

# ANTHONY-JOHNSON

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## Site Address:

Old Dairy,  
Harford Gate,  
Gedney Broadgate.

## Overview:

It is proposed that a pair of former farm buildings be converted to residential use and the purpose of the survey was to discern their structural suitability and outline any significant defects that may impair their functionality.

The barns together form a complex that lie within a parcel of land set adjacent an existing access road. The structures are bounded on all sides by grassed areas.

## First Barn (Single Storey, duo-pitch)

The first barn is formed of a single-story structure with masonry to all elevations. Externally, the barn is clearly divided into two with matching gable walls to the rear section of the barn rising above Ridge line. By contrast, the front section of the barn lies with ridge above masonry to the front and marginally below masonry to the separating gable to rear. On this basis, it is surmised that the rearmost section of the barn forms the original structure, with raised masonry gable ends.

This is wholly reflected in the masonry with curved rounded edges to bricks in the rear barn coupled with poor coursing and white wash interior. Externally the same was noted as being formed with a traditional lime mortar and exhibited more patch repairs.

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Image 1.0: Original Barn, with extension visible to right of image.

In the newer section of the barn, a masonry arch set to the side elevation facing the road indicates a former entrance route and this has clearly been bricked up as have windows to this elevation. Notably the lack of cross bond or “toothing” set a clear vertical join between both wall panels preventing the transfer of loads and as a result limited shrinkage and thermal cracking should be expected along the juncture.

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Image 2.0: Masonry arch to head of former opening, now infilled.

The roof structure to the barn is formed of two different materials with the front elevated roof being laid to falls with a corrugated steel finish and the lower (older) roof structure to the rear being laid to falls with an older corrugated cement roofing profile. Both roofs were observed externally as being intact and functioning as intended with no deviation or wandering at eaves or within the falls of the roofline.

Internally, to the single story barn the higher roof is formed of rafters laid to falls, at suitable centres, sets between eaves level wall plates, purlins set mid span and ridge. Rafters appear to have been set at close centres, reflecting a structure that is superior to the corrugated steel sheeting it provides support to. High-level binders are set above the purlin line and provide restraint against spread in the roof structure.

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Image 3.0: Roof structure to newer section of barn with corrugated steel sheeting

The floor within the entire barn is finished with concrete, forming a suitable slab with limited cracking, reflective of restraint cracking. A timber framed opening set within the original Gable provides access to the lower section of rear (original) barn.

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Image 4.0: View internal to newer section of Barn.

This is wholly reflected in the masonry with curved rounded edges to bricks in the rear barn coupled with poor coursing and white wash interior. Externally the same was noted as being formed with a traditional lime mortar and exhibited more patch repairs.

The rear section of the single story barn was found to be formed with a hand cut timber roof with wall plates restrained by large timber sections, set at one third centres, along the length of the barn.

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Image 5.0: Rear section of “original” duo-pitch barn

A Purlin runs either side of the pitch roof with ceiling binders correctly set to the underside and notched so as to provide restraint to the purlins, reducing their effective lengths. Rafters, laid to falls run from eaves to Purlin to Ridge-board, with high level stiffeners set to coincide with Purlin binders. Timbers have been whitewashed and ceiling binders incorporate cast-iron restraint straps which are clearly slung over and down the outer face of the wall plate to restrain it. The underside of the ceiling is partially clad in corrugated steel sheeting and multiple roof lights provide natural lighting, internally to the structure.

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Image 6.0: Purlin, correctly restrained by ceiling binder

The floor finish, although concrete, is clearly older than that to the adjoining single story barn and some surface erosion has occurred. The slab remains intact and appears Crack-Free with no significant variation in floor level reflecting a slab that has been cast to good ground.

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Image 7.0: View of side wall and finished floor

The far gable end was noted as having a crack running local to the corner return with side elevation and whilst it was not possible to discern the cause of this internally, a downpipe set directly outside of this location was found to be draining directly to the ground and has likely resulted in the washing out of fines, causing some limited movement in the structure.

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Image 8.0: Crack to rear gable

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The crack appears historic in nature with render to the exterior not reflecting the extent of movement that is occurred internally. On this basis, it is considered that the movement is historic and likely not ongoing. The location and size of the crack is not reflective of a defect within the structure and has no direct bearing upon structural elements or their continued functionality in the building's present form.



Image 10.0: External view of Gable

Throughout the entire structure, roof timbers clearly show signs of aging with woodworm and some decay to end bearing locations, particularly on low-level ceiling binders. However this is not in itself resulted in movement within the structure, hence it must be surmised that binders continue to provide sufficient restraint at wall-plate level. The same summation must be applied to the wall plates, particularly given the lack of recent

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movement within the head of masonry both side elevations of the structure and in rafters, where deflection of the roof structure remains suitably controlled.

Historic deviation within the wall panel set facing the road was however observed and this is further reflected in the end bearing of ceiling binder relative to wall plate. The deviation however was found to arise local to the large infilled brick arched door opening and is likely the result of combined wind suction on a limited wall panel coupled with poor restraint to the head of the wall panel given the lack of cast-iron strap. Given the lack of recent cracking within masonry and mortar, coupled with weathering mechanisms that indicate historic repair to mortar, it is considered that movement is long-standing and not ongoing.



Image 11.0: Head of masonry deviating outward, local to weaker arch location

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The two storey barn, set within the complex of structures was reviewed with a view to conversion and this was found to comprise a masonry structure rising up to eaves level with solid 9 inch brick walls rising fully to ridge line. A further side extension abuts the building, terminating with flat roof formed local to first floor. The flat roof appears to be formed of a concrete slab, cast in situ and visual inspection indicates that it lacks a watertight finish.



Image 12.0: Two storey structure with single storey extension.

The roof structure to the main section of barn was found to comprise purlins spanning horizontally between adjacent Gable walls, supporting corrugated cement roofing sheets, laid to falls and running from ridge to eaves. The roofing structure was found to be in a

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complete condition and continues to function as originally intended. It is noted that purlins have deflected in the plane of the slope and this is likely the result of their slenderness, about their minor axes. The single truss, splitting the span of the purlins remains intact and functioning as originally intended



Image 13.0: Purlins to underside of corrugated cement roofing sheets

Brickwork was found to be in good condition with deterioration limited to the loss of facing to numerous bricks.

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Image 14.0: Spalling to external brick faces

Walls however continue to function as originally intended with no deviation evident, either vertically or sufficiently to the horizontal. One deviation was noted to the rear Gable with a rotation having developed at the corner return with the side window. Movement of the side elevation is evident relative to the concrete lintel set above the first floor window with corner masonry having moved horizontally relative to end bearing.

A further limited stepped crack was found to have developed to the opposite side elevation.

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Image 15.0: Crack to masonry on side elevation, local to single storey structure.

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Image 16.0: Stepped cracking to opposite side elevation

Limited lateral restraint is present within the structure given the limited mezzanine floor installed inside the building and to this end with The window set close to the corner return the stress concentration has developed through weakening within the wall panel and this is allowed for marginal movement in the structure.

When viewed from the rear, the structure was noted as incorporating a UPVC downpipe with no drainage to carry surface water run-off suitably away from the structure.

Render was found to have been applied to a number of the internal elevations, with limited hairline cracking and some spalling internally to the finishes. The inference being that the structure has not experienced significant or excessive movement local to ground level, or shifted in such a way as to cause damage or debonding to render, except to the locations identified above.

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Image 17.0: Render to internal elevations at ground floor level.

The adjoining single storey extension is noted as not being fully watertight. The flat roof to the structure abuts the two storey structure but lacks sufficient flashing to prevent rainwater from penetrating the juncture between head of roof and underside of supported masonry to opening. This observation is however, not detrimental to the short term suitability of the structure.

The single storey side extension was visually found to be intact and otherwise functioning as intended.

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Image 18.0: water ingress to lintel set to head of doorway. Note polythene to underside of concrete slab, potentially reflective of a release mechanism for formwork to the cast-in-situ slab.

The concrete slab is noted in this instance as being of benefit to the single storey structure through the provision of an additional permanent line load to the head of masonry walls. Brickwork supporting the slab remains in continuous compression, reducing the potential for movement due to the application of the large line load.

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Image 19.0: View towards opposite end of single storey section

The floor to the single story structure, as with the main section of the barn, is formed of a concrete slab, cast in situ. Although inspected with poor lighting conditions, the slab was noted as being intact, functioning as intended with no significant defects evident.

The floor slab to the main section of Barn was again found to be intact. Some wear was observed, with a single crack reflective of limited, long-standing, movement- likely restraint cracking, inherent to large slabs without intentionally formed crack induced expansion joints. Edges to the crack are reflective of movement being historic, with wear to the surface of the slab, local to the crack indicating areas of high traffic. Notably, the weaker smooth cement finish, inherent to cast in situ slabs with segregation upon casting has been worn away to part of the slab, revealing the underlying stronger concrete, with weathering.

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Image 20.0: Concrete slab to main barn.

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## **Conclusion:**

### **Single Storey barn:**

The single storey barn is considered suitable for conversion to residential use for the following reasons:

- 1) The external masonry elevations are in suitable condition, with no defects reflective of settlement due to overloading of supporting geology. Any movement in the structure appears historic and has ceased, having originally arisen as a result of poor building/maintenance practices. Remedial works would invariably be limited, designed to prevent future recurrence. No reinstatement would be required.
- 2) Timber roof elements are suitable for retention and subsuming into the proposed conversion.
- 3) The existing concrete floor appears visually intact and may be employed in the formation of a new finished floor.

The structure may be converted through the addition of new internal timber stud partitions and lining of external elevations with timber stud and insulation, all as specified by the appointed Architect. The existing timber roof visually reflects a hand cut roof structure with capacity in excess of applied loads, including those applied by the weathertight finish. Re-covering of the existing with a suitably insulated finish may be accomplished without the need to retrofit the roof structure with additional elements.

### **Two storey Barn:**

Defects within the barn observed as part of the survey do not detract from its continued robustness. Stability is afforded in the vertical plane and the structure continues to transfer all loads into foundations in a correct manner. Cracks to masonry side elevations are limited and given they appear to mirror each other, about the rear gable wall, infer a minor rotation. Crack stitch reinforcement should be employed as a means to reinstate lateral restraint between abutting wall panels. The mode in which the cracks have formed is a reflection of poor restraint, local to a window opening, coupled with a lack of drainage for surface water. The latter should be repaired, so as to remove the primary mechanism. The former may be mitigated via crack stitch reinforcement.

Where the structure is converted for residential use, the king post truss, set mid span to the purlins is considered suitable for retention.

Given the proposed re-forming of the structure, with second storey set to the head of the single storey structure, it is noted that the mass of the current concrete roof would be sufficient to partially

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off-set the weight of the new storey. If formed of light-weight materials, the increase in line loading to foundations would therefore be within tolerance of the existing footings, not leading to differential settlement.

Repair of the masonry walls, as prescribed, would result in a structure suitable for conversion to residential use. The presence of an existing mezzanine, previously employed in the storage of milk churns, implies a structure robust enough to accommodate a second floor. Moreover, 9" (225mm) solid masonry walls proffer a means to transfer loads imparted by a new first floor down to foundations. The introduction of floor joists at first floor level would have the added benefit of restraining wall panels, reducing their overall slenderness and helping to further mitigate existing limited rotation of the rear gable wall. The incorporation of noggins and ties/ pattress plates would invariably wholly restrain the structure at first floor level, thus prolonging the working life of the existing structure significantly.

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