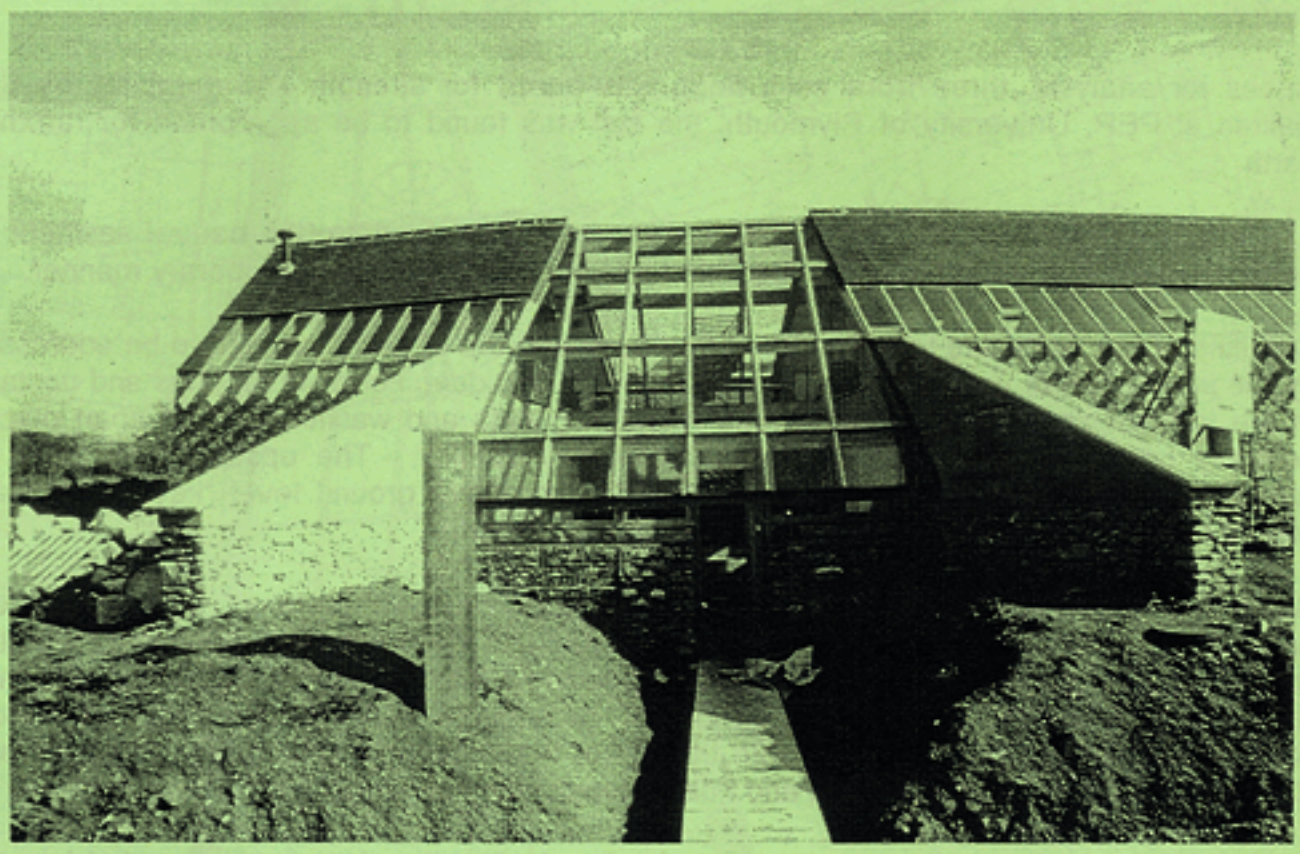
DEVON EARTH BUILDING ASSOCIATION



NEWSLETTER 5
Spring 1998

RAMMED EARTH WALLS IN DEVON

David Sheppard has set out below the techniques used in constructing rammed earth walls to contain the "Green house" which bisects his innovatory house at Westlake Brake, Wembury. This is the first recorded use of rammed earth in a Devon building.

THE PROJECT

Rather than transporting 160 tons of earth to a landfill site at substantial cost. Its utilisation into the fabric of the building seemed practical and environmentally conscious.

Extraction commenced on the "landscape incision" centrally to the building, the creation of the internal garden. "Heaping" the first 300 mm of soil (top soil without vegetation) and two subsequent heaps, located seaward and landward sides for ease of transportation and execution, (front and back of property). Covering heaps of earth in 2000 gauge polythene to retain moisture content; agitating occasionally to aerate, preventing natural compaction. Monitoring dryness and moisture levels, the earth should not be allowed to become too wet or dry.

Cubes for analysis, three from each heap was tested for strength and durability by Box Saxton at PEP, University of Plymouth, the soil was found to be appropriate for rammed earth.

At the outset it was my intention to create earth walls that illustrate "the natural aesthetic of earth", a rough and varied texture, integrated into the building in a contemporary manner.

Detailing of the walls due to exposure at the "base and top of walls" needed to be addressed by the integration of various materials. 600 x 300 x 300 deep concrete footings and upstand in the form or an upside down "T", with reinforcing bars and washers, 1.2 m apart placed centrally counteracts wind pressure and enhances stability. The upstand was faced in random rubble stone, lime cement jointed, 450 mm above ground level "keystones" were placed on tope of wall for keying the eventual rammed earth.

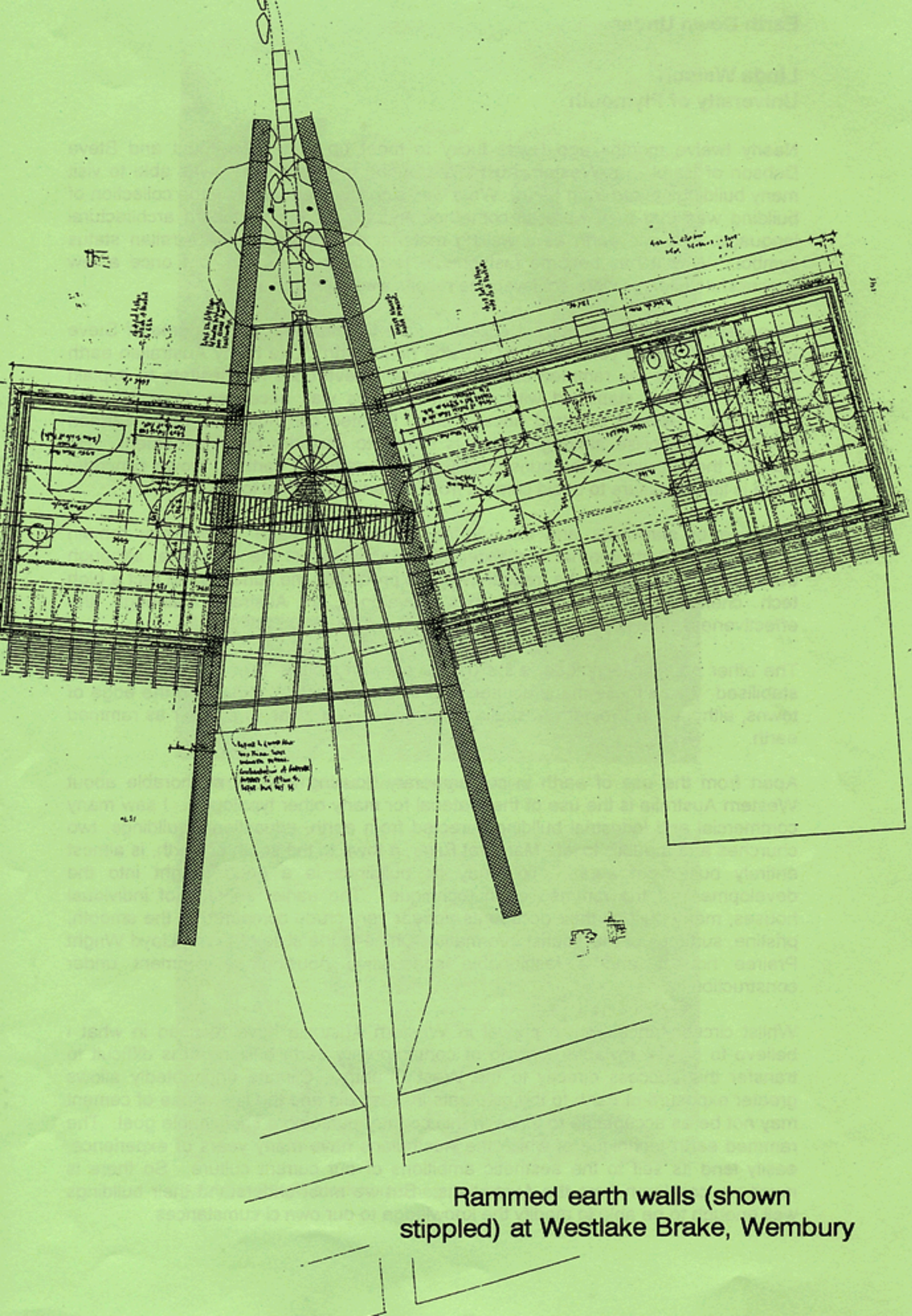
Shuttering was made up in 1.2 m x .9 m x .6 m sizes "clamped" together with threaded bar and bolted. Earth was made in batches according to the recipe as illustrated, vibrated mechanically in approximately 500 m layers, reducing 1.8 m^3 to 1.0 m^3. Shuttering was then removed and re-used adjacent or on top of subsequent earth blocks until completion. Reinforcing bars were cut aligning with the top of the walls and welded with threaded bar. "Capped" with laminated soft wood and bolted, tensioning the whole fabric of the wall.

In planning terms the walls were considered a "garden" walls. Although integrated into the building they have a non-structural purpose (no floors or purlin members bearing on the walls), therefore it was deemed appropriate. Building Regulations was adhered to by proving through engineering calculation that rammed earth was stable and could withstand wind pressure. It is important however to cube test various samples in different locations within the "earth heaps" to obtain a mean level of consistency, together with monitoring "the recipe" of earth before execution.

To date after the first winter, with the occasional 110 mile an hour wind the characteristics of the wall are in fact and coping well with its harsh environment.

- Viewing of property by appointment only.
  Contact: Architect David Sheppard on (01752) 336333

Cover picture - Rammed earth walls at Westlake Brake, Wembury.



Rammed earth walls (shown stippled) at Westlake Brake, Wembury

Earth Down Under

Linda Watson
University of Plymouth

Nearly twelve months ago I was lucky to meet up with Peter Mold and Steve Dobson of Ramtec in Western Australia. During my time there I was able to visit many buildings made from earth. What was significant about this large collection of building was that they were all contemporary, expressing a modern architectural language. To use earth as a walling material has become an Australian status symbol. Why it has become fashionable is difficult to explain, but once a few successful buildings were achieved the results were contagious.

Amongst the first of the current collection of earth buildings is the home of Steve Dobson built fifteen years ago at Cotesloe near Perth. Like many Australian earth buildings it uses the rammed earth technique. Steve does not hesitate to explain that the earth is stabilised with cement and this was necessary to satisfy the legislators. Several hundred houses later, Ramtec continues, as other earthen builders, to stabilise although Steve is happy to consider omitting cement. He accepts the criticism of the purist that Australian rammed earth is 'brown concrete' there is little pressure to avoid cement from the environmental lobby.

The use of stabilisers and the climate, means that earth walling can remain unrendered. Both internal and external surfaces reveal the substrate, although transparent sealants can be frequently found protecting the surfaces. In fact a high tech chemical sealant industry has developed in Australia, although the effectiveness of their products is to be questioned.

The other popular technique is the use of earthen blocks. Again these are often stabilised. I saw these manufactured and sold at industrial estates on the edge of towns, although in Western Australia block does not appear as popular as rammed earth.

Apart from the use of earth in contemporary housing what is memorable about Western Australia is the use of the material for many other typologies. I saw many commercial and industrial buildings erected from earth, educational buildings, two churches and a public toilet. Margaret River, a town to the south of Perth, is almost entirely built from earth. To study its buildings is a good insight into the development of the rammed earth technique. The earlier suburbs of individual houses, many built by their occupants appear very crude compared to the smooth, pristine, surfaces of the Tourist Information Office in the style of Frank Lloyd Wright Prairee houses and a fashionable speculative housing development under construction.

Whilst circumstances which prevail in Western Australia have resulted in what I believe to be an enviable portfolio of contemporary earth building, it is difficult to transfer this success directly to the West Country. Climate undoubtedly allows greater exposure of earth to the elements in Australia and the liberal use of cement may not be as acceptable to those in this country pursuing a sustainable goal. The rammed earth technique of which the Australians have many years of experience, easily lend its self to the aesthetic ambitions of our current culture. So there is much we can learn from the Australians. But we must understand their buildings well enough to be able to modify the knowledge to our own circumstances.

Rammed earth Tourist Office at Margaret River.

Church of St. Thomas More, Margaret River.

Stabilised earth block house near Bunbury.

Rammed earth wall under construction.

Rammed earth house at Prevelly Bay.

EARTH BUILDING MASTER CLASSES

Commencing July 6th 1998. A series of day long master classes will be held at the University of Plymouth. These will be practically based and lead by experts. Each class will focus upon a different earth building technique including cob, rammed earth, adobe, compressed block, mud and stud.

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OUT OF EARTH

A week long project will begin on June 21st to explore the sculptural and textural opportunities of earth. Structures are to be created by artists, sculptors, architects and engineers in the grounds of Dartington Primary School. Volunteers are still needed to help before or during the event. It will be a tremendous opportunity to work with internationally renowned artists who have achieved some inspirational structures.

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SOME NOTES CONCERNING THE USE OF COB BLOCKS AND BRICKS FOR MAJOR REPAIR WORKS

Considerable experience has now been gained in the use of earth based materials for the repair of cob buildings. However, many architects and surveyors are reluctant to specify mass cob for major reconstruction and structural repair works, and many builders, even those experienced in conservation work, seem to lack the confidence to employ this traditional technique. One result of this lack of confidence is that increasing reliance is being placed on the use of cob blocks and bricks, often bought in from outside suppliers.

The main advantages of using cob blocks are that (1) having been pre-fabricated and dried before delivery to site, they do not undergo drying shrinkage and (2) they can be laid in the wall using standard masonry techniques, so that the only new skill the mason needs to acquire is that of mixing and using earth mortar. The mixing and placing of mass cob, on the other hand, requires a degree of skill and experience on the part of the builder, as well as a knowledge of the performance and characteristics of soils on the part of the specifier. However, if well graded soils are used - those containing around 30% stones and gravels, 35% fine to coarse sand and 35% silt and clay - and provided that the cob, when mixed and placed, contains only just sufficient water to ensure that the right degree of plasticity and compaction is achieved, then shrinkage and settlement of the material need not be a problem.
In terms of performance - density and compressive strength - the two materials may be compared as follows: Well compacted cob will achieve a density of about 1,800 kg/m^3, whereas the density of individual hand-compacted blocks will be about 10 to 20% higher. Compressive strength of cob, again depending on degree of compaction, will be in the region of 0.6 to 0.8 N/mm2. The overall compressive strength of a cob block wall is more difficult to estimate because, unlike cob, it is not a monolithic form of construction. The only tests carried out, at Plymouth University on blocks containing 8% lime putty, showed a compressive strength of 2.5 N/mm^2 for a single block laid flat but 0.54 N/mm^2 for a stack of three blocks laid in a mud mortar. An air-dry compressive strength of 0.5 N/mm^2 would be more than adequate for a 500-600 mm thick wall in a two storey building.

With regard to cost, it is considered that a realistic estimate of the cost of mass cob walling would be around £200 per cubic metre plus or minus 20% depending on the logistcs of the project. Currently cob blocks cost about £60 per cubic metre delivered on site, to which must be added labour costs - production of mud mortar, handling and laying of the blocks etc., so the overall cost per m^3 must be somewhat higher, possibly around 20 to 25%.
The point of all this is to emphasise that while cob blocks and bricks are extremely useful in carrying out minor repairs, for major reconstruction works their use may be inappropriate in conservation terms and would certainly prove more expensive. However for emergency repairs that need to be carried out in winter months, when the use of mass cob is not possible, cob blocks may be the only viable alternative.

In conclusion, it should be stressed that the quality of cob blocks, and therefore their durability and usefulness, can be variable. Cases have been noted where blocks containing large stones have split during handling and broken when cut or trimmed. At one site the blocks supplied could easily be broken by hand, and when reduced to small pieces were seen to to contain much dried but decayed organic material. Clearly, there is a need for much greater quality control in the the production of cob blocks. Specifiers should, at the very least, know the source of the raw material and be able to insist on a maximum diameter for the stone and gravel fraction of the soil. Ideally, data relating to soil characteristics (grain size distribution, plasticity and compressive strength) should be provided by the supplier/producer, especially when large numbers of blocks are being ordered.

With regard to the use of re-cycled material, Tristram Risdon, writing about cob building in the 17th century, remarked that 'when any such walls are pulled down to be re-built, they commonly make fresh Cob with other earth; the Value of the old as Manure for Land,

sufficiently compensating the Cost of the new'. So, *caveat emptor*, or else fabricate your own blocks on site; at least then you know what you are getting.

DEBA members with similar experiences of using cob blocks are invited to write to the Association with their comments or observations. Comments from manufacturers would, of course, also be very welcome.

A NEW BOOK ON COB BUILDING

The Cobbers Companion (or "How to Build Your Own Earthen Home") by Michael Smith, May 1997. Obtainable from the Cob Cottage Company, PO Box 123, Cottage Grove, OR97424, USA (Telephone 541-942-2005). Price not known. 117pp.

This is a publication that DEBA has yet to achieve - a complete practical guide to building a cob house from A-Z. As the author rightly says, no book on its own can teach cob building; it has to be combined with "hands-on" experience. Nevertheless, this is a comprehensive attempt at a manual, albeit for the North American market. Absolutely no mention is made of building regulations or planning constraints, and perhaps Oregon in the Land of the Free is not encumbered with these. It is a work which emerges from the Green Movement, rightly emphasising the sustainability of cob as a building material, and as a human means of building, capable of being carried out without dependence on machinery. At the same time, it is essentially a practical guide and covers all aspects of constructing a house in cob: components, site work, mixes, roofs, floors and finishes. There are appendices on errors, tools, cost-cutting and references. Much of the material will be familiar to cob builders in this country, but other suggested techniques will not be - as for instance, rammed motor-tyre foundations, mixing cob in a "tarp" (a tarpaulin) and manufacturing cob in "loaves" or small lumps for easy handling. The text is extensively and clearly illustrated with line drawings and is easy to understand, avoiding complicated technical details.

There are certainly some techniques recommended in this book which will not meet with the approval of experienced British cob builders, but if you are interested in building in cob, you cannot fail but to be interested in this book. Its suggested constructional methods probably will not produce a work of fine architecture or even a dwelling which would be legal in the UK, but if the Apocalypse comes and you survive it, you would be very delighted to find a copy in the rubble with which to start rebuilding!

TWENTIETH CENTURY COB

Cob building in Devon did not die out entirely in the second half of the C19 before its revival in the 1980s. Apart from Gimson's well-known house, Coxen, at Budleigh Salterton (1911), there are two otherwise conventional bungalows at Crossways, Sidmouth, built in cob by the local firm of Pinneys in the 1920s. Why they chose cob is not known, but it shows that the art of cob building was not entirely dead even by that date. The substantial walls of the walled garden at Bickleigh Castle are also said to be of the same date.

DEBA would very much like to hear of other C20 examples of cob building. If you know of any, please tell Peter Child, Environment Directorate, County Hall, Exeter, EX2 4QW (01392 382261).

PROPOSED CONFERENCE IN CORNWALL

Following the success of last year's conference on cob conservation and repair at Taunton, it is proposed to hold a similar event in Cornwall in the autumn of this year. This is still in the early stage of planning and further details will be announced in due course.

ERRATUM - The average cost of cob blocks is around £160 per m3, not £60 as stated.