Strawbale Essentials

There are many methods used around the world to construct strawbale buildings. These can vary from using strawbales as infill in post and beam structures to complete Load bearing structures, and a combination of both.

In essence, all consist of using straw bales, stacking them compressing them down to the structures and rendering. Obviously this is a simplified explanation as to achieve a quality structure attention needs to be paid to a range of details.

There are many methods out there that professionals have developed in their practices over the years, in which they are willing to share via regular workshops held around Australasia, primarily in Australia and New Zealand. Check out the events tab or professionals tab to find out more.

Following is an introduction to the basics regarding the practice of strawbale building.

Bales aren't Bales

To make your build go smoothly it is important to have good "construction" bales. Let's get this out of the way early, they ARE NOT hay, this is what horses eat. The straw is the stalk remaining after the grain has been harvested from a grain crop. If not used in strawbale building, this would typically otherwise be a waste product. It is not advisable to just buy bales from your fodder store as they will not be tightly compressed. There are suppliers who will provide construction bales (check out the professionals tab), these are more tightly compressed bales approximately 20kg and 950x450x350mm in dimension. Some of the more popular crops used are barley, triticale, lucerne, and even rice.

Straw has been found in excellent condition in Egyptian tombs, dated thousands of years old. It has been used as an insulating material for many centuries. This shows that kept in the right environment straw can last indefinitely, just like timber.

Without adequate protection strawbales can rot, also just like timber. Also fungi and mites can live in wet straw, so it's essential to buy bales that have had no exposure to moisture. Bales must be kept dry prior to and throughout construction, and of course during the life of the building.

To maintain an ideal environment after construction the appropriate render and paint should be selected. These should be "breathable" (i.e. permeable to water vapour) so that moisture doesn't get trapped inside the wall. The design of the building should be appropriate for the local climate, and prevent water concentrating anywhere on or within the strawbale walls.

Durability

As with all buildings, durability is obtained through understanding of the building material, evidence based construction methods, and attention to detailing. The oldest existing strawbale building is in Nebraska, USA. It was built 1903.

Keeping out moisture is the most important factor. Properly constructed walls that have been opened up many years down the track have demonstrated that the straw has not deteriorated at all.

What about the pesticides used in farming

Some concerns have been raised about hay fever, toxins and pesticide residues. When the bales are rendered the irritants (if any) are unlikely to transfer into the building. For the extremely sensitive, there are organic farmers of cereals who bale organic straw.

Insulative Qualities

There has not been definitive insulation testing for strawbale walls as yet in Australia or New Zealand. The Ausbale committee is currently developing a plan to carry out such testing. With the range of different straw bale building techniques used (e.g. bales on flat or on edge, type of straw used, render thickness and composition), Ausbale will ensure that the testing will cover as many different scenarios as possible.

There has been insulation testing for strawbale walls performed around the world that approximately equates to an R8 to R10 rating. At present, computer models used by energy assessors in Australia and New Zealand are limited to an R4.5 rating, which doesn't truly reflect the potential star rating strawbale buildings could obtain, hence Ausbale's intent to carry out testing.

Passive Thermal Design

Strawbale walls are typically built with an earth or lime render on both sides. The high insulation value inherent in strawbale walls, combined with the thermal mass in the internal render, combine to make an ideal wall system for a passive thermal design in many climates.

Temperature and energy consumption observations that have included strawbale buildings have rated extremely high, outdoing most other building methods. Above all else just ask anyone that lives in a strawbale house, they will tell you that they remain a consistent comfortable temperate all year round with little or no need for heating or cooling. "The proof is in the pudding."

Fire

Many parts of Australia are bushfire prone, with bush fire events threatening people or property most summers. This is also the case in other parts of Australasia. As a result, regulations around building in bushfire prone areas have tightened in recent years.

In 2002 Ausbale commissioned fire testing based on the previous standards, which meets the current (Bushfire Attack Level) BAL-29 rating. The testing was successful, and strawbale walls are allowed to be built in areas with a BAL rating up to BAL-29. The current standard, AS 3959-2009 "Construction of Building in Bushfire Prone Areas (2009)", has two higher BAL ratings than what was covered previously, BAL-40 and BAL-FZ (Flame Zone). Ausbale is working towards having strawbale walls

tested and recognised as a suitable wall system for construction in areas with a BAL-FZ rating, which is the highest BAL rating.

We are confident the wall system will pass, based on our previous experience and testing conducted elsewhere in the world. Compressed straw is like trying to burn a telephone book - it doesn't really burn due to lack of oxygen. Add to this the bales are protected by a minimum of 35mm of render. There have also been a number of buildings in large bush fires, such as the SA Pinery fires in 2015 and the Victorian Black Saturday bush fires that have stood up extremely well.

Vermin

Many people's first reaction when they hear about strawbale is what about the mice or vermin. Straw is made of cellulose which is not an attractive food source for pests. With attention to detail in the building process a strawbale wall can be more secure than conventional houses. There is usually a minimum on 35mm of render over the walls which ensures nothing can get in. The key is to secure the tops of the wall, this can be done by rendering the tops of the walls. This can be tricky so some people use other materials such as ply or cement sheet prepared before baling to seal the tops of walls.

Termites are another question people have, however this concern is abated by conventional building requirements of termite protection that is required in all buildings. When you talk to a pest controller they are not aware of any species that would attack strawbales.

Wall finishings

The surfaces of straw bales offer an excellent mechanical bond to various types of render. Lime, earth and combinations of these are common finishes on both the inside and outside of the walls. In times past, cement based renders were common. It has been found that this could cause moisture to be trapped inside the bale wall, as too much cement in the render inhibits the movement of moisture. Today, it is common practise to not use cement, or only a small proportion, in the render mix.

The type of render to use depends on many factors including climate, micro-climate, the design of the building, material and skills availability and cost.

Render can be applied by hand, and this is where owner builders and their friends can really contribute and save. Alternatively, a pump can be hired and the process will take much less time, although cost more.

Bale walls carrying loads

Both load-bearing and non-load-bearing strawbale houses have been built in Australia, NZ and around the world. Currently most builders use the conventional timber post-and-beam system that carries vertical loads and use the bales as in-fills (this is a non-load-bearing system). Lateral loads, such as wind loads and earthquake loads are carried by means such as diagonal steel straps. Also the rendered straw bale walls act as an additional structural system which makes them more resilient and flexible than the conventional brick/veneer homes. As the saying goes "nature will break what doesn't bend".

Load-bearing walls are constructed with pre-compressed straw bales carrying the load of the roof.

These homes have special requirements in regards to maximum height, size and locations of openings, etc. Your strawbale builder or designer can advise you of these.

Attaching things to the walls

There are many approaches to this. Tapered stakes can be driven into the walls and items can be secured to these. This will hold electrical boxes and typical shelving.

For extra-heavy loads, bolts can be run through the wall to oversized washers on the opposite side. When, for example, securing window and door jambs in openings, wooden dowels can be driven through pre-drilled holes in the wood and perpendicular to the "grain" of the straws.

Ply or timber frames can even be cut in and attached to the straw and rendered over.

Incorporating plumbing and electrical?

There are many approaches to this. Many builders use the precaution of installing pipes which could sweat or leak inside continuous sleeves within bale walls. Electrical boxes can be screwed to tapered stakes driven flush with the back of recesses cut into the straw, or use surface-mounted boxes. Conduits can be chased into the walls, or skirting ducts are a good option.

Workshops and Information sessions

Nothing prepares you for building your own home like hands on experience backed with theory which is based on research and current practice. There are several professional groups throughout Australia that are providing this experience for owner builders, professionals, and those who are just looking to be part of an old fashion barn raising. Dates for upcoming events can be found on the AUSBALE calendar.

A workshop will give you a sense about the construction process and whether you should take on your own home. It provides a realistic idea of time to construct and render, and the opportunity to ask the questions that you have not thought of yet.

The options then are: to build yourself or employ someone to build it for you. You could employ a builder to do areas such as earthworks, slabs & footings, plumbing, frames, roofing etc; with the walls maybe sub-contracted by owner, or other experienced people who know how to raise straw bale walls. In terms of ease of construction and practicability, building with straw is very forgiving. Those who have attended workshops testify that the process of raising walls is great fun. Preparation for wall finishing and rendering/plastering is the longest part of a wall raising exercise.

Be wary of the friendly souls that have built one and become an instant expert.

Are there any people who do this form of building and/or design?

You will need council approval to build your strawbale home (or any other home). No councils are difficult – some just need more information so they understand this new building material. As there in not an Australian Standards for strawbale building, each building is assessed on its merits. This is called an “alternative solution" where you have to convince the Council that your proposal meets the requirements of the Building Code.

A Building Designer or Architect and a structural engineer with knowledge in current practices in strawbale building should be able to provide this information required by your council. One of the goals of AUSBALE is to have the strawbale building technology incorporated into the Building Codes.

What it takes to get residential buildings designed, approved and built

The process roughly follows these steps; this may vary depending on your particular situation and the local regulations:

1. site meeting with architect / designer to view over property
2. determine general location of building and any other conditions
3. formulation of design brief
4. conceptual design
5. a contour & detail survey may be necessary for sloping or complex sites
6. development of design
7. planning approval from the Council (if required), and any additional requirements
7. liaison with structural engineer - who can arrange a soil test if required
8. construction drawings developed
9. applications to council with engineer's certificate and energy assessment.
10. tenders
11. construction
12. post-construction / warranty period, etc.

Affordability

A strawbale house may cost the same if not more than the conventional house. Owner built, simple structures can cost very little, and there have been homes built for well above $1million. There are many variables that go into building a house such as:

* the size and complexity of the building
* the complexity of the site
* the cost of materials, including bales - these vary depending on where you are, but generally about $9 per bale (delivered)
* the type of render (cement is more expensive than earth)
* the cost of labour; the amount of labour donated by the owner and friends
* choice of finishes such as roofing, flooring, and other selections
* your 'waste' treatment/composting system or sewer connection

There are many factors that can make a strawbale house less expensive and there are additional benefits to building with straw. Strawbale homes coupled with passive solar design can be designed in such a way that they do not require artificial heating or cooling. This could translate to a savings of several hundred dollars a year over the life of a home.

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Further Information

There are a range of texts and websites available with further information. See the Resources page for further information.