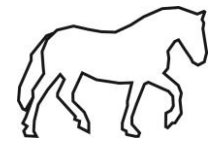


Project: Horton Grange
Client: Mr. I. Lancaster
Description: First issue
Date: 10 April 2019



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Structural survey with respect to proposed development at Horton Grange, Horton.

Version: 1.0 **Description:** First issue for client approval / planning submission

General notes and recommendations



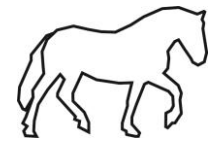
Figure 1: View of the western gable elevation, with the arched barn in the foreground and the pitched barn in the background

The barns at Horton Grange were surveyed by Richard Lines on Thursday the 4th of April, 2019. This survey was concerned only with the structural aspects that were visible at the time. The structure was not dismantled, and it was assumed that the aspects visible were representative of the rest of the structure.

Any recommendations that are made are from the point of view of the author on the potential for conversion from a structural perspective, and does not make any conclusion on the economics of conversion or the likelihood of the proposals achieving planning permission or meeting current building regulations.

It is understood that the current roof is not featured in the conversion plans. With this in mind, it is the author's opinion that the remainder of the structure is well suited to residential or commercial conversion, subject to several recommendations which are listed at the end of this section.

Project: Horton Grange
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Figure 2: View of the northern elevation showing the partial masonry and steel/timber cladding construction

For the purposes of this report, the structure is divided into two distinct regions. The first is covered by a pitched roof, the other covered by an arched roof. The two regions share a central wall.

The barns are predominantly of masonry construction, with the masonry walls providing lateral and longitudinal stability. The roof is supported on five steel trusses in the arched section and four steel trusses and the masonry gables in the pitched section. The trusses bear onto padstones provided in the masonry, or onto steel columns in the case of the northern elevation of the arched barn.

The surrounding terrain is pastoral grazing and no evidence of geotechnical instability or drainage issues were observed on the day. The site is outside of the coal authority reporting area, and the BGS online portal suggests that the site is underlaid by glacial clay deposits. The barns are situated on a gently sloping site, made flat locally using cut and fill approaches.

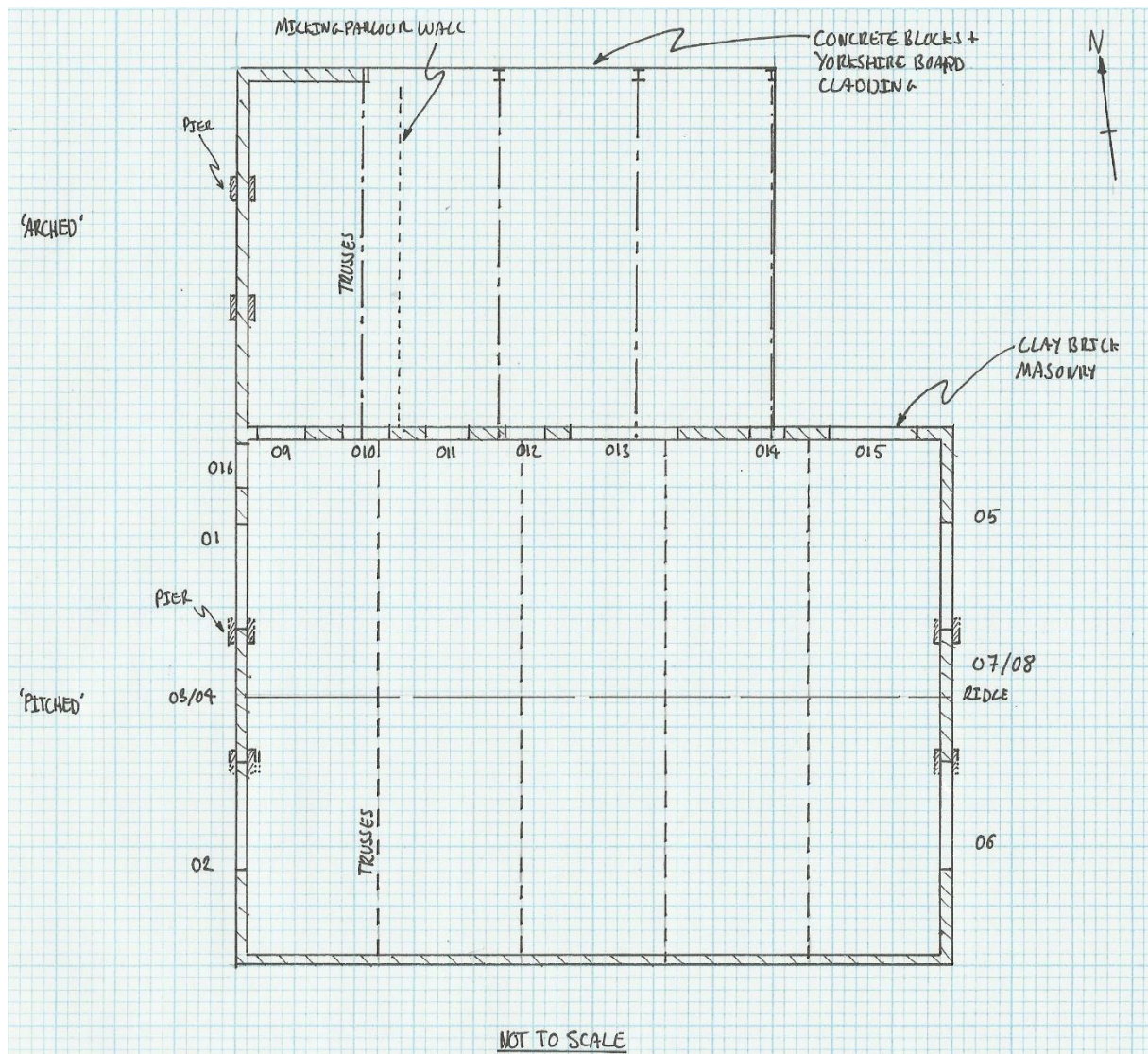
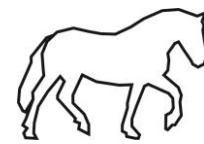
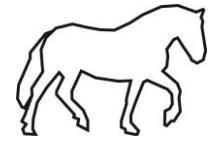


Figure 3: General layout of the barn structures and openings, not to scale

The following recommendations are made with respect to the existing structure:

- All damage to the existing masonry should be repaired. Notable issues include the missing masonry above opening O2 in the western gable, and the missing masonry to the northern edge of opening O6 in the rear gable.
- All missing or loose masonry in the southern elevation or otherwise should be replaced and repaired where necessary.
- During structural design for the conversion, the gables should be analysed for lateral resistance and stability in light of the removal of the lower sections of the two masonry piers at each gable of the pitched barn. The possible addition of a first-floor structure would greatly assist the lateral stability of these panels, otherwise it is recommended that the piers are verified by calculation and reinstated, or some other suitable system of support developed.
- The foundations should be exposed before or during works to assess their adequacy with respect to the loading imposed by the proposed developments.

Project: Horton Grange
Client: Mr. I. Lancaster
Description: First issue
Date: 10 April 2019

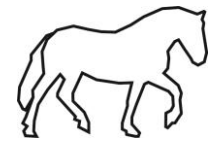


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- A small section of the current concrete slab should be removed, and the section assessed for its ability to resist loads imposed by the proposed developments.
- All timber lintels should be replaced with modern concrete or steel units, and the in-situ steel lintels should be checked for suitability against the proposed scheme loading.

Project: Horton Grange
Client: Mr. I. Lancaster
Description: First issue
Date: 10 April 2019



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Roof

Arched

The roof on the arched barn is covered by a mix of newer profiled steel sheets and older sheets which are suspected to contain asbestos. The roof sheets are fixed using 'J' bolts to the steel angle purlins and the purlins are supported by steel trusses at approx. 3.5m centres.

The trusses are composed of a pre-curved steel angle section, trussed with steel flat tension members and steel angle compression members. Inspection suggests that the roof structure is effective under gravity loads and not necessarily designed for the suction forces developed by the wind and the roof shape. The trusses bear onto padstones in the masonry wall

The roof has many holes of varying sizes. The roof is not considered to be suited to conversion to a domestic or commercial use since the steel supporting structure is unlikely to perform to modern standards meaning that interior finishes such as plaster may readily crack under service loading, compounded by the additional loading due to the addition of insulation, services etcetera. However, it is understood that the existing roof structure is not included in the proposed development plans.



Figure 4: Internal view of the arched roof structure

Pitched

The roof on the pitched barn follows a similar layout to that of the arched barn with the inclusion of a vented ridge and roof lights. The steel trusses are composed of steel angle compression/bending members and flat tension members. The pitched roof trusses are provided with longitudinal bracing which is to act to restrain the bottom chord of the truss under wind uplift conditions. The roof sheets may contain asbestos and due care should be exercised during works.

The roof of the pitched barn is not considered fit for conversion, for the same reasons detailed in the arched section above.

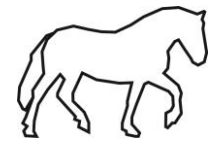
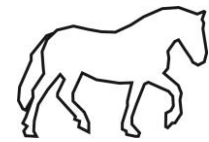


Figure 5: Internal view of the pitched roof structure, noting longitudinal restraints to truss chords



Figure 6: Padstone truss bearings

Project: Horton Grange
Client: Mr. I. Lancaster
Description: First issue
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Walls

Arched:

The arched barn has a partial north elevation wall, a shared southern elevation wall, a full western gable and no eastern gable (the rear of the barn flows through to a modern portal frame extension). All walls are of solid one and a half brick thick construction, laid in English garden bond with high strength clay units and suspected lime mortar. The large gable panels feature large piers which are two and a half bricks thick to assist in the resistance of lateral wind loading. The masonry is generally plumb, straight and in good order. No cracks are visible in the masonry (with one exception in the 'pitched roof' area, to follow) which suggests that minimal movement at foundation level or otherwise has occurred in the ~100yrs since construction.

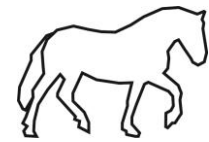


Figure 7: View of the northern elevation showing the partial masonry and steel/timber cladding construction

The infill sections between the steel columns on the northern elevation are 215 x 215 x 440 hollow concrete blocks in a variable state of repair. These blocks are not understood to be included in future development plans.

There are no significant openings in the arched barn, save for the multiple openings in the shared central wall (see 'pitched roof' section). The large openings in the barn are not formed from masonry and are supported either by the roof truss or the steel angle purlin at eaves level.

Project: Horton Grange
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Pitched:

Western gable:



Figure 8: View of the western gable

Opening O1: This opening is believed to have been widened at some point (and subsequently reduced again or repaired), supported by evidence of piecemeal concrete infill at ground level and the apparent removal of the adjacent pier below lintel height. The masonry above the current lintel has been rebuilt but shows no sign of distress, indicating that this was likely to have been undertaken as part of the previous works.

The opening is supported by two lintels, the 'outer' a 6" x 3" steel channel and the inner an approx. 10" x 4" timber section. The masonry is likely to be developing a good arching action and therefore the timber lintel appears to be performing adequately. The lintels should be checked against proposed loading and replaced where necessary. For long term performance, the timber lintels require replacement.

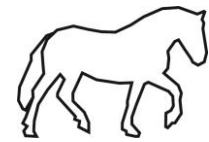


Figure 9: Opening O1 and O16 to the left

Opening O2: Opening O2 shares many characteristics with opening O1, and also appears to have been widened at some point at the expense of the adjacent masonry pier. The masonry above is in disrepair, although does not exhibit classic failure patterns related to, e.g. lintel failure, and the client advised that this masonry had been struck with a tractor in the past. The purlins above appear to be adequately supported by the arching action of the substantial masonry walls.

The opening is supported by two lintels, the outer a ~120 x72mm steel 'I' section and the 'inner' a 7" x 4" timber unit. Clearly, under the current loading situation (no masonry contact) both lintels show no signs of distress. As with all other lintels, the existing lintels should be verified for performance according to the proposed developments.

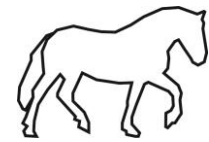


Figure 10: Opening O2

Opening O3: Opening three is an arched window opening higher up in the gable. The arch appears to be well constructed and is still providing adequate support.

Opening O4: Opening 4 is a rectangular window opening, supported by a timber lintel to the inner and a stone (or stone effect) lintel on the outside. The three courses of bricks above the inner timber lintel appear to have settled and been repaired. The lintel does not appear to be excessively deflecting and the masonry above does not appear to be in distress currently. The outer lintel and masonry above appears to be in good order.

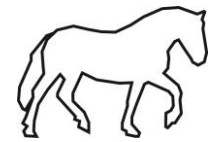


Figure 11: Openings O3 and O4

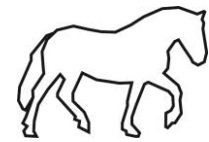
Southern elevation:

The southern elevation is in a variable condition. Several infilled openings are present, and many bricks have become loose, particularly at the south eastern corner and at the eaves.

Several holes are present at eaves level, one of which is supporting a timber stump. These holes are believed to have supported timber rafters for a lean-to extension which has since been removed. The presence of a concrete floor slab further supports this theory.

The masonry missing does not currently appear to be affecting the overall stability of the structure, however all masonry should be locally repaired at the earliest convenience to control degradation and weathering of the mortar joints internally.

Project: Horton Grange
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Description: First issue
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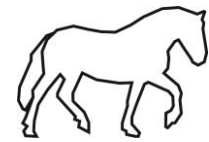


Figure 12: View of the southern elevation, looking west



Figure 13: south eastern corner of pitched barn in disrepair

Project: Horton Grange
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Description: First issue
Date: 10 April 2019



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Eastern gable:

The eastern gable shares a common layout with the western gable, including two openings at ground level which appear to have been altered previously. The eastern gable is generally in a poorer state of repair than the western gable.

Opening O5:

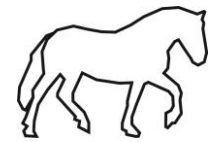


Figure 14: Opening O5



Figure 15: Opening O5

Project: Horton Grange
Client: Mr. I. Lancaster
Description: First issue
Date: 10 April 2019



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This opening is a similar format to its western counterpart, having been widened into the adjacent masonry pier. The inner lintel is a 7" x 4" timber unit and the outer is a steel I-section. The masonry above exhibits a significant crack. The masonry directly below this crack has been repaired recently.

The owner advised that this opening had also been struck with a tractor at some point. The crack pattern appears to support this. The other likely cause of such a crack could be lintel failure, which (if the lintel was inadequate) will be addressed when all lintels are verified according to proposed loading conditions.

Besides the obvious damage noted, the masonry supported by the lintel appears to be in reasonable condition. As with all other lintels, the existing lintels should be verified for performance according to the proposed developments.

Opening O6:



Figure 16: Opening O6

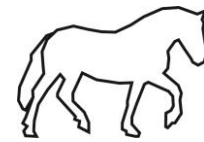


Figure 17: Damaged masonry at opening O6

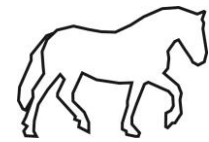
This opening is a similar format to its western gable counterpart, having been widened into the adjacent masonry pier. The inner and the outer lintel is a steel I-section which both appear to function well. There is a significant amount of masonry missing from the rear gable at the northern edge of opening six, which should be rebuilt to maintain structural function.

Openings O7 and O8 are similar to their western gable counterparts and appear to be functioning well.

Northern elevation:

The shared wall has numerous openings to connect the two structures. The amount of masonry removed (and hence the amount that remains) means that care should be taken in later structural design not to overload the remaining masonry or the foundation if the shared wall is required to bear significant loading from the first-floor structure etc. In addition, the milking parlour masonry may be offering lateral restraint to one masonry column between O10 and O11, and this should be checked for stability in compression should the buttressing masonry wall be removed.

Project: Horton Grange
Client: Mr. I. Lancaster
Description: First issue
Date: 10 April 2019



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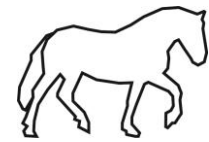
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The lintels are generally steel or modern reinforced concrete units. The opening lintels which themselves support a roof truss are generally stout steel sections. None of these lintels appear to be in distress and the masonry above appears to be in good condition.



Figure 18: Shared internal wall, punctuated with openings O9 to O15

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Description: First issue
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Foundations and floor

Both areas feature a textured concrete slab (ground bearing) which has been laid in a piecemeal fashion. The slabs show no sign of cracking or overloading and are likely to be suited to general domestic loading. A core should be cut, and the section verified if significant loads are intended for the slab (point, line or otherwise). The slab section was not accessible during the survey; however a small channel had been cut in the slab externally, and the slab appeared to be 100mm thick on a made ground / hardcore base.

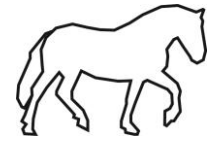


Figure 19: Arched barn floor



Figure 20: Pitched barn floor

Project: Horton Grange
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The foundations were not accessible or visible during the survey, however no evidence was observed to suggest that the foundations to the main masonry structure were unstable under the current loading. The foundations should be exposed, inspected and verified for proposed loading during works.

The infill masonry blocks are unlikely to be supported by formal foundations, and care should be taken if masonry is to be built up off of the slab in these locations.

Milking parlour

A milking parlour has been created within the western end of the arched structure and features a large excavated pit in the centre of the rectangular space which is enclosed by the front gable, the partial side (north) wall and a more modern single skin blockwork wall internally, all with unknown foundation arrangements. The 'hayloft' roof is generally timber, supported by steel sections as principle rafters.

The milking parlour structure is unlikely to be included in the proposed developments. If the masonry partition wall is to remain, the adequacy of its foundation should be assessed with regard to the proposed loading.