

ANTHONY-JOHNSON

Consulting Engineer Ltd

Site Address:

Carter's Farm,
Oxcroft Bank,
Shepeau Stow,
Spalding, Lincs.
PE12 0TY

Overview

The visual survey of four existing structures, previously employed as Barn structures on a farm. The purpose of this survey is to consider three of the structures with a view to conversion to residential use and review the retention and use of existing structural elements.



Address:
3 Westgate Street,
Southery
Downham Market
PE38 0PA

ANTHONY-JOHNSON

Consulting Engineer Ltd

Image 1: Layout of Barns, using excerpt from Architect's drawing

Barn 1:

Overview:

Barn 1 comprises a steel portal framed structure, employing 152x89UB16 sections, set at suitable centres, forming frames that resist vertical and horizontal loading imparted by the mass of the structure, wind and snow loading on the external cladding.



Image 1.0: Internal view of Barn

Portal frames provide support to timber purlins, which span between adjacent steel frames, in turn proffering support to the external steel corrugated cladding.

Address:
3 Westgate Street,
Southery
Downham Market
PE38 0PA

ANTHONY-JOHNSON

Consulting Engineer Ltd

Appearance and Function of superstructure:

Sway perpendicular to the portal frames is resisted by circular hollow sections, forming crossed tubular bracing, set in the depth of the Portal frame rafters. The bracing transfers loads in tension into the eaves of the building, at the confluence of rafters and columns. Loads are then carried in shear in the external cladding of the building. Conversely, the portal frames carry sway due to wind loading in moment resisting connections, formed at eaves and apex.



Image 2.0: View of cross bracing, removing longitudinal sway due to wind loading

The superstructure appears to be visually intact. Cladding does not exhibit defects and sections are not missing. Cladding was noted as having been finished with a zinc coating,

Address:
3 Westgate Street,
Southery
Downham Market
PE38 0PA

ANTHONY-JOHNSON

Consulting Engineer Ltd

providing a long-term sacrificial coating that corrodes in preference to the underlying steel.

Purlins were found to run with no significant deviation within their span, reflecting elements that have been suitably spaced and are not overloaded. Purlins have been affixed to the head of steel portal frame beams, providing restraint to the compression flanges of the beams, preventing the development of lateral torsional buckling.

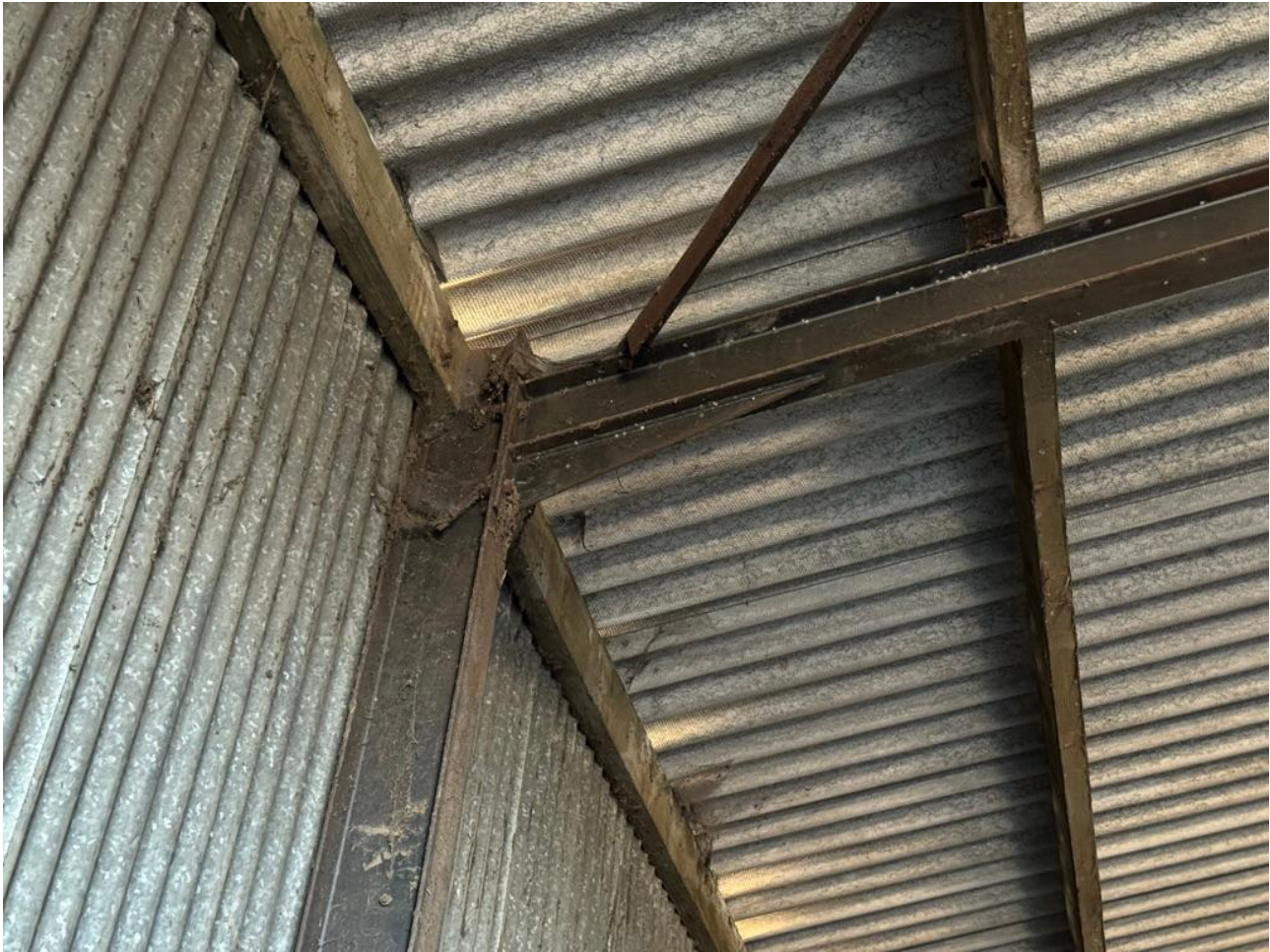


Image 3.0: Hunch connection between column and beam, fixing between CHS brace and beam and cleated purlin running to head of rafter.

To the front gable elevation of the structure, a pair of sliding doors run from ground to eaves level. Supported off rails at the head of the door, they were found to remain intact

Address:
3 Westgate Street,
Southery
Downham Market
PE38 0PA

ANTHONY-JOHNSON

Consulting Engineer Ltd

and functioning as originally intended. Columns run from ground to roof either side of the doors and support a header beam, set to the head of the doors.



Image 4.0: Sliding doors to the front of the Barn

To the rear elevation, the structure comprises a final portal frame with steel rising from finished floor level to underside of Haunch at ridge. The purpose of the vertical steel element is to form a horizontal restraint to the horizontal purlins and supported cladding, preventing flexure under wind load. The column is not intended to provide support to the portal frame at ridge line.

Address:
3 Westgate Street,
Southery
Downham Market
PE38 0PA

ANTHONY-JOHNSON

Consulting Engineer Ltd

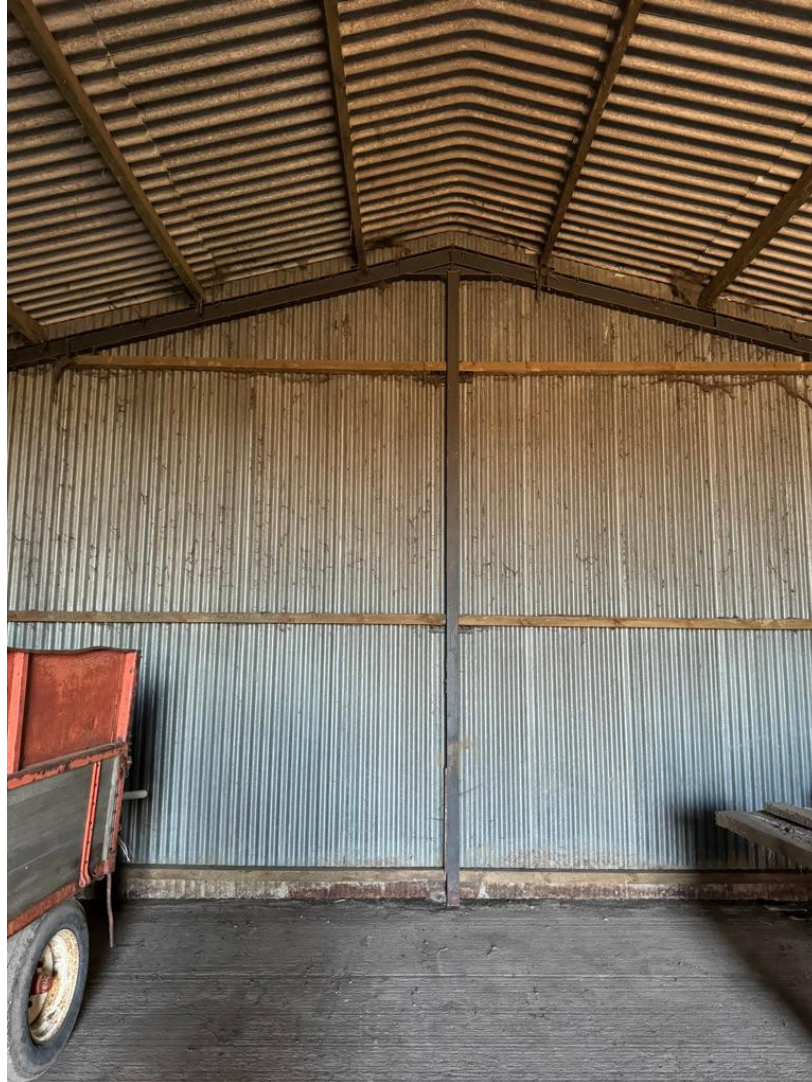


Image 5.0: Prop running floor to ridge, providing horizontal restraint to horizontal purlins against wind suction/ pressure

The floor to the footprint of the barn is formed from concrete, cast in situ and tamped/ levelled by hand. The concrete appears intact with no visible movement. However, cracking within the concrete was observed and may be ascribed to the lack of expansion joints, resulting in non-structural shrinkage cracking. This coupled with a lack of vertical movement infers that the finished floor suitably distributes applied loads to a suitable sub-base.

Address:
3 Westgate Street,
Southery
Downham Market
PE38 0PA

ANTHONY-JOHNSON

Consulting Engineer Ltd



Image 6.0: Existing concrete floor, noted as being intact and functioning as originally intended

Conclusion:

The conversion of the structure to single storey residential use may be carried out with the retention of the existing steel portal frames and associated purlins. Timber stud, set suitably in-board of the steel framing and purlins will allow for the formation of an insulated shell, internal to and separate from the external superstructure. Sway due to wind loading, for which the portal frame structure is designed, will consequently not be transferred to the internal timber stud walls. Given the limited mass of the timber stud walls, they may be sited to the head of the existing concrete floor. Line loads imparted by the timber studwork will be less than unit loading applied to the concrete floor by farm vehicles, plant and other machinery.

Address:
3 Westgate Street,
Southery
Downham Market
PE38 0PA

ANTHONY-JOHNSON

Consulting Engineer Ltd

Barn 3:

Overview & Function of elements:

The middle of three barns is formed of timber framing with hand cut duo-pitch timber roof supporting corrugated Iron sheeting, laid to falls with metal dressing to the ridge-line, forming a watertight seal.



Image 12.0: External view to front of Barn 2

The structure is open at the front with a timber header beam spanning side to side between supporting timber columns. A single knee brace runs from a column up at 70° to meet the underside of the eaves beam forming a brace to prevent sway due to wind.

Address:
3 Westgate Street,
Southery
Downham Market
PE38 0PA

ANTHONY-JOHNSON

Consulting Engineer Ltd

Internally, the roof structure is formed of timber purlins and ridge boards, spanning side to side between supporting side elevations. Purlins and ridge are supported midspan by a hand cut timber truss, formed of rafters and ceiling binder. A timber post is set central to the underside of the ceiling binder, providing a support to the long span timber member.



Image 13.0: Internal view of existing roof structure

Side elevations of the structure are clad in timber between floor level and eaves. Corrugated metal sheeting runs vertically from eaves level terminating at roof level. Structural support to the side elevations is provided by railway sleepers set vertically at suitable centres and running from finished floor to a Tie Beam set in the depth of the wall running horizontally front to back.

Address:
3 Westgate Street,
Southery
Downham Market
PE38 0PA

ANTHONY-JOHNSON

Consulting Engineer Ltd

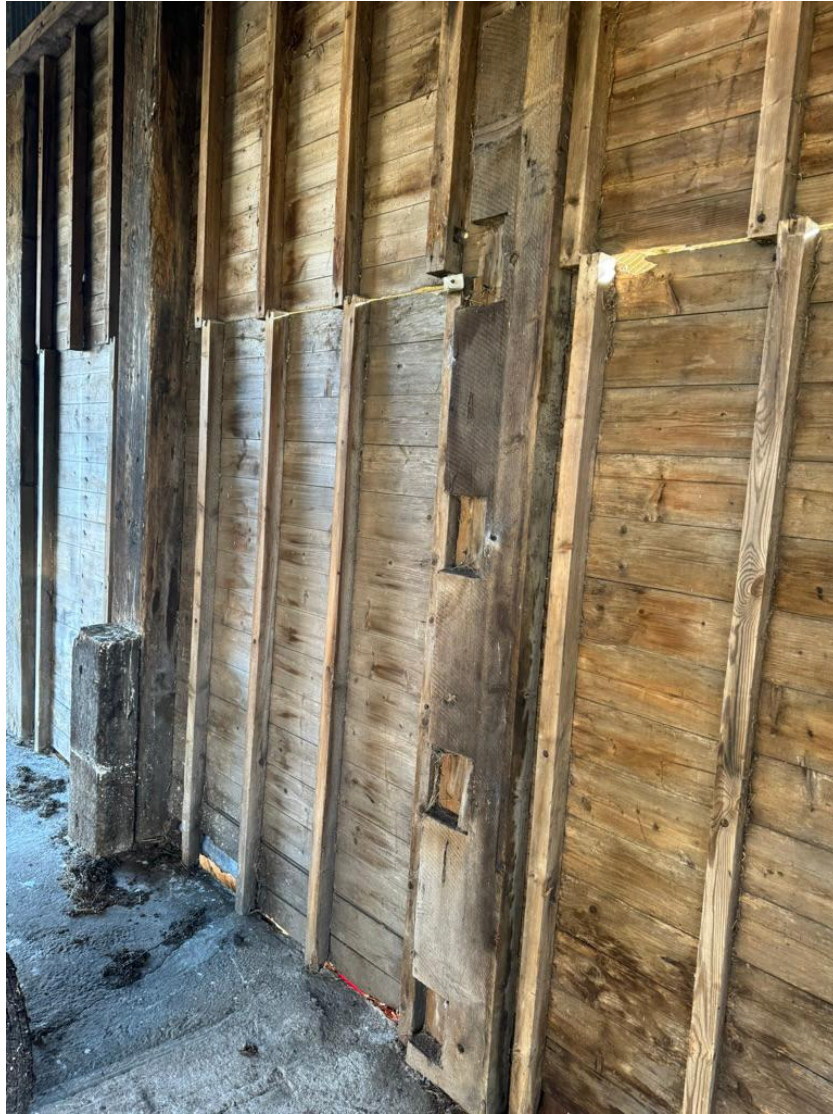


Image 14.0: Timber columns, formed of railway sleepers set to side elevations.

The rear of the structure incorporates timber cladding, supported by a framing system formed of timber with a central timber post formed from a railway sleeper. The finished floor is formed of concrete that has been cast in situ and Tamped firm by hand. The slab appears intact with limited movement, likely arising as a result of a lack of expansion joints. Vertical deviation in the slab was not observed.

Address:
3 Westgate Street,
Southery
Downham Market
PE38 0PA

ANTHONY-JOHNSON

Consulting Engineer Ltd



Image 15.0: View of floor slab.

Appearance:

Structural elements within the roof appear intact and functioning as originally intended. The roof panels and ridge line have not visibly deviated or deflected. No excessive flexure was observed and neither rafters, nor purlins were found to deviate significantly along their run. Cladding to the side elevations appears to remain intact and functioning as originally intended. To the rear, part of the cladding appears to have been damaged. However, the superstructure and framing remain suitably intact. Timber posts formed from railway sleepers, coupled with the eaves level tie beams form a suitable frame which remains intact with no significant deviation. To this, timber infill panels have been formed

Address:
3 Westgate Street,
Southery
Downham Market
PE38 0PA

ANTHONY-JOHNSON

Consulting Engineer Ltd

with studs, running vertically from ground to Tie beam level and again these appear suitably intact.

Conclusion:

The structure is considered suitable for conversion to residential use, with retention of the majority of timber elements to the existing superstructure. These may be retained, forming the weatherproof shell of the converted structure. Internally, freestanding timber studwork may be formed, so as to allow for the fixing of finishes whilst at the same time providing sufficient depth to external walls so as to allow for the inclusion of sufficient insulation. Internal studwork should be formed separate to external elevations, so as to decouple the two, preventing cold bridging and allowing a suitable vapour gap to be formed. The existing floor may be retained allowing for the formation of a suitable finished floor, incorporating insulation to modern standards.

The roof structure is suitable for use with the replacement of the existing corrugated metal sheeting on a Like for like basis, with a suitable composite insulated corrugated sheeting.

Address:
3 Westgate Street,
Southery
Downham Market
PE38 0PA

ANTHONY-JOHNSON

Consulting Engineer Ltd

Barn 4:

Overview:

Barn Four comprises a long, single storey structure clad to the rear and end gable elevation in timber, rising to the underside of a series of small window openings, set just below eaves level. Corrugated steel sheeting run vertically between eaves and the head of the timber. To the gable end, the corrugated sheet runs from roof line down to meet the head of the timber.



Image 16.0: Gable and rear elevation of Barn 4

Address:
3 Westgate Street,
Southery
Downham Market
PE38 0PA

ANTHONY-JOHNSON

Consulting Engineer Ltd

On the front elevation, a corrugated steel door provide access to the barn and the remainder of the front elevation is partially clad in a plastic sheet with timber cladding to the head of this, set to timber studs which clearly form the infill structure to this elevation.



Image 17.0: View of front entrance into Barn 4

The roof structure is clad in corrugated steel sheeting, again laid to falls and the roof line is noted as being straight and with no deviation evident.

Address:
3 Westgate Street,
Southery
Downham Market
PE38 0PA

ANTHONY-JOHNSON

Consulting Engineer Ltd



Image 18.0: View along roof and rear of Barn 4, with roof remaining intact

Internal to the barn, the structure is clad on the side elevations with timber. On the rear elevation, steel props run from ground level up to the timber cladding, inferring a robust structure used for storage of grain.

Address:
3 Westgate Street,
Southery
Downham Market
PE38 0PA

ANTHONY-JOHNSON

Consulting Engineer Ltd



Image 19.0: Props between rear elevation of floor of barn 4

The roof structure comprises a series of timber hand cut trusses, set at centres to match supporting timber columns formed from railway sleepers. To the head of the roof are set a series of timber purlins, running between trusses. The trusses have been propped at their centres with additional railway sleepers, running from finish floor to underside of ceiling binders.

Address:
3 Westgate Street,
Southery
Downham Market
PE38 0PA

ANTHONY-JOHNSON

Consulting Engineer Ltd



Image 20.0: Hand cut timber roof with timber supports formed from railway sleepers

The finished floor has been cast in situ, formed of hand tamped concrete, set without suitable expansion joints. As a result, cracking has occurred. However, the slab remains suitably intact with no significant vertical deviation, indicating that it is set to a good hard-core base.

Address:
3 Westgate Street,
Southery
Downham Market
PE38 0PA

ANTHONY-JOHNSON

Consulting Engineer Ltd



Image 21.0: View of finished concrete floor

A block Work wall has been formed to the rear gable end, concealing a timber stud frame with corrugated steel sheeting running vertically to the head of this.

Address:
3 Westgate Street,
Southery
Downham Market
PE38 0PA

ANTHONY-JOHNSON

Consulting Engineer Ltd



Image 22.0: Gable end of structure

Appearance:

The structure remains intact and suitably water-tight. Structural elements continue to function as originally intended with no significant deviation or deflection. The lack of either of these indicates that structural elements have not been subjected to forces exceeding their available strength, and that consequently applied stresses remain within the capacity of the various elements.

Rainwater goods have clearly failed to the perimeter of the structure, and some discolouration to the rear and gable elevation is indicative of a high moisture content as a result of rainwater, shedding onto the relevant elevations.

Address:
3 Westgate Street,
Southery
Downham Market
PE38 0PA

ANTHONY-JOHNSON

Consulting Engineer Ltd

Conclusion

The structure is suitable for conversion with all existing structural elements of the barn used in the formation of the external structure, inside which works will be carried out to form the living accommodation. These elements include the concrete floor slab, timber columns, trusses, purlins, stud work, bracing and external walls.

Conversion may take the form of introducing internal freestanding non load bearing stud partitions, decoupled from the existing superstructure. These should incorporate suitable insulation and plasterboard finishes where formed up against but separate from existing load bearing external walls. Where partitions are formed with a view to subdividing the unit into various rooms, the stud walls should line through with existing load bearing columns so as to conceal the columns in the depth of the walls, providing the existing structural elements with additional fire protection. Any exposed structural timber Work should be provided with a suitable fire protection, such as the use of intumescent paint.

Address:
3 Westgate Street,
Southery
Downham Market
PE38 0PA