Transactions on the Built Environment vol 4, © 1993 WIT Press, www.witpress.com, ISSN 1743-3509

The repair of english ancient monuments: two case studies

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INTRODUCTION.

The English Heritage philosophy for the conservation and repair of ancient monuments, historic buildings and other historic structures in England is to conserve as found whilst carrying out the minimum work possible to the fabric in order to maintain its structural stability. The main aim is generally to conserve the building as found rather than to restore it to some previous state however scholarly that restoration might be.

This paper will illustrate this philosophy using two case studies of structural repairs carried out under the direction of the author. Both structures are, in their own way, important English ancient monuments

CASTLE BOLTON, NORTH YORKSHIRE.

General description.
Situated in a prominent location on a steep hillside in the Yorkshire Dales in the north of England, Castle Bolton is a massive and very well preserved medieval castle. Built round an open courtyard (see figure 1) and with a huge tower at each corner it is a rectangular building some 50 m by 40 m in plan and up to 30 m in height. In 1379 King Richard II granted a licence to build a castle to Richard, Lord Scrope, one of the most powerful men of that time,

for whom the castle was built by John Lewyn, a leading English military engineer.

Whilst Castle Bolton was built as a castle considerable efforts were made to make it domestically comfortable. Mary Queen of Scots was incarcerated in Castle Bolton for six months in 1569. It was slighted (deliberately partially ruined) by Parliament in the English Civil War in the 1640's.

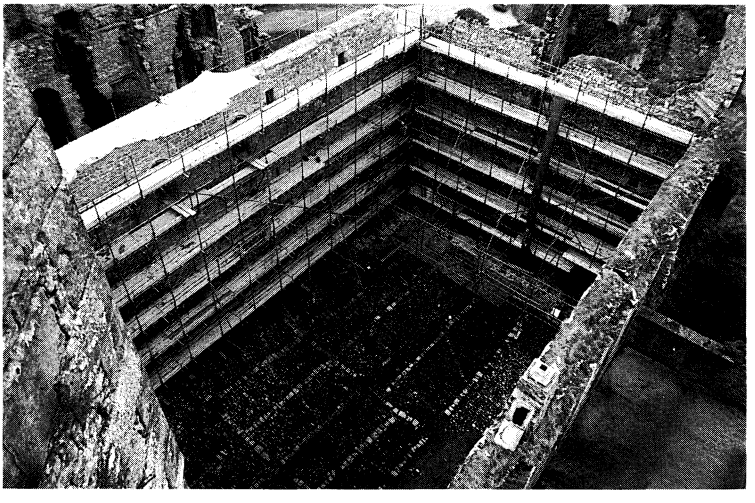

Figure 1: Looking into the courtyard.

Since being partially deliberately destroyed, the castle has been largely unoccupied and remained very much a ruin. No serious attempt at restoration has ever been made.

As the castle is situated in a popular holiday area, it is open to the public for a large part of the year. A small area of the castle currently functions as a restaurant, together with shop and some exhibition space.

Consolidation works.

The author became involved in the proposals to carry out conservation works at Castle Bolton in 1987 when he was asked to prepare a report on its structural condition. It soon became clear that although no single item could be described as serious, extensive consolidation works were necessary in order that the pattern of gentle decay which had long since set in could be halted.

Some relatively low-key works were carried out in the early part of this century by the present owners grandfather but only one or two small areas had received attention recently. The authors 1987 report was part of a series of discussions which led to a major programme of conservation works being put in hand. With financial and professional assistance from English Heritage phase I of the work on site commenced in the summer of 1990. Work on phase III is currently in hand.

The work carried out has been the minimum necessary to ensure the continued stability of the castle in its current state. During these works no attempt has been made to rebuild anything and the only additions made are in locations necessary to support dangerously overhanging masonry.

The major problems with Castle Bolton were twofold:-

the deliberate slighting of the castle during the English Civil war and subsequent "quarrying" of masonry for use in other buildings has left a number of unstable and apparently unstable areas and

the ingress of dampness into the masonry encouraged the growth of weeds, plants and trees. In some cases quite substantial trees were growing in the masonry in inaccessible positions leaving large stones very precariously balanced.

Before any work on the walls was allowed to commence thorough photogrammetric surveys were made of the building, both internally and externally and a substantial amount of scaffolding was erected. Archaeologists then carried out very careful hand surveys of the wall structure and made alterations and additions to the photogrammetric surveys where these close inspections showed errors or where areas had been hidden by plant growth.

The work carried out at Bolton Castle falls into a number of categories:

Pointing. The major proportion of the work done at Castle Bolton is very careful pointing of the masonry. Old and decayed pointing is raked out and replaced with new lime mortar pointing but sound existing mortar has been left intact. Considerable trouble has been taken to ensure that the mortar is of consistent mix and colour

and that the joints are properly treated before repointing takes place.

Grouting. It was originally thought that considerable areas of the walls would be found to be voided but close inspection as the work has proceeded has shown that, unusually for an English medieval structure, the walls are generally solid. Some gravity grouting has been necessary in localised areas.

Weatherproofing of wall tops. Many of the walls at Castle Bolton are in excess of 1 m wide and therefore provide very good places for plant growth. The tops of the walls were dismantled where the masonry was loose and then rebuilt. Great efforts have been made to ensure that the stones on the face are replaced in their original position so that it is certain that no historic detail is lost.

Additional supporting works. As discussed earlier a number of areas have, over the years, become poorly supported. The additional supporting works thought necessary at Castle Bolton, apart from numbers of small stainless steel dowels and brackets to fix loose masonry back locally, consists of some vertical square

Figure 2: New posts supporting massive overhangs. tube supports constructed from cold formed stainless steel. These have been installed to support major

overhangs of potentially unstable masonry. As there was no clear detailed evidence for what supported these areas previously the stainless steel posts are intended as a clear statement of 20th century intervention. Figure 2 shows two of these new posts.

It is felt that the intervention is as minimal as could be achieved in the circumstances and that given some minimum maintenance, the areas treated are safe and secure for many years to come. Work is currently continuing and further phases are being planned.

LEIGH COURT BARN, WORCESTERSHIRE.

General description.

Leigh Court Barn is reputed to be the largest cruck barn in the world, measuring 43 m long by 11 m wide and 11 m high. Each of the two halves (or blades) of the 11 main frames of a cruck barn consist of matching halves of curved or crooked oak trees from whence comes the name "cruck". The cruck blades are about 450 mm by 300 mm and 10 m in length. Each of the 11 frames has a very similar curvature which leaves a mystery as to how the medieval builders found so many large trees all with a corresponding curved shape.

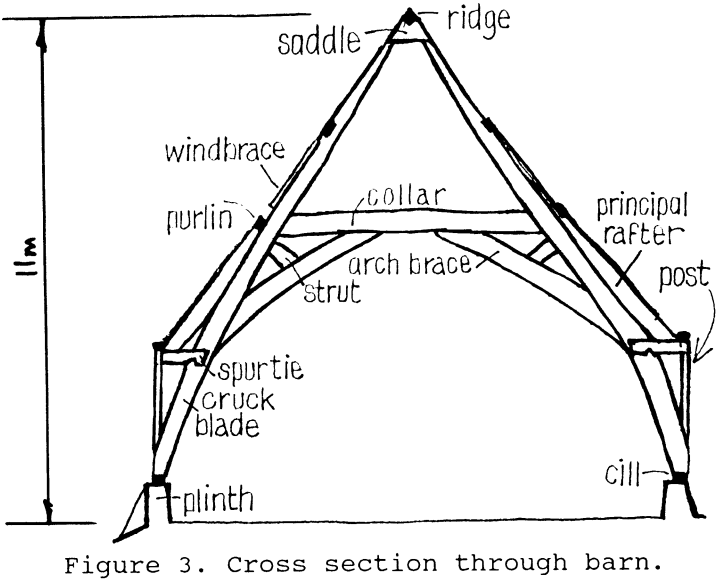

Figure 3. Cross section through barn.

No iron was used in the construction of the barn, all joints being carefully morticed and tenoned together and held by timber pegs. Some decayed joints had been

repaired in the distant past with iron straps.

The barn was built in about 1300 and it has been in use as a barn since its construction but in recent years, due to changes in farming practice, it has become more of an occasional store than a barn. Being such a large structure its repair was beyond the financial means of its owner and therefore English Heritage made substantial financial grant aid and provided all the professional services necessary for the restoration work, the author acting as project engineer.

Structural problems.

The feet of the crucks sit on sole plates which in turn sit on masonry walls 500 mm - 600 mm thick, approximately 1.5 m above ground level. The bottom of these walls was only a few centimetres below ground level and the ground conditions around the barn are often waterlogged. The thrusts from the feet of the crucks had pushed out these masonry walls to varying degrees and additionally the barn had taken on a distinct lean lengthways. These quite considerable movements had caused some damage to bracing members in the timber frame and had pulled many joints apart. The first action taken was to provide substantial temporary shoring to one end of the barn to restrain its tendency to lean further and thus precipitate total collapse and prior to the work commencing in earnest, the barn was provided with a temporary cover built from steel scaffolding.

Site work commenced in the spring of 1987 and continued for 18 months. It was decided to partially dismantle the barn very carefully in order that the main cruck arch-braces could be pulled vertical, it being felt that the lean which had taken place was causing unduly high stresses any increase in which the timber framework would not be capable of resisting. All members removed from the structure were numbered so that they could be replaced in their original location this being important from an historical as well as a practical standpoint

Additionally, due to the poor state of the supporting walls and the lack of anything resembling foundations, new foundations were installed. The new foundations consisted of large concrete pads supporting steel columns, which in turn were connected to the bottom of the cruck arches using steel dowels. The concrete foundations being below ground were completely buried and the steel supporting posts have been totally

surrounded in the original masonry, which again was all replaced in its original locations. These modern interventions are totally invisible. The original timber work was replaced almost in its entirety with only a very few members being renewed. Some minor repairs of a traditional type were made to severely decayed members. Although few calculations on the strengths of the individual members were done it is felt than none of the decayed timber could be justified to meet modern codes of practice. As the barn has been thorough "tested" over the last 700 years this lack of compliance was not felt to be of consequence.

Figure 4. Leigh Court Barn.

In order to be certain of the structural adequacy of some of the more decayed rafters simple load tests were carried out to prove that these were strong enough for their purpose. These and other similar tests on members from other buildings have shown that

old timbers have a much greater modulus of elasticity and are capable of sustaining much higher stresses than modern timber.

The whole barn was re-assembled with no signs of modern intervention whatever and few new timbers being used.

CONCLUSION.

It is hoped that the foregoing case studies show that the philosophy of minimum intervention and of conserving the structure in its "as found" state whilst ensuring its stability is a structurally satisfactory alternative to a full restoration scheme.