DEVON EARTH BUILDING ASSOCIATION

NEWSLETTER 6
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MUD PLASTERS

1. Historical background and physical characteristics.

The forthcoming revised edition of the DEBA Plasters and Renders leaflet will contain a section on loam/hair plasters. The following notes represent an overall survey of this traditional technique, upon which the brief section in the leaflet will be based.

Loam/hair and, to a much lesser extent, loam/chopped hay plasters were applied to the internal walls and ceilings of both cob and random stone buildings from the earliest times up to the end of the 19th century. Their widespread use in the mediaeval and early modern periods could probably be explained by the difficulty and expense involved, especially in remote inland areas, in obtaining building lime and good quality sand.

However, the main reason that mud plasters were so popular and continued in use for several centuries, even after lime and sand became more readily available, was that, for internal use, they were not only much cheaper but provided a finish that was durable, flexible and easily maintained. Virtually all decorative plasterwork, from the 16th up to the mid-19th century, was applied to mud plasters on riven oak lathing; mainly because the craftsmen, understandably, wanted their work to last and were aware of the proven toughness and flexibility of loam/hair plasters as a substrate and support for decorative lime plasters.

It is the hair (normally cow hair) combined with the clay binder that gives the material its considerable tensile and flexural strength. A properly mixed and applied loam/hair plaster is very difficult to pull apart by hand, even when it has been immersed in water for several hours. It is usually quite difficult to separate the layer of applied mud plaster from its substrate, especially if this is a cob wall, because of its very strong adhesion, even when, as is often the case, it has been in situ for three to four centuries.

A typical mud plaster will vary in thickness from 5 to 6 mm (early work) up to 10 to 12 mm in 19th century buildings. Often it will be finished either with a pure lime or 1:1 lime/fine sand skim coat, 1 to 2 mm thick, or with numerous coats of limewash. Mud plasters usually seem to have been applied in one coat.

During 1995/6 extensive repair and restoration works were carried out at Cullacott Farm near Launceston. Cullacott is a grade one Listed small manor house of 15th to 17th century date, constructed of cob and stone. Most of its internal walls and ceilings were, prior to restoration, covered with original mud plasters. In some cases, where severe decay and damage had occurred, these were replaced with lime plasters; but where only minor patching was required this was done using new or reconstituted mud plaster. It was decided to completely replaster one large room using a traditional loam/hair plaster to match the original finishes, and this proved to be very successful. It was finished with a skim coat of 1:1 lime and silver sand.
A sample of loam/hair plaster taken from the wall of the cross passage at Cullacott (probably 17th century) was analysed by sieving and gave the following results:

Particle dia.	Percentage
Silt and clay, <63 micron	54.7
Fine sand, 63 to 500 micron	18.7
Coarse to medium sand, 0.5 to 2.0 mm	14.1
Grit, 2.0 to 5.0 mm	7.8
Cow hair and other organic matter	4.7

Cover illustration - threshing barn at Livaton Farm, South Tawton.

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Some very fine (possibly digested) organic matter would suggest the presence of animal dung in the mix. A sample of early mud plaster from Pitt Farm, Lower Ashton was found to contain 3% of cow hair. Although, in terms of percentage weight, 3 to 5% of hair seems relatively little, volumetrically this would represent more or less equal parts of hair and sieved subsoil.

2. Mixing and application.

As with lime based plasters, it is always best to do two or three experimental mixes, containing variable amounts of water and, if necessary, added sand and apply these to 500 mm square trial panels so that drying, shrinkage and adhesion can be monitored and measured. Local subsoil or reconstituted cob is first dried and pulverised, then passed through a garden (5 mm mesh) sieve. Subsoils containing more than about 40 to 50% of fines (clay and silt) may need to be gauged with coarse to medium sand, as otherwise they may be too sticky to be workable and may develop shrinkage cracks too wide to be controlled by subsequent re-working.

Mud plasters and mortars may be mixed manually on a hard, smooth surface - a sheet of exterior grade plywood, for example, or, if large quantities are required, a Cretangle or similar pan mixer may be employed. It is important to ensure that the large quantity of hair required should be incorporated in such a way that it is evenly distributed throughout the mix.

Mud plasters, like lime plasters, should be applied to a thoroughly pre-wetted surface. In cob walls which have hollows and cavities, these should first be 'dubbed out' with a subsoil/chopped hay or straw mix, keyed into the cob. Mud mortars are very cohesive and, in order to be workable, may need to be fairly wet, around 20% or more water content. Unless gauged with sand, clay-rich plasters may be almost impossible to apply.

Mud plasters may not be 'thrown' on to the walls (they are normally too sticky) but are applied with a trowel or float, using a normal lime plastering technique. Being applied to internal walls, surface cracking is usually less of a problem than it is with externally applied plasters. Repeated re-working of the material should be avoided as this will bring the coarse aggregates and hair to the surface. Surface cracks can be filled with limewash or an applied lime based skim coat.

Larry Keefe

NOTE. Since this article was written B. Honeysett has noted the presence of mud plasters on two formerly external cob walls at Spaxton, Somerset and Braunton in North Devon. Any further information on externally applied mud plasters would be welcomed. Please contact Peter Child at County Hall.

COB BUILDING IN BRITTANY

Cob buildings may be found in various areas of north west France, from Seine Maritime in the north down to the Vendée and Poitou-Charentes in the south. However, by far the largest concentration is in the Rennes basin, in central Brittany, where several thousand cob structures have been identified.

Traditionally, two methods of construction have been used in this area. The first known as *bauge*, is more or less identical to that used in south-west england, but the second method, known as *banchage*, is rather different, being somewhat similar to the 'puddled earth' technique. The subsoil is is mixed with chopped straw and then more or less saturated . It is poured into timber shuttering and then rammed in order to consolidate it and to squeeze out excess water; after allowing the material to partially dry, the formwork is removed.

Unlike Devon, where numerous buildings from the late mediaeval period are known to survive, the Breton cob tradition is somewhat later. Although some buildings have been dated to the early 17th century, the vast majority that remain were built during the 19th and early 20th centuries.

The large house shown in the photograph is fairly typical. It is at St. Méen le Grand about 35 km west of Rennes. Dating probably from the second half of the 19th century, its walls are around 6.5m in heigth - 5.5m of cob built off a 1.0m stone plinth. Its rear, north-east facing wall of exposed cob originally had no openings but has had areas of glass brick inserted to provide light to the interior.

There appear to be six lifts of (shuttered?) cob and some evidence of bird and masonry bee damage as well as an area of rising damp. A sign advertising a supermarket chain adds interest to an otherwise rather boring facade!

For further reading on this topic see 'The Vernacular Architecture of Brittany' by G. Meirion-Jones.

Some Notes on Hydraulic Limes.

Pure, non-hydraulic or 'high calcium' limes are comprised of between 94 and 98% calcium. Hydraulic limes, on the other hand, are manufactured from limestones containing variable amounts of impurities, mainly in the form of hydrous alumino-silicates (clays) and ferrous oxides. When the hydraulic lime - supplied in bagged, powdered form - is mixed with water a chemical reaction takes place between the clays and the calcium, the result of which is the formation of cementitious compounds. Hydraulic limes have, therefore, the ability to set under water, unlike pure limes, which need to be exposed to the air in order to carbonate.

The strength of hydraulic limes varies according to the percentage of clay present. It is considered that the only hydraulic limes suitable for conservation work are probably those classed as 'feebly hydraulic', that is containing less than 12% of clay, though even these are thought to be too strong for use in plasters and renders on cob walls. The weakest (feebly hydraulic) lime mortars have a compressive strength around three times that of pure lime mortars. However, as already noted, plaster and render coats need to be weaker than the walls to which they are applied, so the increased strength of hydraulic limes provides no advantage whatsoever. On the other hand, in winter conditions or in very exposed situations, their use as a basis for mortars, renders for stone plinths, or for random stone walls may be justified. The permeability of hydraulic lime based renders is said to be similar to that of those made from pure lime, though no comparative data has been seen which would support this view.

A great deal of uncertainty still exists concerning the performance of hydraulic limes, so the Association feels unable, at this stage, to provide definitive guidance relating to their use and suitability for conservation and repair work to traditional cob and random stone buildings. We recommend, therefore, that, wherever possible, pure lime in putty form should be used, and that hydraulic limes should be specified only in cases where their use is unavoidable (they are certainly to be preferred to ordinary Portland or white cement). An experienced artisan or contractor, accustomed to working with the material, should be employed, or at least consulted, before any work is carried out.

A CAREER IN COB?

Kevin McCabe is looking for an assistant/apprentice to work in his building business which specialises in cob repair and especially in new cob building. He is based at Northleigh near Colyton in East Devon. Ring him on 01404 871487 to discuss.

ANSWER LIES IN THE SOIL

The following article appeared in the Building Engineer, September 1998 and is reproduced here by their kind permission.

Good news for earth wall fans - Taylor Woodrow Construction believes the solution to cheap, sustainable, good quality housing could be right under our feet.

The company's engineering division based in Southall, Middlesex, is exploring the possibilities of rammed earth construction (pisé) for use in domestic dwellings.

The technique involves mechanically compacting soil into a formwork . Rammed earth construction is already in use in Africa, where it has proved ideal for sustainable housing because structures are easily built and use inexpensive local materials.

In Australia, we're told, rammed earth construction is proving popular for high-value housing because it offers high heat insulation and fire resistance and low noise transmission, and an attractive finish.

The district of Amesbury, Wiltshire has some good examples of English rammed earth construction, with some buildings dating from the 18th century.

Dr. Phil Bamforth, Taylor Woodrow's construction consultancy manager, told the journal:

" Given the current demand for increased use of sustainable materials, combined with the thermal and acoustic properties of the finished product, there is great potential for rammed earth structures in the UK. Rammed earth construction has extremely low embodied energy(1) which is a material characteristic that we anticipate will become increasingly important in the future."

As part of its investigation, Taylor Woodrow has constructed a three meter high rammed earth wall. The lower half was constructed from "as dug" selected soil stabilised with 5% cement, while the upper half is constructed of compacted soil alone.

The material was compacted into conventional concrete formwork in layers approximately 50mm thick using a hand-held sand compactor.

Wall openings representative of window or door apertures are totally unreinforced, demonstrating the surprising stability of rammed earth.

Taylor Woodrow construction says that the completed wall could be protected,plastered or finished to suit the desired application. The feasibility of using this form of construction to make noise and fire resistant party walls between houses is currently being assessed.

(1)*embodied energy - the total amount of enegy used to produce the final product; an indicator of how much the production of a given object or product "costs" the environment.*

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EARTH STRUCTURES AND CONSTRUCTION IN SCOTLAND : A guide to the Recognition of Earth Technology in Scottish Buildings.

Bruce Walker and Christopher McGregor with Rebecca Little.

Historic Scotland 1996. Price £12.50.

This publication is no 6 in the series of Technical Advice Notes published by Historic Scotland. With 128 pages and many interesting photos and excellent line drawings, it is a substantial work - this substance is the result of it attempting to cover every possible use of earth in traditional Scottish construction from wholly mud-walled houses to turf-faced hedgebanks, from the infilling of timber frames to to the puddled clay under C18 bridges. This is a laudably broader view of earth construction than is generally taken in England but it has the disadvantage that it makes it difficult from this work to obtain a clear idea of the significance of the various earth construction techniques in Scotland, since as much emphasis is put on apparently totally obscure usages as on relatively common ones. Indeed Section 3 opens with an example of a turf house built in Nebraska by a Belgo-French family in1885 and not unsurprisingly unparalleled in Scotland!

It is stated that wholly mud-walled buildings (seemingly bilt in a similar way to the thin-layered cob -"clay dabbins"- houses of Cumbria) extend over half of Scotland from Sutherland to Dumfries but it is not possible to gain any idea of the quantity of surviving examples. Buildings defined as "clay-wall" are shuttered structures with the external faces formed of rough stones held in a clay core; it is unclear how these can be distinguished from unshuttered rubble stone structures. The dividing line between buildings using this technique and those simply walled in rubble with earth mortar (as might be found in England) is not made at all apparent. Much space is devoted to quoting verbatim the advice in 19C building and farm manuals on such techniques as adobe and pisé but only one example of a Scottish pisé building is shown and none of an adobe structure. More analysis of surviving vernacular techniques would have been welcome instead.

The book is concluded with sections on colouring agents, conservation issues, case studies and tools and equipment. Conservation issues are only given four pages which in a publication by Historic Scotland seems surprisingly little; there is however some more information on conservation techniques in the case studies. Nothing is suggested in this area which would seem novel to DEBA members. There is an extensive and useful bibliography. There is undoubtedly plenty of interesting material in this well-produced book but it regrettably leaves some issues unclear and a lack of balance between the various sections leaves the reader wondering which are the significant issues in Scottish earth building and which are only peripheral.

Peter Child

Re-construction of cob boundary wall in Eure, Normandy.