TIMBERCRETE®
An Introduction

Version 3

Image Courtesy of AD Architecture NZ

What is Timbercrete®?

Timbercrete® is an award-winning, environmentally sensitive building material that has many advantages over clay and concrete bricks. Whether used as bricks, blocks, panels or pavers, its comprehensive performance and benefits to the environment are impressive.

This unique product can be moulded or pressed into a vast range of sizes, shapes, colours and textures. It can be used for residential, industrial and commercial construction, as well as landscaping and a range of other applications.

Please read on to discover how Timbercrete stands out from the rest of the products on the market.

- Timbercrete is the only structural brick or block product on the Australian market that traps carbon which would normally end up as greenhouse gases in our atmosphere.
- It has substantially lower embodied energy compared to clay fired bricks.
- It has a higher insulation value (R) in comparison with traditional solid masonry bricks blocks and panels.
- It has a workable thermal mass which is the ability to store thermal energy and release it slowly.
- It boasts unique and in some situations improved engineering qualities such as better resilience and improved breaking load resistance compared to unreinforced clay and concrete products (as tested).
- Lighter weight (up to 2.5 X lighter than concrete or clay).
- Unique workability, it can be nailed and screwed into just like timber, but retains all the advantages of conventional masonry.
- Higher fire resistance – at 190 mm thick, outperforming typical concrete blocks, clay, timber and steel construction. It has the highest possible fire rating exceeding FRL240/240/240.

This ground-breaking innovation is an Australian invention and proudly Australian owned. It has several international patents (PCT) and trademark protection granted in most of the world's population. Granted Australian patents include numbers: 531909, 2010227105, and 201020365, along with several patents pending.

What is Timbercrete Made Of?

Timbercrete is made of a unique blend of cellulose (timber waste), cement, sand, binders, and other materials.

Recycled Waste

As the name suggests "Timber-crete" is made primarily from timber waste such as sawdust or recycled timber from discarded pallets and the like. No trees have been cut down specifically to produce Timbercrete. Instead, we use the excess sawmill waste from plantation timbers that would otherwise be burnt or used in a form that would cause it to degrade, releasing greenhouse gases into our atmosphere.

Other Ingredients

- **Sand** - Sand is carefully selected (sometimes blended) to maximise its load bearing capacity (MPA) and minimise water ingress.
- **Binders** - Cement binders, such as Portland cement or other cementitious material, along with a special non-toxic "deflocculate" and other products that improve density and cement performance. These products also aid as a waterproofing agent.

Environmentally Friendly

Timbercrete is very environmentally friendly all the way from its raw ingredients through to its everyday use. Its main ingredient is recycled timber waste (cellulose). It has significantly lower embodied energy, and acts as a carbon trap. On top of all this, its improved insulation qualities mean Timbercrete homes are more energy efficient throughout the year.

Carbon Trap

Timbercrete's main ingredient is cellulose, such as sawdust. This is often used for producing fertilisers, as floor cover in horse stables, or is simply discarded or burnt. All of these uses have a negative impact on our environment, because as the product breaks down, it releases carbon dioxide gas into the atmosphere. This is referred to as "greenhouse gases". When used for Timbercrete however, this vicious cycle is stopped because Timbercrete acts as a carbon trap, when the cellulose waste is preserved within a concrete tomb and never breaks down.

Lower Embodied Energy Due To:

- **No Kiln Firing** – Timbercrete does not need to use artificial or man-made drying processes. Conventional clay bricks require firing for strength and durability. This process consumes a large amount of energy and the toxic by-product is a poisonous cocktail of sulphuric, carbon monoxide and carbon dioxide gases.
- **Energy use during manufacturing** - To manufacture 1m2 of wall area, Timbercrete uses far less equipment and energy than other traditional brick and block making systems in its production process.
- **Energy to attain raw materials** - Wherever practically possible Timbercrete utilises locally sourced raw materials.

Performance

Timbercrete's unique density and matrix achieve improved acoustic and thermal insulation qualities compared to conventional bricks. It has unique resilience and a good load-bearing capacity, yet allows you to nail or screw into it like timber. Blocks are typically larger and lighter, resulting in construction being easier and faster. (Comparison data can be provided upon request)

Density and Matrix

Timbercrete's dry density can be altered to suit specific requirements, ranging from 900 kg/m^3 to 1500 kg/m^3. Standard or typical Timbercrete Is approximately 1.1 kg/L^3. Its density is similar to water, followed by hardwood timber.

Sound Qualities

Airborne sound transmission loss

100 mm to 110 mm thick Concrete and clay masonry performs well at preventing airborne sound transmission with an Rw rating of approximately 44 and 49 respectively, with 100mm (low density) TIMBERCRETE being slightly less with an Rw rating of 41. While still to be tested, one can reasonably assume that a slightly higher density Timbercrete will result in a higher Rw rating. However, 100mm Aerated concrete blocks performs less than all the above mentioned products at Rw rating of 38.

Sound absorption

Timbercrete outperforms higher density clay and concrete bricks with a "weighted sound absorption coefficient" of 0.20 and a noise reduction coefficient (NRC) of 0.15 whereas typical clay and concrete products have an approximate NRC of 0.04.

Timbercrete provides better resistance to airborne sound transmission then aerated concrete while providing less deflecting sound than higher density clay and concrete. (Refer to test results on website)

In summary Timbercrete performs well at preventing sound transmission while having a sound absorbent quality which in effect helps to reduce echo or the "noisy room" phenomena.

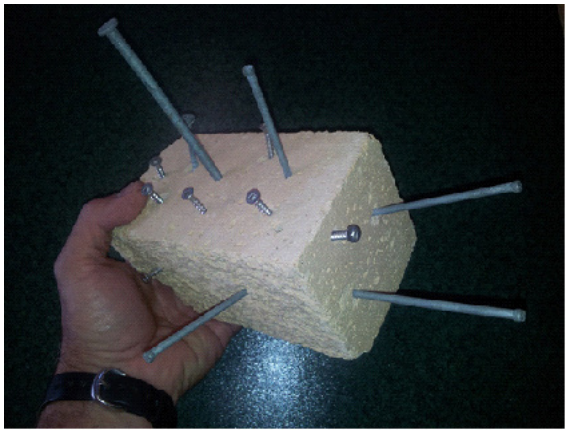
Load-bearing Capacity

Timbercrete has a good load-bearing capacity. The formula can be altered slightly to achieve specific engineering requirements. Load-bearing typically ranges from 5 MPA through to 15 MPA or potentially greater if necessary. At 5 MPA a single standard 400 long X 200 mm thick Timbercrete block can load-bear up to 40 tonnes.

Ease and Simplicity of Building

Tradesmen enjoy working with Timbercrete because it is lightweight, coming in at only 1,100kg/m3 (approximately). This is less than half the weight of traditional concrete or clay products, (2,400kg/m3) which makes Timbercrete much easier to handle.

Timbercrete can be nailed and screwed without the need for pre-drilling. It is just like nailing into a piece of timber. This makes life simple when it comes to attaching various fixtures to the walls. Unlike other lightweight building products such as aerated concrete, nails and screws in Timbercrete stay fixed.



As easy as working with timber

Drilling any size hole is easy

Timbercrete is Bullet-proof

Timbercrete (tested in the US) was subjected to ballistic tests using a range of calibre projectiles. Tests showed that Timbercrete blocks absorbed the projectiles instead of shattering like concrete blocks. To date no bullet has ever been able to penetrate through a 200mm Timbercrete brick. Astonishingly even a 50 calibre armour piercing bullet only penetrated 50 mm into Timbercrete.

The photo below shows a typical 200 mm thick Timbercrete single skinned cobblestone block. The block above was hit multiple times by several different calibre weapons.

Depth of penetration is depicted by coloured pens.

- **GREEN**
  .44 magnum full metal jacket fired from 4.5m.
- **RED**
  .45 magnum hollow point fired from 4.5m.
- **BLUE**
  .50 Calibre full metal jacket (Sniper) fired from 15.25m.
- **PURPLE**
  SKS47 full metal jacket fired from 15.25m.

Note: .50 calibre sniper bullets are designed to blow through an engine block from nearly a mile away!

Tests have demonstrated that a single shot from any of these weapons (as well as a small-load .22 calibre) will blow apart all traditional masonry products such as concrete blocks or clay fired bricks. Softer aerated or autoclaved masonry blocks seem to offer no resistance at all, even against a .22 calibre rifle.

Thermal Efficiency

Superior Insulation

R Value Comparison

- Timbercrete will always thermally outperform traditional or non-traditional higher density products when comparing like for like regardless of wall thickness. Timbercrete has a lower density and therefore higher insulation value (R value) than clay fired bricks, mud bricks, rammed earth, concrete and concrete blocks.

- Peter Collier the inventor of Timbercrete has also developed a range of patented wall systems. It is his professional opinion that Timbercrete products such as the patented “Super Insulating Series Block” will provide a superior overall thermal performance compared to any other wall system developed within Australia. He is also convinced that the soon to be released Timbercrete Insulating Cladding Panel will thermally outperform any other cladding product in the Australian market.

- Timbercrete has a range of blocks, bricks and panels with varying thickness from 50mm up to 300mm. The patented “Super Insulator Block” (Patent No 531909), can achieve an insulation rating of approximately R 4.0 along with a workable thermal mass and the cladding panel has a calculated R-value of approximately R 3.0 with no other insulation required in the wall.

Workable Thermal Mass & Lower Thermal Drag

Timbercrete has a density and matrix unlike most other products, resulting in a unique combination of thermal characteristics. We firmly believe Timbercrete offers a unique thermal dynamic, achieved by a three-fold approach.

1. A workable THERMAL MASS, (Specific heat) or (thermal momentum) or

(Volumetric thermal capacitance) = MJ/m3.K 1,171

2. Improved THERMAL INSULATION (R value) Approximate Thermal conductivity ranging from k W/m.K 0.234 to 0.391 depending on density.

3. Reduction of excessive THERMAL DRAG (high conductivity).

The reason why Timbercrete has a superior thermal dynamic when comparing it with traditional building materials such as clay and concrete, is mainly because of the cellulose content in Timbercrete.

Timber has a much higher insulation value or lower conductivity than clay or concrete. What many people don't understand, is that while timber is lighter (less dense) than clay or concrete, kilo for kilo it has a much higher thermal mass (specific heat) or the ability to store absorbed thermal energy.

As seen in the figures below, products such as water have a very high specific heat whereas iron or copper have a very low specific heat.

Specific Heat of Wood for Selected Temperatures and Moisture Contents

Specific heat (kJ kg-1 K-1)

Temperature

(K)	c(dry)	c(5%)	c(12%)	c(20%)
280	1·2	1·3	1·5	1·7
300	1·3	1·4	1·7	1·9
320	1·3	1·5	1·8	2·0
340	1·4	1·6	1·9	2·2
360	1·5	1·7	2·0	2·3

Material	**Specific Heat Cp (J/ kg x oK)**
Iron	*.470*
Copper	*.390*
Water	*4.186*
Concrete (approximately)	*.800*
Mortar (approximately)	*.700*
Timbercrete (independent value approximately)	*1.171*

Building With Timbercrete

The problem with products with higher density is that they also have a high conductivity; these products are thermally hungry. If one was to build out of such materials, when the inside temperature drops below or rises above a comfortable level, the energy generated by an active heating or cooling source is absorbed by the walls, and a greater proportion of energy is dragged from one side of the wall through to the other (thermal drag).

In other words, the walls consume large amounts of energy that should be spent on moderating the temperature of the building.

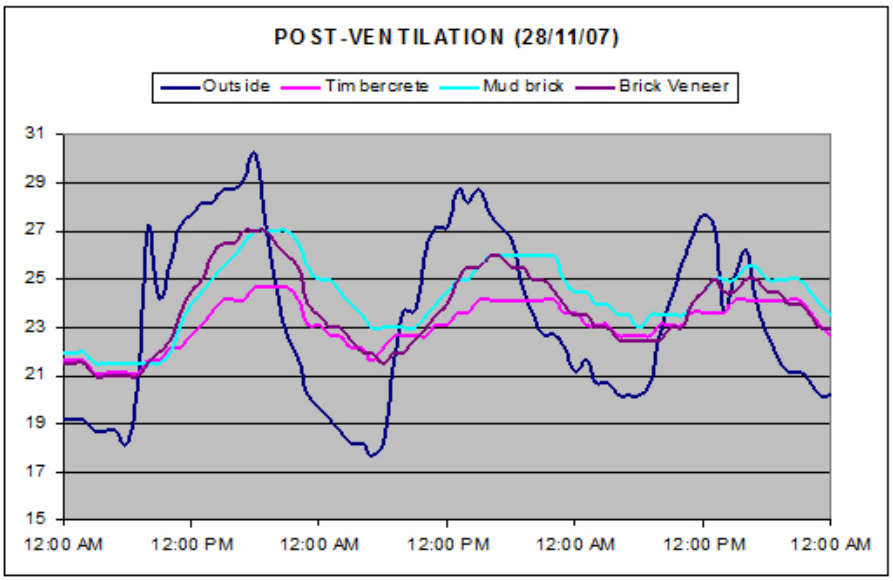
Therefore thermal efficiency is a question of balance. The thermal mass which causes thermal momentum is an important dynamic, but not at the cost of losing too much insulation value.

Evidence (as demonstrated in the temperature graph below) indicates that houses built with single skin Timbercrete external walls have achieved this “balance”.

Thermal Efficiency Test Results

Test graphs below represent three identical buildings constructed with different types of building materials of the same thickness (250mm). Independent tests were conducted by Kevin Heathcote from the University of Technology in Sydney.

- The single skin high density Timbercrete wall has a respectable total R-value of approximately R 1 and a high specific heat of approximately C 1.171
- The Mud Brick wall has a total of R-value of less than R 0.4 (approximately and depending on density) which is fairly low but it does have a respectable specific heat of approximately C 0.7
- The Brick Veneer wall is a standard composite system with reflective foil insulation (R 1) plus insulation (R 1.5) plus air cavity (50mm) plus brick plus plasterboard lining. All this adds up to a total insulation value of approximately R 3. Due to the fact that the bricks were used on the outside layer of the wall, the specific heat of the wall is very low. Therefore thermal momentum was due largely to the specific heat available in the concrete slab.



When it comes to getting the thermal dynamic balance right, these tests clearly indicate that Timbercrete has achieved that. As seen by the pink line, which represents Timbercrete, the thermal swing was far less dramatic.

These tests were carried out in the Australian summer but similar readings occurred during the winter months.

Durability

Timbercrete is designed to last for generations. Independent tests prove that a Timbercrete block that is 190 mm wide has the highest possible fire resistance rating for building materials in Australia. It is impervious to termites and rot, and even bullet-proof! The colour will not fade and the bricks, blocks, panels and pavers will not wear away when exposed to extreme weather conditions. It even has superior bracing values (both in and out of plane) for those in earthquake prone or cyclonic areas.

Lifespan

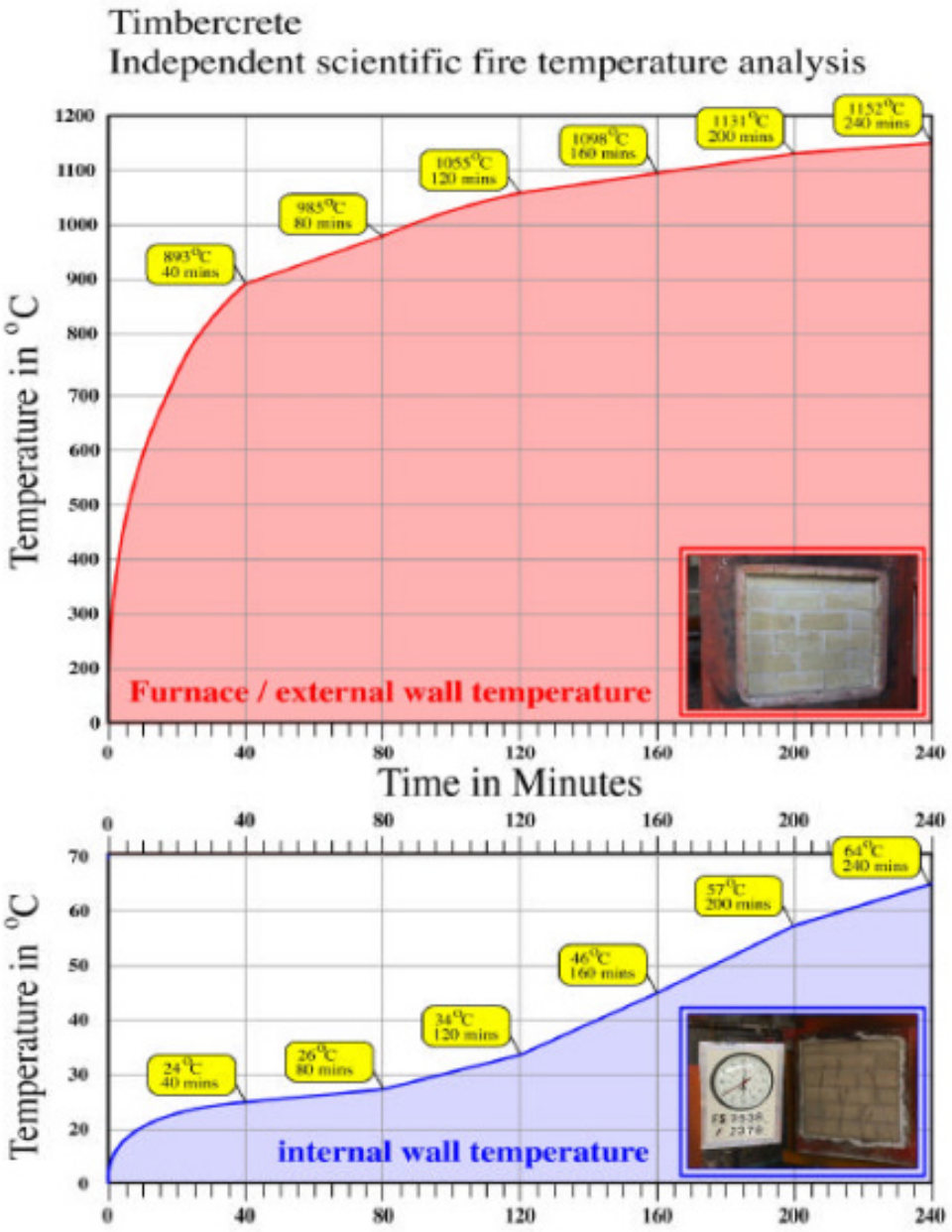
Timbercrete longevity is the same as any other concrete product such as, 'Hollow Core Concrete Blocks'. The expected life span is therefore hundreds of years. Also like other concrete products, sealing or rendering increases its longevity.

House constructed in 2000

Fire Resistance

Level Rating (FRL240/240/240 minutes)

With a 190 mm wide block, Timbercrete has the highest possible fire rating, which outperforms most other building blocks & bricks according to independent accredited fire tests. With 30 tonnes of pressure applied, over a 3 metre expanse, Timbercrete's Fire Resistance Level Rating exceeds the highest possible of FRL 240/240/240. This easily exceeds the BAL "Flame Zone" requirements for bushfire prone areas.



Freeze – Thaw Proof

At the other end of the scale, 'freeze-thaw' tests have shown that Timbercrete withstands the extremes of weather, regardless if it is hot or freezing, or rapidly changing between extremes. Timbercrete was tested according to the requirements of ASTM C1262-05a at ENSIS NZ (The joint forces of CSIRO & SCION).

Test results demonstrate that all samples lost less than 0.2% of their mass after exposure to 25 cycles, with the average loss being less than 0.1%. (Full test results refer to website)

Versatility

Greater Choice

Timbercrete can be made in a variety of different colours sizes and shapes.

Range of Products

Construction alternatives include: feature cladding, single skin blocks, veneer or double brick, and wall panels. Products are available in a wide range of styles and textures, with landscaping products and pavers also available.

Cost Effective

Cost Competitive to Construct

- Easier and faster to construct veneer and cladding systems, reduces m2 labour costs. Refer to document on our website entitled "5 reasons building with Timbercrete should be cheaper" in the Contact Us and Pricing section….. Read more on the rationale behind cost saving.
- Timbercrete will be releasing a new wall panel system that will be a cost-effective alternative to standard brick veneer and quicker to install.

Year Round Savings

- Timbercrete's amazing thermal efficiency saves you money on heating and cooling year in and year out.
- Single skin walls are extremely low maintenance, with no need for painting and repainting and with high durability compared to fragile gyprock internal walls.

Visually Pleasing

Timbercrete is a uniquely visually pleasing and hand crafted product. This look is normally associated with sandstone or limestone. In the midst of a street full of common brick veneer (cookie cutter) houses, Timbercrete homes stand out.

Image Courtesy of Designers By Nature

Single Skin Simplicity

Timbercrete also offers a single skin building system that allows the builder and homeowner to enjoy some financial and time saving costs. This is due largely to the fact that many conventional building elements are not required. The following are a selection of some of the areas where economies are achieved.

NO Need For:

- Sisalation (reflective foil or vapour barrier)
- Wall Insulation
- Timber frames
- Gyprock (plasterboard sheeting)
- Paint (normally re-applied after a few years)
- Timber reveals for windows (when building with our single skin)
- Skirting to protect fragile Gyprock
- Acid cleaning (standard procedure for clay fired bricks)

New Cladding Panel

Timbercrete soon be offering a lightweight panel that is a drop-in replacement for brick veneer. This new panel system eliminates many of the problems and costs associated with masonry veneer. It is much faster to erect and will provide a unique and attractive alternative to the" busy little bricks" look.

Because of the flexible wall system and reduced weight one can anticipate savings on footings and foundations in reactive soil types. Panels are typically 50 to 135 mm thick and will come in a variety of sizes shapes and textures.

Proposed Further Applications for Timbercrete

Timbercrete is an exciting and proven building material, which can be produced in a wet cast or dry press form. This enables a number of new potential applications that are currently being explored and developed, some of these applications include:

- Acoustic barriers for highways.
- Acoustic and fireproof walls for multi-storey apartments.
- Architectural features.
- Rammed earth structures.
- Cladding panels.
- Prefab wall panels.
- Pizza ovens.
- Firewalls or partition walls for commercial structures.
- Fire resistant lift shafts for multi-storey buildings.
- Roof tiles.
- Bullet-proof structures for the military.
- Low-cost reconstruction housing after man-made and natural disasters. Timbercrete can be manufactured from recycling timber waste product as well as recycling masonry products like clay fired bricks and concrete.