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Repairs to English Monuments: Some Case Studies

Réparation de monuments anglais: études de cas

Einige Reparaturbeispiele an englischen Baudenkmälern

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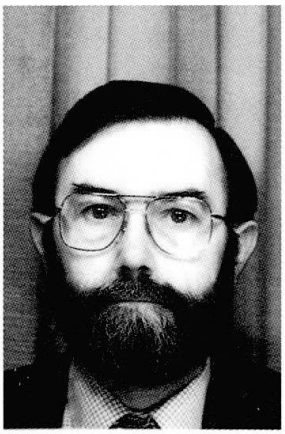

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SUMMARY

The English Heritage approach to the conservation and repair of historic buildings and structures in England is a minimalist approach. The main aim is to conserve the building as found and to carry out the minimum repairs necessary to ensure its safety and long life and to ensure that it will cause no danger either to its occupants or to passers-by. The aim of this paper will be to illustrate this philosophy by means of a series of brief case studies of structural repairs carried out under the direction of the author.

RÉSUMÉ

L'approche anglaise à la conservation et la réparation de bâtiments et structures historiques est une approche minimaliste. L'objectif principal est de conserver le bâtiment dans son état actuel et de réaliser les réparations minimales, afin d'en garantir la sécurité et une longue durée de vie et d'assurer qu'il ne représentera aucun danger pour ses occupants ou ses utilisateurs. Le but de cet article est d'illustrer cette philosophie au moyen de quelques études de cas de réparations structurales réalisées sous la direction de l'auteur.

ZUSAMMENFASSUNG

Die English Heritage-Stiftung geht mit der Einstellung eines Minimalisten an die Erhaltung und Reparatur historischer Gebäude und Ingenieurbauten in England heran. Das Hauptziel besteht darin, den gegenwärtigen Zustand zu erhalten und nur die notwendigsten Unterhaltsarbeiten vorzunehmen, damit die Sicherheit und das Fortbestehen der Gebäude sichergestellt und weder Bewohner noch Passanten gefährdet sind. Der Artikel schildert diese Philosophie anhand einiger Fallbeispiele von Reparaturarbeiten, die unter der Leitung des Autors durchgeführt wurden.

1. INTRODUCTION.

1.1.1 The English Heritage philosophy for the conservation and repair of ancient monuments, historic buildings and other historic structures in England is one of carrying out as little work as possible to the fabric in order to preserve it. It is a minimalist approach.

1.1.2 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. Only the minimum repairs necessary to ensure its safety and long life and to ensure that it will cause no danger either to its occupants or to passers-by are carried out.

1.1.3 The aim of this paper is to illustrate this philosophy by means of a series of brief case studies of structural repairs carried out under the direction of the author.

2. THE SCHEDULING AND LISTING OF HISTORIC BUILDINGS.

2.1.1 There are a number of grades of importance of historic fabric in the United Kingdom. Major ruined structures are often "scheduled" as ancient monuments; they are generally uninhabitable and medieval and earlier although later buildings can also be scheduled.

2.1.2 The most important structures are "listed" at grade I and others can be "listed" as grade II* and grade II. Important townscapes can become "conservation areas". All of these grades of structure are subjected to the same philosophy although the application of the rules can vary according to circumstance and importance.

2.1.3 A building or other structure is not scheduled or listed for one particular feature but as a whole, all parts being considered important. Clearly however some parts will in fact be less important than others. All demolition, complete or partial and all alterations need consent prior to the commencement of work starting on site.

2.1.4 The hidden part of a structure is often considered to be a very important part of the building and is dealt with accordingly. Alterations to the interior of a building or indeed its hidden fabric are scrutinized closely to ensure that wherever possible no important detail is lost during alterations.

3. CHANGES TO SCHEDULED AND LISTED BUILDINGS.

3.1.1 Most people understand that the exterior appearance is of historic and aesthetic value even if they do not subscribe to that view themselves. Discussions often arise about interior details and about details that are hidden such as the carcassing of the floor structure. This may contain unusual details but may equally be a very common form of construction. Either way the removal or alteration of such hidden structure is not allowed lightly by English Heritage but decisions will vary from case to case.

3.1.2 While a building with the original external shell but with a completely new internal structure may look the same externally to passers-by, the building is not considered, according to this philosophy, to be historically correct. English Heritage generally objects to facadism work. It also objects frequently to major alterations to the structure of floors and the like, particularly when this involves the removal of details such as joist to beam joints. It would much prefer to see material added to a structure to strengthen it if weak areas are a problem.

3.1.3 The following case studies show how this minimalist approach is applied.

4. CASTLE BOLTON, NORTH YORKSHIRE.

4.1.1 Castle Bolton is a massive and very well preserved medieval castle built for Richard de Scrope who was granted a licence to build a castle by King Richard II in 1379. Castle Bolton was not only built as a castle, but considerable efforts were put in to make domestically comfortable. In 1568-69 Castle Bolton served as a prison for Mary Queen of Scots and it was slighted by Parliament in the English Civil War in the 1640's. Since being partially deliberately destroyed, the castle has been largely unoccupied and remained very much a ruin. A small part of the castle currently functions as a restaurant, together with shop and some exhibition space. No serious attempt at restoration has ever been made.

4.1.2 Some relatively low-key works were carried out early this century. In recent years the owner of Castle Bolton has instituted a major programme of conservation works with financial and professional assistance from English Heritage. The work being 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.

4.1.3 The major problems with Castle Bolton were due to the ingress of dampness into the masonry and the subsequent growth of weeds, plants and trees. In some cases some quite substantial trees were growing in the masonry in inaccessible positions.

4.1.4 Before any work could commence thorough photogrammetric surveys were made of the building, both internally and externally and a substantial amount of scaffolding was erected. Archaeologists carried out very careful surveys of the wall structure and made alterations and additions to the photogrammetric surveys where close inspections showed errors.

4.1.5 The work carried out on the structure of Bolton Castle falls into a number of categories:

- Pointing. The major amount of work done at Castle Bolton is very careful pointing of the masonry work. Old and decayed pointing is raked out and replaced with new lime mortar pointing.

- Weatherproofing of wall tops. Many of the walls at Castle Bolton

are in excess of 1m 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 to ensure that no historic detail is lost.

- Additional supporting works. The additional supporting works thought necessary at Castle Bolton, apart from numbers of small stainless steel dowels to fix loose masonry back locally, consists of some vertical square tube supports in stainless steel. These have been installed to support major overhangs of potentially unstable masonry and are intended as a clear statement of 20th century minimal intervention.

Figure 1.
Castle Bolton.

Major overhangs of masonry now supported by stainless steel posts.

5. LEIGH COURT BARN, WORCESTERSHIRE.

5.1.1 Leigh Court Barn is reputed to be the largest cruck barn in the United Kingdom and measures some 43m by 11m by 11m high. It has been in use as a barn since its construction in the medieval times but recently, 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 grant aid financially and provided all the professional services necessary for the restoration work.

5.1.2 The feet of the crucks sit on masonry walls approximately 1m above ground level. The ground conditions are often fairly wet. The thrusts from the feet of the crucks had pushed out these masonry walls to varying degrees and the barn had taken on a distinct lean lengthways. These quite considerable movements had caused some damage to bracing members in the timber frame.

5.1.3 It was decided in this instance to partially dismantle the barn in order that the main cruck arch-braces could be pulled vertical, it being felt that the lean which had taken place was causing undue stress on the timber framework.

5.1.4 Additionally, due to the poor state of the supporting walls,

new foundations were installed. The foundations consisted of large concrete pads supporting steel columns, which in turn were connected to the bottom of the cruck arches. The concrete foundations being below ground were of course completely buried and the steel supporting posts have been totally surrounded in the original masonry, which was replaced in its original locations. The original timber work was replaced almost 100% with very few members being renewed. Some minor repairs were made to severely decayed members. 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.

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

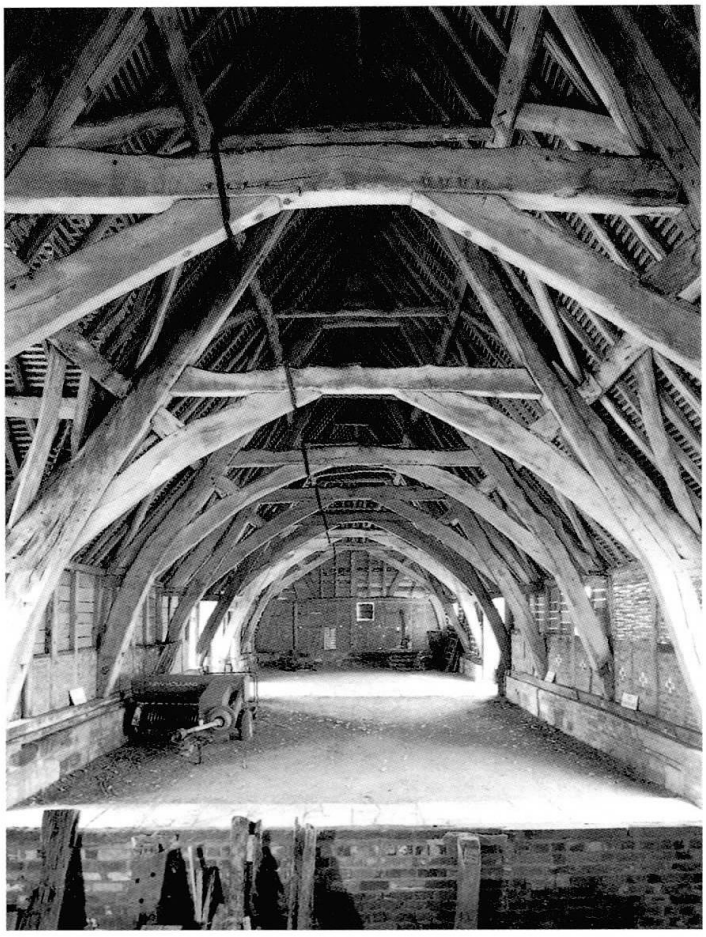

Figure 2.

Leigh Court Barn.

6. ST ANDREW'S CHURCH, GREENSTED, ESSEX.

6.1.1 St Andrew's Church is the only surviving example of a Saxon timber framed church in England and has been dated to AD 845, making it the oldest wooden church in the world. The only remaining Saxon part of the church are the vertical oak logs that form the walls of the nave. The roof of the nave is Victorian, whilst the chancel and porch are Tudor.

6.1.2 It was noticed in early 1990 that one roof truss had broken Further investigations showed that a second roof truss was also damaged and that the nave was beginning to lean to the north. A

scheme of accurate structural monitoring was immediately installed and when this monitoring proved continuing movement, shoring was installed to the north wall to restrain any further leaning. Investigation of the construction of the building showed that it is, structurally, an exceedingly complex and much altered building. Its complicated construction and important history restricted the possible repair methods available.

6.1.3 Although the roof covering was in good condition it was decided to strip this to expose the rafters to insert steel T-bars into the upper surface of the principal rafters and to introduce steel bracing to the upper faces of the secondary rafters.

6.1.4 The intention of this was to repair the fractures in the principal rafters rather than to replace them and to strengthen unbroken principal rafters. The bracing created a strong diaphragm on each slope of the nave roof such that sideways forces were transmitted to the substantial brick built chancel arch and the west gable of the nave. When the building was re-roofed all of the bracing work was hidden and the only visible signs of the repair works are some small steel brackets forming end plates to the principal rafter repairs hidden under the overhanging eaves of the nave.

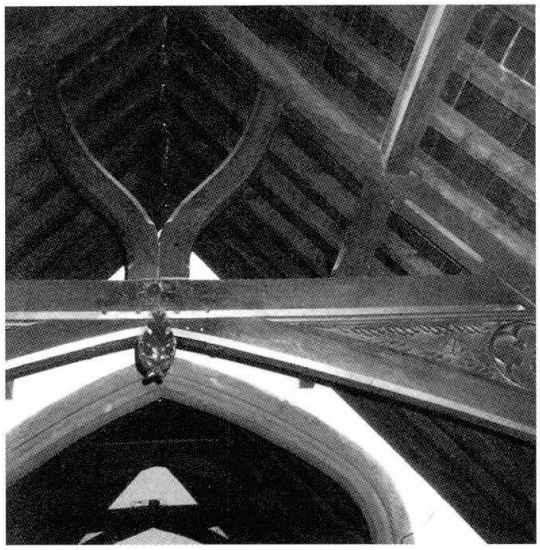

Figure 3.

Greensted Church. The roof truss joints had pulled apart and the principal rafter had broken at the purlin.

7. BURTON CONSTABLE HALL, HUMBERSIDE, ENGLAND.

7.1.1 Burton Constable Hall is a very large brick built Tudor house, mainly built about AD 1570. Problems were noted when cracks appeared in the very elaborate ceiling of the Long Gallery which is on an upper floor.

7.1.2 Investigations showed that the beam supporting a substantial gable wall over a bay window at the end of the Long Gallery had decayed due to insect attack. This decay was allowing the timber beam to deflect and to crack the ceiling below. Damage was also being caused to the substantial brickwork wall above the beam.

7.1.3 For various reasons, not least the importance of the ceiling, and the massive amount of brickwork which it carried, removal of the decayed beam was not practical. It was therefore

decided to insert some steelwork into the roof space at a slightly higher level than the decayed timber beam and to ensure that this new steelwork relieved the decayed timber beam of its load. A steel channel was inserted behind the gable wall in the roof space close to the gable wall. This steel channel was brought into the roof in 2 sections and bolted together using high strength friction grip bolts. Two further beams were inserted at 90° to this steel channel and buried into the wall over the decayed timber beam. Padstones were inserted on top of the cross beams and when the concrete padstones had matured sufficiently the bolts connecting the cross beams and the main channel beam were tightened, thus transferring load from the existing decayed timber beam to the new steel channel.

7.1.4 This work was carried out without any temporary works and with only minimal damage to the existing building being caused by two small holes for the cross beams and some removal of roof coverings for access.

8. ST JOHN'S ABBEY GATEWAY, COLCHESTER, ESSEX.

8.1.1 This gateway, although small, is a fine 15th century example of flintwork construction common to this area of England. The structure generally was in good order, but the walls to the spiral staircase leading from ground level to the first floor and the roof were beginning to seriously deteriorate and form numerous cracks. Investigations showed that the walls to this spiral staircase were in many instances no more than 200mm in thickness. In some places the thickness was reduced even from this minimal amount. The thinness of the walls precluded the installation of ring beams into the thickness of the walls and the narrow access stairway meant that anything fitted internally had to be of minimum dimensions.

8.1.2 Various schemes for inserting steel rings were investigated, but the final solution decided on was to attach stainless steel expanded metal to the inside face of the turret walls. Stainless steel bolts had their heads partially ground down to enable them to be fitted into joints between the flintwork and these were grouted in position with a lime mortar. These bolts were inserted at close centres. The stainless steel mesh sheets were attached to these bolts and curved to follow the curvature of the inside face of the walls. Stainless steel mesh was bolted to the wall using washers and half-nuts. This then provided a good restraint to the inside of the masonry with minimal thickness. At this stage the inside face of the turret stair was covered with expanded metal bolted to the wall tying the entire inside face of the wall together. The expanded metal was rendered with a lime mortar render more to prevent serious injury to people using the stairs rather than for any structural reason.

8.1.3 Once again, the original construction of the gateway was not altered or interfered with in any way and the minimalist approach was adhered to.

9. THE IRON BRIDGE, IRONBRIDGE, SHROPSHIRE.

9.1.1 The Iron Bridge in Shropshire, as will be well known, is the world's first cast iron bridge, being built in 1779 and opened for traffic in 1781. It spans the river Severn at Coalbrookdale with a span of some 32m. In 1981 a scaffold was erected to enable access to be gained to all parts of the bridge. Subsequent survey work showed that there were 83 cracks to various members of the bridge structure. It was decided after considerable thought and a certain amount of computer analysis of the structure, that no action need be taken to repair any of these fractures and therefore work was restricted to thoroughly repainting the bridge and some cosmetic repairs to items such as railings.

Figure 4.

Ironbridge.
A typical fractured member.

9.1.2 The reasons for taking no action were:

- Some years previously a reinforced concrete strut had been put across the bed of the river to restrict movement of the bridge abutments.

- The arch crown connecting detail which connects the main arches together was a rigidly fixed detail and this had in no instance cracked or become deformed and this clearly showed that no major movements had taken place.

- There was concern that repairing any fracture could, if new movements occurred, create a further fracture rather than allowing the bridge to move on an old fracture point.

- No work was done on the understanding that regular inspections of the bridge were possible and that any further movement would be detected quickly.

10. 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.