
- 1.5 No investigations into the foundations of the buildings or ground conditions below them have been made but the underlying ground is likely to be of glacial origin overlying sandstone bedrock.



BAILEY HALL BARN - Ground Floor Plan



BAILEY HALL BARN - First Floor Plan

2.0 NOTES ON STRUCTURAL CONDITION

The Barn

- 2.1 The Barn was, I understand, originally a 16th century timber frame building, running north-south, that has been altered and extended extensively. It now has solid masonry walls added in the 18th and 19th centuries, rudimentary loft floors and a slate roof. The roof has been renewed but the primary roof structure appears to be original and there are three cruck frames and a king post truss remaining. The loft floors are more recent.

Roof

- 2.2 The roof is primarily of slate but there are three courses of stone slate above the eaves on the west side. It is carried on battens on single span timber rafters, between 50 and 75mm wide and 100mm deep at centres varying from 310 to 470mm, supported on five purlins and the east and west walls. The purlins vary in size but are up to 250mm square, and span a maximum of 4.8m between the north and south walls, the three cruck frames and the truss. The ridge purlin is butt jointed on the frames / truss, the other four purlins are lap-jointed over the truss and additional principal rafters on the backs of the cruck frames. The frames and the truss are of substantial timber construction, in the case of the frames cut from a whole tree.
- 2.3 The ridgeline is relatively straight and true and sags only slightly between the trusses and frames. The slopes on both the east and west sides are reasonably plane and show no sign of excessive sagging.

There are a few missing slates but no evidence of any significant water ingress.

- 2.4 The rafters could not be inspected closely except at the eaves from the floor of the south loft. Generally they appear to be in good condition except at eaves level on the west side in Bay 2, where some are split and some affected by past rot. In Bays 1 and 2 the wall plate on the west side is in poor condition or missing; on the east side it remains and appears to be generally sound. In Bays 3, 4 & 5 the wallplate was too high to be inspected.
- 2.5 The purlins are of robust construction and are lapped unusually the same way on each truss / frame with the south end of one purlin always above the north end of the other. The upper purlin on the east side of Bay 5 appears to be different and may well be a replacement. Some but not all of them have braces back to the timber frame. In Bay 1 on the west side there is a loose brace resting on top of the lower purlin. The purlins are not all straight and in particular the upper purlin on the west side of Bay 2 is severely distorted. The braces remain in place and it was probably this shape when first installed.

The purlins show no sign of any significant deflection or inherent structural defect and appear to be in reasonable condition.

Cruck Frames

- 2.6 The cruck frames consist of two curved timber blades cut from a suitably shaped tree, jointed at the apex and restrained with two collars, one just below the apex and a second roughly 5.1m above ground level. There are lower collars but these do not run across the frame and may have been cut out in the past. The frames do not follow the profile of the roof and additional principal rafters, behind and above the blades, were included in the original construction to carry the purlins on each slope.
- 2.7 Each blade of the frames is up to 250mm wide x 500mm deep, tapering down in depth as it runs into the roof. The collars are let into the south side of the blades in all cases, with simple lap joints, reducing the effective size of the timber. The timbers forming the blades have drying shakes and splits but otherwise appear to be in good condition and show no evidence of any structural distress.
- 2.8 The frames spring from raised plinths, of at least three course of stone roughly 800mm high, projecting from the wall. The feet of the blades are built into the external wall by about 250mm except on the west side of frame 4 which does not appear to be built in at all on the south face as the wall steps outwards at this point.

The foot of the blade on the east side of frame 2 has a marked slope down to the north. The stone plinth has been rendered with cement, or may have been replaced with concrete and there are no signs that the base has slipped sideways in the recent past. There are what appear to be two bolts in the face of the post and it is possible that it has been “bolted” back to the wall. Further investigation is required to ensure its continued stability.



The foot of the blade on the east side of frame 3 is twisted to the north and sits on the edge of the plinth, with the top stone displaced to the north as well. Again it appears to be stable and there is no sign of recent movement but it should be checked for its long-term stability.



The plinth supporting the foot of the west blade of frame 4 has tilted over to the south by about 110mm, the timber projects beyond the stone by 25mm and the top stone has a slope of at least 80mm down to the south. There is a gap of 80mm between the timber and the wall to the north. The wall to the north follows the tilt of the plinth but there is a gap of 25mm between the two suggesting that there has been movement since the wall was built. There is no evidence of any recent movement but this situation is clearly not stable and strengthening works involving tying the timber / plinth back to the wall will be required.



The other three plinths appear to be reasonably plumb and stable, though the cruck blades are not vertical (see section 2.9). In view of the condition of the others though it makes sense to treat them all similarly and ensure that they are well restrained.

- 2.9 All three frames have a noticeable lean to the south. The overall lean was not measured but it appears to be reasonably consistent, though the timbers are not straight. The lean recorded over the 900mm length of a spirit level, above and below the hayloft floor, suggests that the total lean will be somewhere in the order of 450mm over the full height of the frames (nominally 6.5m from the plinth).

The south wall has recently been rebuilt and is plumb, but the north wall and the roof show no sign of this sway movement, and it is likely therefore that this lean developed before the walls were built and the roof renewed.

Other than the purlin braces there is no formal bracing within the roof construction. The frames would have been cut reasonably accurately when first built but the timbers will have been green and subsequent drying shrinkage will have allowed some sway movement to occur. This movement will have tightened up the purlin braces, which would have provided some restraint against further movement, along with the walls and the general rigidity of all the timber connections in the roof.

Further shrinkage will occur when the house is occupied and heated, loosening the connections. Measures involving additional bracing in the form of straps on the underside of the rafters will probably be required to ensure that further sway does not occur.

Truss 5

- 2.10 This is a traditional king post truss built using substantial timbers, originally on timber posts with knee braces between the posts and tiebeam. The west side is now supported on the internal cross wall but on the east the top half of the post, partially embedded in the wall, the brace and a 600mm length of the floor beam remain.

The truss appears to be adequate but the principal rafter on the east side is noticeably bent under the lower purlins and possibly split. Further investigation is required to ensure it is adequate. No particular remedial works are anticipated but if necessary steel plates could be added to strengthen the principal rafter, or struts inserted off the tiebeam.

The embedded post can be seen on the face of the wall. It stops just short of the top of the floor beam with a jagged end and appears to be rotten. There is a void in the wall below and the post cannot be seen. The support of the post is questionable; further investigations are required and remedial works will probably be necessary, in the form of masonry infill to ensure the long-term stability of the remains of the post and the truss.

Hayloft Floors

- 2.11 The two hayloft floors consist of timber boards on substantial timber joists at between 1.5 and 2.1m centres on 75mm diameter steel posts, many of which are heavily corroded and some of which have failed.

These floors are sufficient for inspection purposes only and will have to be removed and replaced with new floors complying with current regulations for dwelling houses.

Walls

- 2.12 The barn walls are of solid masonry construction with two skins of gritstone and presumably a rubble filled core, nominally about 500mm thick, 4m tall to the eaves and 7m on the gable. There is no projecting plinth at or above ground level and no investigations of the foundations have been made. Originally the walls would have been built using lime but they have been extensively repointed with cement-based mortars. External lintels are of stone, internally they are of timber and there are odd pieces of timber built into the internal face of the walls.

- 2.13 The east wall is a long straight wall with four doors, six windows, six slit windows, a large barn opening and a slight step outwards of 150mm at truss 5 between Bays 4 & 5. The south end has recently been rebuilt because of impact damage, I understand. There are a few minor defects:

- Cracks around the windows.
- The vertical stone reveals to the second door from the south have moved slightly and there is a tapering gap between the reveal stone and the wall on the north side
- The stone lintel over the third door slopes down slightly to the south and the reveal stone is fractured where an old bolt has corroded and expanded.

The wall is generally plumb except for Bay 4 where there is a noticeable outwards belly in the wall as a whole, showing both internally and externally. Associated with this there is an old roughly vertical fracture, adjacent to the east wall, right through the internal cross wall below truss 5.

At the north end in Bay 5 there are a number of fine vertical cracks in the external face of the wall, running up to and above the slit windows. Internally there are four cracks, three between the slit windows and one adjacent to truss 5. These are far more pronounced at between 5 and 15mm wide. They appear to be old but the fine cracks in the re-pointed external face suggest that they have either re-appeared, as cracks tend to do, or that the movement is continuing. The floor in the stalls at the north end is about 700mm below the floor level in the Barn; the cracks in the inner skin in Bay 5 peter out in this part of the wall below the hayloft floor.

The minor defects recorded above are probably the result of some minor settlement of the wall over the years. They are not of major structural significance and can be simply made good installing a few ties etc as necessary.

The belly in the wall in bay 4 and the fracture in the cross wall are probably caused by settlement and rotation of the footings of the east wall. Despite the belly the wall remains stable and is in no immediate danger of collapse. The footings however need to be checked and some underpinning of at least Bay 4 may well be required. In the proposed scheme there is to be a new floor in Bay 4 and it would be beneficial if ties back to the west wall were installed within the depth of the floor. Ties back to the cross wall across the fracture would also be of benefit.

The cause of the cracking in Bay 5 is not so readily explained. The pattern of the cracking is not typical of those normally generated by settlement but the fact that they peter out towards the base of the wall suggests that settlement may well have occurred. They are too large and at too close a spacing to be solely the result of movement due to moisture and thermal changes in the wall itself. The stonework is poorly bonded and this will have been a contributory factor but not the primary cause. It is possible that the core of the wall is made up of materials rich in sulphates that react with mortar when wet, causing the core to expand and "stretch" the inner and outer stone skins. Samples of the core would need to be taken and tested in a laboratory for sulphate content to confirm if this is the case, but keeping the wall dry would resolve this problem. Investigation of the footings is required and some underpinning may be necessary.

- 2.14 The north wall is just over 8m to the top of the gable; there is a vertical joint above the lintel over door D9, where the wall has been extended. It has a slight outwards belly and has been repointed on various occasions, some obviously quite recently. There is a short fine crack on the external face running up through some of the most recent repointing from the west side of the east door to the level of the slit windows. Internally there are two more pronounced cracks between 5 and 10mm wide running up from the level of the loft floor to the level of window W9.

The most likely cause of the cracking in the north wall is settlement, probably towards the east end of the wall, exacerbated by moisture and thermal movements and some underpinning may be required.

- 2.15 The west wall of the Barn, now partly internal is essentially the same as the east wall, with a matching 150mm step inwards but at truss 4 between Bays 3 & 4. At the south end it acts as a retaining wall. At the north end above the hayloft floor there are three cracks running more or less vertically upwards, above the top south slit window, between the middle two windows (12mm) and for the full height floor to eaves adjacent to the north wall (maximum 20mm). These are all old and show no sign of any recent movement. The other side of the wall could not be readily inspected so it is not clear if these cracks run through the full width of the wall.

The cracks are similar to those in the east wall and there may have been some settlement in the past. Again the footings should be checked and underpinned if too narrow or too shallow.

- 2.16 The south wall of the Barn, now internal, is similar in construction to the north wall, but not quite as tall. Timber remnants of the head of the truss can be seen in the north face of the wall above the top two purlins. There are four vertical cracks running up to the purlins on the south face of the wall. One of these cracks, to the east of the first floor opening, runs through the wall and can be seen on the north face. They are all clearly old and there is no evidence of any recent movement.

These cracks are similar to those in the north wall, namely some settlement associated with moisture and thermal movements within the wall. As it is internal the wall is no longer subject to significant changes in its moisture content that external walls can be and as such further movement is considered unlikely. The footings of the east wall should be checked and if necessary underpinned and the cracks in the south wall repaired by installing threaded stainless bars in the mortar joints across the cracks.

South Shippon and Shed

- 2.17 The roof is of slate with stone slates on the bottom half of the west slope and of similar construction to the Barn consisting of rafters on nominally 225mm square timber purlins spanning between the Barn wall and the south wall. There are a few missing slates and the ridge dips slightly between the walls, but otherwise the roof appears to be reasonably sound.
- 2.18 The south wall and the return on the east side back to the door opening were, I understand, seriously damaged by vehicle impact and have been rebuilt recently. An old crack can still be seen above the north side of the door opening in the east wall at the junction with the rebuilt wall. The wall around the west side is a retaining wall and appears to be sound. There is an old crack through the internal wall running up to the head of the wall adjacent to the rebuilt south wall; this can be seen at ground level on the west side and above the low level bulge, in the face of the wall on the east side, running up to the top of the wall.

The crack running up through the internal wall is likely to be the result of settlement of the original south wall, which was probably not in good condition prior to being damaged. The land slopes down from the field to the west of the building and the ground to the south of the west end of the wall was very wet at the time of my inspection despite the dry weather. This will undoubtedly have increased the risk of settlement, but can probably be cured by good drainage. Assuming that the south wall has been rebuilt on sound foundations there should be little or no further movement across the crack in the internal wall, and it can be made good by installing threaded stainless bars in the mortar joints across the crack. If this has not already been done a check should be made on the footings of the original part of the south wall in the southwest corner and some underpinning may be required.

- 2.19 Above the Shippon there is a loft floor consisting of timber boards on three joists at about 2m centres carried on the internal wall and the lowest of the purlins. Such a floor is suitable for light storage only. In the Shed there is a timber framework supporting joists again at approximately 2m centres but only a few boards. The central beam is split on the line of a mortice for a post that is no longer there and cannot be relied upon to carry more than a nominal load. There is to be a first floor bedroom in the proposed scheme and a new floor will be required.

West Shippon

- 2.20 The West Shippon was added as a single-storey lean-to extension to the west wall of the Barn. The roof is predominantly of stone slate but there are 8 courses of slate at the top where it runs into the barn roof. The slates are carried on rafters and four sawn purlins (between 100 & 135mm x 225mm deep) spanning up to 3.8m between the gable walls and four mono-pitch trusses consisting of 130 x 290mm tiebeams and 100 x 290mm principal rafters, all probably pitch pine. There are quite a few broken / slipped slates and some of the purlins show signs of sagging down the slope.

The principal rafter on the second truss from the north shows signs of rot where it bears on the beam, and this needs to be investigated but otherwise the roof appears to be adequate, though the purlins may need strengthening to take the increased loads when plasterboard etc are added.

- 2.21 The three external walls are of the same construction as the Barn, roughly 500mm thick. The south and west walls retain the ground in the field, which is generally at eaves level but slopes down to the window cills of the west wall at about 1.3m above floor level. The walls are very damp but otherwise appear to be in reasonable condition. There is a vertical joint between the north walls of the Shippon and the Barn, with only the lintels over the door opening bonded into the Barn wall. As such the lintels carry considerably more load than they would be required to, if the wall was fully bonded across the joint; despite this there is no sign of any movement in the joint or other obvious structural problem with the walls.

The Calf House

- 2.22 The Calf House is a long narrow single-storey building split into four sheds. The roof is duo-pitched and consists of slate with a stone ridge on rafters and purlins spanning between the two gable walls and the dividing walls. There are a number of holes in the slate roofing particularly on the north slope and some missing ridge stones. The purlins are wet and some show signs of rot, some severe. In the east shed there are four purlins that have a noticeable sag and are clearly are too undersize for the span.

The timbers need to be checked for rot and repaired as necessary and the purlins at the east end will need to be strengthened to take the increased loads.

- 2.23 The walls are of the same construction as the Barn, with the north wall, the west wall and the circular wall between the West Shippon and the Calf House retaining the ground in the field on the west and north sides; 1.8m at the west end reducing to 0.7m at the east end. The survey suggests that the west half of the north wall is slightly thicker than the other walls.

The retaining walls are very damp but show no sign of structural distress, nor is there any sign of significant movement due to settlement in the other walls.

The East Store

- 2.24 The East Store is a single storey building running north-south with a central dividing wall. The northern half is a storeroom and the southern half a stable at present. The slate roof is carried on rafters on 100 x 160mm timber purlins spanning between the gable and internal walls. The ridge has a noticeable dip between the supporting walls and the purlins can be seen to sag. There are a number of missing slates but no evidence of serious rot was observed.

The purlins in general are undersize for the spans and will need to be strengthened.

- 2.25 The walls are the same as those in the Barn, but slightly thinner and are lime washed internally. The external walls show no signs of significant cracking. There is a vertical crack at the junction of the crosswall and the east wall running up two thirds of the height to the eaves and then running diagonally up through the crosswall itself. This crack can be seen on both sides of the crosswall. There is a much less marked vertical crack at the other end of the crosswall at the junction with the west wall. There is a similar vertical crack internally at the junction of the two external walls in the southwest corner; externally the mortar is much eroded on the corner by water running off the roof but there is no sign of cracking on the external face.

The cracking in the crosswall suggests that there has been some slight settlement of this wall, particularly adjacent to the external wall on the east side. There also may have been a little settlement in the southwest corner, possibly caused by the gully on the corner, which may be cracked, or the water simply running down off the roof. In both cases there are no signs of any recent movement and it may well have ceased. It is worth making a check on the condition of the footings and underpinning them if found to be too shallow or narrow.

The Cart Shed

- 2.26 The original cart shed had three bays and is open on the north side, with two single stone pillars between the bays; the three external walls are made up of two gritstone skins between 400 and 450mm thick. There are three further bays, one on the east and two on the west side, consisting of timber posts, boarded at the west end but open to the east.
- 2.27 The roof over the whole building is of corrugated iron on purlins and is in poor condition. It will have to be replaced, renewing the structure to carry a slate roof.
- 2.28 There is a vertical fracture in the original west wall of the shed; it is about 20mm wide, clearly very old and probably the result of some settlement but shows no sign of any recent movement. The south wall is a retaining wall, supporting the ground in the field; at the west end there is a pronounced fracture stepping up vertically through the mortar joints. Again this is old but is probably the result of past settlement.
- The footings need to be checked out particularly along the west wall and at the southwest corner and some underpinning may be required.
- 2.29 The timber bays at both ends of the stone shed, are not in good condition and if required will need to be rebuilt entirely.

3.0 ASSESSMENT

The Barn

- 3.1 The roof structure consists of rafters on purlins spanning between the gable walls, the three remaining cruck frames and truss 5. The rafters and purlins could not be inspected closely except at the eaves from the floor of the south loft. There are problems with the rafters and wallplate at eaves level on the west side in Bays 1 & 2, but otherwise the rafters appear to be adequate and suitable for the proposed conversion. The purlins are of substantial construction and though not necessarily straight show no sign of any significant deflection or inherent structural defect and appear to be in reasonable condition. When the roof is stripped the timbers will need to be examined for local areas of rot / insect infestation.
- 3.2 There are three cruck frames and each frame is cut from a single tree, split down the middle and adapted in this case with additional principal rafters taking the purlins, to suit the profile of the tree. They are seated on stone plinths about 800mm above ground level. There are braces between the purlins and frames. Originally the walls would have been timber framed tied into the cruck frames, but the timber blades are now partially built into the external walls.

The timber blades are a unique shape; they have drying shakes and splits but otherwise appear to be in good condition and show no sign of any structural distress.

- 3.3 The base of the east blade of frame 2 slopes down to the north and of frame 3 is twisted to the north and right on the edge of the plinth, with the top stone displaced to the north. There are no signs of any recent movement either of the timbers on the plinths or the plinths themselves, and they appear to be stable. Further investigations should be made to ensure that they remain stable and it is likely that ties back to the wall will be required.

The plinth supporting the west blade of frame 4 has tilted over to the south by about 110mm, the timber projects beyond the stone and the top stone of the plinth has a pronounced slope down to the south. There is a large gap between the timber and the wall to the north. The wall to the north follows the tilt of the plinth but a gap has developed between the two suggesting that there has been movement since the wall was built. There is no evidence of any recent movement but this situation is clearly not stable. Strengthening works involving tying the timber / plinth back to the wall with stainless steel rods resin anchored into the wall or propping the plinth / timber on the south side with timber / masonry will be required.

The other three plinths show no sign of significant movement and appear to be reasonably plumb and stable. All three frames, however, have a marked lean to the south. The lean was not measured; the timbers are not straight but the lean appears consistent and is estimated to be 450mm. In view of the lean and the condition of three of the bases and plinths it makes sense to treat them all similarly and ensure that they are well restrained.

- 3.4 The cruck frames have all had a tiebeam removed in the past. These frames are substantial enough to cope with the changes in the way the loads are carried but this does involve a large increase in the outwards horizontal thrust at the foot of the frame, in this case at the top of the plinths. As explained above there are problems at plinth level and to reduce the loads these ties should be reinstated. Alternatively modern steel tierods could be installed within the depth of the new first floor. In the proposed scheme frame 2 can readily be treated in this way. The floor stops short of frames 3 and 4, but the frames could be anchored back to the walls and ties inserted in the floor to restrain the walls.

- 3.5 The south wall has recently been rebuilt and is plumb, but the north wall and the roof show no sign of this lean / sway to the south, and it is likely that it developed before the walls were built and the roof renewed.

Other than the purlin braces there is no formal bracing within the roof construction. The frames would have been cut reasonably accurately when first built but the timbers will have been green and subsequent drying shrinkage will have loosened the connections and allowed some sway movement to occur. This movement will have tightened up the purlin braces, which would have provided some restraint against further movement, along with the walls and the general rigidity of all the timber connections in the roof.

When the building is occupied and heated the timbers will dry out further and there is likely to be more sway. Measures to control this sway should be implemented. These would involve additional bracing as straps on the underside of the rafters, bracing behind any wall lining that may be installed or ties back to the walls.

- 3.6 Truss 5 appears to be adequate but the principal rafter on the east side needs to be checked as it is possibly split and it may be necessary to strengthen it with steel plates bolted to the sides.

The embedded post, supporting truss 5 in the east wall, appears to be rotten just below the old floor beam. The support of the post cannot be relied upon; some opening up is required to get a better view. It is likely that masonry infill at least will be required.

- 3.7 Both Hayloft floors are totally unsuitable for use in housing and will have to be removed and replaced with new floors complying with current regulations for dwelling houses.

- 3.8 The walls of the barn are of two skins of gritstone about 500mm thick, built in lime but extensively repointed with cement mortar. External lintels are of stone and internal ones timber. There are isolated timbers built into the internal face of the walls.

- 3.9 The east wall is generally plumb except for a marked outwards belly in Bay 4. There is also an old roughly vertical fracture, adjacent to the east wall, right through the internal cross wall below truss 5. These are most likely the result of settlement and rotation of the footings of the east wall. The wall remains stable and is in no immediate danger of collapse. The footings need to be checked and some underpinning of at least Bay 4 may well be required. It would be beneficial if ties back to the west wall within the depth of the new floor and ties back to the cross wall across the fracture were installed.

- 3.10 The cracks on the internal face of the east, north and west walls in Bay 5 are all essentially the same, running up more or less vertically around and between the slit windows. Externally the walls have been repointed but on the east face they have re-appeared.

The pattern of these cracks is not typical of those normally generated by settlement but the fact that they peter out towards the base of the wall suggests that there may have been some settlement. They are too large and at too close a spacing to be solely the result of movement due to moisture and thermal changes in the wall itself. The stonework is poorly bonded and this will have been a contributory factor but not the primary cause.

It is possible that the core of the wall is made up of materials rich in sulphates that react with mortar when wet, causing the core to expand and “stretch” the inner and outer stone skins. Samples would have to be tested in a laboratory for sulphate content to confirm if this is the case, but keeping the wall dry would resolve this problem and in my view such tests are not justified.

The walls show no evidence of serious instability but in view of the amount of work proposed in converting the buildings the footings should be inspected and some underpinning may be found to be necessary.

- 3.11 The cracks in the south wall of the barn are very similar to those in the north wall, and probably caused by settlement associated with moisture and thermal movements within the wall. As it is now internal the wall is no longer subject to the changes in moisture content that external walls are and as such further significant movement is considered unlikely. The footings of the east wall should be checked and if necessary underpinned and the cracks in the south wall repaired by installing threaded stainless bars in the mortar joints across the cracks.

The South Shippon

- 3.12 The construction of the south shippon is essentially the same as the barn except that the purlins are supported directly on the walls. The south wall has been rebuilt but large cracks in the old east wall and the internal wall adjacent to the rebuilt sections can still be seen. These cracks are likely to be the result of past settlement of the original south wall, which was probably not in good condition prior to being damaged. The ground to the south was very wet at the time of my inspection despite the dry weather. This will undoubtedly have increased the risk of settlement, but can probably be cured by good drainage.

The south wall should have been rebuilt on sound foundations. There should be little further movement across these cracks, and they can be made good by installing threaded stainless bars in the mortar joints across them. The footings of the original part of the south wall in the southwest corner should be inspected and some underpinning may be required.

- 3.13 The loft floor above the Shippon is suitable for light storage only. In the Shed the remaining timber framework is unreliable and will have to be replaced.

The West Shippon

- 3.14 The west shippon is a lean-to extension with a slate roof and gritstone walls. The roof consists of sawn timber purlins on mono-pitch trusses. The purlins are probably undersize for the spans involved and may need to be strengthened especially as the loads will be increased. There is rot in the foot of the principal rafter on the second truss from the north. This needs to be examined and repaired as necessary.

- 3.15 The walls are very wet as they retain the ground to the south and west but show no sign of structural problems. The vertical joint at the junction with the barn wall on the north means that the lintels carry considerably more load than normal. Despite this there is no sign of any movement in the joint or other obvious structural problem with the walls.

The Calf House

- 3.16 The calf house is a long narrow tapering single storey building. The roof is of slate on sawn timber purlins spanning between the gritstone walls. The roof is in poor condition and some of the timbers including the purlins are rotten. Further examination is required once work starts. The purlins at the east end are undersize and will need to be strengthened to take the increased loads.

- 3.17 The walls are again very damp as they retain the ground to the north and west but appear to be adequate.

The East Store

- 3.18 The east store is a single storey building with a central dividing wall. The roof is of slate on sawn timber purlins spanning between the stone walls. The purlins in general are undersize for the spans and will need to be strengthened.
- 3.19 The cracks in the dividing wall suggests that there has been some slight settlement of this wall, particularly adjacent to the external wall on the east side. There also may have been a little settlement in the southwest corner, possibly caused by the gully on the corner, which may be cracked, or by the water simply running down off the roof. The footings should be inspected and underpinned if found to be too shallow or narrow.

The Cart Shed

- 3.20 The original cart shed had three bays with stone walls and has been extended to the east and west with timber. Presumably the original roof would have been of slate but it is now of corrugated steel on purlins and is in poor condition. It will have to be replaced, renewing the structure to carry a slate roof. The timber bays at both ends are in poor condition and will need to be rebuilt.
- 3.21 There are substantial old cracks in the original west wall and at the west end of the south wall. They show no sign of recent movement but it is worth checking the footings and some underpinning may be required.

General

- 3.22 The buildings are generally in relatively good condition, with the timberwork in the barn almost as good as new. There are a few inherent structural defects, particularly the bracing and restraint for the cruck frames, but these can be dealt with simply, as described above, using modern techniques that are not excessively intrusive.
- 3.23 Water penetration is always a problem in old buildings and some roof timbers particularly in the calf house have suffered as a result. These are not major structural problems but when the roof is renewed all timbers should be examined and any defects made good. Similarly many of the gutters are missing and need to be replaced.
- 3.24 There is evidence of settlement in quite a few of the walls and inspection of the footings is required all round. Some underpinning will be necessary. This is a standard solution for dealing with settlement and whilst being labour intensive is not likely to be a major structural difficulty. Where appropriate the walls can be tied back within the depth of the first floor. If external parrass plates are not desired it should be possible to grout anchors into the walls so that they cannot readily be seen on the external face. The cracks generally can be repaired with reinforcing rods embedded in the mortar, or where more severe resin grouted in holes bored down the length of the wall.

- 3.25 A number of the walls retain the ground of the surrounding fields and are very damp as a result. They appear to be adequate structurally but care will be needed to ensure that water penetration does not become an issue, possibly by inserting drains externally at the base of the walls.
- 3.26 The stone lintels in all the buildings appear to be in sound condition, the timber lintels likewise. Some of the latter have deflected under the weight of stonework. All timber lintels need to be inspected once the works are underway to ensure that they are adequate
- 3.27 Once converted to houses the building will be heated and will dry out further. Both the walls and timbers will shrink as a result and cracks will reappear. These should settle down in due course but it could take a few years.
- 3.28 The buildings do not suffer from any major structural defects but more a lack of maintenance. There has been some settlement in the walls and movement within the timber work but in my opinion providing the works listed above are completed in a proper manner there is no doubt that the buildings can be converted satisfactorily without resorting to extensive rebuilding of the external fabric.



DAC Wood

20th April 2012