

Low impact construction

One of the pleasures of most low impact constructions is that materials are safe and the processes are easy



Small scale and rural

One characteristic of almost all low impact construction is that it remains small scale and usually rural. This often diminishes its value and relevance so it is worth stressing that there are few technical reasons why most of the construction types discussed could not be employed on both a large scale, and in urban situations.

It is likely that the small scale and rural

aspect to most low impact buildings is one reason why clients and builders feel able to experiment. As a result it is likely that many of the most valuable innovations and developments which will pervade more mainstream construction in the future are being tried out even now in sheds, extensions and small homes up and down the country!

Very low embodied energy

Low impact buildings are almost always buildings with low embodied energy in their fabric, where the use of natural materials is often the starting point for clients and designers alike. Such buildings tend to be energy efficient as well, but this is often secondary.

Local, unconventional materials

Sourcing materials can be problematic. Simply finding the material(s) can be difficult, particularly in urban areas. In addition, materials

All buildings which aim to reduce their impact on the environment could be called, at least, 'lower impact' but the term has come to mean those buildings using largely natural or organic materials. 'Low Impact Construction' serves to describe a body of work which takes in most of the more radical attempts to produce 'deep green' buildings with a quite different approach to construction and the creation of comfort. **Chris Morgan** explains...

Although the term describes a wide range of techniques, many of the principles, or characteristics of these buildings are shared and are distinct from much mainstream construction.

are rarely standard, nor have any recognised performance criteria (in a conventional sense). This puts the onus onto someone involved in the construction to be sufficiently expert in the field to be confident when it comes to sourcing the right material.

In addition there is often no commonly recognised framework for cost so it can be difficult not only to budget, but to know if you are getting a good deal. And the issue of cost is complicated by transport, storage and by the seasons.

Low material costs, high labour costs

Generally speaking the material costs of low impact constructions tend to be low, but these are usually offset by higher costs associated with labour and time.

This often means that the anticipated lower costs of low impact buildings are not realised. Many self builders get involved in building in order to offset some of the labour costs associated with builders and the normal mark-ups by developers and so on. However, the costs of materials remain broadly the same, due to lack of trade discounts, whereas low impact construction using naturally occurring materials or resources can offer further opportunities to save money.

Passive environmental control

Most of the natural materials and coatings associated with low impact construction are hygroscopic. Clay in particular absorbs and desorbs moisture freely and as such can act as a moderator of the humidity in the air, though ventilation remains the key tool for this. This function of balancing the relative humidity in the room is particularly valuable for occupant health, since many of the health problems associated with modern buildings can be exacerbated by extremes of relative humidity.

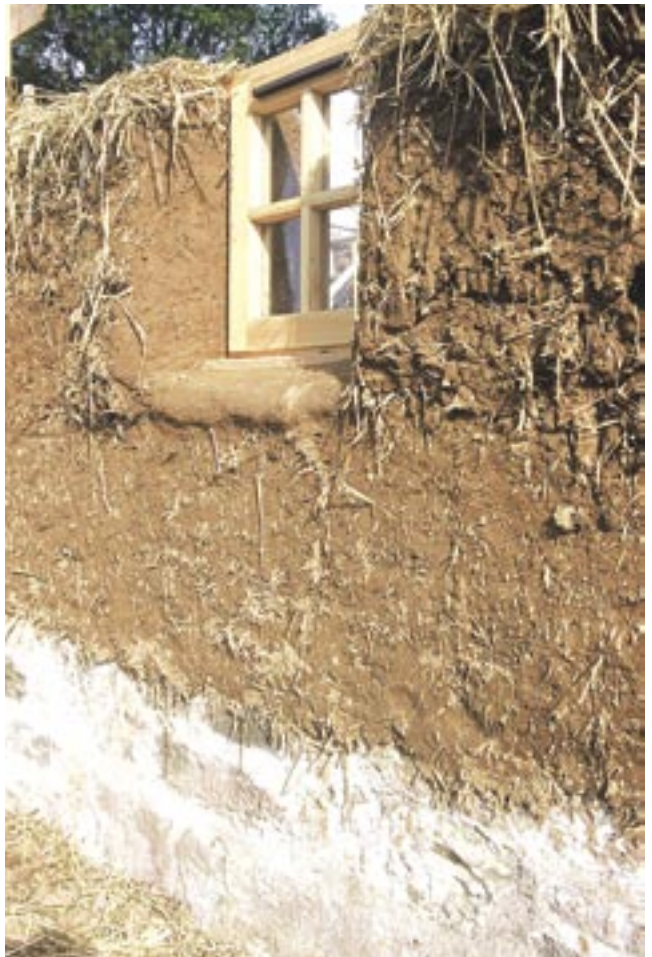
The same is true in regard to heating, and the concept of thermal mass is well understood. With both thermal mass, and moisture mass, some

understanding of the issues is required, but it is possible to actually design the internal climate of a building so as to most benefit the health of occupants without the use of moving parts and the associated maintenance problems.

Maintenance

Maintenance has become a dirty word for some, and much talk is made of "maintenance free" construction and products. However, in cheating the natural cycles of decay, these products have invariably introduced toxins and alien materials which are environmentally damaging and in

A cob building being built up in stages. A lime and stone foundation wall has layers of a mix of earth and straw laid over. The lower parts have been 'shaved' to form a (relatively) neat surface, while the most recently added top section is 'as trodden in'.



most cases, can only prolong the inevitable for a certain time. In the process, the culture of maintenance is abandoned and when something does go wrong, even when only a small part is broken, most "maintenance free" products are removed and landfilled.

In contrast, an environmental approach – and the approach of all low impact construction – is to accept an element of maintenance and to design this into the process of co-habitation with your building. Maintenance is regular, but simple, and in the process the building and its elements are able to be kept in good order far longer – and therefore far more cheaply in the long run – than

A completed straw bale wall with the first coat of lime plaster being applied. Note the use of chicken wire over the corners to form a firmer substrate for the plaster and help protect the corners.



their maintenance-free counterparts.

Part of a wider vision

For many who undertake low impact buildings, it is part of a much wider approach to life in general. However, this is not strictly necessary, as the advantages can be appreciated on their own merits. Unfortunately, it is usually only those already disposed toward this sort of thing, and who make the leap of faith which is often required, who are able to experience the advantages.

Common materials and systems of low impact construction

Earth

Earth is still the most widespread construction material known and one third of humanity still live in earthen buildings. The material even gave its name to the entire planet – or was it the other way around - but in any event comes with significant pedigree.

Vernacular forms of earth construction survive in many parts of the world and remain instructive on the most efficient way to produce earthen buildings even today. There are a number of techniques but broadly they can be divided into three. The first involves stacking and compressing earth to form a monolithic wall – examples are 'cob' and rammed earth (using shuttering). The second uses earth pre-formed and dried into blocks or 'adobes' and then built up. Both techniques employ earth as the principal load-bearing material. The principal advantage of the latter is that it avoids most of the problems associated with shrinkage, whilst the main disadvantage is that it entails double handling.

The third alternative is to mix earth with some filler material like straw and apply it to a framework which takes the structural loads. This was more common traditionally where timber supplies were plentiful.

The common disadvantage of all

earth constructions nowadays is that it is difficult to attain the thermal insulation values required by the Building Regulations.

Light earth and hemp-lime

One way around the above problem of insulation is to increase the level of insulating filler, and usually the depth of the mix so that the overall wall complies with modern requirements for thermal performance. This can be done in a number of ways, but the main techniques employed use earth / clay and straw, or in one example lime and hemp, to form a solid, non-loadbearing fairly well insulating mass wall.

Both techniques require drying out times and are still fairly labour intensive, though more mechanised, and pre-fabricated options exist.

Straw bale construction

Straw bale construction normally involves placing rectangular bales exactly as bricks are placed to form a wide, hairy wall which can be either load bearing or infill to a structural frame, and which is normally plastered on both sides with a clay or lime-based render. Straw bale construction has a number of advantages over earth and insulated earth construction types. It is a dry system and so has none of the (admittedly minor) problems associated with drying out and shrinkage. It is also a very good insulation material which, when combined with the sensible placement of thermal mass, makes a lot of sense overall in the UK.

Third, it is quite quick to construct, but possibly more involved than the other techniques to adequately finish. There is no doubt however that straw bale construction is relatively quick, cheap and easy to do, and increasingly easy to get through the legislative and financial hurdles which often bedevil low impact projects.

Other crops

A number of bio-based materials have found their way into the building material supply chain, though these are mostly imported into the UK.



This shows a gridshell roof construction which uses a very small amount of timber to form a substantial span. The gridshell is braced by the overlayers of timber boarding.

Among these are hemp, flax, and sheep's wool, all used for insulation while flax is also used in the manufacture of linoleum. sisal, coir and jute are used in carpet manufacture, and reeds are becoming a little more common not only for traditional thatching, but bound and used as backings to plasters and renders.

Timber

So widespread it is easily overlooked that timber forms the mainstay of much conventional, very high impact construction, but has the capacity also to be an integral part of very low impact construction if used wisely.

If sourced from local (at least, not imported) and certified forests, and if used efficiently and without chemical treatment, and if detailed well so as to be durable, timber represents a low



This shows the gridshell building from the previous page but from the outside, with stone walls using both lime and clay mortars, and clay external render under a large roof overhang.

impact material choice.

The Segal method uses timber very efficiently, roundpole construction reduces the machining of timber while retaining all of its strength, and gridshell construction enables very efficient use of small amounts of timber yet creates large span structures. Using 'green' timber avoids the energy associated with kiln drying and there are a number of ways in which timber can be

A building built largely of waste tyres and tin cans, submerged into a hillside and using clay internal plasters to attempt a zero energy input construction through the use of large amounts of thermal mass.



used, such as with 'Brettstapel' construction where good use is made of a material which has little other value.

Masonry

Traditional stone and brick construction, using lime and clay mortars probably counts as a low impact strategy, depending on how the insulation required is achieved. Reclaimed elements such as tiles and slates reduce the overall impact, and it is becoming possible in some parts of England to reproduce traditional footings with stone and lime in what may be termed low impact foundations.

People are becoming more familiar with the use of lime, and increasingly, clay, for mortars and plasters. Perhaps the main advantage of these materials for mortars, unlike cement, is that the bricks or blocks can more readily be re-used at the end of their lifetime, and that is the real tragedy of cement (which acts as a type of glue).

Re-used and recycled materials

A few constructional techniques have been developed to deal directly with some of the waste arisings from industry. One of the most enduring has been the common tyre. Rammed full of earth and tied together these have become symbols, especially in the US, of ecological design through the re-use of waste (Earthships). Drinks cans and bottles, short logs and many other unlikely materials have been similarly employed to create walls, which are often however sadly little more than a matrix of cement mortar.

However, the principal of using waste materials is a sound one, and be it tyres or recycled paper insulation there is no doubt the impact of development is reduced.

Conclusion

Many of the ideas and techniques employed in these constructions appear strange or even affected, but a great deal of genuine innovation in sustainability abounds, and it is not unreasonable to imagine the lessons being learnt now in remote fields and forests becoming familiar to the mainstream construction industry. ❖

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All photos were taken by the author.

