STRAW BALE CONSTRUCTION

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CHAPTER 1 SCOPE, NATURE, AND APPLICATIONS

Straw or dried grass has been used as a building material since ancient times (over 10,000 years ago). We know of straw bales being used for construction in Germany in the17th century. During the late 1800's when machines were introduced that could harvest straw and create straw bales, the use of bales in buildings became even easier. Throughout the 19th century in the Great Plains region of the United States straw bales were plentiful, but timber for construction was scarce. Therefore, it didn't take long before straw bales were being used for building construction. The concept of straw bale construction has seen something of a revival since the 1990s due to its sustainability attributes and acceptance into many building codes.

Straw

THE BASICS

Straw buildings are made by stacking bales to form walls, then coating the outside of the bales with cement, mud, or some other type of plaster-like material.

The process can go wrong though, if you do not understand what you are doing. Common problems to be avoided include:

- The coating does not stick to the straw. If it falls off leaving gaps it compromises durability and strength, not to mention aesthetics.
- Moisture getting into the straw can cause it to rot or become exposed to insects and vermin.
- Moist, unsealed straw can become mouldy, and mould can pose a health problem apart from other issues.
- Surface cracking can break the seal between straw and either the outside or inside of a building.
- The surface is not properly sealed, or the seal is broken.
- Gravity, or pressure from a roof above can cause the wall to partially, or fully, collapse.

There are methods of overcoming all such problems though. One way of helping the coating to adhere to the wall is to tie a cover of wire mesh (or other material) over the surface, and then add plaster layers over that wire mesh. Walls may also be strengthened by pinning bales together with stakes or pins made of metal, bamboo, or wood. It is also normal to create a waterproof barrier at the bottom of a wall, to prevent moisture from wet ground being soaked up into the straw.

Staw bale building in progress

WHY STRAW BALE?

Sustainability

Straw bales are biodegradable and more environmentally friendly than other building materials. Grasses can be grown in one season, then harvested, baled, and used for building. Timber takes many seasons to grow, if not decades, before it can be harvested. When grass is cut and baled, there is relatively little impact on the microclimate, but when timber is harvested it has much more impact, turning what were shaded, wind protected places into exposed sites. Other building materials such as brick, stone and metal are derived from extraction industries, which again have a greater environmental impact.

Straw Bales

Straw bales can be produced from waste that may be grown sustainably within a short time frame of about six months. The tough, tubular stalks of grasses such as sugar cane, wheat and rice are by-products from farms that are largely unsuitable for stock feed but may be ideal for straw bale building. Cereal and cane farmers have dealt with this waste in a variety of ways (e.g., burning, processing into garden mulch). Straw bale building can be the most environmentally friendly and perhaps economically viable way of using such waste.

Using straw can reduce pressure to use more environmentally damaging materials. In the event of a straw building being no longer required, much of the building may be compostable.

Ease of Use

Straw bales are relatively easy to build with. They can easily be modified and used in multiple ways. They are solid, durable and can be easy to maintain. Much of the work can be done with unskilled labour, making them often suitable for owner-builder projects.

Durability

If built properly, and under the right conditions, a straw bale building can last hundreds of years. Durability largely depends on the straw remaining dry. If moisture in a bale reaches 20% the straw can decompose in a matter of weeks. Some types of straw resist decomposition more than others though. Rice straw, for example, has a higher silica concentration than wheat straw and is more resistant to rot. Rice straw bales are significantly heavier and denser

than some others, but provided the bales are kept dry most people's choice will probably depend on what is available, and most types of grass will do the job.

Cost

Straw bale building can be more labour intensive than some other modern building methods, but the cost of materials may be less. Also, working with strawbales does not require expensive, specialised tools and equipment. The need to employ costly, highly skilled tradesmen such as carpenters, bricklayers or stone masons may be reduced or eliminated.

Non-Toxic

Straw bales do not emit toxic fumes that may be a problem with other types of modern materials (e.g., laminates and particle boards which contain glues). Straw bale walls can be finished with natural plasters and paints are breathable, allowing air to slowly permeate throughout the structure without moisture penetration, resulting in fresh, clean indoor air. Provided the straw is kept sealed and dry, dust and fungal spores are avoided, making a straw bale construction much more friendly to human health.

Insulation

Straw bale walls deliver high insulation value. They create a more stable indoor environment with respect to temperature. They are easier to keep cool in summer and warm in winter. Insulation is rated by an R-value, which indicates the resistance to heat flow. A rendered straw bale wall has nearly seven times the R-value of a brick veneer wall. This excellent insulation value makes passive cooling systems such as cool pool or downdraft cooling towers more practical and efficient for homeowners in very hot and arid regions.

Straw bales also provide excellent sound insulation. The inside of a straw bale building is much quieter than a conventional building.

After stacking straw and wrapping in wire mesh the first layer of plastering begins (eg. with mud or cement)

Fire and Pest Resistance

Bales of straw are densely packed and skinned with render that seals the organic material from fire and pests. Without oxygen, fire cannot burn, and the thick walls create a practically airless internal atmosphere. This only works if you seal the top and bottom of walls. Walls should be capped by applying additional render over the top of the bales and roof plates to prevent an unintentional flue effect that might bring in air to feed a fire and support combustion.

Straw bale structures should be covered in a plaster or render which is solid enough to keep animals out. Regular inspections and prompt action to reseal any damage is important to maintaining the integrity of walls. If pests do manage to get inside, tightly packed dry straw will make it difficult for them to move around, until repairs are done. Baiting vermin before sealing might be needed to avoid having a decomposing animal inside a wall.

Aesthetics

The thickness and subtle curves of walls constructed with straw bales are aesthetically pleasing, giving the building a unique character and beauty. Straw bale walls resemble old thick stone and adobe walls typical of European country cottages or Mediterranean villas. Imperfections like bumps in a wall surface are acceptable, unlike modern plasterboard walls. Additives (e.g., pigments, masonry additives) can be used to create desired colour in the wall.

The mass dimension of straw bales can induce physical and psychological feelings of wellbeing.

Cement render over straw bale construction