CALVERT BRAIN & FRAULO LTD

STRUCTURAL INSPECTION

OF

WIMBOTSHAM VILLAGE HALL
LOW ROAD
WIMBOTSHAM
NORFOLK
PE34 9QG

JOB No. 167625

INSTRUCTED BY :
JOHN CLARK OF
WIMBOTSHAM VILLAGE HALL

PREPARED BY :
R.W. BRAIN BEng (Hons) CEng MIStructE
ICIOB MFPWS

DATE : OCTOBER 2016

CONSULTING STRUCTURAL & CIVIL ENGINEERS
3 PORTLAND STREET, KING'S LYNN, NORFOLK, PE30 1PB
TEL 01553 766220 FAX 01553 766033 WWW.C-B-F.CO.UK

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1. INTRODUCTION

1.1 Following instructions received from Mr John Clark on behalf of Wimbotsham Village Hall on 31st August 2016 and subsequent confirmation from Charlotte Stannard on behalf of Community Action Norfolk on 5th September 2016 regarding payment of professional fees, a visual Structural Inspection of Wimbotsham Village Hall, Low Road, Wimbotsham, Norfolk was carried out on Thursday 22nd September 2016.

1.2 The following report is based upon the findings of the above inspection to consider the condition of the property as it presently exists.

1.3 Our brief for this report was to carry out a visual structural inspection to facilitate comment specifically upon the adequacy of the roof structure to support a replacement roof covering.

1.4 This report only relates to those areas of the property noted in 1.3 above. It should not be taken as a full building survey and specifically excludes the following general items :

1.4.1 The decorative condition of the property.

1.4.2 The condition of roof, wall, floor and ceiling coverings.

1.4.3 The condition of the property with regard to dampness, dry rot, timber infestation and the like.

1.4.4 The condition of the services including electrical, plumbing and heating installations.

1.4.5 The value of the property and other aspects such as legal searches, boundaries etc.

1.5 The report is based upon the parts of the property visible at the time of the inspection. We have not moved any items of furniture, fixtures or fittings in order to facilitate the inspection.

1.6 We have not inspected woodwork or other parts of the structure which were covered, unexposed or inaccessible and we are therefore unable to report that any such part of the property is free from defect.

1.7 No long term investigations of the locality or services have been made. We have no direct knowledge of the history of the property.

1.8 This report has been prepared solely for the use of Wimbotsham Village Hall Committee and the Parish Council pursuant to the maintenance and potential upgrading of the property. Its findings and liabilities are therefore non-transferable save with the express permission of Calvert Brain & Fraulo Limited.

1.9 For the purposes of this report, the front of the hall will be taken as the long elevation facing onto Low Road which is orientated approximately south east. For clarity, the front door to the hall is not located in the long elevation fronting Low Road but in the gable facing approximately east. In the following text the global orientation will be taken as if standing in Low Road facing the front elevation (long elevation) of the hall and the local orientation left and right on a particular wall will be taken as if standing directly in front of the elevation in question.

2. BACKGROUND

2.1 We understand that the building which is currently the Village Hall was relocated in 1951 from the airfield at Bexwell, Downham Market. This airfield was known as RAF Downham Market or RAF Bexwell. A brief search of the internet revealed that the airfield and buildings were constructed in 1941 / 1942 as a satellite station for RAF Marham. It would appear therefore that the building probably dates from the early 1940s.

2.2 The main section of the building consisting of the hall and bar is rectangular on plan with a pitched roof with ridge running parallel to the front elevation. To the north eastern end the building cranks through approximately 30^{o} on plan to create a gable facing approximately east. The cranked section of the hall contains the main access corridor off which are located the kitchen to the south and the toilets to the north. At the south western end of the hall there is an extension to the building forming the main store for the hall. The width of this extension is less than the width of the main building, the roof is therefore lower than the main hall roof and the ridge is offset, see photos 1 and 2 below.

Photo 1 – Front north eastern elevation and eastern gable elevation containing main front entrance door

Photo 2 – Photo from the south west showing main hall and store extension

2.3 External walls around the entire perimeter of the building are rendered and painted. The roof has a layered mineral felt covering which probably consists of more than one layer of felt, although the total number cannot be determined from a visual inspection. There are two ventilation cowls on the roof over the main hall, although these did not appear to be providing ventilation internally.

2.4 Along the north western and northern elevations, ground level is lower revealing a low level rising brick plinth beneath the main rendered walls, see photos 3 and 4 below.

Photo 3 – Northern elevation

Photo 4 – North western elevation showing low level rising brick plinth

2.5 All of the windows are timber casement windows opening outwards and all doors are timber as well. There are two chimney stacks projecting through the roof at eaves, one on the front elevation and one on the rear elevation directly above the fireplaces in the main hall on the front and rear internal walls.

2.6 The external walls of the main original hall structure comprising the bar, hall and kitchen / toilet block are approximately 85mm wide above the perimeter plinth. The wider low level plinth wall is approximately 250mm wide for approximately 1250mm above internal floor level.

2.7 Internally the roof covering can be seen to be supported on purlins spanning between timber roof trusses, which are exposed in the main hall but enclosed above a horizontal ceiling in the kitchen and toilet block and above a suspended ceiling in the bar. The roof structure in the store is vaulted and open up to the apex.

2.8 The floor in the main hall is timber boards probably on battens on a concrete floor slab, although the lower make-up is conjecture. In the bar there is a vinyl floor covering and tiles in the kitchen / toilet block. There is a step down from the bar into the adjacent store which has a concrete floor.

2.9 There were no significant trees near the building.

2.10 The Geological Map of Great Britain indicates the likely bearing stratum in this area to be sand of the Mintlyn member. This is a sedimentary bedrock formed in the Cretaceous period.

2.11 Drawing 167625 / 01, attached to this report as Appendix 1, indicates a general floor plan and cross section through the building.

3. EXTERNAL INSPECTION

3.1 A visual inspection of the external wall surfaces was carried out.

3.2 On the eastern gable elevation containing the front entrance door and also along the south eastern front elevation, ground level is at or slightly higher than internal floor level and a small drainage channel has been created between the gravelled car parking area and the walls of the hall. This will assist greatly in terms of rising damp in the walls where ground level is at or higher than floor level. Ground level should ideally be at least 150mm lower than DPC / internal floor level. There was various fine cracking in the render forming the external finish on these elevations. Some areas of render at low level were damaged, particularly on the eastern gable elevation. A small patch repair has been implemented in the render at the far left side of the main original building adjacent to the store extension. The chimney stack which exits through the roof at eaves level on the front elevation does not extend sufficiently high above the roof to enable the chimney to function properly and the stack may in fact be capped. The actual details of the top of the chimney were not inspected at high level.

3.3 The roof over the main building undulates along the length of the front roof pitch. This can be seen on the main roof pitch as well as at ridge. The high point in the undulations correspond with the timber trusses internally and the undulations between the trusses are the result of the roof structure between the trusses sagging. The extent of the deflection in the roof structure between the trusses can clearly be seen in photos 5 and 6 below.

Photo 5 – Undulations in ridge over main hall

3.4 The flashing at the abutment of the lower roof over the store to the original south western gable of the main hall building appears to have been repaired in a rudimentary manner potentially using self-adhesive flash band. The arrangement of this flashing should be improved upon, see photo 6 below.

Photo 6 – Rudimentary arrangement of flashing between roof over store and main hall. Undulations in ridge of main roof also clearly evident in this photo.

3.5 In the western internal corner created where the store extension abuts the original south western gable of the original building there is a vertical joint which has been filled in the past. This joint will need regular attendance to maintain watertightness at this junction, see photo 7 below.

Photo 7 – Vertical joint at junction of store extension with main hall

3.6 The rear north western and northern elevations of the main hall also contain numerous fine cracks in the external render, see photos 8 and 9 below.

Photo 8 – Fine cracking in rear north western elevation

Photo 9 – Typical fine cracking below window in rear north western elevation

3.7 The cracks illustrated in the photos above are typical around the external perimeter of the building.

3.8 Some damaged render also exists on the rear north western elevation as indicated in photo 10 below, as well as in other areas around the building.

Photo 10 – Damage to low level render on rear north western elevation

3.9 At low level on the rear north western elevation the upper two courses of brickwork oversail the lower rising masonry. This movement in the upper courses of masonry could potentially be the result of lateral expansion of the ground floor slab or expansion / contraction of the low level masonry. We believe both of these potential causes of the movement in the masonry to be unlikely. Expansion and contraction of the low level masonry is unlikely because this elevation faces north west and will not therefore receive significant increases in temperature due to exposure to the sun and there is no evidence internally of lateral expansion movement of the floor slab. It is also the case that the mortar forming the course immediately below the upper two brick courses appears to overhang the rising masonry below and therefore we suspect that the upper two courses were originally constructed in this arrangement due to the fact that the lower rising masonry was potentially misaligned, see photo 11 below.

Photo 11 – Upper two courses of low level masonry oversailing rising wall below

3.10 To facilitate a more detailed inspection of the structure of the building, a section of external render had been removed prior to our attendance by Mr John Clark, see photo 12 below.

Photo 12 – Section of external render removed at location of internal truss and post at position indicated on drawing 167625 / 01

3.11 This revealed a timber post on the line of the truss over the hall internally to be made up of four timber components. The overall depth of the timbers in the wall appear to be approximately 70mm. The two middle timbers are approximately 15mm x 70mm. There is then an additional timber on each side of the central core which is rebated front and back to receive plasterboard. The plasterboard on the outer surface appeared to be 9½mm thick and that on the inner surface 12½mm thick. There was no insulation present between the studs and on the outer surface there was a bituminous building paper onto which an expanded metal lathing had been fixed over which 15mm of render had been applied. The overall thickness of the external walls at high level around the perimeter was therefore approximately 85mm. This width of wall is very slender for a building of this size and type.

3.12 At the location where the render had been removed there was also some diagonal bracing present in the plane of the wall and no rot was noted in any of the timbers at this specific location. Part way up the multiple stud there were two bolts and a steel plate noted. These correspond with a bracket internally on this column which fixes a steel post internally to the multiple timber stud, as described further on in this report and as shown in photo 17.

4. INTERNAL INSPECTION

4.1 Internal wall surfaces above the low level plinth were checked, using a 1200mm long spirit level, and leans in millimetres / metre over the length of the level are noted on drawing 167625 / 01. This exercise was only undertaken in the main hall and immediately adjacent the hall in the female WC and kitchen.

4.2 These measurements indicate that there are some minor leans on the walls forming the main hall. No overriding pattern emerges, although the rear wall appears to lean in towards the hall for most of its length and there is some similar inwards lean on the front wall towards the stage (south western) end of the hall.

4.3 The main hall has seven trusses visible throughout its length with blockwork walls at either end built up to the underside of further trusses. At the south western end one additional truss is evident over the bar and at the eastern end there is at least one truss on the change in direction of the building plus an additional truss evident over the kitchen and male WC. The eastern gable end appears to have been formed without a truss as does the original south western gable end of the building.

4.4 The internal blockwork walls at either end of the main hall appear to have been built up to the underside of a truss. From the top of the blockwork up to the underside of the roof the truss appears to have been boarded on the hall side to create a vertical internal gable at each end of the main hall. Photo 13 below shows an internal view of the hall from the southern corner adjacent to the stage and photo 14 below shows an internal view of the hall from the north eastern end.

Photo 13 – Internal view of the hall from the southern corner adjacent the stage

Photo 14 – Internal view of the hall from the north eastern end

4.5 An inspection in the bar area revealed a suspended ceiling and the low level sections of one truss visible on the front and rear elevations, see photo 15 below. An inspection was made above the suspended ceiling where one of the trusses could be seen spanning across the bar and the truss located over the blockwork wall at the south western end of the hall could also be seen. See photo 16 below.

Photo 15 – Internal view of bar

Photo 16 – View of roof structure over bar looking towards the main hall

4.6 The truss over the bar is slightly different to that over the main hall in that it has not been clad with additional plywood or hardboard cladding to improve its appearance. The truss over the bar area is therefore the original format of the trusses in this building. It can be seen from this truss how these structural members were formed by building up various components with multiple timbers with spacers and additional plywood gussets at joints. In the hall various sections of these members have been overclad I believe to create a more aesthetic appearance for the main hall. It can also be seen in photo 12 above that additional vertical studs were added to the truss at the end of the hall in order to facilitate overcladding the truss above the masonry wall below.

4.7 In photo 12 above it can be seen that there are three intermediate purlins on each roof pitch spanning between the trusses and there is a significant sag in these purlins between adjacent roof trusses.

4.8 It was not possible to inspect the roof structure over the kitchen and toilet accommodation at the eastern end of the building due to lack of access, however we anticipate that similar trusses have been used at that end of the building to form the kitchen and toilet block, although the exact arrangement of how the additional trusses at the northern external corner have been installed to maintain the span of the purlins is not clear.

4.9 Internally some sections of the existing structure were opened up by Mr John Clark for our inspection, as indicated on drawing 167625 / 01. Cladding was removed to a column on the rear elevation as indicated in photo 17 below. This revealed the inside face of the multiple timber stud described within my external inspection notes with the addition of a vertical steel column bolted to the inside face of the timber member. The connection of the steel to the timber was via the bracket described in paragraph 3.12. The steel section appeared to be a piece of small gauge railway line. The steel appeared to extend upwards beyond the knee brace visible in the photo and the extent of the bottom end of the steel was also unclear from the section of column that was revealed. It is not clear from our inspection whether the steel column exposed and illustrated in photo 17 is an isolated repair or forms part of the structure elsewhere.

Photo 17 – Column on rear elevation adjacent to the stage

Photo 18 – Column and low level wall exposed on front elevation adjacent to the redundant fireplace

4.10 The column immediately adjacent to the redundant fireplace on the front elevation was exposed for inspection together with a section of the low level wall, all as indicated in photo 18 above. At this location this revealed what appeared to be 9" wide brickwork directly below the timber column with a horizontal timber plate located above the brickwork. It was not clear whether or not the multiple timber column continued below the timber plate and into the front face of the 9" brickwork. The brickwork appeared to reduce in thickness immediately to the side of the column where additional vertical timber studs were placed between a horizontal sole plate and the upper timber head plate with horizontal battens in line with the head plate above to provide support to the vertical timber matchboard cladding. It is of note that some of the timbers in this exposed area were partially rotten. It is also of note that there appeared to be some possible rot in the matchboard cladding.

Photo 19 – Low level wall adjacent to redundant fireplace with horizontal timbers containing some rot

Photo 20 – Timber column above low level wall indicating multiple timber stud and steel bolts but no reinforcing steel column

4.11 In addition to the exposure of the external walls, a section of ceiling was removed at the location indicated on drawing 167625 / 01. This revealed a make-up very similar to the external wall make up where twin recessed timbers form each purlin spanning between the principal trusses. The lower plasterboard fixed into the lower recess was 9mm in thickness and the upper plasterboard appeared to be 12½mm thickness. Above the upper plasterboard there appeared to be sawn boards of unknown thickness. Between the boards and the upper plasterboard there was a layer of bituminous building paper. We suspect that the bituminous building paper (vapour membrane) passes over the roof and over the external surfaces of the walls to create a complete vapour barrier, although this was not proven by inspection, see photo 21.

Photo 21 – Section of internal ceiling removed in hall for inspection

4.12 The roof structure over the store consisted of 95mm x 45mm jack rafters at 1 metre centres supported upon one purlin under each roof pitch. The purlin was 95mm x 70mm in cross section and spanned the full width of the store. At high level there was a ridge board with collar beneath. The purlins are undersized for their span and we suspect the rafters are also insufficient for the span and there is no horizontal tie therefore there may well be some horizontal thrust at eaves from this roof configuration.

5. DISCUSSION

5.1 The levelling of the walls in the main hall indicate that the wall and roof structures are currently performing reasonably adequately. There are no significant leans on the walls nor bowing of the walls and the roof trusses also appear to be performing adequately, with no signs of distress in the roof trusses. However, the purlins spanning between the roof trusses are visibly distorted, sagging downwards under the self-weight of the roof covering and other elements which form the roof between the purlins.

5.2 We were not able to identify the arrangement of the purlin as clearly we were for the studding forming the walls at each column location. However we expect the purlins comprise a pair of 55mm x 45mm timbers at 980mm centres supporting two layers of plasterboard and probably a 10mm – 12mm thick sawn timber board plus mineral felt covering. The size and spacing of the purlins is clearly inadequate to carry this load.

5.3 Standard 9.5mm plasterboard weights 6.3kg/m^2 and a 12.5mm thick plasterboard weights 8kg/m^2. The weight of a sawn timber board, say 10mm thick, is approximately 5kg/m^2. The weight of the structure spanning between the purlins is therefore approximately 21kg/m^2 excluding the weight of the mineralised felt covering.

5.4 We believe it may be possible that when the original building was relocated from RAF Downham Market / RAF Bexwell that potentially it was simply waterproofed with the bituminous building paper over the roof and walls. Subsequently the walls have been supplemented with a cement render on either an expanded metal lathing or chicken wire fixed back to the original wall structure and potentially the roof has been overboarded with the sawn timber boards and mineralised felt thus adding additional weight to the walls and roof.

5.5 It also needs to be borne in mind that a building originally erected during World War II for use on a RAF base was probably produced on the basis that it was to be a temporary building and therefore never built to the standards of a permanent long term building. Also taking into account war time shortages it is likely that structural members would have been on the smaller size rather than oversized. The fact that this building structure is now in operation in 2016 could therefore be construed as slightly surprising. Notwithstanding these comments the building does currently appear to be performing reasonably adequately with the exception of the purlins spanning between the principal trusses.

5.6 Notwithstanding the fact that the building currently appears to be performing reasonably adequately, given the original location and use for the building, it must be that this building is nearing the end of its useful life. We did not inspect any low level areas of timber framing. Some timber in the vicinity of the redundant fireplace on the front elevation were however showing signs of rot and there may therefore be rot in other areas of the building currently covered up.

5.7 The principal trusses which support the roof structure are also of an unorthodox construction and we would suggest are probably undersized for their function. We are of the opinion that it would be impossible to prove the adequacy of the principal trusses and their supporting columns for any additional load. It may also be the fact that significant snow loading could be problematic to the structure, although of course it has now performed adequately for some 75 years succumbing to significant snow falls and wind forces and therefore it could be argued that due to this long term performance the building has proved its adequacy. This is of course subject to the existing primary structure being in good condition.

5.8 The reason for commissioning this report, we believe, was due to the fact that the Village Hall Committee / Parish Council wish to re-roof the building and the contractor approached to undertake this task suggested that the existing roof structure may not be adequate to take the temporary weight of workman installing a new roof covering, due to the evident sagging of the purlins between the principal trusses.

5.9 The weight of the current roof structure is in excess of 20kg/m^2. We have suggested to Mr John Clark that potentially the existing roof covering including the purlins could be removed and replaced with appropriately sized purlins supporting a composite steel roof panel. The typical weight of a composite roof panel comprising 0.5mm thick outer steel sheet and 0.4mm inner steel sheet with a 115mm thick core of insulation is of the order of 12.5kg/m^2. It would therefore appear that the existing roof structure could potentially be removed and an insulated steel composite sheet be installed without adding any additional load to the existing roof trusses and the trusses would be loaded exactly in the same manner that presently exists. New purlins would need to be installed, appropriately designed and fixed to the principal trusses in exactly the same location as the existing purlins. In this manner no additional self-weight would be applied to the existing trusses. The fixing arrangements of new purlins to existing trusses would need to be fully considered and designed as would fixings of the steel composite sheets to the new purlins which would likely be timber and therefore a non-standard fixing arrangement.

5.10 Another issue which would need to be considered would be wind uplift. Currently there is a reasonable weight in the roof structure which is obviously, given the roof has not currently been sucked off by wind uplift, adequate for the current location. Adding a new lightweight roof covering would mean there was more potential for wind uplift to cause structural damage to the building and therefore some consideration would need to be given to this particular design case. Wind uplift can cause the bottom chord of a truss to go into compression and therefore some additional bracing of the bottom chord of the existing trusses may be required, pending a fuller consideration of the situation.

5.11 We would like to reiterate the fact that although the building appears to have performed adequately for the last 75 years or so, it is of a very slender form of construction and not one which we would consider robust. It is therefore questionable whether it is appropriate to spend significant sums of money replacing the roof covering. This is of course not entirely a matter that we have been asked to comment upon and simply include it in our discussion for further consideration by the appropriate authorities. There is also the issue that although no rotten timbers have been exposed in the areas inspected by ourselves, there may be areas of the existing structure which are suffering from decay and therefore the question arises as to how much of the existing structure should be the subject of a more detailed inspection prior to contemplating significant expenditure replacing the roof covering.

5.12 With regard to the roof over the store, the existing purlins will need to be removed and replaced with appropriately designed purlins should a new roof covering be considered over this section of the building.

5.13 General comments regarding the existing building fabric are listed below under recommendations.

6. RECOMMENDATIONS

6.1 General matters to be considered as part of any ongoing refurbishment / maintenance including the following :

6.1.1 Potentially reduce the two existing chimney stacks to a level below any new roof covering. If existing chimney stacks are to be retained then inspection of the flashings between the stacks and the roof covering should be made in the short term.

6.1.2 There are two existing roof ventilators on the ridge over the main hall. These would obviously benefit from removal if they are not currently performing any function in terms of ventilating the hall.

6.1.3 Adjacent the front elevation and eastern elevation, the ground level has been dug away from the wall because ground level is too high. This recess should be maintained clear at all times to prevent issues relating to rising damp.

6.1.4 The flashing between the roof of the store and the gable wall of the original building appears rudimentary and will need attention in the short term.

6.1.5 The low level brickwork along the rear elevation bows out for the upper two brick courses. Ongoing monitoring of this situation should occur and if the brickwork appears to move further in the future then some remedial attention will be required.

6.1.6 All cracks in the existing render need to be made watertight to prevent water ingress and potential rot of the timber structure. Local repairs and redecoration should be sufficient to keep the external wall envelope watertight.

6.1.7 Prior to contemplating any significant expenditure on the existing building we would recommend that a thorough inspection of all timber elements is undertaken.

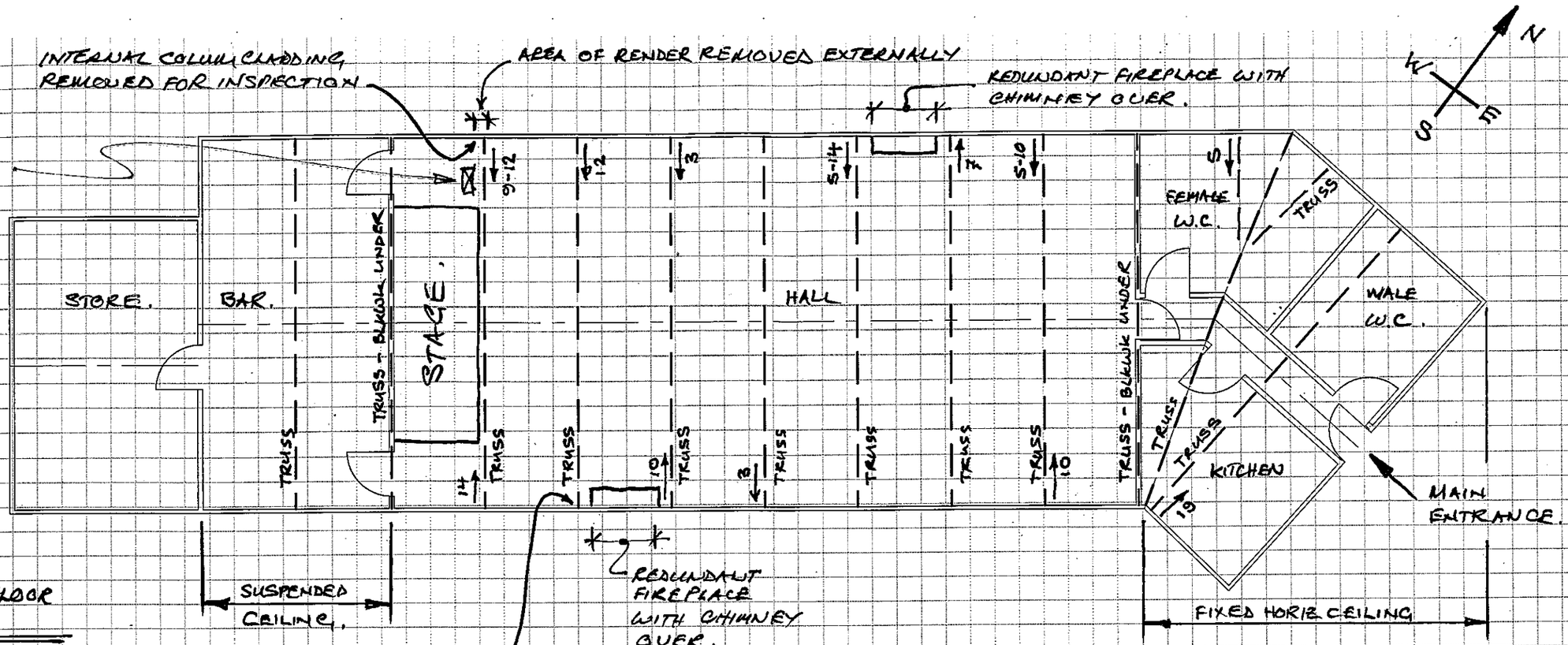
6.1.8 The connection of the rear store wall with the main hall gable wall needs to be maintained weathertight and ongoing maintenance in terms of filling the crack at this junction should occur.

6.1.9 All guttering should be regularly overhauled and cleared on an annual basis.

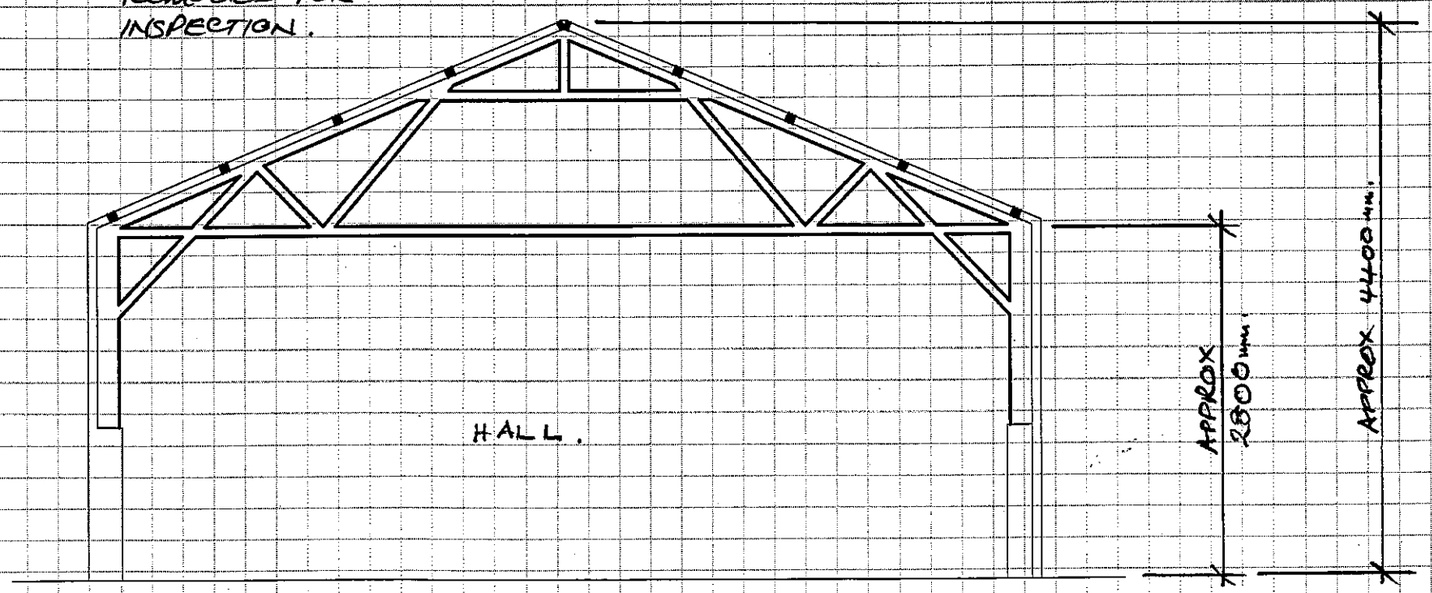
6.1.10 The bottom edge of the render at its junction with the low level rising brickwork should be maintained in good condition to prevent water penetration.

APPENDIX 1

Drawing 167625 / 01



GROUND FLOOR PLAN.



TYPICAL CROSS SECTION THROUGH HALL.

SCALES
APPROX 1:100

CLIENT
VILLAGE HALL COMMITTEE & PARISH COUNCIL

PROJECT
WIMBOTSHAM VILLAGE HALL

DRAWING TITLE
PLAN & SECTION.

CALVERT BRAIN & FRAULO LTD
CONSULTING STRUCTURAL & CIVIL ENGINEERS
3 PORTLAND STREET, KING'S LYNN, NORFOLK, PE30 1PB
TEL 01553 766220 FAX 01553 766033 WWW.C-B-F.CO.UK

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