



**Integral
Design
Developments Ltd**

Structural Engineering
Surveys & Design

T: 07749 141 836
E: enquiries.idd@gmail.com

Structural Inspection Report



Address

Barns A & B
Marshfield Gate Farm
Marshfield Lane
Gillow Heath
Staffordshire
ST8 6RG

Date of inspection: 26th May 2023

Prepared By:

J R Cooper Bsc Hons IEng AMIStructE

CONTENTS

Circulation / Issue History

1.0 Introduction

2.0 Executive Summary

3.0 Survey and Observations

4.0 Conclusion & Recommendations

Appendix A: Photographs

Appendix B: Supplementary Information

Circulation/Issue History

Version	Ref	Status	Issued To	Date
A	250-SIR-001	Information	M Stanmore	31-07-2023

1. Introduction

Integral Design Developments Ltd were instructed by the Client to carry out a non-intrusive structural inspection of 2 agricultural outbuildings in a rural setting.

The report does not consider the general fabric of the building or any requirement for general refurbishment.

It should be noted that this survey relates to the inspection of the existing building only, not the design and modifications to the same, or the design of new structures.

It is advised that as a non-intrusive survey, we did not cut into the fabric of the property during the course of our inspection and our findings must be considered in this light.

This report does not address matters related to timber and damp, building services or the presence of asbestos containing materials, all of which it is assumed will be subject to separate specialists reports.

The report is prepared on the basis of a visual inspection of the building by Mr J R Cooper.

The weather at the time of inspection was warm and dry.

The terms of this report are limited to matters of a structural nature. Whilst non structural building defects and hazardous materials may be noted and commented upon, these are not within the remit of the services provided. The survey has been limited to accessible areas. Below ground investigations have not been undertaken.

This report is prepared specifically for our Client. It is not for transmission in whole or in part to any other third party and we bear no obligation to any such party for its content without our express permission in writing. Such permission will not be unreasonably withheld.

For description orientation, the elevations are set as viewing the building from the courtyard i.e. front, rear, left and right.

Specific defects are described as facing each particular elevation.

2.0 Executive Summary

This report is prepared on the basis of a usual inspection carried out over a one day period to the outbuildings Barn A & Barn B.

The purpose of the report is to assess the condition and stability of the main structural elements, i.e. the roofs, walls, floors and foundations. The report is intended to highlight what, if any, significant remedial work should be allowed for as part of the overall refurbishment works.

Barn A

In general, this building is structurally sound with no evidence of significant or severe recent structural movement.

There is visible evidence to suggest that the building has been modified with several internal layout alterations and extensions added over the years.

There are visible signs both internally and externally where movement has occurred to the loadbearing masonry elements which will require intrusive investigations to expose areas to adequately diagnose and provide a remedial solution. Hairline to moderate cracking to the external brickwork mortar joints both high and low level can be seen to all elevations. However, there are no visible severe or significant structural defects.

Barn B

This single storey building has no visible signs of significant or severe structural movement. However, there are hairline cracks to the external render, weathered mortar joints in small areas and severe timber decay to the fascias and soffits to the rear of the flat roof area which if left unattended could lead to water ingress high level.



Aerial view of site showing the location of Barn A & B.

3.0 Survey & Observations

Barn A

Barn A is positioned immediately to the left side of the main entrance gate which leads into the courtyard and is visible from Marshfield Lane.

Approximate date of construction is mid 17th century. The barn has one and two storey areas. The ground floor historically has been used for agricultural purposes for livestock such as cattle and horses. The 1st floor level has been used for general storage.

The construction comprises of the following:

Roof

A duo pitched roof profile with masonry gables to the front and rear elevations. The structure consists of softwood rafters which are supported midspan by softwood purlins. The purlins bear onto the masonry gables to the front and rear elevations and by a kingpost softwood truss in the middle portion of the building. There are additional timber props and some raised collar ties which have been installed to provide additional support to the roof. The roof covering uses rosemary clay tiles with a bitumen felt sarking.

The ridge line undulates approximately 40mm overall. The intermediate purlins have deflected laterally which are the likely cause for this and have since had timber collar ties installed to strengthen the roof. This is not considered to be structurally significant.

There were no obvious signs of timber decay to the roof timbers, but a timber condition survey would be recommended as part of any refurbishment works.

The rosemary clay tiles appear to be in reasonable condition, but the bitumen felt sarking is torn and degrading in various parts of the roof and should be replaced.

Walls

The ground floor level perimeter walls have been constructed using handmade clay bricks with a lime-based mortar. The upper level was added at a later date (circa early 1900s) with a Cheshire pre-war wire cut brick. The bond is English garden wall for both the upper and lower level.

Precast concrete lintels and windowsills have been used to form openings for many of the doorways and windows. In other parts, steel railway track has been installed to support larger openings.

The front elevation is covered by a substantial amount of common ivy (*Hedera Helix*) which has limited the extent of the inspection to this elevation. The exposed areas however, do not show any signs of severe or significant structural defects. However, I would recommend that the vegetation is removed as part of the refurbishment works as there is a risk of deterioration to the fabric of the building façade and roof should it remain. The lintel over the garage door should also be replaced for a galvanised steel lintel.

The righthand elevation has a series of single glazed windows and a door leading into the ground floor. The masonry above the doorway up to the eaves level is of a later era of construction. Attempts to straighten out this wall panel can be seen with corbelling of the brickwork over the lintels to the right side. However, whilst this is not aesthetically pleasing it does not create an issue from a structural sense.

There is a store room opening which has a section of steel railway track used as a lintel to support a panel of masonry. The beam is suffering from corrosion and has begun to laminate. This should be replaced as part of any refurbishment works.

The rear elevation wall has a fine stepped diagonal crack running from the corner of a doorway formed at 1st floor level downwards and is approximately 900mm long. There is another stepped diagonal crack from the top of the doorway running up to the ridge of the roof. There is no apparent lintel installed where this doorway has been formed so would be recommended that an appropriate lintel for a solid external wall is fitted as part of the refurbishment works. The cracks appear to be historic and are not deemed to be structurally severe or significant defects.

The left hand elevation runs parallel to Marshfield lane shows visible signs of lateral movement to the original ground floor level masonry. The mortar to the middle of the wall panel has allowed the right side to lean outwards creating a step in the wall panel by 25mm up to 2.4m in height. However, this does not continue above into the later era of construction (circa 1900s) which suggests that this movement is historic and is not considered to be a structurally significant defect.

Floors

The upper floor is constructed using softwood timber joists which span front to back and are supported at regular intervals using a combination of steel I beams and railway track sections. There are no visible signs of failure and are adequately sized for its current use.

The ground floor has a ground bearing concrete slab. It is unlikely that the slab is original as it would be typical to see stone paving laid throughout. The concrete slab is also not likely to be insulated or have a damp proof membrane beneath.

Barn B

Barn B is sited further into the courtyard area behind Barn A. This is of newer construction dated at around early 1900s and could have been when the alterations to Barn A were carried out. It is a single storey building, rectangular on plan with 2 different roof constructions.

The building is construction using the following:

Roof

A duo pitched roof with gables to the left and righthand elevations with a change in ridge level midway.

The left side of the building is constructed using softwood rafters with a series of purlins that span onto the left gable and an internal panel of loadbearing masonry. This is covered with rosemary clay tiles with no sarking membrane present. Other than some minor areas where daylight is coming through the roof due to the occasional slipped/broken tile, there are no obvious issues with the fabric of the roof. However, There appears to have been noticeable deflection of the roof structure across the rear. Some of the rafters appear to have failed with longitudinal splits. The damaged timbers should be replaced like for like as required.

The right side has a corrugated cement/asbestos sheets covering which are supported by steel angle purlins. The purlins span onto loadbearing masonry and supported midspan by a steel fink truss formed using similar sized angle sections. The roof structure overall appears to be in good order. There is some slight surface corrosion to some of the steel members but nothing visible suggests there are significant defects.

Walls

The perimeter walls are solid brickwork construction using Cheshire pre-war wire cut bricks. The walls are solid using English garden wall bond.

The front elevation has a series of windows and entrance door. The openings are formed with precast concrete lintels above and the windowsills have a brick on edge corbel detail. The concrete lintels have spalled in parts exposing the steel reinforcement. It is recommended that these are replaced as part of the refurbishment works.

There are areas below windowsill level where the mortar has eroded. The condition of the mortar joints should be examined further and raked out and repointed where required.

The righthand elevation wall acts as a retaining wall to approximately 1m high along its length where an access road runs parallel. There are some fine horizontal cracks at approximately the level of the road internally close to where a window opening has been formed. This area should be locally rebuilt and made good.

The left-hand elevation shows no visible signs of severe or significant structural defects.

The rear elevation has a temporary lean-to timber structure fixed to the perimeter wall. A doorway has been poorly infilled with brickwork and should be made good to match. The rear right side wall has bowed outwards by approximately 40mm. This is believed to be as a result of deflection in the roof applying lateral force to the top of the wall. As part of the remedial repairs to the roof, an allowance to take down and rebuild this section of wall to straighten and level it should be considered.

Floors

The ground floor has a ground bearing concrete slab. The slab is unlikely to be insulated or have a damp proof membrane beneath. There are some fine cracks over the surface of the slab which are believed to be a result of seasonal effects as there are no movement joints. There are no obvious signs of failure to the slab structurally.

4.0 Conclusion & Recommendations

Overall, the buildings are in reasonable condition and considered to be economically viable for refurbishment and adequate for change of use as residential dwellings. There are minor structural defects identified but none thought to be significant at this stage subject to further intrusive investigations. There will be a requirement to undertake intrusive investigations to provide suitable recommendations as mentioned in the survey & observations section. The following works should therefore be undertaken as part of the refurbishment works:

Barn A

Roof

1. The roof coverings should be removed to allow a new sarking membrane to be installed.
2. A roof condition survey should be carried out to inspect the fabric of the roof and rainwater goods by an accredited NRFC member.
3. Any defective timber sections should be replaced like for like.
4. The rainwater goods and external fascia boards will likely need to be replaced at the same time.

Walls

1. Install crack stitching to damaged masonry sections using a Helifix Helibar and Dryfix system (See Appendix B).
2. Rake out and repoint cracked and weathered mortar joints once remedial works are completed where required in a mortar mix to match existing.
3. The steel railway track section that has been installed over the garage door opening should be removed and replaced for a galvanised steel lintel (By CATNIC CN81B or similar approved).
4. Where lintels are absent above doorways, a steel lintel (By CATNIC CN71A or similar approved) should be used.

Floors

1. It is recommended that the existing concrete floor slab is removed and a new 125mm thick slab using C28/35 concrete with A142 mesh with 35mm cover to the bottom with 1200g visqueen dpm beneath, laid over 150mm type 1 compacted aggregate with 50mm sand blinding. Insulation could also be installed at this stage.

Misc

1. If loads are to be increased to the superstructure, it would be recommended that the existing foundations are exposed and the subsoils are assessed for suitability.
2. Below ground drainage should be inspected and a CCTV camera survey carried out to check there are no cracks or slipped connections.
3. In addition to the roof survey, it is recommended that a timber and damp survey is undertaken by an accredited PCA member to assess the general fabric of the superstructure.
4. Allow for lateral restraint straps to be installed in accordance with approved document A of the building regulations (See Appendix B for extract).

Barn B

Roof

1. Access to be provided to carry out a closer inspection of the apparent lateral roof spread within timber structure to the left side. Damaged or decayed timber sections to be replaced for matching section sizes.
2. A roof condition survey should be carried out to inspect the fabric of the roof and rainwater goods by an accredited NRFC member.
3. The rainwater goods and external fascia boards will likely need to be replaced at the same time.

Walls

1. Install crack stitching to damaged masonry sections using a Helifix Helibar and Dryfix system (See Appendix B).
2. Rake out and repoint cracked and weathered mortar joints once remedial works are completed where required in a mortar mix to match existing.
3. Damaged concrete lintels where steel reinforcement is exposed should be replaced for a new steel or concrete lintel (By CATNIC or Naylor or similar approved).
4. Where lintels are absent above doorways, a steel lintel (By CATNIC CN71A or similar approved) should be used.

Misc

1. If loads are to be increased to the superstructure, it would be recommended that the existing foundations are exposed and the subsoils are assessed for suitability.
2. Below ground drainage should be inspected and a CCTV camera survey carried out to check there are no cracks or slipped connections.

3. In addition to the roof survey, it is recommended that a timber and damp survey is undertaken by an accredited PCA member to assess the general fabric of the superstructure.
4. Allow for lateral restraint straps to be installed in accordance with approved document A of the building regulations (See Appendix B for extract).

APPENDIX A – PHOTOGRAPHS

Barn A



Fig 1. Common ivy growth to front and righthand elevation.



Fig 2. Corbelled brickwork over concrete lintel and steel railway track section over store room entrance.



Fig 3. Front elevation where lintel has deflected and should be replaced (By CATNIC or similar approved).



Fig 4. View of rear and left hand elevation.



Fig 5. Fine stepped diagonal cracks above and below doorway to rear elevation.

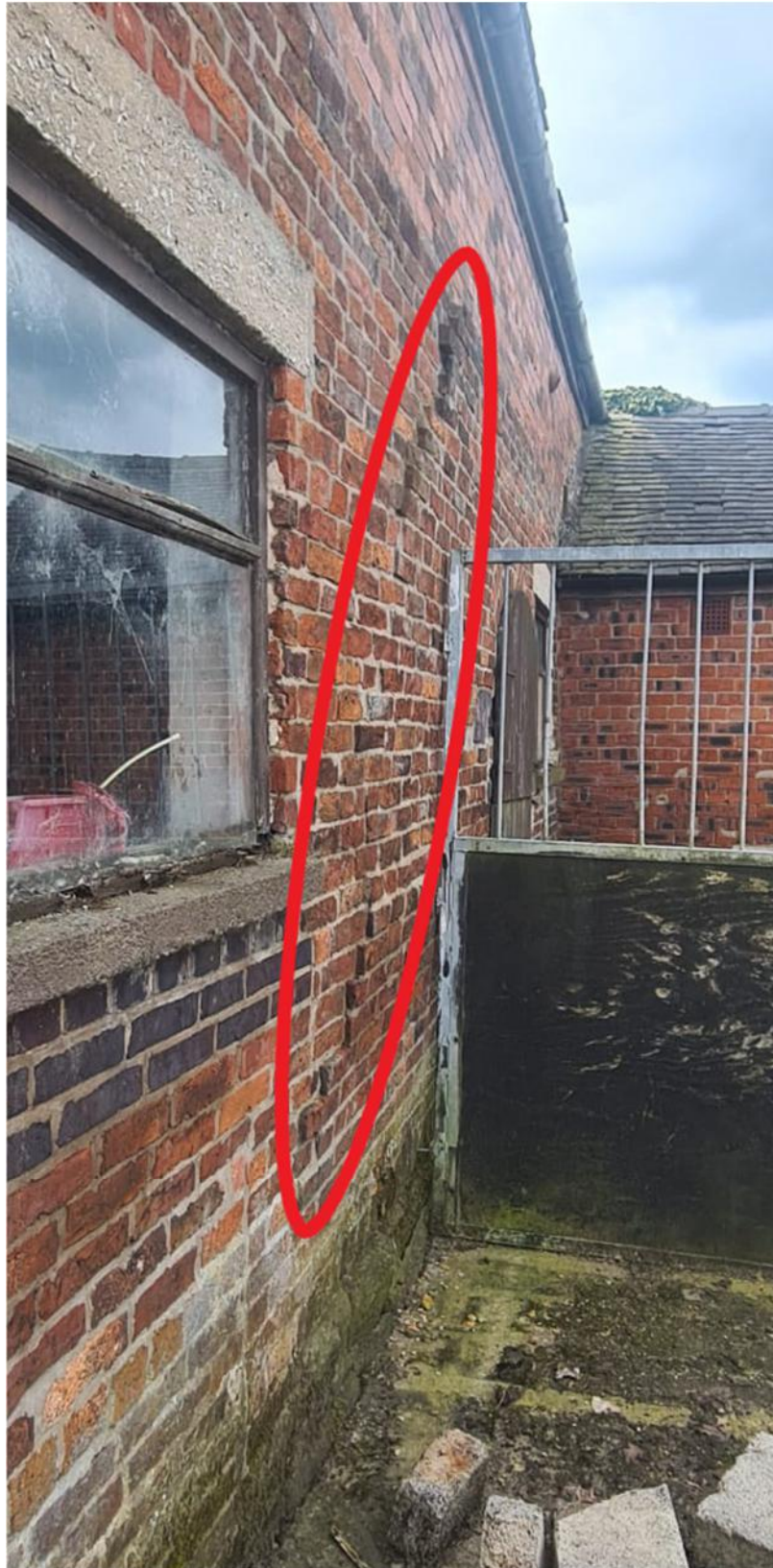


Fig 6. Step in wall panel due to historic lateral movement.



Fig 7. View internally of the ground floor showing steel beams and floor joist arrangement.



Fig 8. View internally of the 1st floor showing timber posts and raised ties supporting the roof.



Fig 9. View internally of the 1st floor showing kingpost truss supporting purlins within the roof.

Barn B



Fig 10. Front elevation. Eroded mortar joints low level and damaged concrete lintels.



Fig 11. Left hand side of front elevation. Weathered face to stone lintels.



Fig 12. Rear and righthand elevation showing raised level access road.



Fig 13. Rear elevation. Doorway partly blocked up with bowed wall panel where lean to is.



Fig 14. Internal view of steel fink roof truss and steel purlins.



Fig 15. Internal view of timber purlins with steel rod ties.



Fig 16. Internal view of bowed rear external wall.

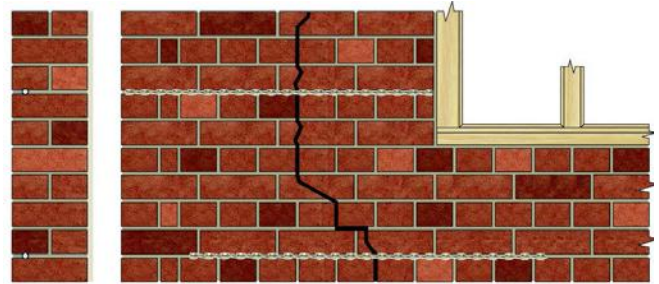
APPENDIX B – SUPPLEMENTARY INFORMATION

Crack Stitching a Solid Wall using HeliBars

METHOD STATEMENT

1. Using a twin-bladed, diamond-tipped wall chaser with vacuum attachment, cut slots into the horizontal mortar joints to the specified depth and at the required vertical spacing. Ensure that NO mortar is left attached to the exposed brick surfaces in order to provide a good masonry/grout bond.
2. Remove ALL dust and mortar from the slots and thoroughly flush with water. Where the substrate is very porous or flushing with water is inappropriate, use HeliPrimer WB. Ensure the slot is damp or primed prior to commencing step 5.
3. Mix HeliBond cementitious grout using a power mixer and load into the Helifix Pointing Gun CS.
4. Fit the appropriate mortar nozzle.
5. Inject a bead of HeliBond grout, approx. 15mm deep, into the back of the slot.
6. Push the 6mm HeliBar into the grout to obtain good coverage.
7. Inject a second bead of HeliBond grout over the exposed HeliBar and iron it into the slot using a finger trowel. Inject additional HeliBond as necessary, leaving 10-15mm for new pointing.
8. The crack within the wall should be weather-proofed using an appropriate Helifix bonding agent e.g. HeliBond or CrackBond, depending on the width of the crack and the surface made good or left ready for any decoration.
9. Clean tools with clean, fresh water.

N.B. Pointing may be carried out as soon as is convenient after the HeliBond has started to gel.



RECOMMENDED TOOLING

- **For cutting slots up to 40mm deep**
Twin bladed cutter with vacuum attachment
- **For mixing HeliBond**
3-jaw-chuck drill with mixing paddle
- **For injection of HeliBond into slots**
Helifix Pointing Gun CS with mortar nozzle
- **For smoothing pointing**
Standard finger trowel

Specification Notes

The following criteria are to be used unless specified otherwise:

- A. Depth of slot into the masonry to be 35mm to 40mm.
- B. Height of slot to be equal to full mortar joint height, with a minimum of 8mm. For thin mortar joint specifications refer to the Helifix Technical Dept.

Continued...

- C.** HeliBar to be long enough to extend a minimum of 500mm either side of the crack or 500mm beyond the outer cracks if two or more adjacent cracks are being stitched using one rod.
- D.** Normal vertical spacing is 450mm (6 brick courses).
- E.** Where a crack is less than 500mm from the end of a wall or an opening, the HeliBar is to be continued for at least 100mm around the corner and bonded into the adjoining wall or bent back and fixed into the reveal, avoiding any DPC.
- F.** In hot conditions ensure the masonry is well wetted or primed to prevent premature curing of the HeliBond due to rapid de-watering. Ideally additional wetting of the slot, or priming with HeliPrimer WB, should be carried out just prior to injecting the HeliBond grout.
- G.** Do not use HeliBond when the air temperature is +4°C and falling or apply over ice. In all instances the slot must be thoroughly damp or primed prior to injection of the HeliBond grout.

The above specification notes are for general guidance only and Helifix reserves the right to amend details/notes as necessary.

GENERAL NOTES

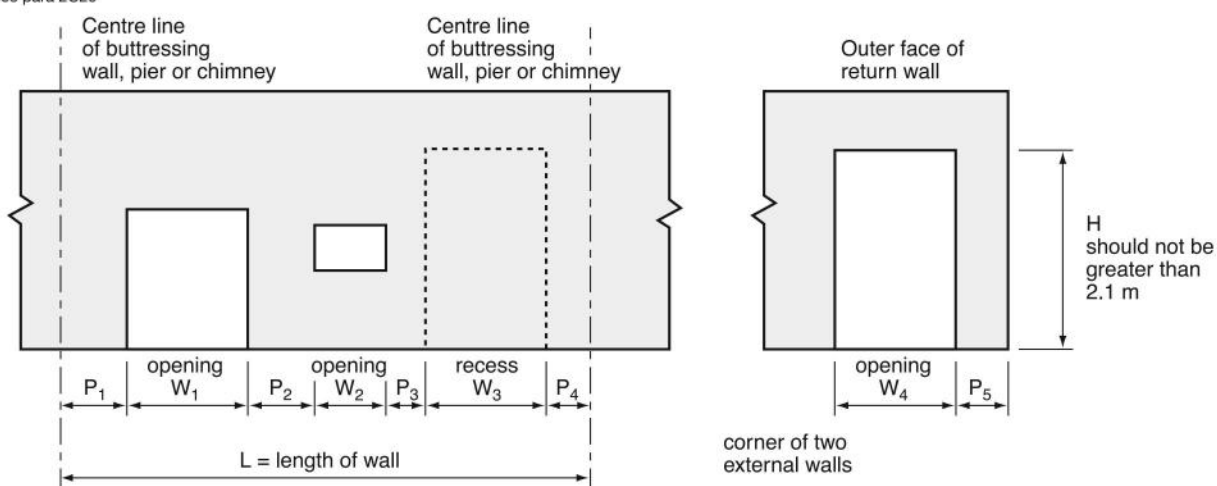
If your application differs from this repair detail or you require specific advice on your particular project or Helifix products, call our Technical Sales Team on **020 8735 5222**.

Our Technical Department can provide you with a full support service including:

- Advice, assistance and recommendations on all structural repair matters
- Devising and preparing complete repair proposals for specific situations
- An insurance-backed warranty via our Approved Installers scheme

Diagram 14 Sizes of openings and recesses

See para 2C29

**Notes**

Requirements (refer to Table 8 for values of Factor X).

- 1 $W_1 + W_2 + W_3$ should not exceed $\frac{2L}{3}$
- 2 W_1 , W_2 or W_3 should not exceed 3m
- 3 P_1 should be greater than or equal to $\frac{W_1}{X}$
- 4 P_2 should be greater than or equal to $\frac{W_1 + W_2}{X}$

- 5 P_3 should be greater than or equal to $\frac{W_2 + W_3}{X}$

- 6 P_4 should be greater than or equal to $\frac{W_3}{X}$

- 7 P_5 should be greater than or equal to $\frac{W_4}{X}$ but should not be less than 665mm.

- 8 Take the value of the Factor X from Table 8, or it can be given the value 6, provided the declared compressive strength of the bricks or blocks (in the case of a cavity wall – in the loaded leaf) is not less than 7.3N/mm².

Table 8 Value of Factor 'X' (see Diagram 14)

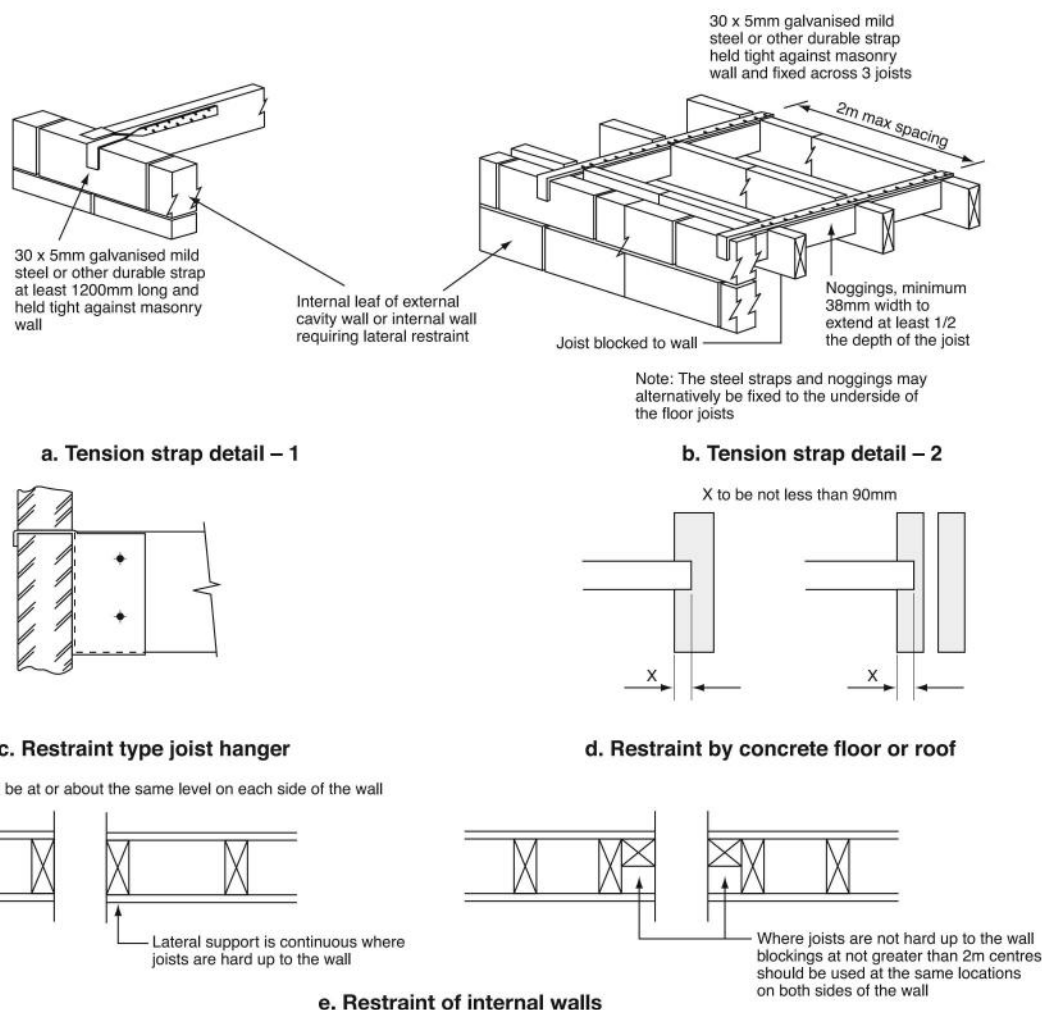
Nature of roof span	Maximum roof span (m)	Minimum thickness of wall inner (mm)	Span of floor is parallel to wall	Span of timber floor into wall		Span of concrete floor into wall	
				max 4.5m	max 6.0m	max 4.5m	max 6.0m
Value of Factor 'X'							
Roof spans parallel to wall	Not applicable	100	6	6	6	6	6
		90	6	6	6	6	5
Timber roof spans into wall	9	100	6	6	5	4	3
		90	6	4	4	3	3

Table 9 Lateral support for walls

Wall type	Wall length	Lateral support required
Solid or cavity: external compartment separating	Any length	Roof lateral support by every roof forming a junction with the supported wall
	Greater than 3m	Floor lateral support by every floor forming a junction with the supported wall
Internal load-bearing wall (not being a compartment or separating wall)	Any length	Roof or floor lateral support at the top of each storey

Diagram 15 **Lateral support by floors**

See para 2C35



specifications including material references 1 or 3 (austenitic stainless steel). The declared tensile strength of tension straps should not be less than 8kN.

Tension straps need not be provided:

- in the longitudinal direction of joists in houses of not more than 2 storeys, if the joists are at not more than 1.2m centres and have at least 90mm bearing on the supported walls or 75mm bearing on a timber wall-plate at each end, and
- in the longitudinal direction of joists in houses of not more than 2 storeys, if the joists are carried on the supported wall by joist hangers in accordance with BS EN 845-1 of the restraint type described by additional guidance given in BSI Published Document PD 6697:2010 and shown in Diagram 15(c), and are incorporated at not more than 2m centres, and
- when a concrete floor has at least 90mm bearing on the supported wall (see Diagram 15(d)), and

- where floors are at or about the same level on each side of a supported wall, and contact between the floors and wall is either continuous or at intervals not exceeding 2m. Where contact is intermittent, the points of contact should be in line or nearly in line on plan (see Diagram 15(e)).

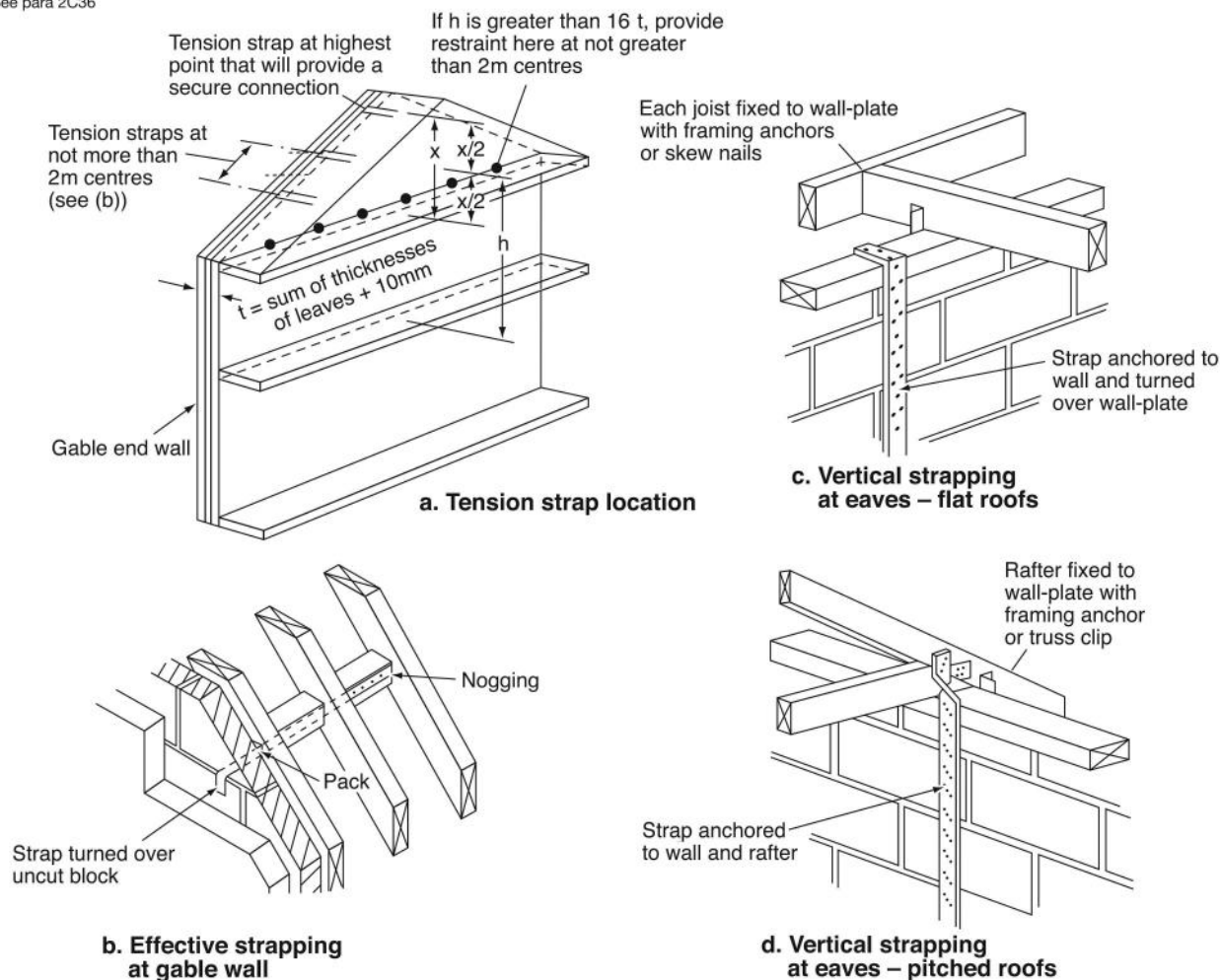
2C36 Gable walls should be strapped to roofs as shown in Diagram 16(a) and (b) by tension straps as described in **2C35**.

Vertical strapping at least 1m in length should be provided at eaves level at intervals not exceeding 2m as shown in Diagram 16(c) and (d). Vertical strapping may be omitted if the roof:

- has a pitch of 15° or more, and
- is tiled or slated, and
- is of a type known by local experience to be resistant to wind gusts, and
- has main timber members spanning onto the supported wall at not more than 1.2m centres.

Diagram 16 Lateral support at roof level

See para 2C36



Interruption of lateral support

2C37 Where an opening in a floor or roof for a stairway or the like adjoins a supported wall and interrupts the continuity of lateral support, the following conditions should be satisfied for the purposes of Section 2C:

- the maximum permitted length of the opening is to be 3m, measured parallel to the supported wall, and
- where a connection is provided by means other than by anchor, this should be provided throughout the length of each portion of the wall situated on each side of the opening, and
- where a connection is provided by mild steel anchors, these should be spaced closer than 2m on each side of the opening to provide the same number of anchors as if there were no opening, and
- there should be no other interruption of lateral support.

Small single-storey non-residential buildings and annexes

2C38 Size and proportion

i. General

The guidance given applies in the following circumstances:

- The floor area of the building or annexe does not exceed 36m².
- The walls are solidly constructed in brickwork or blockwork using materials which comply with paragraphs 2C19 to 2C22.
- Where the floor area of the building or annexe exceeds 10m² the walls have a mass of not less than 130kg/m².

Note: There is no surface mass limitation recommended for floor areas of 10m² or less.

- Access to the roof is only for the purposes of maintenance and repair.
- The only lateral loads are wind loads.