Building materials

Concrete

Concrete is an excellent material for creating thermal mass in a passive solar designed home. In temperate and cool climates thermal mass helps regulate a home's temperature and keep it warm in winter and cool in summer. An exposed concrete slab floor, positioned in front of windows in a north-facing living room, receives direct sun in winter. It absorbs the solar radiation and warms the house into the night. With appropriate shading, the sun won't hit the concrete over summer, so the chill of the concrete will help the home stay cool.

Other benefits of concrete are that it can have a long life time if designed and used properly, can be used as a non-chemical termite barrier, can be easily formed into complex and adaptable shapes and designs, is fully recyclable and fire resistant.

On the downside it is a poor insulator and conventional concrete has a high environmental footprint due to the amount of energy needed to create it. However there are some concrete products on the market which are reducing the carbon footprint of concrete. Some concretes contain fly ash and slag (by-products of burning coal and smelting iron ore, respectively) which comfortably replace over one-fifth of the cement content – more with chemical admixtures – without adversely affecting the quality of the product.

More info

Sanctuary magazine - www.sanctuarymagazine.org.au

Your Home - www.yourhome.gov.au/technical/pubs/fs512.pdf

SUPPLIERS

AAA Sexy Floors - www.aaasexyfloors.com.au - Ph: 1300 789 821

Boral - www.boral.com.au/productcatalogue/product.aspx?product=2031

Independent Cement - www.independentcement.com.au - Ph. (03) 9676 0000

Sadler Stone - www.sadlerstone.com - Ph. 1800 262 011

Zeostone - www.zeostone.com.au - Ph: (03) 9555 6066

ICF blocks

These are a relatively new building system that started in Australia with thermacell blocks. Generally, these systems consist of a range of wall blocks and corner blocks that are assembled onto a solid foundation, such as concrete slab or footings, to make a complete wall.

The blocks are made from expanded polystyrene foam and are hollow inside, a lot like a styrofoam besser block.

Internal plastic ties provide support across the block, as well as for holding metal rebar in place.

Building with ICFs is much like building with giant toy blocks. You assemble the blocks, fit any plumbing and electrical conduit required, and then the entire wall is filled with concrete. The end result is a very strong wall ready for cladding or rendering.

The advantages of ICFs include short building times and an all-in-one construction system. They also provide good levels of both thermal and acoustic insulation as well as a central core of thermal mass. ICFs are a non-combustible product so are suitable for bushfire prone areas.

The main disadvantage comes at end of life when the building is deconstructed. The foam, being contaminated with render and concrete, is generally not recyclable and will end up in landfill.

ICFs are similar in cost to regular building systems and can even work out cheaper in some cases. It should be remembered that, if renovating, installation of new doors or windows in the walls will require concrete cutting equipment.

More info

Your Home - www.yourhome.gov.au/technical/pubs/fs511.pdf

SUPPLIERS

Eco-block - www.eco-blockaustralia.com.au - Ph. 1800 669 696

Hebel - www.hebelaustralia.com.au - Ph. 1300 369 448

Thermacell - www.thermacell.com.au - Ph. (03) 5977 7996

Zego - www.zego.com.au - Ph. 1300 13 9346

Timber

Timber is probably the most commonly used building material there is. It is strong, flexible, readily available and providing it is sourced properly, is a renewable resource. It is an easy material to work with and requires relatively basic skills, making it ideal for owner-builders. Wood has a high strength for its weight and can be used to support high vertical loads, such as in main roof support pillars. With correct engineering it can support high loads in horizontal spans, such as when used for roofing trusses. Timber is commonly used for framing, trusses, internal and external cladding (weatherboards).

Timbers come in both softwoods (radiata pine is an example) and hardwoods (redgum, for example), although the names can be a bit misleading, as some softwoods are harder than many hardwoods

and vice versa.

Most timbers have little thermal mass. Softer, lighter timbers have no usable thermal mass, but are reasonable insulators. High density woods have moderate thermal mass but short thermal lag times. Timber homes should be well insulated, and additional thermal mass added if so required, such as the use of concrete floors. Where floors are wood only, they should be insulated underneath.

When buying timber, you need to be careful of where it is sourced. Ideally, you should buy reclaimed/recycled timber if possible. There are a number of suppliers who have a range of high grade timbers which have been reclaimed from demolished buildings and structures.

If you need to buy new timber, look for plantation timbers, although not all woods are available plantation grown. If you have to buy forest-sourced timber look for sustainably certified timbers, such as Forestry Stewardship Council (FSC) certified. This way you are most likely buying a product from well-managed forests.

Wood is often considered a CO2 neutral or even CO2 positive material, as the growth of trees removes CO2 from the atmosphere and locks it up in wood. However, wood, like all natural materials, eventually rots, even if it takes a few hundred years, so the carbon is eventually released, although some of it ends up locked up in soil, so trees can be considered CO2 removers to some degree.

Some timbers are better suited to outdoor and building use than others. Most pines are not ideal for outdoor use as they are subject to rot and insect attack. Cypress pine has a natural resistance to attack and can be used unfinished in fences and similar applications. However, timber should be protected from the natural environment by paint, natural oils or varnishes.

There are many wood-based materials available, such as engineered wooden beams, laminated boards (plywood) and fibreboards such as MDF (medium density fibreboard). These are usually available in low or zero VOC (volatile organic compound) versions which are less toxic than the regular varieties.

As you would expect most wood is a highly combustible building material so may not be suitable for high risk bushfire areas. For example a wide range of Australian hardwood timbers may be used in low to medium bushfire risk areas, becoming more restrictive in species with higher Bushfire Attack Level (BAL) zones. Only a selected number of timber species (listed in AS 3959-2009) will meet higher bushfire requirements and these are are: Blackbutt, Spotted Gum, Silvertop Ash, Kwila (Merbau), Red Ironbark, River Red Gum; Turpentine.

Before building check with your designer, builder or local council building surveyor to see what bushfire protection building standards and BAL applies to your home.

More info

Building Commission - www.buildingcommission.com.au/www/html/2420-before-a-bushfire-building-and-renovating.asp

Ecospecifier - www.ecospecifier.org/

Good Environmental Choice - www.geca.org.au/

Forestry Stewardship Council - www.fscaustralia.org/

resourceSmart - www.resourcesmart.vic.gov.au/documents/SRI_material_selection.pdf

Your Home - www.yourhome.gov.au/technical/pubs/fs59.pdf

Listed suppliers are a guide and are not endorsed by Green Cross Australia or the Alternative Technology Association.

SUPPLIERS

Australian Recycled Timber - www.australianrecycledtimber.com - Ph. (03) 9359 0300

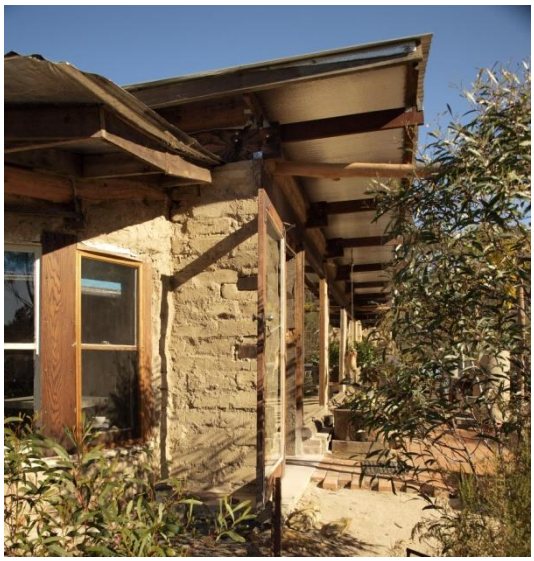
Radial Timbers - www.radialtimbers.com.au - Ph. (03) 97682100

Shiver Me Timbers - www.shivermetimbers.com.au/ - Ph. (03) 9317 7122

Timberzoo - www.timberzoo.com.au - Ph. (03) 5248 1223

Urban Salvage - www.urbansalvage.com.au Ph. (03) 9391 0466

Mudbrick



Mudbricks are pretty much what they sound like – bricks made of mud. Often, they are made on site from local soil, providing there is enough clay content. The soil is mixed with water and reinforcing materials such as straw and even cement and then pressed into wooden forms and allowed to set. The forms are removed and the bricks set aside to dry for up to several weeks. As they are made from natural materials they are a sustainable, recyclable, non-toxic and healthy form of building construction.

When building, mudbricks require suitable footings such as a course of regular fired bricks or concrete footings or slab. They are held together with a mud mortar mixture which is similar in composition to the mudbrick mixture itself. Mudbricks, being soft and unfired, are easy to cut with hand tools, and can be formed into interesting shapes.

Once laying of the bricks is finished and the mortar is dry, the brick walls are often rendered with cement or mud-based renders, although many mudbrick walls are left au-naturale or are sealed with a transparent water-based sealant to improve weather resistance.

Mudbricks have many advantages, including low cost and low embodied energy (especially if they are made on site and not transported long distances) and ease of use. They also have high thermal mass (the ability to store and release heat), if the bricks are a minimum of 300mm thick.

Earth buildings have excellent fire ratings which makes them suitable for building in bushfire prone areas and for the construction of fire rated walls within buildings. When designing new buildings consider using low pitched or curved roofs and parapet walls to reduce the impact of radiant heat and possibility of embers entering the roof area.

The drawbacks of mudbricks are, they are easily damaged, especially by rain and wind if not protected, and have high weight, making working with them a strenuous exercise if using larger bricks, which is quite common. They also are not good thermal insulators however insulation can be added to mudbrick walls with linings. However they are excellent sound insulators.

Mudbricks are ideal for fit owner-builders and can reduce the building cost of a home by a large margin if there are no labour costs. However commercially produced mud brick construction can cost the same , or even cost more than brick veneer. There are several companies that specialise in the supply and manufacture of mudbricks if your building site doesn't have suitable soils.

More info

Amcer submission to Victorian Bushfire Royal Commission - http://www.amcer.com.au/articles/vbrc-submission.pdf

Earth Building Association of Australia - www.ebaa.asn.au

Your Home - www.yourhome.gov.au/technical/pubs/fs56.pdf

SUPPLIERS

Amcer - www.amcer.com.au - Ph. (03) 9714 8688

Mudbrick Circus - www.mudbrickcircus.com.au -Ph. (03) 5422 1808

Strawbale

Strawbale building like mudbrick is a good sustainable choice as it is made from natural materials they are a sustainable, recyclable, non-toxic and healthy form of building construction. Rectangular strawbales are stacked up to form walls, fixed in place with metal or wooden pins, and then trimmed and shaped (often using a chainsaw!) before being rendered with mud or cement based renders.

Building with strawbales has many advantages, including ease of use, especially for the owner-builder. However they can be labour-intensive especially the rendering of the strawbale walls.

There are two main construction techniques when using strawbales – post and beam and load bearing.

With post and beam, the basic structure of the home is assembled using wood or metal posts, beams and rails, and the roof is fitted. The space between the posts is then infilled with strawbales, window and door frames are fitted and the bales given their final shape. The bales are then rendered.

With load-bearing construction, the strawbales form the structural component of the home. The bales are put in place and then tensioned down using long-threaded rods that pass right through the bales into the foundations. Spreader boards are used along the top of each wall to compress the bales evenly. The roof trusses are mounted directly to the top of the strawbale walls, which bear the entire roof weight, hence the name. Once again, render is applied to seal the bales against water and animal attack.

Strawbales are lightweight for their size and can be readily cut to unusual shapes. They produce walls with very high levels of insulation and provided they are rendered properly, are highly fire and vermin resistant. The end result is a very 'organic' effect, often sought after by owner-builders.

The main disadvantages of strawbale construction is the sheer thickness of the walls, which can often approach 600mm, can be labour intensive and have low thermal mass (though rendering up to 75mm thick on either side can help increase thermal mass) While the cost of strawbale is low they can be quite labour intensive. This has led to many strawbale houses being made by workshop or volunteer groups who receive training on the spot.

Recent CSIRO bushfire tests to Australian Standard *Construction of buildings in bushfire-prone areas* (AS3959) have shown that a rendered strawbale wall can withstand most bushfires. This is because the straw bales are compacted firmly and thus don't hold enough air to permit combustion.

Since render applied to the uneven bale surfaces tends to be thicker than normally found on buildings, the bales can be said to carry an extra layer of protection. Nevertheless it is important to apply a coat of render as soon as the walls are in place, as un-rendered bales and loose straw will burn. Fire tests in Canada & USA suggest that bale walls provide a two hour fire rating, which is higher than timber-framed buildings.

More info

Australasian Strawbale Association - www.ausbale.org

Your Home - www.yourhome.gov.au/technical/pubs/fs58.pdf

SUPPLIERS

Durra - www.ortech.com.au/ - Ph. 1800 805 919

Professional Strawbale - www.strawbale.com.au - Ph. (03) 5448 7229

Sustainabylt - www.sustainabylt.com.au

Timbercrete

Timbercrete is an interesting material, being a combination of timber waste (sawdust) from various sources and concrete. This results in a material that is lighter than solid concrete, but of greater strength and with better insulating capabilities. Some Timbercrete products can produce walls with R ratings of 3.7, which is higher than most other materials except strawbale.

Timbercrete is not a specific type of material, but rather a brand name of timber/concrete composite, and is available in bricks, blocks, pavers and panels.

Because of the fibre content, the material can be screwed or nailed into directly, without the need for special fixings as is required in materials like AAC. The fibre gives it considerable strength, and it won't shatter when impacted like many other materials do.

SUPPLIERS

Timbercrete - www.timbercrete.com.au - Ph. (03) 5859 4294

Rapidwall

Rapidwall is a load-bearing wall construction system that uses large prefabricated panels to assemble both inner and outer walls in one go. The panels are made of fibreglass reinforced water resistant gypsum plaster which is moulded to the required size. Panels are available up to 12 metres long and 3 metres high, so entire walls can be prefabricated and then installed onsite using a crane.

The panels are 124 millimetres thick and have a cellular internal structure to accommodate plumbing and wiring, or the cavities can be filled with insulation or concrete.

Rapidwall is claimed to have considerably lower embodied energy than conventional building materials, although materials such as strawbale and mudbrick will be lower. Rapidwall has a high thermal insulation and when the hollows are filled with insulation even greater thermal properties are achieved.

Rapidwall has a 1 hour fire rating when unfilled or a 4 hour fire rating when filled with concrete.

More info

Rapidwall - www.rapidwall.com.au

Rammed earth

Not to be confused with mud brick, rammed earth is a precisely controlled mixture of gravel, clay, sand, cement, and sometimes lime or waterproofing additives. The contents are carefully proportioned and mixed, and then machine-compacted in removable formwork to yield a stone-like wall that is massive, water resistant, load bearing and long lasting.

One of the attractions of rammed earth is its low embodied energy. Most of the energy used in rammed earth is in quarrying and transportation. The ultimate is if your materials can be quarried on site.

Though you can always tell a rammed earth wall, no two are ever the same. The appearance of rammed earth is a function of its materials and of the ramming process. Most walls are horizontally stratified, a result of ramming the materials layer by layer. Colour and texture can be controlled during the ramming process, and features such as niches, embedded stones and leaves can be added.

Being a niche product, rammed earth sells at a premium over conventional building materials. For a vertical square metre of rammed earth with 30cm thickness, the usual cost is $250 to $300. The more complicated the job, the more it will cost. But the highly customised qualities of rammed earth are what attract people to it.

Rammed earth has a number of practical advantages. Tests by CSIRO have given it a four-hour fire resistance rating, which is very favourable. Rammed earth is also highly durable and moisture resistant. While you need to prevent continued exposure to water at the top and bottom of walls – just as with clay brick – most Australian rammed earth walls do not require additional waterproofing. The non-toxic nature of rammed earth is one of its main attractions.

Rammed earth is particularly renowned for its thermal mass, which is its ability to store heat then release it hours later. When there's a big difference between outside and inside temperatures, and daytime and night time temperatures, thermal mass can give you heat when you want it and store it when you don't. However to get the best out of rammed earth you have to know how to build with it. Poorly installed, it will radiate heat all night during summer and absorb the heat you produce at night in winter.

Unfortunately materials with high thermal mass are not good insulators – they don't stop heat, they just slow its flow. And that is the main drawback of rammed earth. Even though it has low embodied energy and excellent thermal mass, its R value – the measure of its insulating qualities, crucial for a home's energy rating – is low. However the problem is not the material, it's how you use it. With appropriate passive solar design (and in some cases the addition of insulation within the thickness of the wall) rammed earth can achieve comfort conditions in every one of Australia's climate zones.

So don't let a narrow focus on R values put you off. Coupled with appropriate design, rammed earth can be a powerful material for increasing the comfort and liveability of your home. Not to mention its beauty and uniqueness.

More info

Your Home - http://www.yourhome.gov.au/technical/pubs/fs57.pdf

SUPPLIERS

Earth Structures - www.earthstructures.com.au - Ph. (03) 5778 7797

Murchison Rammed Earth - www.murchisonrammedearth.com.au

Rammed Earth Constructions - www.rammedearthconstructions.com.au

Rammed Earth Victoria - www.rammedearthvictoria.com

Ramtec - www.ramtec.com.au

Unique Earth - www.uniqueearth.com.au