



Earth homes: Sustainable, Economical, Safe and Beautiful

by Mary Malyon



When I leave New Zealand, it's the light I miss: those saturated spring days in blue and green technicolour. It makes sense that as a nation we like our homes airy, spacious and full of magical light. The Goodeys' new home in Hamilton is all these things. Set in the lush Waikato landscape of sheep, grass and pine trees under that turquoise sky which keeps us smiling: toddlers free-range around the property and mum's baking in the open-plan kitchen.

Inside, sunlight beams through ceiling-high French windows reflecting on the rammed earth walls. "Different qualities of light through the day and seasons produce subtle effects on the warm, earthy coloured walls," explains Paul Geraets, founder of sustainable building company Terra Firma.

Because this Hamilton family-home is no run-of-the-mill new build, but one of New Zealand's growing number of rammed earth homes whose walls are made almost entirely from pressed, or rammed, soil with a small amount of cement mixed in. In an ideal world, the soil comes from the very ground beneath the building's feet, in practice this isn't always possible as it isn't always appropriate but it is dug from as near a source as possible.

Anyone of an eco-friendly bent will have pricked her ears by now, and it gets better. Not only are rammed earth homes primarily constructed from soil, you don't get much more sustainable and natural than that, but the thick walls also provide fantastic insulation.

I consulted an architect friend of mine, Matt Oliver, and he agreed: "The high thermal mass of a rammed earth building retains heat during the winter and keeps buildings cool during the summer. The material's sculptural possibilities are endless," he continues. "And the energy that can be saved by not transporting materials around the world is incalculable."

The list of sustainable features goes on: earth houses are designed with passive and active solar systems in mind - solar panels on the roof and large north facing windows to capture the sun's heat and concrete floors to store and conduct this energy. Of course the other huge advantage of all this energy efficiency is low running costs, a boon to any family.

Geraets is also conscious about Terra Firma homes being as toxic-free as possible. Toxins in the home are a concern for many parents - especially those of young children whose small bodies are far more sensitive to toxins than adults and who like crawl around the floor licking everything in sight! With this in mind, the finish on earth home walls and any wood is an all-natural oil product and insulation in the ceiling and any timber walls is recycled NZ wool, both renewable and non-toxic.

And the list goes on: with little timber framing earth homes come with a four-hour fire rating (the highest needed in most general building codes), in fact rammed earth walls do not

burn or emit smoke or toxic chemicals as many other building products do.

There are well-documented cases of old earth buildings having their roofs and fitments destroyed by fire, whilst the earth walls are left undamaged. Because they are simply too difficult to demolish, earth homes are often used again as the basic skeleton for any new building: recycling on a grand scale!

Paul Geraets is hugely knowledgeable when it comes to the history of earth homes. "In Washington, DC, a formidable two-story rammed earth building, with walls 2 feet (610 mm) thick, was constructed in 1773," he tells me. "It stood at 1300 Rhode Island Avenue for two centuries, serving for a period as an embassy, and was demolished only when the land became more valuable for other real estate. It is said that the wrecking ball used in this effort was ineffective, the thick earth walls absorbed the shock."

It goes without saying that this stability is a good thing in earthquake prone New Zealand: rammed earth homes are engineered to withstand or reduce the damaging effects of earthquakes; Canterbury planners take note.

In Mendoza, Argentina, historical rammed earth homes with walls of 60 to 100 cm thick had enough resistance to withstand all earthquakes of the last centuries, whereas all modern buildings built of adobe or bricks collapsed.

Research in New Zealand also indicates that monolithic earth walls perform better under earthquake conditions than walls made of separate bricks or blocks.

These buildings are incredibly low maintenance, a good thing for anyone who's lived in your typical Kiwi Settler's Villa, charming they may be but a combination of leaky roofs, non-existent insulation and shoddy plumbing all make for an eye-watering maintenance bill.

In contrast, according to Terra Firma's literature, "The Church of the Holy Cross in Sumter, South Carolina, was constructed in 1850 of rammed earth and is still in use today. This impressive public structure, with its steeple and steeply pitched gable roof, has required relatively little maintenance over its 148 years."

They sound like a good thing these Earth Homes, but what exactly are they made of? And what does rammed earth mean? Well, simple as it may sound 'Rammed Earth' consists of compacting soil and a small percentage of cement into a mould. Geraets expands, "walls are constructed by ramming a mixture of selected aggregates, including sand, silt and clay, into a structural arrangement called the form."

It is an incredibly simple concept, a theme that continues into the houses' calming, nurturing interiors. The rammed

earth walls and their solid formed mass with its distinctive patterns, textures and natural tones offer strong, contrasting impressions of mass and lightness that create a structural simplicity. Don't be fooled though, this isn't some new-fangled design concept. In fact, it has a long and illustrious history.

Archaeological evidence can date entire cities constructed from earth back over 10,000 years. Putting that in context: Stonehenge is only around half that age at 4,500 years old. All of the great civilisations of the Middle East were constructed with mud brick and rammed earth – Assyria, Babylon, Persia and Sumeria.

The same construction technique was also used for countless monuments, temples, ziggurats, churches, and mosques. Many of these structures, the Great Wall of China being one, have stood the test of time and are still standing today.

The technique of ramming earth into forms to create structures was first used in arid climates that had little wood and other resources available for construction. It was the Romans that brought the technique to Europe around the first century AD. From then until the dawn of The Industrial Revolution, earthen construction saw increased use.

The Industrial Revolution though, along with the development of production techniques for timber and wood saw the decline of earth construction, accompanied with the creation of mass-produced manufactured materials, which could be assembled quickly saving money.

It wasn't until the mid-twentieth century that public awareness on environmental issues emerged and constructing

environmentally responsible houses became popular again. This has brought rammed earth construction for modern houses back into the spot light.

The basic principle of construction – ramming moist earth into movable formwork was pretty much unchanged until 18th century. A French builder, Francois Cointeraux, discovered Pisé construction being used in the region of Lyon and was

drawn to its simplicity and uniqueness. He began a series of experiments on the structures, being the first to document the basic methods used in construction.

Cointeraux saw rammed earth as, “a means by which the common man could vastly improve the quality of his life.” The ideals of rammed earth such as ‘free earth’ and ‘honourable labour,’ matched those of The French Revolution, which was occurring at the time. In 1788, Cointeraux founded a Pisé Construction school in Paris and wrote four textbooks on the tools, soil, formwork, and mythology of building with Pisé. His body of work formed the building blocks for all earthen construction in the following century.

The first decade of the nineteenth century experienced an exponential increase in the number of experiments and research in Pisé housing techniques.

As the boom of published information based upon

Cointeraux's work was beginning to gain wide acceptance; the mid 1800's brought other building materials, such as timber, steel, and fired brick. Earth construction went untouched, except for continued agricultural use, until the outbreak of the Great Depression. Prior to this, earth housing was looked at only for the poor.



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It was the US Department of Agriculture in the mid 1920's that performed a study of the first rammed earth structures built over seventy years ago. The results of this study surprised many, with the structures still in serviceable conditions.

The Agriculture Department published several complete technical papers detailing all aspects of rammed earth construction in the late twenties, which allowed many novice home owners to construct their own houses affordably. Coupled with The Depression, which created a shortage in building materials and flooded the market with cheap, available labour, rammed earth housing saw a boom exceeding that of the previous century.

After World War II though, the construction industry moved towards more manufactured and component-based building, particularly plastic based products which were gaining widespread acceptance regardless that we knew so little about their life span and durability. Consumer's saw earth building as old-fashioned and out-dated, a view encouraged by the material suppliers who had, and still have, a monopoly over the supply of these plastic-type products.

It wasn't until the oil embargo and resulting energy crisis of the mid-seventies that rammed earth housing was rediscovered throughout the world. Governmental agencies initiated energy saving credits, which offered financial rewards for investments in energy conservation measures. The simplicity of the rammed earth system and the logic of building with such an abundant and basic material, coupled with energy efficiency and government tax credits, spawned many new houses.

In the last 30 years there has been considerable growth in the number of rammed earth buildings worldwide, in Australia, France, Germany, USA, New Zealand and in France, where about 15% of the population live in earth houses. In some regions of Australia over 20% of the houses are built with walls of unfired earth. In addition to the many housing projects, applications have included churches, hotels, factories, schools, and exhibition centres.

In New Zealand, early European settlers applied traditional English techniques of earth construction - using predominantly wattle-and-daub in the South Island and rammed earth in the North Island. Pompallier House at Russell is a well-known



example of rammed earth construction, which has stood the test of earthquake, storms, and time.

Earth Building in New Zealand has undergone a revival in interest and this interest is reflected in the number of earth buildings that have been erected in the last two decades: there are currently some 600 Earth Buildings in Godzone.

Sustainable, economical, warm, safe and a beautiful, calming place to live: "Its a technology that has been forgotten about for too long," Matt, my architect friend, concluded and I'm inclined to agree.

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