

REPORT

on the

STRUCTURAL INSPECTION

of

Barn Structure
Rook's Nest Farm
Therfield
Hertfordshire

for

Mr & Mrs J Williams

PHILIP HARVEY ASSOCIATES LTD

**1 Avon Drive
Brickhill
BEDFORD
MK41 7AB**



Report No. 4698/001

November 2010

GENERAL

We have been requested by Mr & Mrs Williams to examine and report on the structural condition of a traditional agricultural barn structure on Rooks Nest Farm, Therfield, Hertfordshire, with particular reference to the structural integrity of the barn structure for future conversion to residential premises.

The Structural Inspection was carried out on 12th November 2010. The weather was cold and dry during the inspection, following a period of wet and windy weather.

GENERAL OUTLINE AND LIMITATIONS

The following report is based upon a visual inspection of the items described and not upon a physical or a mechanical examination. We have not inspected each individual element in detail or any parts of the structure which are unexposed or inaccessible and we are, therefore, unable to comment that any such part of the property is free from defect.

We have been requested to examine and report on the structural condition of the structural elements of the building and to prepare a report with general recommendations for rectifying any defects identified during this inspection. The report encompasses general observations on the structural integrity of the existing building together with identification of specific defects and their recommended repair/strengthening.

LOCATION AND DESCRIPTION

The barn complex is situated on relatively level ground immediately adjacent the main house. It is currently used for general storage.

Geological Drift Maps for the area indicate that the immediate sub-strata to be Boulder Clay over Chalk at some depth. This was confirmed in the trial holes that were excavated in three locations around the internal perimeter of the barn. The results of the Trial Hole investigation are appended to this report. The Boulder Clay is known to possess medium shrinkability characteristics. It will be noted from the Trial Hole investigation report that the nature of the foundations varies around the building perimeter. Generally, the foundations exhibit no evidence of settlement or distortion, with the exception of the front right-hand corner - which is adjacent the Weeping Willow trees and pond - which has settled and fractured considerably.

There are two large Weeping Willow trees on the front right-hand corner of the building, together with a small, shallow pond. A Leylandi hedge is located at approximately six metres from the rear right-hand corner of the barn.

INSPECTION AND RECOMMENDATIONS

A visual inspection of the building was carried out, which identified the following defects. The majority of these defects are the result of normal age and weather deterioration of the building fabric, exacerbated by low levels of maintenance in the past, particularly to rainwater goods.

Locations refer to building viewed from the courtyard. Report is to be read in conjunction with the barn layout plan appended to this report:

Existing Construction

The detached barn dates from the 17th century and is of timber-framed construction, with horizontal timber wall boarding. The roof has been covered in more recent steel profiled sheeting, as has the wall on gridline D gable. The sheeting is supported on softwood battens, which span between widely spaced purlins and posts respectively. The softwood rafters are propped down to the original vernacular timber purlins. The main roof purlins are 100mm x 100mm vernacular hardwood members, splay-scarfed over the Queen-post truss struts. Reference should be made to the section appended to this report for the construction of the main Queen-post truss frames. Details of the construction of the gable panels and front & rear elevation walls are provided within the body of the report.

The frames on gridline 2 are constructed from a 180mm x 180mm hardwood wall plate, with vernacular 75mm x 120mm hardwood knee braces between the underside and the face of the principal posts.

There are no rainwater goods.

Internal Inspection and Recommendations

Gridline D Gable

This comprises a new softwood frame off a 170x110 cill plate on a 500mm high 225mm brickwork plinth. The plinth is formed with common bricks bedded in sand/lime mortar. The original hardwood purlins are supported on more recent 100x140 softwood posts. The purlins are supported on timber cleats bolted to the face of the posts.

The infill members between the main purlin support posts are chevron softwood diagonals. There is a steel wire tie at eaves level, passing between the front and rear wall plates to posts 2D and 3D. The corner posts are the original vernacular 140mm x 150mm hardwood jowled posts, which are tenon-jointed to the cill plates. The steel tie appears to have been installed to maintain lateral restraint following earlier removal of the timber framework on Gridline D.

Post D3 will require surgery to the lower 300mm section, where it has rotted away due to rainwater saturation. The cill plates locally will also require half-lap surgery to approximately 400mm of the front elevation cill plate and the formation of a new mortice. It is recommended that the existing blacksmith-formed corner strap to the adjacent cill plates is retained in this location.

The front wall panel has displaced outwards historically due to settlement of the front wall foundations. The present tie bars and straps have been introduced to try and arrest further movement. Once the foundation settlement problems have been addressed, it will be possible for the distorted framework, along with others noted later in this report, to be pulled back into vertical alignment. Further restraints ties may need to be introduced following this operation.

Post D1 is a 170mm x 190mm hardwood stub post, which has been strapped to the top of gridline D cill plate. Minor surgery will be required to the lower 300mm of this post and half-lap surgery will also be necessary to approximately 400mm of the lower 170mm x 120mm rear cill plate adjacent.

Bays C - D

The front elevation wall panel has been formed from a 200mm x 180mm deep wall plate, supported on 50mm x 100mm vernacular timber studs at 550mm centres, supported on a 200mm x 150mm deep vernacular cill plate. The cill plate is seated on a 500mm high brickwork plinth wall. The original mid-height transom was a 120mm x 200mm deep member, but has been strengthened with a 50mm x 200mm piece of softwood nailed to the side.

There has been severe vertical and outward displacement of the brickwork plinth wall. The foundations are extremely shallow and the wall is fractured in two places along its length as a result of localised settlement. The plinth wall will require rebuilding locally using salvaged bricks in similar sand/cement mortar, built up off new foundations. Due to the close proximity of the Weeping Willow trees and the presence of medium shrinkability clay, this would be best carried out using a pile and pin solution. The plinth wall would be supported on precast concrete lintels spanning between each pin beam. The bay of the offshot on gridline C will also need similar foundations, after which the distorted timber frame may be jacked back up to vertical alignment.

The wall frame on Gridline 1 is comprised of the original 150mm x 150mm timber wall plate with later 120mm x 150mm hardwood bolted to the internal face; the studs are 75mm x 100mm vernacular hardwood members at 550mm average centres, supported onto a 200mm x 120mm deep hardwood cill plate. The cill plate is supported on a 330mm thick solid brickwork plinth wall.

Minor washout of the bed and perpend mortar joint was noted to the plinth wall on Gridline 1. All loose and deteriorated masonry should be raked out back to sound material and all voids infilled with sand/lime mortar of similar appearance and consistency as the existing.

Frame on Gridline C

Refer to section appended to this report for the configuration and member sizes of the Queen-post frame arrangement:

Post 1C has a significant number of historic mortices which have weakened the member. It is recommended that the mortices are infilled by resin-bonding cut shims of hardwood into the voids. Mortice and tenon of the knee brace will also require surgery in this location.

The frame on Gridline C has displaced towards the front elevation by up to 150mm, as a result of the settlement of the foundations to bay C to D. It should be possible to pull the distorted frame back into vertical alignment following the recommended underpinning works, before repair and strengthening is carried out.

Post C2 will require the introduction of a lower level plinth foundation, as it is presently supported on the mass concrete floor slab. New foundations in this location may be mass concrete strip footings, taken to the same depth as the foundations on gridline 1 and dowel bar connected. Dowel bars to be 2No. T16

dowel bars x 400mm long, drilled and resin bonded to the side of the existing footings.

The knee brace to post 2C has displaced due to fractured pegs. This will need to be realigned and re-pegged, once the frame has been pulled back into vertical alignment.

There is a major split at the knee-brace junction with the principal tie underside. This will need to be repaired using resin injection and ensure pegs that new hardwood timber pegs are introduced to secure it in position.

The missing knee-brace adjacent the front elevation will need to be replaced using existing mortices and pegged into position. The knee brace is presently on the floor of the barn.

Post C3 will need to be pulled back into alignment with the tie member and the principal tie re-pegged into position.

The side panel of the offshot requires jacking up into vertical alignment and the deteriorated brickwork plinth reconstructed on a new piled foundation. Post C4 may also require surgery to the cill plate. The fractured and deteriorated cill plate will require replacing for approximately 1300mm, using timber of similar scantling and species as the existing, half-lap jointed to the remaining sound timber.

Bay B - C

The wall plate on gridline 3 has bowed considerably at the junction with the frame on gridline B. It will be necessary to carry out surgery to at least 1500mm of the member, which is 120mm x 200mm wide. All new timber is to be of similar scantling and species as the existing, half-lapped to remaining sound timber.

The frame on gridline B is roughly the same configuration as gridline C and has similar defects.

The rotation of the frame towards the front has caused the studs on gridline 1 to fracture at the tenon joints. Some rot deterioration at the base is also evident due to the high external ground level. Where visible, the cill plate is in good condition; however, allow for surgery to the bottom 200mm of at least five studwork members.

Frame on Gridline B

This timber frame is in reasonable condition. However, a horizontal fracture to the principal tie will need to be repaired with resin injection at the knee brace junction.

Post B2 will require the introduction of a lower level plinth foundation, as it is presently supported on the mass concrete floor slab. New foundations in this location may be mass concrete strip footings, taken to the same depth as the foundations on gridline 1 and dowel bar connected. Dowel bars to be 2No. T16 dowel bars x 400mm long, drilled and resin bonded to the side of the existing footings.

The side panel of the offshot requires jacking up into vertical alignment and the deteriorated brickwork plinth reconstructed on a new piled foundation.

Bay A - B

This elevation is completely covered in climbers, which have invaded internally. All climbers are to be removed and their roots poisoned.

The splits to the side of the wall plates on gridline 1 will need to be repaired using resin-injection.

The purlin on the rear slope is completely severed and dangerous. This is a previous use member with multiple mortice voids, which is wholly inadequate for its current purpose. This will need to be replaced with a member of similar species and scantling, between the main supports.

The other purlin on the front slope has slipped down from the scarf-joint on frame B and propped onto a new queen strut. This will need to be realigned onto the original queen strut. The redundant queen strut may then be removed.

The plinth wall on the front elevation has been disturbed by mortar washout and climber ingress. This will require rebuilding using salvaged bricks, bedded in and/lime mortar of similar appearance and consistency as the existing.

Frame on Gridline A

The original frame consists of a 120mm x 220mm deep collar tie, 130mm x 130mm transoms and 75mm x 100mm studs at 550mm centres. The studs are supported onto a 150mm x 120mm deep cill plate. The post A2 is 150mm x 150mm scantling.

The frame on this elevation is in relatively good condition, where exposed. The cill plate is cloaked by a clunched chalk plinth. The embedded cill plate appears to be in poor condition, where exposed and may require some localised surgery, once the deteriorated areas have been revealed.

General Observations

It will be necessary to remove the steel sheeting and a large majority of the existing timber boarding as part of the proposed refurbishment and conversion works. The original rafters were removed during earlier repair works and the more recent steel roof sheeting supported on softwood timber elements. It will be necessary to replace the original rafters to re-instate the clay tiled roof finish. At this stage, it would be prudent to introduce new timber or steel purlins above the existing bowed vernacular purlins to maintain a uniform roof alignment and maintain the structural integrity of the building.

It will be necessary to replace all rainwater goods, discharging down pipes to soakaways located at minimum five metres from the building or to the adjacent pond.

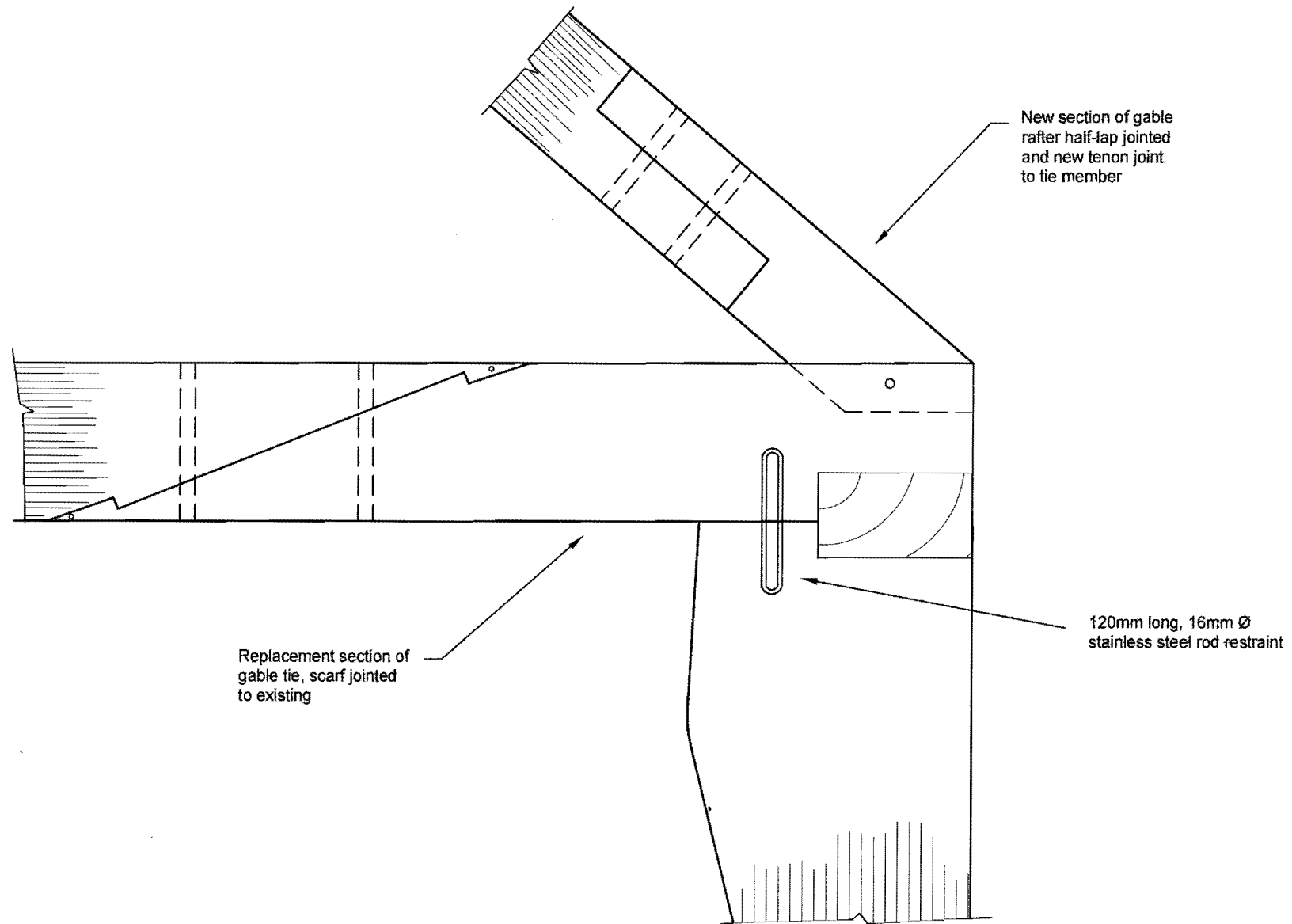
The new mezzanine floor structure forming the proposed first floor areas associated with the proposed residential conversion works will need to be independently supported, either on a grid of steelwork beams and posts, or supported on load-bearing internal walls. All new load-bearing elements will be supported off new foundations. The mezzanine floor will have independent lateral rigidity, which can benefit the existing barn structure by providing a horizontal diaphragm, which can transfer lateral loads down to ground floor level. A new concrete ground-bearing floor slab will also be adopted as part of the proposed conversion works.

CONCLUSION

Generally, the defects noted during the inspection are the result of age and weather deterioration, which do not significantly affect the overall structural integrity of the building and could be easily repaired and strengthened, as detailed in the body of this report.

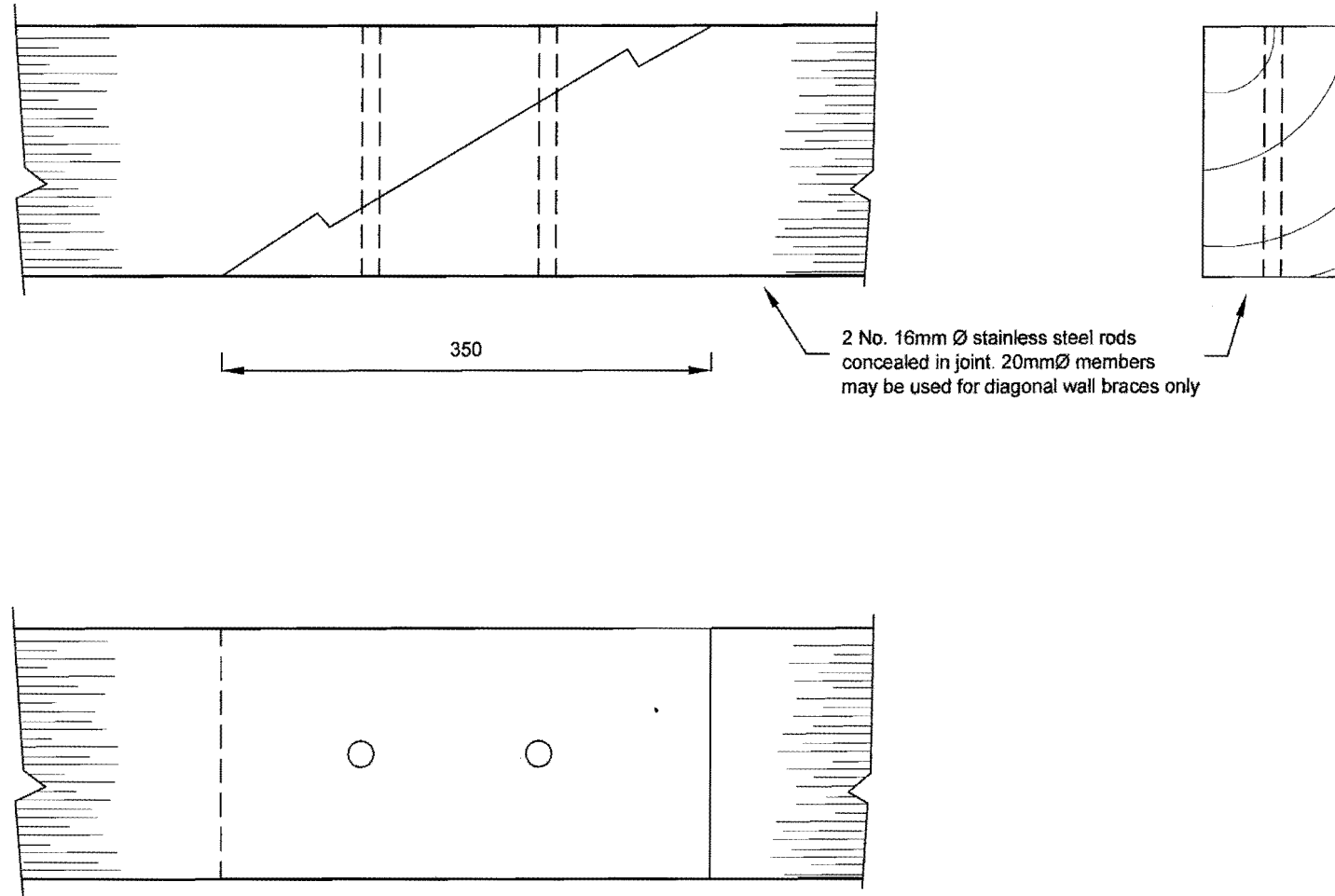
The survey has been carried out in accordance with Clause 4.10, Section 4 of Approved Document A1/2, which requires a detailed Structural Inspection to be carried out in accordance with the guidance given in BRE 366 *Structural Appraisal of existing buildings for change of use*. The barn structures are considered to be of permanent and substantial construction and would be suitable for conversion to other uses, without the necessity for further strengthening or alteration. Indeed, the introduction of additional walls and floors within the barn structure would provide additional lateral rigidity.

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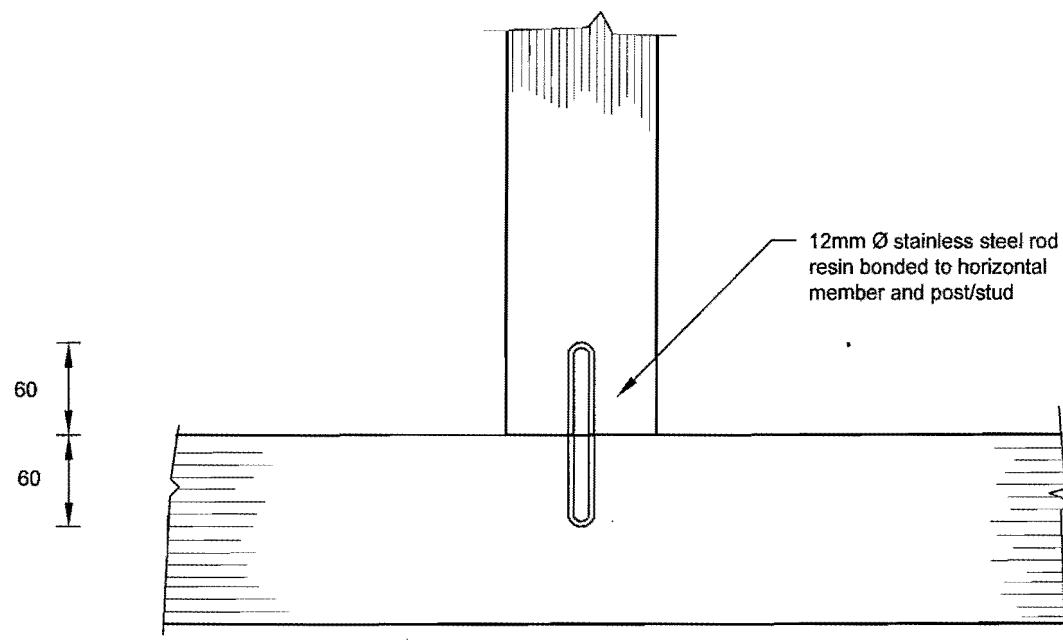
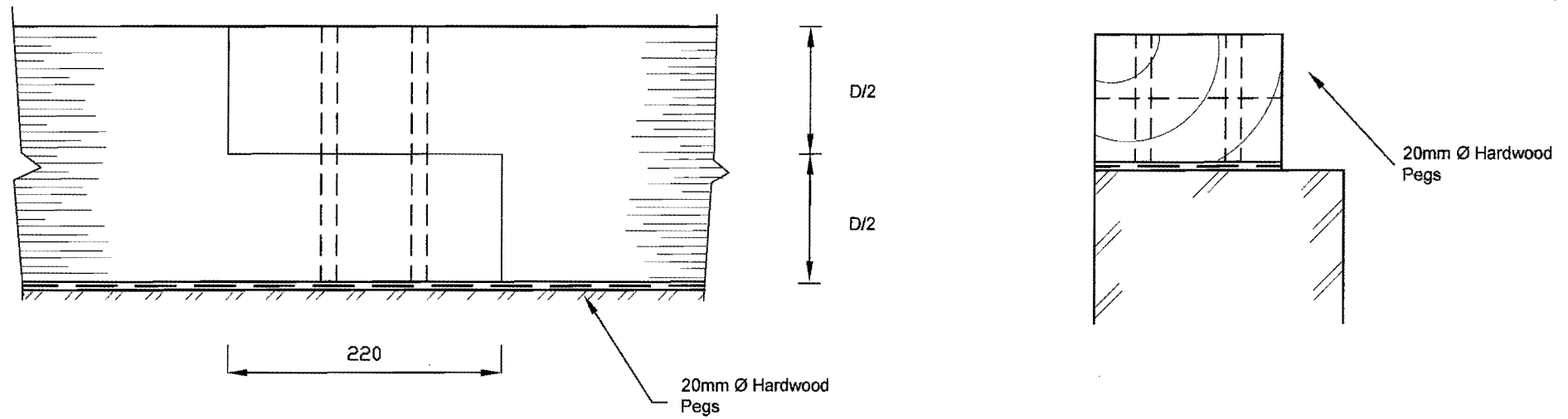


PRINCIPAL TIE/RAFTER REPAIR (1.5)

SPLAY-SCARF REPAIR JOINT (1:5)

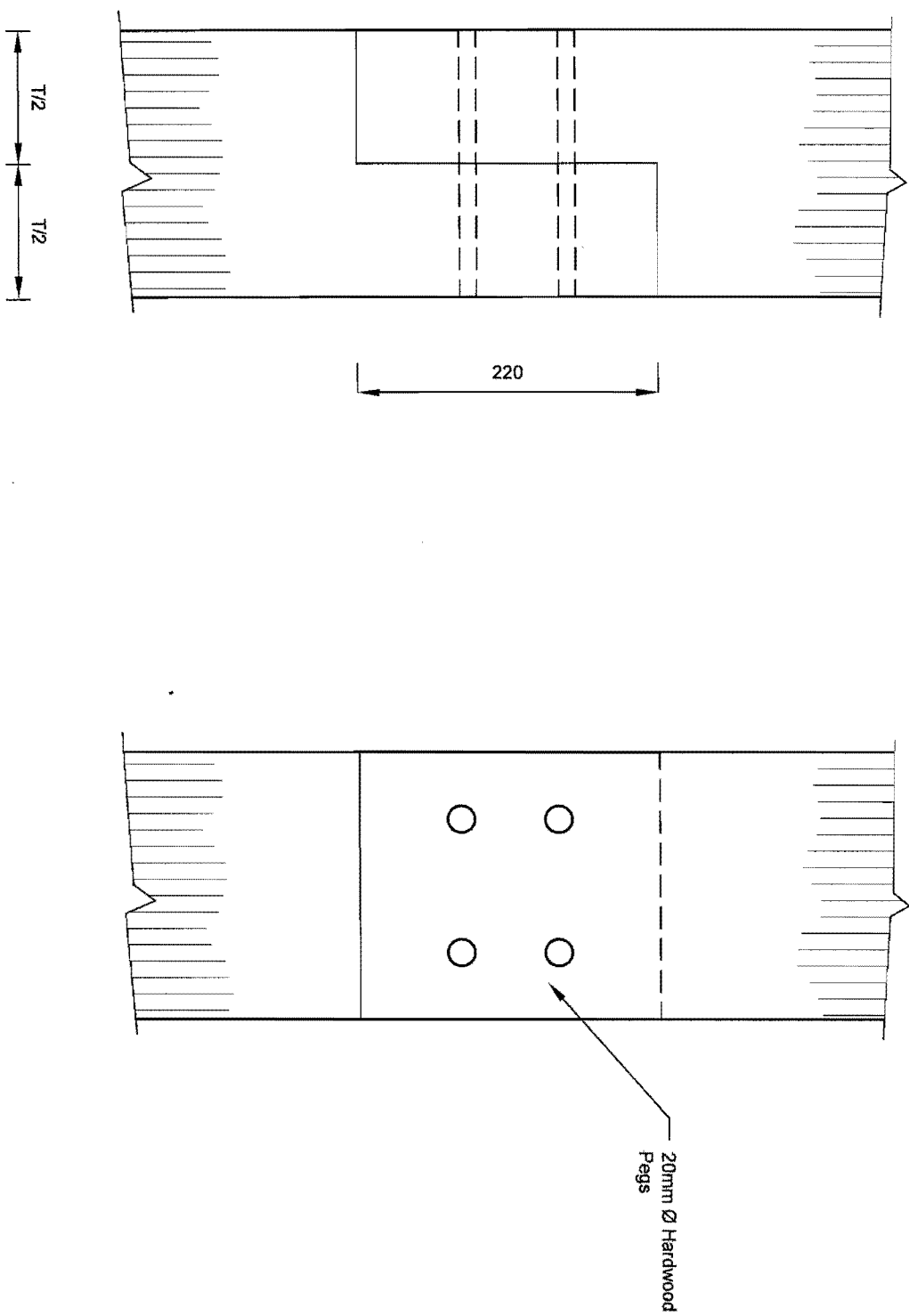


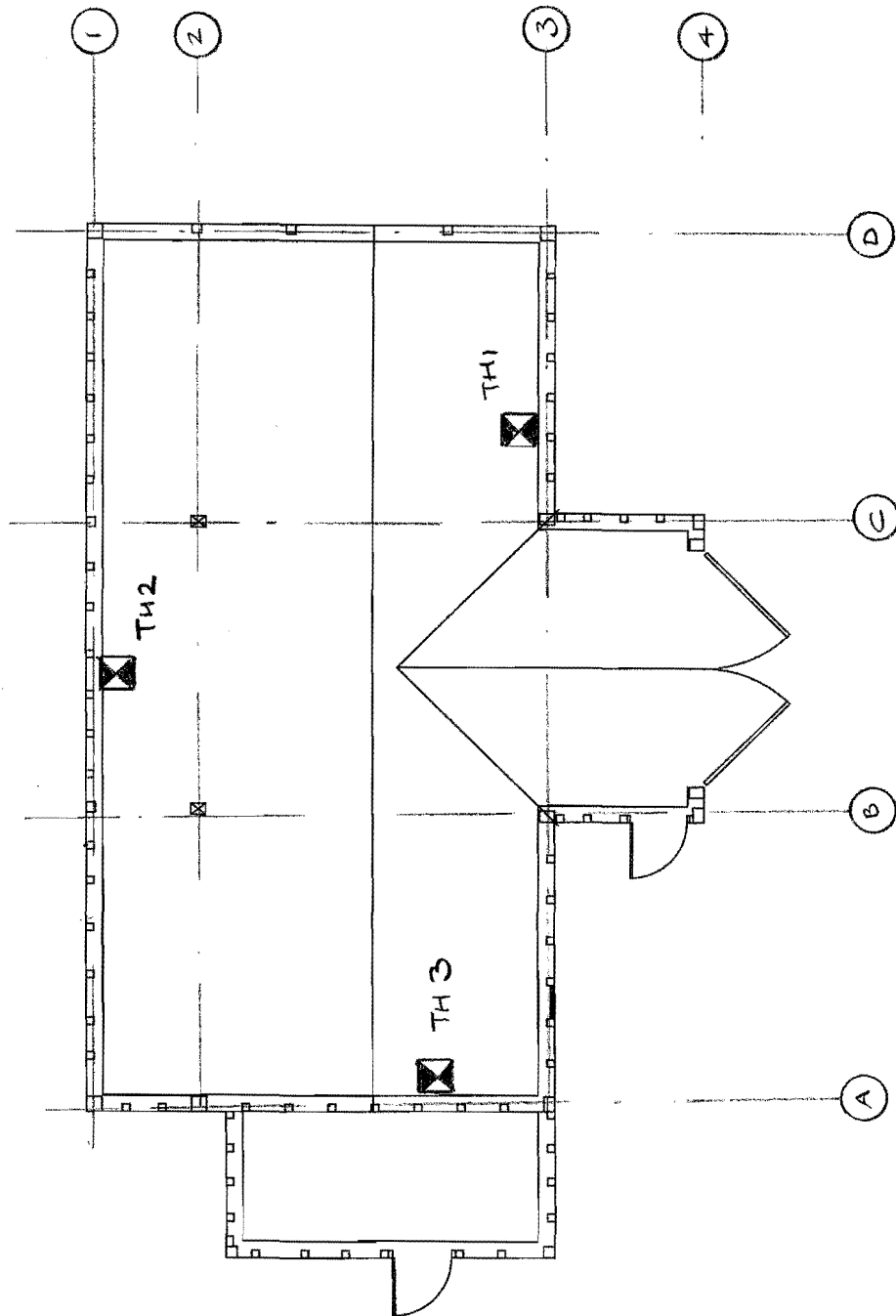
CILL-PLATE HALF-LAP JOINT (1:5)



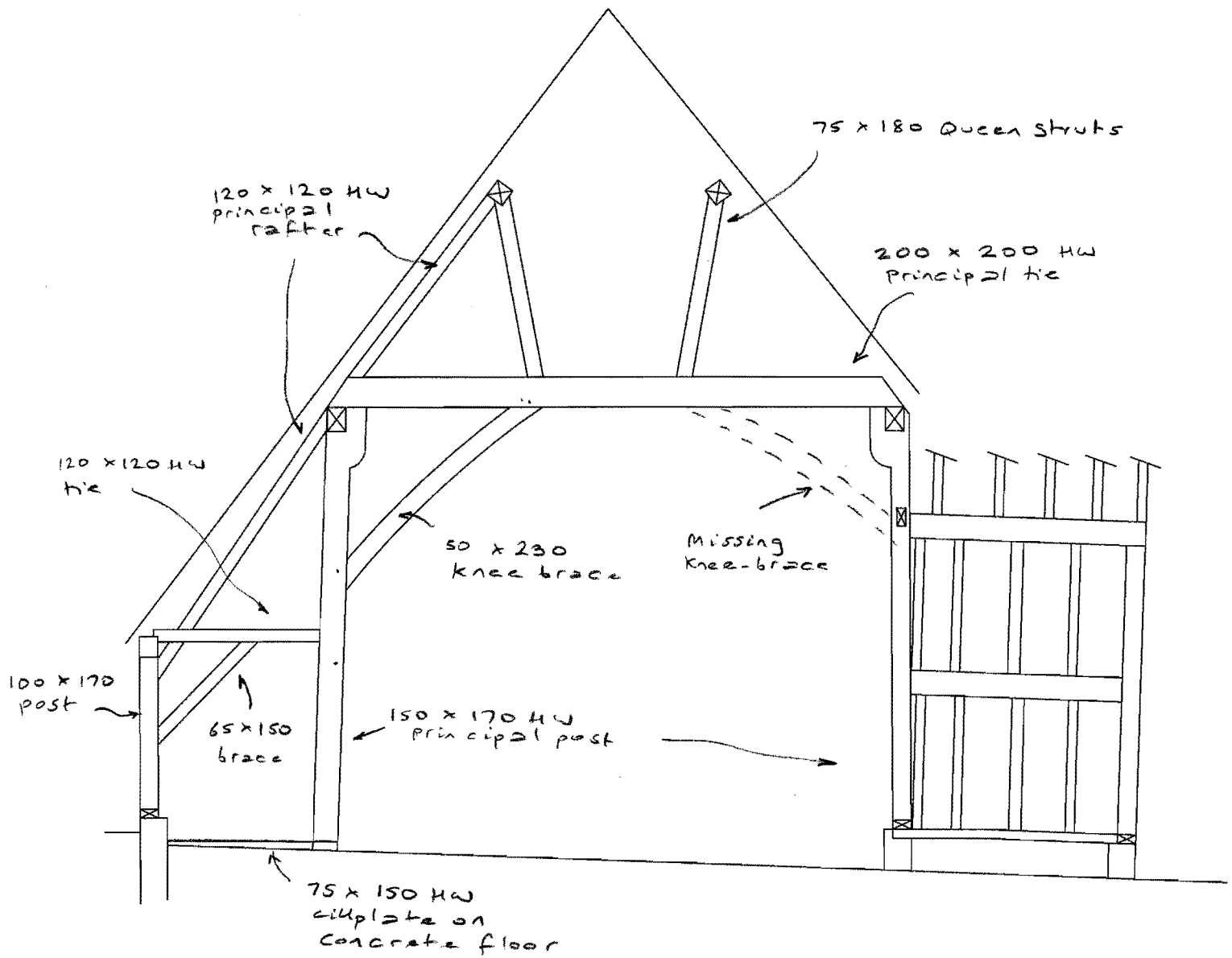
POST/HORIZONTAL JOINT (1:5)

POST HALF-LAP JOINT (1:5)





TRIAL HOLE LOCATIONS
(1:100)



TYPICAL QUEEN-POST FRAME
(1:50)