the earth stone and lime company

building conservation consultancy and practice

Barn behind Cairnmoors and Preston Cottages, Main Street, Hutton Buscel.
Provisional assessment of materials of construction for Mr and Mrs R Crocker.

It is proposed to sympathetically convert the barn into a dwelling. Edward Freedman of the North York Moors National Park Authority has requested a provisional assessment of the materials and pattern of construction to inform the planning application and approach.

The barn is of raised cruck construction, with three pairs of forks and five bays between stone gables, the cruck blades embedded in the masonry walls at variable levels. One of the crucks is a jointed cruck, the upper sections lap-jointed to the lower timbers. This is unusual in the region, although two cruck houses in Thornton Dale, the timbers of one of these dendro-dated to around 1513, display a similar pattern. All of the crucks lack collars, being lap-jointed at the apex.

Whilst it is most likely that the walls of the building were always of stone, these have been raised in the past, carrying the roof away from the crucks, the primary structural purpose of which is now to carry the ridge and, to some extent, via chocks of wood, the purlins. The raising will have been carried out

in association with re-roofing in pantile and all rafters were replaced during this operation, creating a simple rafter roof. The raising occurred a long time ago – the stonework of this raising is bedded in an earth-lime mortar and plastering within, upon both original and raised walls is also of earth-lime plaster, with a limewash finish. Masons locally switched from earth-lime to sand-lime bedding mortars around 1800, although this gives only a probable 'latest' date for the changes to the roof. The current roof is much more recent than this date and laths laid over the rafters, which traditionally carried a haired lime mortar coating, are sawn, rather than riven. Sawn rafters became the norm towards the end of the 19thC. The sawn rafters here may be much more recent, displacing earlier riven rafters, and may not carry lime mortar. Certainly, the mortar that encapsulates the wall-plates is of Portland cement mortar, indicating relatively recent – and extensive – repair of the roof.

The earliest stonework is of smaller stones, such as may have been cleared from fields, or from the upper levels of shallow quarries; the stonework of the raising is larger in scale, consistent with deliberate (and active) quarrying and partial dressing. Geologically, both are immediately local, iron-rich limestone.

The stonework is bedded in an earth-lime mortar, the earth used having been very fine. This was an almost universal craft practice in the region, extending also to interior plaster base-coats. Typically, a lime-rich, haired pointing mortar was laid over the earth bedding mortars externally, and a typically 4mm – 8mm haired lime finish coat laid over earth-lime plasters internally. Some of the haired lime pointing survives to the exterior and much of the earth-lime plaster internally. This seems not to have been given a lime finish coat, but to have been limewashed only.

earth-lime plaster, with probable hay inclusion to reduce original shrinkage

It is essential that any building constructed with earth or earth-lime mortars is repointed or plastered with eminently breathable, effectively porous lime mortars. This will be typically made by hot mixing from quicklime and will have a high free lime content. Cement or Natural Hydraulic Lime mortars will be too hard, dense and brittle, as well as having a low effective porosity and would lead to accumulation of moisture within the fabric of the wall, as well as promoting localised decay of the stonework.

There has been extensive repointing with an NHL mortar to the South elevation. Such repointing should be removed before repointing of the whole with a hot mixed lime mortar.

The west gable wall has been repointed in the past with a cement-lime mortar. Ironically, this may be more breathable and less damaging to the stonework in the long run than a typical NHL mortar, depending upon the relative proportions of cement and lime, but it is not ideal.

Within, the lower floor of the barn has remnants of a traditional earth floor. This appears to be of earth-lime mortar, around 4 inches deep over the natural soil layer. This may be seen as a relatively rare survival of a once very common flooring pattern in the region, although historic accounts of the making of such floors do not reference the addition of lime (Best 1641). The earth floor is much disrupted, surviving in best condition at the east end of the building. It offers inadequate head-room above to enable easy use of the building and any conversion proposal would inevitably require its removal to achieve necessary head-room. To the north-west corner, the earth floor has been displaced by cobbles associated with the use of this part of the building as a cow-byre or

milking parlour. It would be essential that the floor as a whole was properly recorded in context before any removal – a 3-D laser-scan of the interior, recording the extent of its survival, as well as a thorough analysis by a materials scientist, would likely be the minimum requirement. If removed, the floor should be set aside to make deeper repair mortars for works upon the stonework.

sample of earth floor, displaying apparent lime lumps, though these may be salts.

The dilemma here would seem to be that without removal of the floor, plans to convert the building could not be reasonably achieved. Whilst the floor is of

historic importance, its retention might derail plans to refurbish and repair the whole structure, leading to the on-going neglect of the building.

The upper floors are comprised mainly of tongue and groove boarding of dubious structural integrity. At the east end, however, the floor is of lime concrete, laid over wide boards. The lime concrete is unusually light-weight, suggesting the use of some wood ash aggregate, perhaps. It was hot-mixed from quicklime. The floor is much disrupted due to localised decay of supporting timbers beneath leaks in the roof, as well as by a general crazing into 'lime cobbles'. This floor is unlikely to be saved during repair or conversion works, due to the need to repair supporting joinery elements, as well as its general structural disruption. Again, similar recording as discussed above in the context of the earth floor would be recommended.

The crucks are very likely to be of similar age to the main, stone walls of the building. This age is currently indeterminate and dendrochronology would be recommended to establish their antiquity before any works commence. They are likely to date from the 16th or earlier 17th Century, but may be older than this. They may have been recycled from an earlier building on the site. Cruck construction was the most common house form in North East Yorkshire into the

17thC. Most cruck houses have been lost or significantly diminished by later addition and alteration.

All materials used in the course of the repair and conversion of this building should be like-for-like where possible and all of them compatible in their performance with the original materials of construction. This will guarantee not only the health of the original fabric, but also that of its occupants. There are numerous 'eco' materials on the market which are not compatible with historic fabric. The use of 'capillary closed, vapour open' materials, or of any that contain water repellants, should be avoided, as these have minimal effective porosity and will be incompatible. The groundfloor surface should be similarly breathable and this breathability may not be achieved by the use of cement concrete or NHL. A 1:2:9 cement: lime: aggregate floor may be more breathable, especially if made substantially with limestone aggregate. The introduction of an impermeable membrane would lead to excessive dampness in the lower walls and should not be entertained. The foundation of the building is likely to be quite shallow – care should be taken during any excavation and the installation of any breathable floor insulation (such as foamed glass) must be executed with care not to undermine these footings.

It would be recommended that original materials be left in situ wherever possible – still-attached earth-lime plasters may be encapsulated with air lime plaster-coats, for example.

This document is accompanied by images of Pond Farmhouse in Crambe, a remarkably well-preserved cruck farmhouse with original sub-divisions.

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