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In house... 40 years on!

The whole is greater than the sum of its parts

Wow, 40 years since the very first issue of *The Owner Builder* magazine hit the streets! Let's first take a little look back... the following are extracts from the **In house** page of each of the issues when the magazine changed hands.

TOB 1 MID 1981

This is the first issue of *The Owner Builder*.

We have wanted to produce a magazine for self builders for several years ... our conviction that the presence of such a magazine was necessary and important has never wavered.

We invite contributions from anyone interested but particularly from owner builders. We would like to know your problems and help find practical solutions. We would like to share your solutions with others who may need the benefit of your experience.

There are problems. Many are legal and administrative, made more complex by an official lack of understanding. Building regulations often create unnecessary stumbling blocks for low income builders in relation to the minimum size of structures and the materials which can be used for construction.

John and Gerry Archer

TOB 25 NOVEMBER 1987-FEBRUARY 1988

Many readers have followed the magazine since it began back in 1981. Gerry and John Archer, together with sons Justin and Simon, have built the magazine into what it is today. In doing so they have given technical help and encouragement to thousands of people throughout Australia and beyond. Valued friendships have been formed with readers, contributors and advertisers alike.

Now, as the new publishers, we look forward to seeing *The Owner Builder* magazine continue as a meaningful force in promoting and assisting the cause of owner building. Above all, we look forward to continued interest and input by you the reader. Each of us has our own backyard and community. Together we can share a wider community based on the very positive activity of owner building.

Valerie and Russell Andrews

TOB 121 DECEMBER 2003-JANUARY 2004

I have only recently learnt to be a 'land lubber' again, after seven years living, working and travelling aboard a sailing catamaran. So the last few months have been pretty hectic, without me further deciding that editing and publishing *The Owner Builder* would be a good ideal!

For the moment, my efforts need to be strongly focussed on maintaining the high regard in which the magazine is currently held. Every edition of the magazine that I have read has opened new avenues of exploration for me. Along with the support of Toni, Art Director of long standing, I hope that I will continue to create a magazine which inspires, challenges and informs.

Lynda Brighton

In celebration of 40 great years, I sincerely hope you enjoy this bumper 132-page issue. I am extremely proud to have been part of the evolution of this publication. It has always been a team effort – staffers, advertisers, contributors, subscribers and readers – all working together to create and share this invaluable resource.

As for the future? Well, major changes are underfoot, as detailed in **From the back porch** on page 130.



CONGRATULATIONS FROM ADVERTISERS

I've been reading *The Owner Builder*, and contributing the occasional article, since about 2009 but the magazine was well and truly part of the owner builder culture and community long before then. I thoroughly enjoy the content every time a new issue comes out, and I have kept every issue in hard copy, because the information never seems to get old! – *AllRisk Insurance*

For a majority of the last 15 to 20 years Ausbale has enjoyed a fruitful relationship with *The Owner Builder*. Thank you for your continued support. – *Ausbale*

Congratulations to the team for reaching 40 years. *The Owner Builder* provides valuable and relevant information to the public and industry. – *Board of Professional Engineers of Queensland*

We are so thankful to the team at *The Owner Builder* for supporting us since the beginning of our start-up social enterprise operation. Congratulations on 40 years! – *CERES Fair Wood*

The Owner Builder has been an invaluable mutual working relationship for us, over the decades. Publishing relevant earth building stories and information like no other magazine in Australia does. Congratulations. – *Earth Building Association of Australia*

Wow, has it really been 40 years of reading *The Owner Builder*. It's always been a reliable publication for quality information and contacts. Congratulations Lynda and all the team! – *House of Bales*

Congratulations to *The Owner Builder* on your 40th anniversary! We have advertised continually for well over a decade and found that Lynda is great to work with! – *Lucas Mill Pty Ltd*

Congratulations on reaching this amazing milestone, contributing to grassroot building technologies surviving and flourishing. Lynda, you have added so much value since you took over this labour of love, thank you. – *MDB Projects*

Congratulations to *The Owner Builder* for being an independently published magazine that has been supporting, sharing stories and inspiring owner builders for 40 years. – *Shelter Building Design*

What an amazing resource and such inspiring stories helping owner builders. We are proud to be part of this great magazine. – *Timber Frames of Australia*

40 years of giving people the inspiration and knowledge to be CREATIVE in their building projects, what an achievement! – *Two Creative*

The Owner Builder has been the perfect fit for us to reach our customer base over the years, and it still remains the only choice for us to do so. It is the only magazine to report on owner builders honest experiences using the system to build their homes. Thank you. – *Formblock*

The Owner Builder is an independently published magazine – the first issue came out in 1981 – informing and inspiring owner builders ever since. While it changed in appearance over that time, it still remains true to its origins – a unique publication that is of value to those who choose to be involved in creating their own shelter and to share and celebrate their creativity and hard work.

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Published by: AfriCat Pty Ltd

ABN: 24 106 576 881

Distributed to newsagents by: Ovato Retail Distribution

Printed by: Ovato Print

DISCLAIMER

We thoroughly support the continued sharing of ideas amongst owner builders. However, you should be aware that any particular solution may not suit your situation or even be tolerated by your council. Always be aware of on-site safety; just because a photograph shows someone performing a task one way does not necessarily mean that it is safe or suggested best practice.

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- The inks used in the printing are linseed oil based.
- Printed by Ovato Print under ISO 14001 Environmental Certification. They recycle 97.5% of their paper waste.



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...in a rammed earth house after 20 years.

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Hold the vision, trust the process

My Hobart hemp house story

BY BECKY MCLOUGHLIN

It was early 2017 and a time of astounding life changes. I was in my early fifties and had just recovered from multiple major surgeries. I was also single for the first time in 30 years. All my immediate family, apart from my adult children, Joseph and Bethany, live in England where I was born.

Despite working hard all my life, for various reasons I realised that if I wanted to buy a house near my workplace in the city, I would need a big mortgage and I would probably be working forever to pay it off. I was also finding it hard to find anything suitable. So I started thinking about another way of approaching it. Perhaps I could buy a small plot of land and build something? Maybe it could incorporate a self-contained section I could rent out for a source of income? That's when Bethany's partner Laurence suggested I talk to his father, Andrias.

Natural building

Andrias McMahon is a designer-builder who went on to set up a specialist natural building company. We all share a passion for the natural world and for the beautiful state of Tasmania I had chosen as my home some 16 years before.

Hobart's property market was on the rise and even finding land was proving difficult. Eventually I discovered a 700m² block in the Waterworks Valley, just a few minutes from the city centre yet overlooking the bush and adjacent to a walk and bike trail that links Hobart

with our beloved mountain, kunanyi/ Mount Wellington. The land was subdivided from the house at the top of the drive, with services ready to be connected. It is on a slope leading down to the Sandy Bay Rivulet, but when I first inspected the land all its beauty was hidden by brambles, huge willow branches and rubbish that had collected over many years.

Andrias agreed to come and have a look, and while he told me the block would be tricky to build on for a number of reasons, he agreed that it had potential. The idea of building a home with a relatively small footprint in such a special and challenging place interested him. The problem was that he had not long moved back from the mainland and did not yet have his Tasmanian builder licence. If I wanted him to work on it, I would need to become an owner builder and take on the project administration and full responsibility for the build. But I would also need to keep working full time to keep the money coming in.

I had never built a house before, but I did at least have some experience of dealing with architects, engineers and builders through managing office fit-outs. During my career I had also led not-for-profit organisations (for example, I was Director of the Bibbulmun Track Foundation in Western Australia), so I knew all about the importance of a clear vision, having to achieve results with limited funds and the stresses of cash flow. And I'd watched a great many

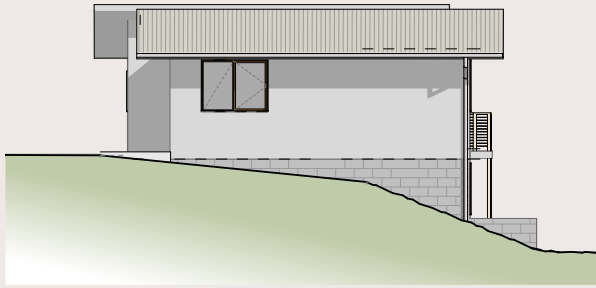
episodes of *Grand Designs*, so I was under no illusion that it would be easy.

With a huge leap of faith, I bought the land with my divorce settlement. By December that year I had completed the owner builder course through ABE Education and was issued my WorkSafe card. I was then issued my Owner Builder Registration Permit by the Tasmanian Government Department of Justice.

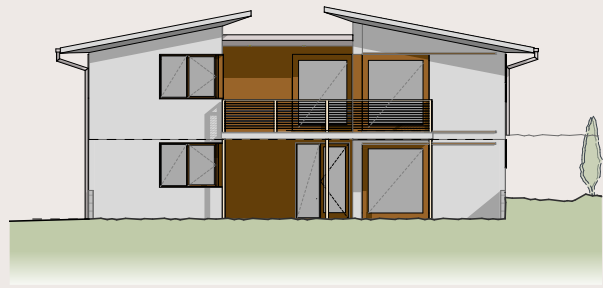
Design brief

Meanwhile Andrias and I were discussing the design of the house. I knew he had built a straw bale house on the mainland and I was interested in that approach. However there were limitations for this type of construction on my site, not least of which was the wall thickness with the very limited available building footprint. So Andrias suggested hempcrete. He had never built with it before and I had not even heard of it, but when I started to investigate I became very excited by the idea.

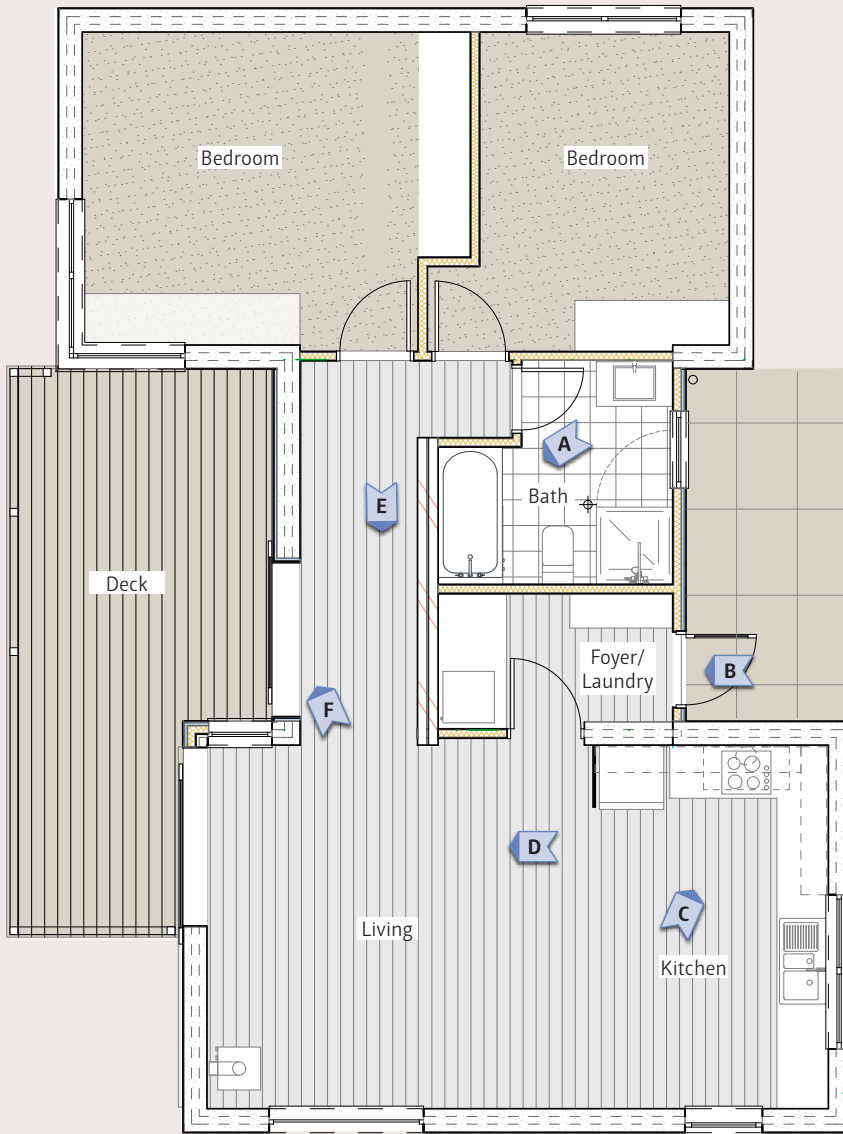
I read stories of hempcrete builds and I was reassured by a *YouTube* video of Kevin McCloud espousing the merits of hemp as a building material. Call it foolish or brave, I was influenced by a desire to make my remaining years mean something, so I embarked on the riskiest thing I had ever done. It was scary, but also very exciting to be involved in the sustainable building movement as a way to help protect our planet from further degradation.



East elevation



North elevation



Upper floor plan

Arrow letters refer to photos

I only had enough money left over from the land purchase to pay for the design, engineering and other consultant fees, architectural drawings and council costs, but I needed to borrow the entire amount for the actual build.

I'd been doing a lot of thinking and researching for the design brief and I'd gathered ideas in an account I created in Houzz. Front of mind was how I could get the most out of a small space within the lowest cost possible.

Andrias gave me two design options and he had nailed it first time. He said it really helped to have my detailed written brief. He then worked with Apogee from Launceston to draw up the plans, with Director Martin Green having studied with Andrias at the University of Tasmania School of Architecture. I had a good friend, Astrid, with an interior design background, so it was great to bounce ideas around with her. I also

learned to trust my own instinct, which is more difficult than it sounds. Stephen Cole of Integral Consulting Engineers also played an important role in this project, and is very supportive of the hempcrete movement.

Industrial heritage

Although we were using hemp and I love its earthy look, we were conscious that it was a city fringe home and we didn't want it to be too 'hobbyity'. I was keen on incorporating the industrial heritage aesthetic, influenced by the heritage-listed remnants of infrastructure that are scattered in the adjacent Waterworks Reserve and along the Pipeline Track up the mountain. It was here on the Sandy Bay Rivulet that a series of reservoirs were created in the 1860s to supply fresh water to the growing settlement of 'Hobart Town'.

In line with my earlier thinking about how to create an income, together with the fact that my land is on a slope, our design was for a two-storey house with separate entrances for each floor. The lower floor is a 65m² one-bedroom flat

with shower room, open plan kitchen and living area. On the upper floor is a two-bedroom home of just under 100m² plus the deck, and with an entrance that doubles as a laundry.

It took time, but we got the plans through the council building approval process without too many issues, despite this being Hobart's first hemp house and located in a moderate BAL 19-classed bushfire risk area. We bought the hemp hurd and binder from the Australian Hemp Masonry Company, who also provided a construction manual and compliance documentation that formed part of the application. It showed that the evidence for safe building with hempcrete is sound. Our main problem was that council's work on flood-level mapping was advancing the extreme-event flood line up the slope from the rivulet, restricting our building envelope even further.

Engineer Stephen Cole arrives for an inspection. It looks like an archaeological dig, but we only find the odd coin, pieces of china and old farm implements.

Gus (right), an anaesthetic nurse, comes straight off night duty and urgently assists Laurence (left) with the formwork – the concrete is on its way!





Mortgage issues

I used a quantity surveyor's estimate for the build to gain an owner builder mortgage. I had always hoped we could save money on that quote by using volunteer labour but this proved difficult because of the timing. Delays often cost more than they save. As it turned out, the build came in at about 15% over the estimate, but this was due to a number of factors out of our control.

The main issue was cash flow – and it nearly finished me (and the project) off. I made the mistake of obtaining the mortgage through a broker with inadequate owner builder experience, which also meant the bank (a Tasmanian one) would not communicate with me directly. I was promised in writing an advance on the value of the land to start the build. I even took the deeds into the bank as security. We turned the first sod at the end of January 2018 and I started to accumulate a heap of bills, but the bank refused to release the funds. They said there had been a misunderstanding and that I would need stage one to be signed off by their valuer before they would release any money. Bearing in mind they already knew I didn't have any spare cash, how on earth did they expect me to survive this? The company later ceased issuing owner builder mortgages saying that too many people fail. In my experience, the bank was playing a major part in facilitating that failure.

What followed was a frantic and embarrassing plea for loans from friends and family. Those who could least afford it came forward to help. This included a man, an anaesthetic nurse, also from England, who I had met online and had only recently started dating. I wouldn't accept his offer, but fast forward a year and this wonderful, kind and supportive man, Gus, became my husband. When I ask him now what made him so trusting with his offer, he says he totally believed in my vision and he wanted to help see it happen.

Left, top to bottom: This first hempcrete build established Andrias as Tasmania's specialist. Hempcrete was poured into forms and tamped down well. Tasmanian oak-framed bedroom windows were positioned to maximise views, with deep spotted gum sills added.

Another important relationship was to develop during this project – between a father and son. Laurence, my daughter Bethany’s partner, became chief labourer working alongside Andrias while simultaneously completing the final year of his science degree (and graduating with distinction). When I asked Laurence to reflect on his experience, he said how much it strengthened his relationship with his Dad. He gained a deeper understanding and appreciation of what Andrias does for a living, and he liked being able to support him by developing his own skills. Andrias has often said how much he valued having Laurence on the build, not just because of his unfailingly positive attitude, but because he could be trusted to deal with any complicated issues that arose.

Calm on site

I had an optimistic notion that I might be more hands on with the hempcrete. The Australian Hemp Masonry Company ran a workshop on the build site with Andrias as joint trainer, but although we recruited some team members from the participants, I was having a tonsillectomy at the time so I couldn’t join in. In reality I was never going to have enough time to do more than I already did. Groups of architects and engineers were also permitted on site to learn more about hempcrete. There was no personal gain with these visits; they were just about supporting the use of this incredible (and long misunderstood) building material because of the associated environmental, economic and health benefits.

People ask me what the hardest part of the build was. To be honest, I always felt calm on site. There was a lot of juggling I needed to do, but I knew I could trust the core team and that trust was rewarded and reciprocated in abundance. Andrias and I were always on the same wavelength. I admired his many talents, his intelligence and his total dedication. I also felt respected, both as a woman in a predominantly man’s world and as the project owner. Despite this, there were many moments when the fear of not having enough money for materials and trades almost overcame me.

A key low point was running out of hemp before the final wall was completed. The handmade creation



*Top L-R: Shorter, extra deep bath – a space solution for the upstairs bathroom. The lower flat has concrete floors throughout.
Middle L-R: Entrance foyer doubles as laundry. Upper kitchen with natural chalk rendered hempcrete wall above the tiles.
Right: Hurd in a jar by an unrendered hempcrete wall finished with waterglass.*

of hemp walls will always have some variances, but this was incredibly frustrating because the hemp hurd had to be sent from NSW and that caused delays and a whole range of associated costs. I needed to get to the lock-up stage for the bank to release another payment. It was very stressful. But the good news is that this is unlikely to happen to others





Left: The lower floor has a large sliding double glazed door connecting the flat to the garden. 1930's recycled bricks were used for the patio, with Andrias' wife Alli helping to hand clean them.

Above: Galvanised fascia and guttering contrast with the natural lime rendered hempcrete and rough sawn silvertop ash.

here, as Tasmania is soon to have a hemp straw-processing unit with *X-Hemp* having secured the necessary capital and commitments from growers.

Meanwhile another 'Andy', Andrew Otto, had joined the build family. We were very fortunate to have this master craftsman handcraft all the double-glazed windows and doors, as well as the joinery for the study, kitchens and bedrooms. He also completed all the tiling.

Everyone was pushing against time to get the build completed so we could move in over Christmas. In the end, another kind friend gave us a little reprieve by allowing the use of their house for our family Christmas Day. But even when I finally got the occupancy certificate, there was still plenty of work to be done.

Love nest

Over the last few months, Andrias had started telling everyone he was building a 'love nest'. Gus had proposed to me and we decided that we should make the most of pre-planned visits from England by his 90-year-old mother and my older sister, and get married while they were

here. I had a string of credit cards loaded up with tens of thousands of debt and no spare money for a wedding, the house was surrounded by mud, there were no doors on bathrooms or bedrooms, and I was stressed to the max. But it's amazing how love can carry you through – and the support of a wonderful group of friends and extended family.

When the house was completed, Bethany and Laurence said they'd like to move in – and so did my son, Joseph, and his fiancée, Rosie. So we gave them each a year in the downstairs flat at a family rate, and it was a privilege to have that time with them close by.

Upstairs accommodates Gus and me. Although the floor size is modest, we never feel too enclosed. The deck is an obvious bonus that we use all year round, and I am glad we made the decision to go with raked ceilings for the extra feeling of space this provides. I'm also delighted with the way Andy Otto responded to my thoughts around storage space.

As the final touches were being made to the house, our attention turned to the landscaping. What followed was a labour of love in the garden – a true

passion for both Gus and me, despite the best efforts of wallabies to devour everything we planted.

Just over two years later, we are thoroughly enjoying the results of all the hard work and passion of an extraordinary group of creative and innovative craftspeople. The Hemp House is a wonderful place to live and also performs as we had hoped. We don't need airconditioning, our only heating is a small pellet fire for cold winter nights, and our power bill for four people (using two kitchens and two bathrooms) is less than for an average one-person household. It is so peaceful here. ♦

The Hemp House Hobart on Instagram and Facebook: @TheHempHouseHobart



Clockwise from above: The internal recycled 1830s brick thermal mass wall continues up through both floors. Available winter solar gain is maximised through the large double glazed sliding doors, hand made from Tasmanian oak by Andrew Otto. Floors are silvertop ash.

Why hempcrete?

Hempcrete is a biocomposite material for construction and insulation, made by mixing hemp hurd, lime, sand and water. It is:

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- Highly insulative
- Recyclable
- Uses a rapidly growing renewable biomass which improves soils.





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Be inspired!

Digital collection

The Owner Builder back issues are jam packed full of timeless information and inspiration to refer to again and again. The full library of issues from **TOB 1** to **TOB 222** is available in digital PDF format only, individually or as The Lot.

The Lot and individual back issues



Sometimes you just want to immerse yourself entirely in one particular topic – that is where the compilations fit the bill perfectly.

House Plans

Containing 26 plans by Russell Andrews, this makes a great starting point. The plans featured are not finished drawings but idea generators, and are yours to use and modify as needed.



Rob Hadden

Owner builder extraordinaire, Rob Hadden's incredible building prowess has featured in many issues. This compilation of over 200 pages is a time capsule of the projects he has been involved with since the early 80s until 2018.

Owner Builder



Building Diaries

A collection with more than 300 pages featuring nine projects built with *Formblock*, straw bale, hemp, stone and earth, *Timbercrete*; also house relocation, steel framing and a green renovation.



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The Writer's Hut

BY MALCOLM HOLZ

The Writer's Hut is the first 'pavilion' that was built at our home at Wootha, about ten minutes' drive south of Maleny, in south east Queensland. It is one of four separate detached pavilions that make up The Bower, where I have had the privilege of living with my wife-life partner and our two kids for over 25 years. While the hut does not strictly meet the 'owner

builder' requirement, it was nonetheless the first building I designed and had built on a block of land which I 'owned' – thanks to the Maleny Credit Union!

I confess that I helped build a house for my high school basketball coach in the summer of 1978-9, which cured me of ever wanting to become a builder. I was, however, on my way to studying

architecture at the Queensland Institute of Technology (now QUT). This early 'home building experience' and my upbringing on a farm near Clifton on the Darling Downs, had a profound impact on my first built design and, as it turned out, the design of hundreds of houses while working within property development entities in south east Queensland.



'Making do' drove the design of the hut; it was all I could afford. At the time of its approval by the Landsborough Shire Council (now Sunshine Coast Council), the hut was deemed a Class 10 building, as it did not meet the Queensland *Building Act 1975* requirement for a Class 1 building to be a minimum of 60m² in enclosed, internal floor area; the hut was only 15m². However, as our (and later our kids) lived experience showed, this tiny house was more than habitable; it was luxurious, and served us with elegant sufficiency in a variety of uses over the years, mainly as my studio, where I spent countless hours planning, designing, researching, reflecting, and writing.

It was, in fact, a 'glamper's shack', long before glamping gained in the global vocabulary and popularity; the hook for the camp shower under the tiny building a reminder that it was, after all, only a step (or two) up from camping. And everything in the building was done on the cheap including the old kitchen sink, salvaged from my parent's house; it and its cupboard helped make up the first kitchen in the home that my father had built for my family.

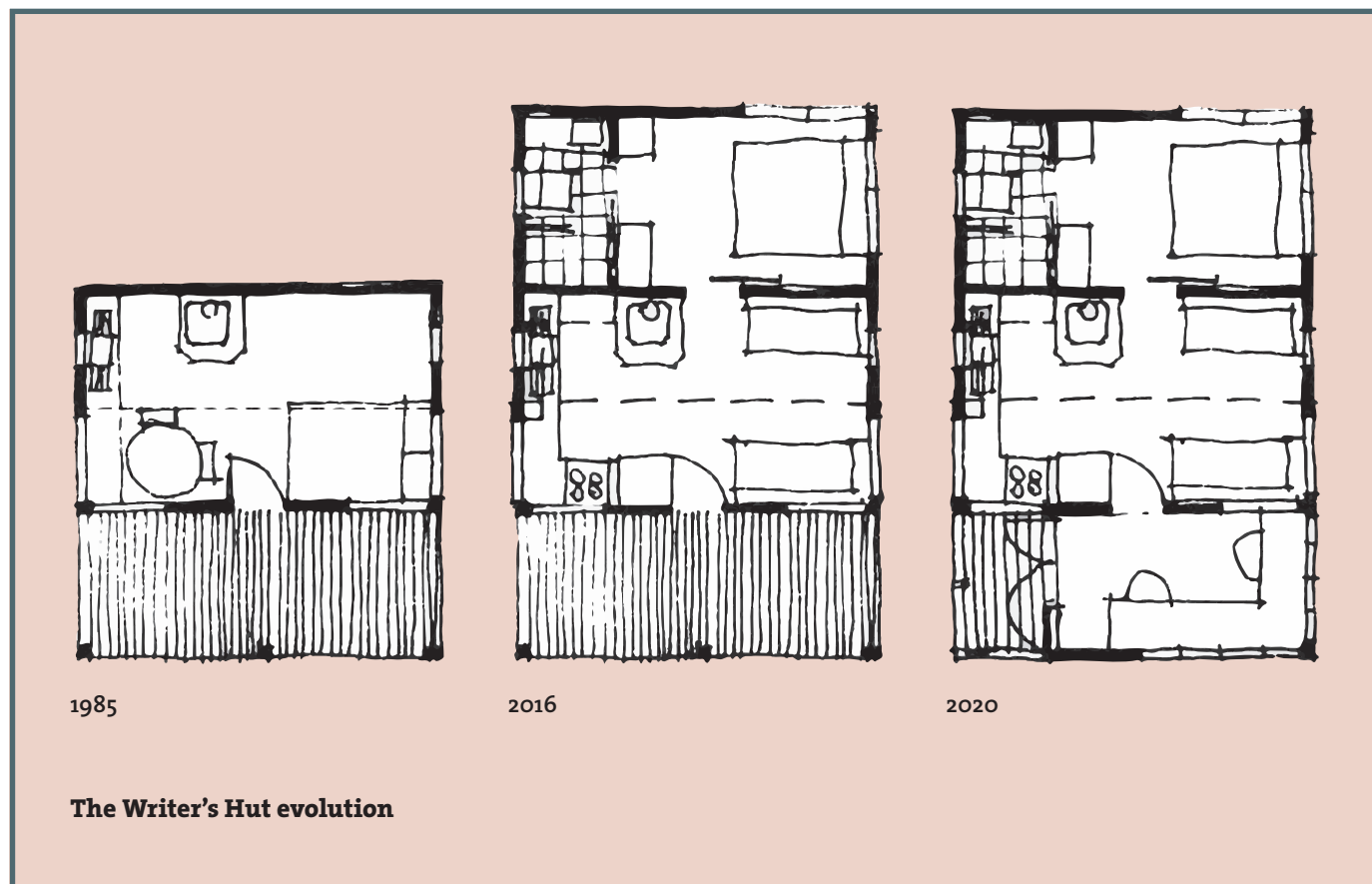
Hut construction

Given the relatively steep slope of the land, the hut was set on steel posts set in concrete. The verandah decking and chipboard floor provided the building platform. Stud-framed walls were used for the east, west and southern walls, lined internally with plywood and externally with fibre-cement pseudo-weatherboard cladding. The roof, corrugated metal. Chicken wire supported stark sheets of foil insulation lining the ceiling of both building and verandah (the foil was not in the specification but nonetheless infinitely wise in the execution and, ultimately, for the climatic comfort of the residents-to-be).

Recycled timber windows, with frosted glass panels – found from a local dump – were fixed high on the east and west walls, not only for high light, but a doff to the unashamedly, early-colonial, Queenslander-like look of the design. Aluminium-framed windows were positioned hard up against the corners of the eastern, western, and northern walls, but the northern wall was set off with old-style crisscrossed timbers framing the

outside of a single-skin pine lining. From the north, the building did look like the minuscule timber and tin cottages which early colonialists built in the Brisbane inner-city suburbs of Spring and Red Hill, and which had formed my grandparents farmhouse on the farm where I grew up.

Apart from new aluminium-framed windows, the only other new (luxury) item to fill in the otherwise rough and rustic refuge, was a brand-new potbelly stove, placed on a raised slate hearth with black-steel surrounds, and centred on the blank, southern, plywood-lined wall, the central feature when walking in the front door. To the right and west of the front door was just enough space for two double bed-sized foam mattresses, which were leant against the southern wall when not in use. To the left of the door, a round, restored, second-hand, timber table was butted up against the bench which, together with the sink, completed the kitchen along the eastern wall. The potbelly was for heating and cooking as the plan was to use the hut mainly as a winter weekender, when temperatures on the Blackall Range could drop close to zero degree Celsius.



A wooden thunderbox (long drop) toilet had also been brought from 'back home' at Clifton; it used to be *en plein air* over a hole dug deep into the hillside, just off the beaten access track, but well south of the small, high tank – sited to gravity feed into the sink inside the hut – next to the southern wall.

The little building was never officially classified, even though it had the local council's seal of approval, and it was for all intents and purposes 'habitable', except for a low window placed just above the floor in the bottom right-hand corner of the western wall. What I had in mind and proved in experience, including an amazing moonrise on my first night in the hut, was to be able to lie in bed – on the floor on a foam mattress – and not only look up and out to the east, but tilt back and see the stars to the north and south-west. Alternatively, I could lie on my stomach or sit on the bed and look directly to the west over what was an entirely cleared paddock, to the Conondale's about 15 kilometres as the crow flies in the distance. And that's how The Writer's Hut was used, on and off, for about ten years.



Pavilion expansion

The second pavilion – The Couple's Cabin – was a more adventurous affair: 45m² in area; when added to the 15m² of The Writer's Hut, it complied with the prevailing, pervasive, draconian, 60m² floor area rule. A 'proper' kitchen and

internal bathroom were installed in the second pavilion, complete with a twin tub washing machine under (by this time we had installed a simple solar system). Our daughter spent the first two years of her life in this situation. And when our son was on-the-way – at the same time mains power made it to the block – we decided to really lash out and build the third pavilion, The Manager's Lodge, a grand 63m² in enclosed building footprint, over three levels, including a carport under, and two lofts over three bedrooms, a bathroom/laundry and 'family' room. For nearly 20 years, The Couple's Cabin remained the main lounging, cooking and eating area. The generous, quintessential Queensland verandahs installed on all pavilions however, were where we spent most of the time.

For our daughter to move into 'a room of her own', in 2014 we extended onto the original hut with a bedroom and tiny bathroom, to the south. Though when our daughter's future husband, and then a Border Collie puppy and a couple of cockatiels moved in, extra space was needed, so the much-beloved verandah of the original and primitive hut was partly enclosed as a studio, mainly for our daughter to run her burgeoning wedding photography business. The previous 'front' door and windows were kept, so that the entire building – now 37m² in area – could be closed up if someone was working or playing in the studio space and someone else was asleep in bed.

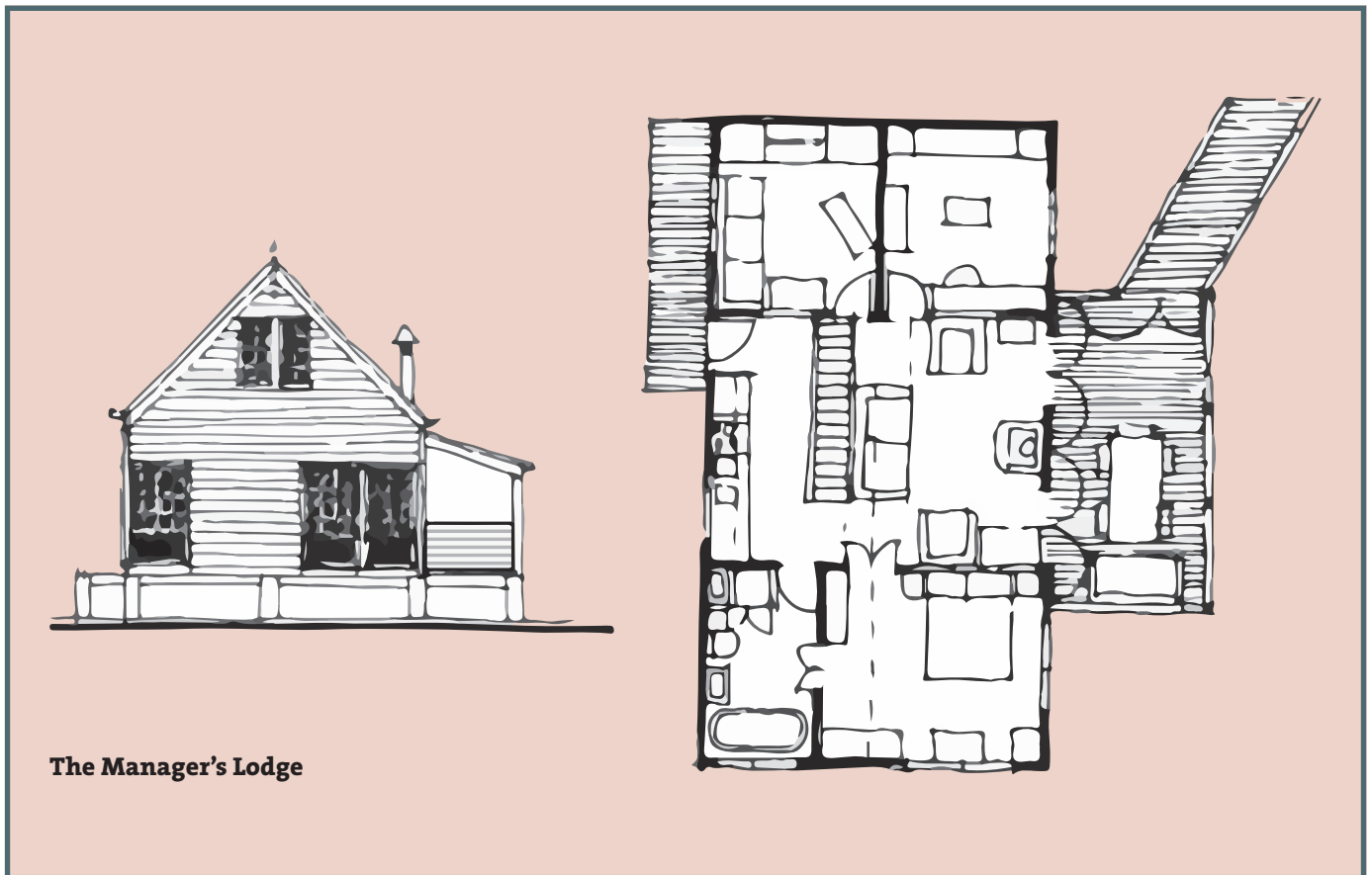
An excerpt from a 1994 diary entry

Now, as I sit on the verandah of my, having-to-be-so-called, shed, I hear the old opera singer – my new next-door neighbour – belting out an aria in the distance. The song strangely blends with the calls of currawongs, cat birds and cockatoos, at dusk. My body is tired from planting and watering in the trees along the fence where the posts are already leaning and the strainer's beginning to rot.

I think about the family farm, and how I ended up here back in the bush after years in the big smoke and the coastal suburbs. You can take the boy out of the country! 'Back to my roots' I convince myself, relaxing with the inevitable tally of VB (Victoria Bitter – or 'very bad' as I came to know it – beer), washing away the dust. I feel the cold bottle, and drift. Simple things. A day's work. A hot shower, albeit still the canvas camp one with a bucket load of water from the tiny tank, heated on the little pot belly stove; a simple stew in a pot on top. A cold beer. A kerosene lamp. I ponder this little place in the fading afternoon light. There in the corner, the kitchen sink from my parent's house, and the old table, my concession to 'new' things limited to four, fold-up timber chairs, a beat-up, ancient acoustic guitar, a blue esky with a high white lid, and a couple of foam mattresses.

Simple, yet how luxuriated do I feel? What more could a bloke want, except, of course, someone to share this with? Anyway, I know this is all I needed then, and for now. It is, after all, still, my dream, and I could not afford anything more then, nor at this time, anyway; tiny, timber, tin, like my grandparents' farmhouse where I spent the first year of my life.

The bush goes even more quiet, as the stew bubbles away in the grey and haze of early evening.



The Manager's Lodge

When our daughter moved out of our home at the start of the 2020 pandemic, our son moved in. Our son's seasonal work in the Victorian and Japanese Alps was subsequently cancelled, but fortunately he continues to live relatively independently in The Writer's Hut.

The fourth and (probably) final pavilion is a tiny house – 18m² internally – on wheels (a THOW), which I lived in during the week for two years when contracting in Brisbane. Technically, The Glamper's Shack is a caravan; the 2016 Queensland Building and Development Dispute Resolution Committee ruling over this particular THOW, set a national precedent for what does not constitute a 'building' under the *National Construction Code*. And ironically, while not the case in Brisbane City, technically, a permit is required from our local council for anyone to occupy a caravan, even in a rural setting. The THOW is however, founded on stumps and is now part of the dwelling house, The Bower.

In total, the four pavilions make up the pavilion dwelling house that is The Bower, a Class 1 building having only one laundry located in The Manager's Lodge.

Model for diverse housing

The moral to this sketch is that over the decades, we have built our home as we could afford it, as income and equity in the property increased. We started out tiny and temporary and maintained a not-so-big approach to growing a little larger, albeit in what remain relatively small permanent pavilions.

At a time when the housing boom in regional Australia has made it impossible for our kids to buy their own home locally, we have come to the realisation that The Bower was and always will be an (un)intentional, intergenerational, micro cohousing-style 'ecovillage' – a hamlet or hermitage of huts – built as a pavilion house in regenerating rainforest.

And while risking making God laugh, it is my wife-life partner's and my hope to continue dwelling here for as long as we possibly can, whereafter our kids will inherit their own pavilion, or two, in what we have created at The Bower. ♦

♦ The Bower

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A pavilion house can be built almost anywhere a 'house' can be built in Australia. It could indeed be the secret to the provision of more affordable, inclusive, and diverse housing in this country. The Bower – our own pavilion house – is our legacy in this regard.

- The Royal Commission into Aged Care Quality and Safety concluded in late 2020 that 'big boxes' are out, and smaller homes are in; in short, aged care providers will be expected to move to smaller-scale housing models integrated within the local community within four years – i.e. 'ageing in place'.
- My independent research has also revealed a mega trend/desire towards smaller-scale community-based living arrangements, where residents have security in tenure of their own room/pavilion, a right in community management, and a choice in community engagement – i.e. having/owning 'shares' in a pavilion-style 'share' house.



Renovating the bathroom in a rammed earth house

BY TIM HAMER

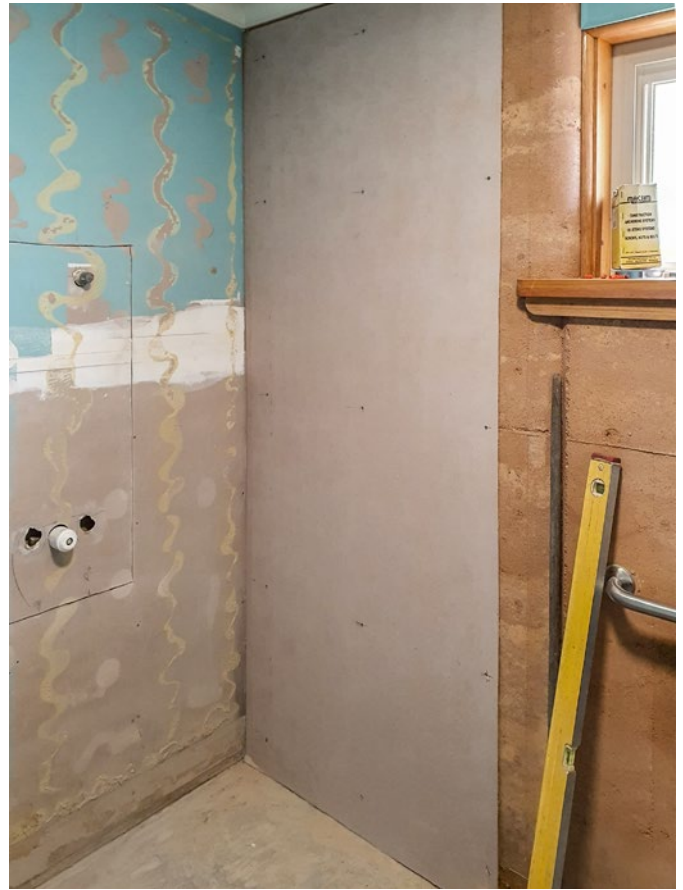


When I removed the original sheet glued to the shower wall, quite a bit of the rammed earth surface came off too. I planned to glue and mechanically fix a sheet of *Villaboard* so that waterproofing could be done before the tiles went on. Twenty years ago, the much lighter *Aquapanel* sheet had been fixed with *Liquid Nails*, but the heavier sheet would need something more heavy duty. Posting my dilemma online via the EBAA and *TOB* Facebook pages, I received a number of suggestions. This is the solution I decided on.

I spoke to *Tech-Dry* about a sealer/binder prior to adhesive application. I bought their *Earth Binder* and applied two coats to the wall. The first was 1:8 and the second 1:10. This worked well even though the original coat on the undamaged wall was still sound.

I predrilled the cement sheet for 15x50x10mm gauge stainless steel countersunk screws, then drilled through the holes to mark the wall after fixing with one screw, and fitted 8mm Fischer plugs into the 7mm holes. The back of the sheet was liberally coated with *Sikaflex-11 FC+* and then screwed on to the wall. ♦





Other solutions

Andy: We recessed thin, sealed hardwood battens into our wall and then chemically anchored them using stainless pins in a splayed pattern. Fix off sheet as normal once anchors are set.

Matt: You would need to batten out the wall. The *Villaboard* needs to be fixed at 200mm centres to hold tiles. Glue does not hold up with the weight of board and tiles. Other option is to render the holes in the wall to give you a flat even surface to tile to. Then waterproof the rammed earth and tile directly.

Jen: We cut into the rammed earth to chemically set timber battens into the earth walls, then attached cement sheeting to the battens.

Brent: As a plasterer I'd try metal battens with a nylon anchor into an adjustable wall clip. If the anchor doesn't hold I'd try spaghetti with a bugle batten screw.

Verna: My plasterer screwed steel channels to the mud brick wall and fixed the *Villaboard* to that for tiling. Solid as!

Paul: I drilled large holes (~20mm in diameter) and 50mm deep then filled with cornice cement. Once dried, I drilled small holes in the cornice cement then used masonry plugs and screws.

Jeff: I would reseal the walls with a rammed earth sealer then glue *Villaboard* on with a *Sikaflex FC* – it will stick to anything and is slightly flexible.



A

Less is more

A small house in Beaufort

BY MATTHEW TURNER
PHOTOS BY TIBOR HEGEDIS

*Home. It's such a personal thing.
What it looks like and what it feels like. How big it is, or how small it is.
Is your home your castle or is it just a place to store all your stuff?*

Let me posit this argument. Every person on this planet – no matter what climate they live in, no matter how affluent or not they are – needs a home. The most basic function of a home must be to provide shelter from inclement weather and security from those who would do us harm. But this needn't be all a home is. It can be so much more.

What if a home were to keep you warm when it's cold outside, without the big energy bill? Imagine waking up on a cool winter's morning with the

sun streaming in through your kitchen windows, warming the floor, warming the air. Your home hugs you like a big down jacket with a heat pack stuffed down the front. The temperature is more or less the same in every room, in every corner of the house.

And there is light, not just when it's a sunny day, but you have thought about what direction the sun comes from and what might obstruct that light, and you have positioned the windows in just the right place so that you needn't turn a

light on so long as its daylight outside. You are exposed to natural light from early in the new day as your serotonin is stimulated and you feel energised and your mood is lifted. You are in tune with the natural rhythms of the day.

With your budget you prioritise quality of the building fabric, over sheer size. Good quality double glazed windows, thick walls with more insulation, low VOC materials and finishes, and of course good passive solar design, which didn't cost anything extra.

The brief

We were approached in 2017 by our client Jodie, with what I would describe as a very modest budget; she wanted to own build a small home for herself that would be environmentally and financially sustainable. No big mortgage to pay off at the end of the build and no big heating and cooling bills. A small, energy efficient and affordable home. Music to my ears.

'I asked for something special, within a budget, that was small and unique and a space that oozes calmness as soon as you enter', said Jodie. That budget was \$90,000, a figure which of course I was sceptical about. But one thing I have learnt in twenty years as an architect is to never underestimate the resourcefulness of the owner builder.

For some context, Australians on average build the largest detached homes in the world, second only to the US, at 235m². Floor area has been steadily getting larger since 1985 when the average was 160m². However, at the same time the average number of occupants has fallen from 4.5 in 1901 to 2.4 in 2006 (*CommSec Economic Insights, 16 November 2018*). Although a minimum energy efficiency standard for new homes has been mandated since 2006, homes continue to get larger and to consume more energy to operate, despite rising land, construction and utility costs and increased awareness of the effect of carbon emissions on climate change.

The design solution

In any new home, the design solution should be a balance of space required for the occupants' needs, efficient thermal and energy performance, and for these to be achieved within the owner's budget. When the budget is low but the desire for low-environmental footprint is high, then the issue of size must be seriously addressed. Fortunately Jodie did not need convincing of this argument at all and a small home was all she needed, as long as there was light and a place for everything.

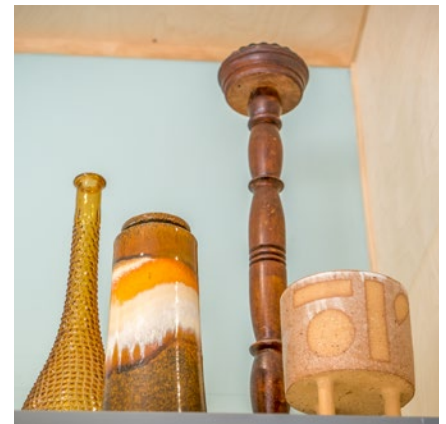
The first challenge was to site the home within the confines of the 552m² residential lot. Once statutory street and side setbacks, the need for privacy and being far enough away from anything which might overshadow you, and the Building Regulation requirement for having two onsite car parking spaces are

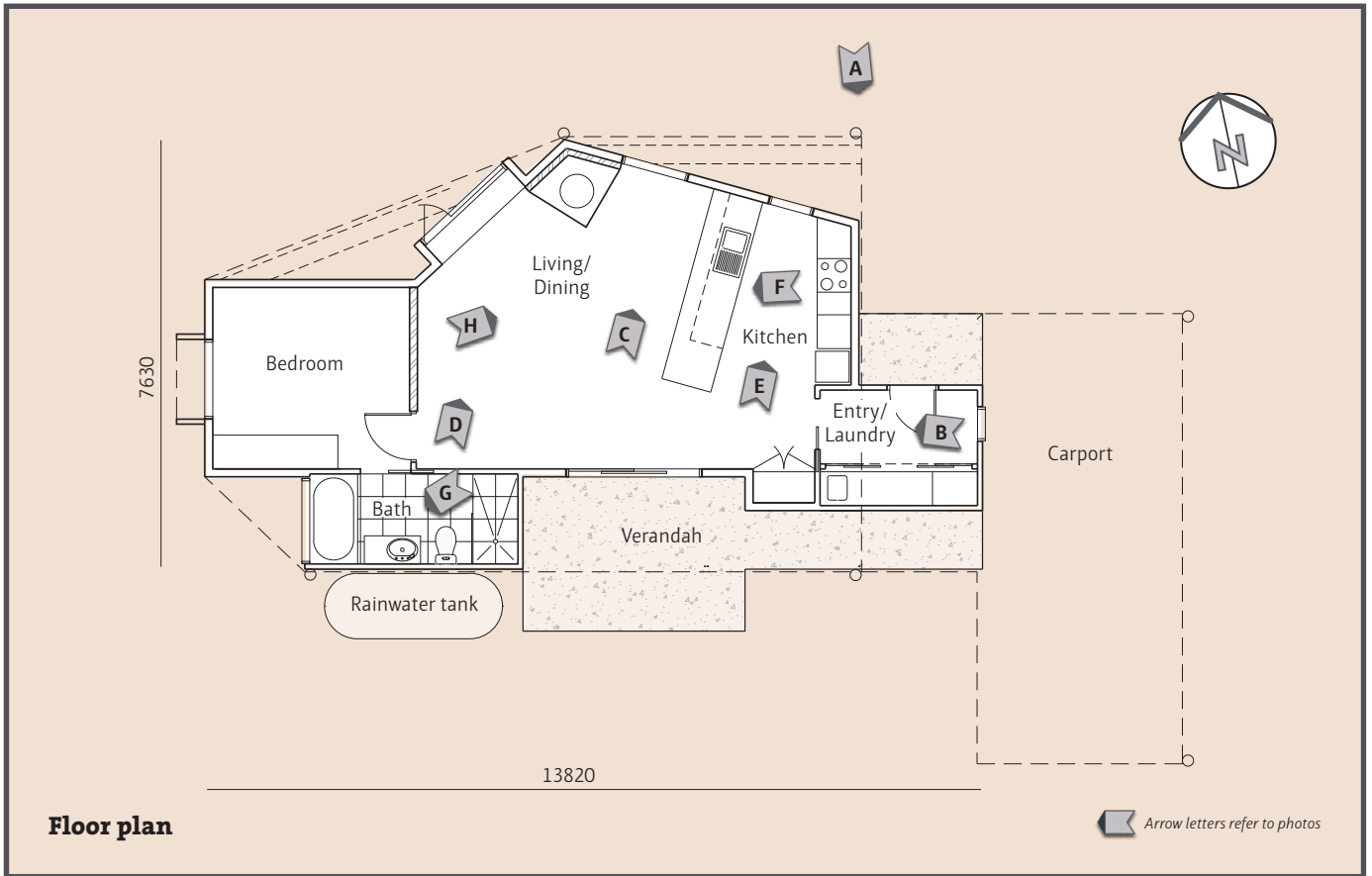
considered, it doesn't leave space for a big house anyway. However, there is nothing to say your house has to be square and align with the street. I am more interested in aligning with solar north, and so we literally used the minimum and maximum street setbacks to allow some angles to occur that would facilitate desirable solar gain. We could get a decent sized north facing window to the living area that faces the side boundary, and so retain a sense of privacy even with the blinds open. We still had room for a usable sized open area to the rear of the home where you could sit in the shade of the house in summer and have your edible garden in the sun throughout the year. There is space for a water tank and room on the roof for photovoltaics. Land is expensive; and Jodie wanted to use every square metre to be productive and not just to drain finite resources from the grid. Self-sufficiency is – and will be – key to our quality of life into the future.

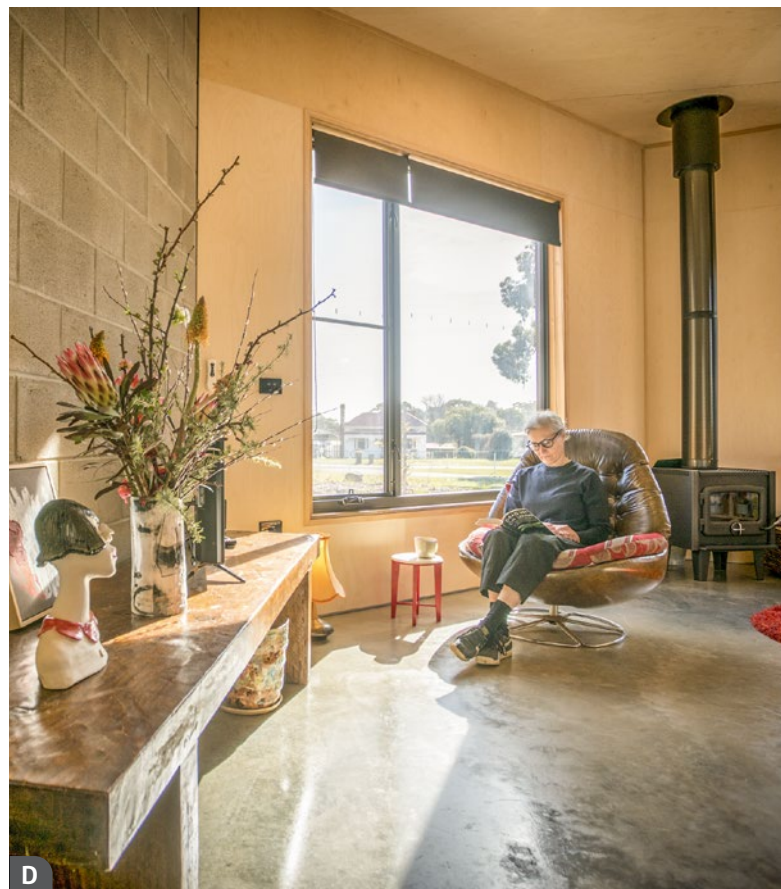
One of the problems with large homes is that the more rooms you have, the more circulation space you need. In a typical floor plan this usually means passageways and dead space that you are paying for by the square metre, resulting in segregation of rooms away from the efficiency of a central heat source. We arrived at a floor plan totalling 65m² consisting of one bedroom, bathroom, laundry and kitchen/dining/living area. There is not one single metre of passage, instead circulation to all rooms of the house is simply through the open plan living space in the centre of the home.

The laundry triples as a mudroom and an entry airlock. Yes, the front door opens directly into the laundry. Why waste space by having a room which serves as an entrance foyer only? Don't worry, the laundry is beautiful and in time your guests arriving at your home will just get over it. You will appreciate the fact that precious warm air is not escaping every time someone opens the front door.

The ethos of *everything you need and nothing you don't* definitely rings true here. There is a space for everything to be put away or left on display without interrupting the smooth passage of movement throughout. But did this come at the cost of simply not being able to fit all the material possessions that one might expect to accumulate over a lifetime? Possibly, but Jodie didn't mind at all. In fact I believe she had already resolved to reduce her life down to the essentials that would bring her day to day joy without cluttering her life.







The building fabric

Jodie was to build her home hands-on with the help of her father, a retired engineer. As such he had some input into the construction method that would suit his experience. We decided on a 140mm stud frame, which would allow for R4.0 insulation batts. The laundry airlock is constructed of conventional 90mm studs with R2.5 batts as a cost saving measure. The roof is asymmetrical pitched trusses with 3m flat ceilings. There are R6.0 batts to the ceiling and a vapour permeable membrane wrapped and taped around the shell. Simple and conventional, with the exception that the roof space is permanently ventilated to draw moist air out of the roof space and provide some cooling in summer (see Passive Roof Ventilation at end).

As is becoming more common practice these days, a ventilated cavity between the building wrap and the cladding was created. This is to allow any moisture vapour which passes through the wall from the inside to condensate on the external surface of the wall membrane and to either drain down the cavity or

evaporate with moving air. It also aids durability of your cladding by not having the rear of it in contact with hidden moisture. If you are using a vertical cladding which requires a horizontal batten fixing system, please make sure you still have a continuous vertical air gap by using vertical counter battens against the stud wall first, or at least leave gaps in your horizontal battens.

Material choices

Jodie chose a simple dark corrugated metal cladding to the walls and roof for low maintenance, with a number of structural timber posts contrasting in an oil finish. The rather unassuming street presence conceals an unexpected rich and colourful interior.

Contrary to popular belief, it is not mandatory to have white plasterboard anywhere in your house. In this case there was some moisture resistant plasterboard used in the bathroom to comply with waterproofing requirements but everywhere else Jodie has used a mid-grade plywood that is simply surface fixed with sheets abutted. If your wall

linings are perfect and straight and untextured in your new home, you will inevitably notice when they crack and get scuffed up from the activities of life. In this case the walls are perfectly imperfect from the outset. Coloured plywood joinery is a nice natural looking alternative to the more commonly used materials. The floor finish is simply burnished concrete with a seal. Durable, textured, and affordable.

Double-glazed windows were used throughout; they don't have to be super expensive but are a must-have in any new building these days. An untreated concrete blockwork wall provides separation between the bedroom and living room; the morning sun strikes this thermal mass wall directly to store slow-release heat throughout the day. There is a small wood heater for ambience and a suitably sized reverse-cycle airconditioner, and one or the other is more than enough to keep every room in this home cosy warm throughout the frigid days and nights of Central Victoria. Together with a heat pump hot water system, the house is all electric with the power demand offset by grid-connected solar.



E



F



G

'A home for me'

Honestly there is no high-tech or overly complicated design or construction method used here. A compact house with good orientation and some attention to detail when sealing up the home will get you 80% of the way to producing an energy efficient home. The other 20% comes from higher quality windows and doors, efficient appliances, and how you actively operate the home to get the best out of it for varying weather conditions.

Jodie summarises, 'I built a home for me that ticks all the boxes. It's comfortable, energy efficient and is easy to keep clean and maintain inside and out. My home is my sanctuary and a place that I can't wait to get back to everyday.' And the final cost? Jodie admitted that she did have to spend substantially more than her original budget, which was partially to allow for the higher quality products and finishes that she wanted, and the final bill was \$170,000. Jodie is still overjoyed that she got a high quality home for that price with a minimal environmental footprint that will not cost a lot to run. And this is of benefit to her and all those that will live to enjoy the home for generations to come. ♦

Matthew Turner is the principal of Enduring Domain Architecture, allowing him to indulge his expertise and passion for environmentally sustainable building projects, alternative building methods and traditional vernacular design.

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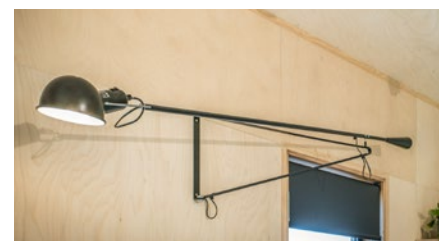
www.enduringdomain.com.au

◆ YouTube

Further video and explanation of the home can be found on the Enduring Domain Architecture YouTube channel.

www.youtube.com

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Budget vs. Cost

Owner builder Jodie

Going into this project I had a dream and that was to build a simple off-grid home and live as sustainably as possible. Once I purchased my block of land in the town of Beaufort, my dream of living off-grid was gone as I had to connect to services.

I had no idea of the cost of materials, let alone how to build a house. I was completely naive when I walked into Matt's office and told him what I wanted; he must have thought I was mad, and in hindsight, I was. Engaging Matt's services was an expense as I could have designed a simple rectangular shaped home and had a draughtsman draw it up. But I wanted something special, and I got that in what Matt designed. Building and council permits were expensive too.

The joinery was the most expensive item in the build; they also supplied the birch ply internal walls and ceiling, as well as mirrors and the glass shower screen at around \$37,000. Other big expenses were the slab and concrete around the perimeter of the house and driveway at \$35,000. Wall and roof trusses were \$9000. The roof was installed by a local company, that was \$12,000.

So I was already over my budget of \$90,000 and I still needed insulation, plumbing, electricity, lighting, fans, tiles and tiler, paint and seals, a shed, wood heater, airconditioning, white goods, heat pump, fencing, landscaping, tanks and solar panels, hence the larger price tag. I used as many local trades as I could (timber walls/roof trusses, joinery, some local builder help, roofing, slab and external concreting, plumber and electrician). I enlisted the help and expertise of trades which preserved my energy and gave me the time and rest I needed to finish the house in a year. Without the help of my dad, who was tireless in his knowledge and hands-on workmanship, the cost of this build would've been at least \$30,000 more.

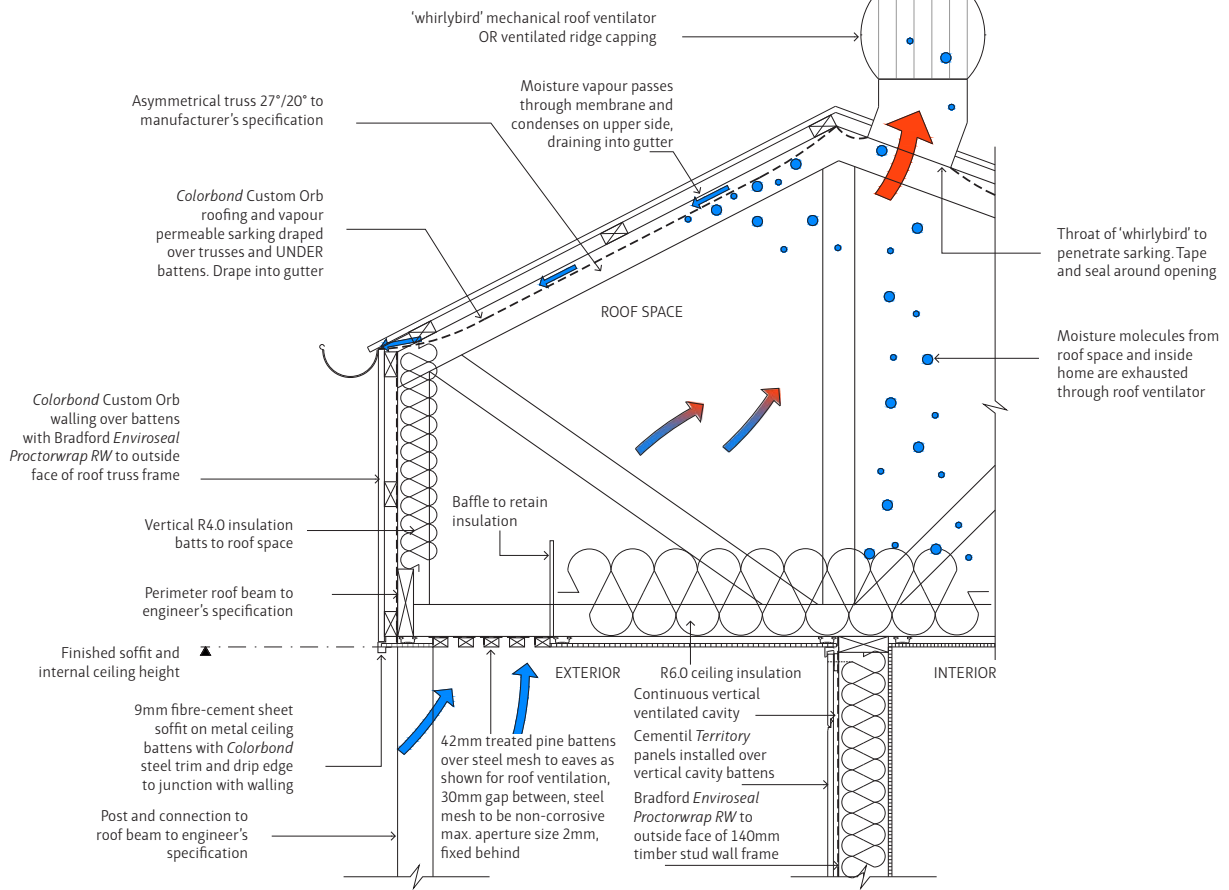
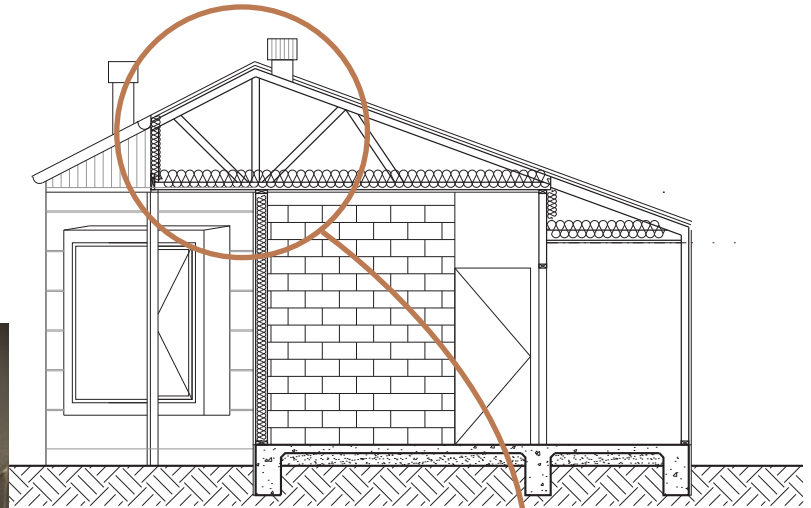
I also didn't want to compromise on quality versus budget on items. Everything from white goods to the sinks, toilet and bath were all high quality products that did cost more. The final cost could've been significantly less had I chosen lower quality products and finishes. Although I didn't get a house built for my \$90,000 budget and have had to compromise a lot along the way, I did build a beautiful comfortable home for myself that ticks most, if not all, the boxes.

Would I do it again? Yes, I would, but next time it will be a small rectangular home and it will be off-grid.

Architect Matt

The initial budget of \$90,000 was very small. You couldn't even get a basic prefabricated module on the back of a truck for that much. So just because somebody has a desired budget doesn't mean that it's possible to get what they want for that. The smaller the house the higher the cost per square metre, because every home will have a kitchen, bathroom and laundry and these are the expensive items. Adding more bedrooms and living spaces are considerably cheaper per square metre, so a bigger house will work out cheaper per square metre overall.

Generally when calculating the cost per square metre of a home, only the build aspects are included and not things like solar panels, water tanks, connections to services, architectural fees, council applications, building permits and insurances. In this case, at a final cost of \$170,000 including all these items, the cost was \$2,600 per square metre. Recent homes I have had priced are around \$3000 per square metre, excluding any of those 'extra' items.



Ventilation detail

DIAGRAMS: MATT TURNER, ENDURING DOMAIN ARCHITECTURE

Passive roof ventilation

Whether to ventilate a roof or not has been a topic of debate in recent years, where there has been more emphasis on the importance of airtightness in a home but also the awareness of condensation and how to mitigate it. Why should you ventilate your roof year-round in the context of a home which does not aim to achieve ultra-low-airtightness such as in a Passive House? The construction detail shown here relates to Jodie's house specifically, but I would also use a similar roof ventilation method with any design that uses an unconditioned roof space where the insulation is placed at the ceiling level, not the roof level.

Why ventilate

In summer, anyone who has ever climbed up into their roof space knows that it can be much hotter than the air temperature outside. As up to 35% of radiant heat gain through your building fabric passes through the roof, having a release for this hot air to escape your roof space – rather than letting it build up – will relieve the pressure on your ceiling insulation. Insulation resists the flow of heat but doesn't stop it. The conventional use of foil sarking draped over the roof battens doesn't help matters, as it simply reflects heat down towards your ceiling insulation and makes the inside of your house hotter.

Throughout the year moisture vapour is created and released into our homes, through occupant activities and exhaling. An average household of four people can generate as much as 20 litres of moisture per day. So where does this go? The aforementioned foil sarking and wall-wrap, which have absolutely dominated modern construction practice in Australia, while possibly doing a good job of keeping external water sources out of our buildings and preventing ignition of invasive burning embers, also does a very good job of keeping all the internally generated moisture in. Timber frames and wall linings, soft furnishings and carpets all absorb this moisture and eventually form mould and cause rot. Not good for structural integrity and not good for human health.

Moisture control

So, you're not looking to build an airtight Passive House with a mechanical ventilation system. You are just wanting a home that can be simply constructed without reliance on technology, keeping your structure dry and air healthy in the old-fashioned 'passive' sense.

Firstly, wrap your walls and roof in a vapour permeable membrane. This is a sturdy fabric akin to *Gore-Tex* which has been used in the outdoor clothing industry for many years. On the outside it is waterproof, but from the inside your excess moisture vapour can pass through. Secondly, there must be a free drainage cavity immediately adjacent to the external surface of the membrane. This is where moisture vapour will condense once it has passed through the fabric and hits the cooler air. Your wall cladding should be fixed over vertical battens that are in turn fixed over the membrane. Moisture can then freely run down this cavity you have created and out the bottom of the wall, which is sitting proud of your floor line. If you want to use a vertical board cladding and need horizontal battens to fix to, consider using some kind of spacer to bring those battens proud of the membrane, or use a vertical counter batten – effectively a double layer of battens. Cumbersome perhaps, but this moisture must be allowed to drain or evaporate with moving air in this cavity.

Now onto the roof. Controversially perhaps, insulation manufacturers like *Bradford Insulation* have issued roof sarking installation guidelines that have the permeable sarking draped over the roof trusses and not over the battens. This is to prevent any ponding of condensate in the low point of the drapes which can get trapped there, particularly if you have a low roof pitch. There should not be any low points in the membrane from ridge to gutter, and it should drape into the gutter and expel the moisture safely away from your structure.

Common wall linings are fairly vapour permeable and so internal moisture vapour can passively pass through into your frame but it needs to get out.

Roof ventilation methods

Once moisture has passed into your roof space this is where it needs a little help to get out. Whirlybird roof ventilators are fairly common on sheds but they can also be used on residential buildings. When positioned at the highest point of your roof, just under the ridge on a pitched roof, they provide a simple way to draw moist warm air out of your roof space. Ventilated ridge cap products can also be used in lieu of whirlybirds and work well with a simple pitched roof with a ridge. For a skillion shaped roof the whirlybird is probably a better option if it is installed at the high end of the roof, but you need to make sure you install enough to do the job.

However, in order for air to be exhausted out, there needs to be free air intake and this should be provided at the lowest level of your roof space. Under the eaves or soffit is an ideal location for this. A larger area of ventilation at the eaves than at the ridge will slightly pressurise the roof space and avoid sucking your airconditioned internal air out through the ceiling.

I like to use timber battens as an eave lining, with a metal mesh behind to prevent vermin or burning ember entry. This not only looks more aesthetically appealing than the standard cement sheet but also pays homage to the many grand heritage buildings that used this same method. In a roof design where there is no eave overhang I have also spaced a fascia board 5mm away from the cladding line to allow a small gap into the roof space. This can be done the entire length of the roof for a discrete yet adequate intake of fresh air.

If you would like further technical information on roof ventilation for different climate zones and different roof structure types, I highly recommend that you refer to the publications of Joseph Lstiburek (www.buildingscience.com) on this subject, as I have done for this brief overview. ♦



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Earth cottage

Completed for under \$5000

BY FAITH GOULD

It seems anti-climactic to open an article about such a fun and successful project with a disclaimer but some context is important. This project was an experiment with all participants first time earth builders. It was not intended to be an earth building until the project was well under way, so considerations such as eaves were not made with earth walls in mind (and we have solutions for that). That being said, what a great project this turned out to be.





Road to recovery

This tiny 10m² house build was conceived in late 2018. The owner builder (and my brother), Rolf, suffers from an auto-immune disorder which seems to be exacerbated by city living. Moving away from the city was identified as a critical step towards recovery and fortunately he was able to build on rural family land. Having worked on many building sites over the years, Rolf had the skills to knock together a timber frame himself but incapacity due to illness led to the decision to order the frame from a local builder. It ended up being the greatest expense but certainly sped up the process. There is a mezzanine bed platform so the internal floor area is approximately 16m².

As is the case with many projects, work was done as finances became available. Several options for cladding were considered but the decision to proceed with cob earth infill wasn't made until after the timber frame was up and several family members offered to help with the project. The decision was driven in part by cost but the non-toxic nature of earth had a huge impact on the decision.

Timber framing

The timber frame was secured to a concrete block with rebar footing wall. The roof was erected and then experiments with local clay began. Initially the cob mixture was made by hand (well, foot actually) with the use of tarps, but the first batches suffered from excessive shrinkage and a little cracking suggesting not enough aggregate. It was very difficult to those uninitiated to work enough straw into the mixture by hand, but the farm was about to acquire a tractor with a rotary hoe that had been previously used to make adobe bricks. Once this arrived, progress was fast.

The sections of timber frame were interwoven with manuka wattle and the new batches of cob were infilled. These were left a few weeks to see how it all held together. There was still a little more shrinkage than ideal so the mixture changed over time improving with each mix. The bottom two thirds of the walls were filled with cob but there were concerns about the effect of the weight of cob going all the way up timber-framed walls that had not been designed for

Clockwise from above left: One can help even with a sleeping baby. Appropriately the swallows made themselves at home. The first layer of light adobe; very fast progress and pleasant to work with.

Previous page: It was lovely having children on site, but hard to keep them from scaling the building using the wattle.

earth. It was decided to use leichlem (straw coated in clay slip and compacted between temporary shutters – also called kram, light adobe, light straw clay) for the upper third of the wall. With the cob thermal mass on the bottom, where there is maximum sun exposure and thermal insulation to keep the heat in as it rises, it seemed like an elegant solution.

Safe building site

The project became something of an obsession for all those involved including Rolf's two nieces and nephew, all under five years old! It is wonderful to work on such a safe building site that preschoolers can be involved and participate, enabling more adults to be involved.

The process speeded up as everyone became more confident in the mixing and more efficient in the setting up process (clay slip is best made way ahead of time and left to soak, and installing guttering on the roof for onsite water should have been done sooner – we live and learn). Each person established their preferred technique of placing the cob; it is quite easy to tell who is responsible for which section of cob. The cob walls were left over winter to dry and the patches of shrinkage were then filled in.

The house has stood up to two wet winters, the cob walls have suffered surface degradation only requiring a broom to brush off a dusting of clay and a few small lumps. Despite being unfinished this building has been the warmest place in winter and the coolest place in summer.

Last spring we invited some friends over to help with the internal plastering and this past summer we decided to finish the outside lime plaster so that Rolf could (finally!) cover over his front patio area doubling his amount of living space before winter. Stephen Moller from Limewave came to run the workshop and we had a full house. The one day workshop opened with lectures on chemistry and the history of lime and its uses. By 5pm the first coat of plaster was complete and the second coat half done. What an achievement!

Invaluable resources

The first time I met Graeme North I asked if he could recommend a good book on earth building. He recommended *Building With Cob* (by Adam Weismann and Katy Bryce); I bought it straight away and it has been our most used resource. *The Hand-Sculpted House* (by Ianto Evans, Michael G. Smith and Linda Smiley) was recommended to me many times by various people and has also been invaluable. We cannot recommend these two books more highly, they were our bibles for this project. I much prefer a few good books over the screed of information one is exposed to online.

This page, top to bottom: Stage one completed. Stephen Moller from Limewave ran the workshop, with a full house for the one-day session. Stephen demonstrates before letting the group have a go.





Start small

I have been told many times by earth builders to start a small building project first to get a feel for the materials. This was good advice. There were plenty of lessons during this process but no major mistakes, earth is a very forgiving material and it only takes practice. It also takes time to build up the necessary supply of buckets, barrels, mixers, trowels and so on. Enthusiastic earth builders were also very generous with time and energy guiding us.

My husband and I are grateful that Rolf was willing to let us experiment, we've gained so much knowledge (and equipment!) and know that our next building, a 30m² studio, will be faster to build and with a much nicer finish. ♦

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Above left and left : First coat half way completed on south east corner. These two books are invaluable resources.

Below and opposite: Completed first coat, thanks to the enthusiasm and generous help of participants in the workshop.

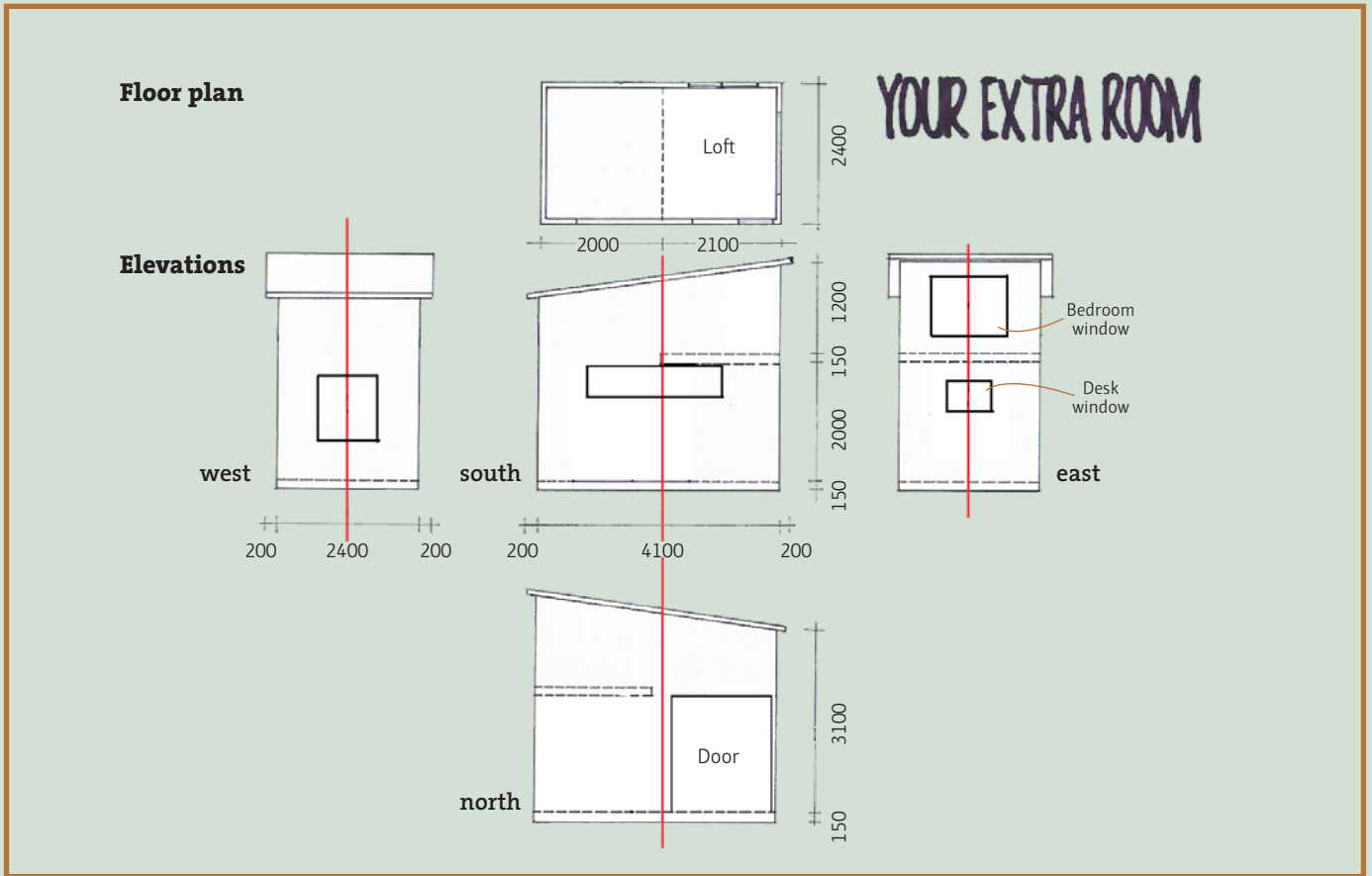
Budget breakdown

Having a good trailer was a boon, it enabled so much scavenging. Joinery was all second-hand and needed sanding and painting; sanding takes time and the paint was acquired second-hand from the local rubbish tip shop. An entire pallet of weathered Douglas fir tongue and groove floorboards were used for the mezzanine.

Below is a summary of costs:

Timber frame	\$2950
Concrete blocks	\$50
Concrete and rebar	\$400
Roofing/roofing paper	\$300
(paper was left over from another project)	
Joinery	\$100
Paint for joinery	\$20
Straw	\$120
Aggregate	\$80
Douglas fir floorboards	\$30
(only used half)	
Lime plaster	\$300
(workshop fees covered the material costs)	
TOTAL	\$4350







Hempcrete house survives Black Summer fires

BY KIRSTIE WULF

A tense summer of bushfires faced those living up and down the east coast of Australia in 2019/2020 and it all came to a head for Nicole on the NSW South Coast on 31 December 2019, when a southerly wind change was predicted. This wind would change the direction of the fires she could see on the ridge, that up until then had been fanned by a westerly. The southerly would bring the fire toward her home. Nicole had some previous RFS training and had been preparing her property for fire for some weeks, but direct confrontation with fire would put

her limited firefighting knowledge to the test and her home depended on it. However, she had the reassurance that her home was made from hempcrete.

Best material for the project

Hempcrete is non-flammable and fire resistant. There are many videos on the internet showing blow torches being put up to hemp blocks and walls. Not wanting to believe everything you see I tried it out myself and held a blowtorch up to an unrendered hempcrete block, only

stopping the test because I did not want to run out of gas in the blowtorch. The top layer of the hempcrete directly in front of the blowtorch charred, but the hempcrete did not ignite and did not spread the flame. The great insulation properties of hempcrete came to the fore as you could put your hand behind the hempcrete block with the blowtorch on it and it did not even feel hot.

Fire resistance was one of the reasons that Nicole chose to build with hempcrete, but it was not the only reason. Nicole's interest in biodynamic

food production extended beyond food to building methods and materials and an interest in leading a more environmentally sustainable life. She had heard about natural building and was attracted to using natural materials. As she was only building a small house, the extra thick walls that straw bale creates wasn't suitable. With cob she was concerned about how heavy the materials were, as she was planning to carry out the build herself.

Nicole saw an article in *The Owner Builder* magazine about hempcrete and was attracted to it because it provided a vapour permeable wall, good insulation and performed thermally efficiently, was termite resistant, lightweight, easy to build with and, of course, fire resistant too. In 2011 when Nicole first started her hempcrete journey, hempcrete was new to Australia and not widely known. As a first step Nicole contacted Klara Marosszeky from The Australian Hemp Masonry Company, followed by her own research to satisfy herself that hempcrete was the best material for her project.

A hempcrete pioneer, Nicole was building the first hempcrete house in her local council area. A gutsy woman with a 'can do' attitude, she looked at what was involved in being an owner builder and thought 'I can do that'. She was good at maths and science as a student and took from that the capacity to look at problems and think through them logically. This enabled her to approach the build with the creativity of an artist and the thoroughness of an engineer.

Simple rectangular plan

The design of her house was simple to make building easier and keep costs down. But her flair for design came out in the choice of large recycled wharf timbers, which feature strongly in the house. The first drawings were done by Nicole using Photoshop, then she worked with retired local builder, Noel, to develop the plans. Initially, Nicole was looking at building a tiny house, but eventually settled on a 9.5x7.5m rectangular plan with steeply pitched roof housing extra space upstairs.

The walls are 300mm thick for extra insulation, as the area is several kilometres inland from the coast and has extremes of temperature from -6°C with severe frost in winter to scorching 40°C days in summer. The property gets the hot westerly wind in summer but no sea breeze. The house is designed on solar passive principals to get the winter sun through the large north facing windows. Having lived there now for over five years Nicole describes it as extremely efficient and the perfect winter house, the house gets full sun inside in winter, warming up the concrete floor, with the small fire box only needing to be used at night if it has been cloudy during the day. In her assessment, the house could be a little cooler in summer, even though she put in the maximum ceiling insulation she could fit. Grapes grow over a pergola to the north to provide shade, but she reflects that the airflow from the south could have been better. The house

functions well in summer if it cools down at night, but even on those hot nights she has found that the upstairs fans offer sufficient cooling.

Planning for the build went through in 2011 and building commenced in 2012. Despite it being the first hemp house in her council area, she had no problems getting approval and found the council were enthusiastic about the sustainable elements of the build and happy to look at alternative building materials.

Learning on the job

It was early days for the hemp building industry in Australia when Nicole started her build and, being on the far south coast of New South Wales, she had not had the opportunity to attend a hempcrete workshop. Instead she learned on a hempcrete chook shed and spend a few days helping me with my build at Culburra Beach. When she started, Nicole had no idea how long the build would take. A common experience for the first time owner builder, she had nothing to compare it to. She really enjoyed doing the hempcrete walls but it took her longer than she had expected. Work on the project was intermittent with breaks for her to work and save more money.

Below L-R: Learning took place on a hempcrete chook shed and helping on another build. Keeping the plan to a simple rectangular shape made for an easier owner-build project.



PHOTO: NICOLE



The structural timber frame in the hemp walls was offset from the centre as she wanted deep window reveals on the inside. This created some issues when trying to get screws from the local hardware long enough to attach the formwork, which was OSB (oriented strand board) recycled from packing crates. Her creative solution was to attach blocks of wood to the frame to which she could attach the screws. Instead of using spacers between the frame and formwork, she measured a base distance for the formwork and installed the rest by just using a vertical level.

With hempcrete being so new at the time of her build an error was made by following the recommendations of her engineer to use sheet bracing;

in retrospect, diagonal steel strapping would have been better, even if extra was needed to meet the requirements of the site's high wind rating. Hempcrete usually keys into itself around both sides of the timber frame and thereby holds itself in place, a large sheet of plywood gets in the way of this and separates the hempcrete into two sides. To prevent the possible delamination of these two sides of the hempcrete wall, Nicole solved the problem by drilling some large holes in the ply bracing that would allow the hempcrete to attach back to itself but not compromise the bracing strength of the ply. She also attached some wedge shaped blocks of wood to the ply to allow the hempcrete to fill in behind them and hold the hempcrete to the wall. These

solutions to this issue have stood the test of time with the walls still in good condition five years later.

The gable ends of Nicole's house are two-storey and on the east side almost three-storey. For this reason, large sheets of formwork were put up the full height of the wall on the outside and 600mm rises were done on the inside, where it was easier to move the formwork up.

Clockwise from top left: Two-storey gable ends needed some formwork changes. Blocks of wood helped close the gap between formwork and frame. Boxing around openings for a neat finish. Large holes in the ply bracing along with timber wedges helped the hempcrete key properly.



Farmhouse aesthetic

The house uses recycled timber extensively. Most of this was sourced from Thor's Hammer in ACT, including the recycled timber floor, posts and beams. Nicole visited the timber yard and looked at stacks of timber from the dismantled CSR factory at Sydney Wharf. The posts, ridge beam, floor joists and decking are all hardwood. A crane was needed twice to install the large timbers, once to do the posts and another time to install the beams. The chunky exposed timber gives the house a great rustic farmhouse aesthetic. Unbeknown to most, two steel posts are hidden in the hempcrete walls, holding up the ridge beam.

The most laborious part of the build for Nicole was doing the plasterboard. By contrast she loved the rendering and did it all herself, with some help from friends, using a sand lime mix. The gently textured render and natural lime colour give the house a French feel.

Approaching fires

The house had been rated and built to BAL-19 on the north and east faces and BAL-29 on the south and west faces. The BAL rating is the Bushfire Attack Level and relates to the number of kilowatts of heat per square metre that the house is likely to be exposed to. Care had been taken to prevent any gaps and all exposed timber was hardwood.

It is hard to imagine having gone through the owner builder journey, loving the house that you have created and then being faced with its possible destruction. In December 2019 the fires which had been ravaging the east coast of Australia moved closer to Nicole's house. For about one month prior Nicole had been preparing her property, she cleared trees, kept the grass low and particularly mowed around the boundaries of the property. Nicole has sprinklers on the boundary and on the water tanks and she checked that the pump and sprinklers were working. The verandah was cleared of anything combustible.

For days Nicole watched as the fires moved closer and the winds changed the direction and speed of the fires. The morning the fires hit she could see them burning on the ridge that runs east/west just behind her home. The westerly wind direction at this time meant that the



fire swept across the ridge until it was directly south of her home at the time of the southerly wind change predicted. On 31 December 2019 the predicted southerly hit around midday, and winds up to 100km an hour brought the fire toward her property. Nicole's fire plan was to stay and defend the property; she knew that she had a good clear defensible space around the property and that she had the necessary pumps, hoses and personal protective equipment to defend.

The sky went from blue to red to black as the fire approached. Nicole describes it as a brief ember attack, the day turning to pitch black night in the thick smoke. She watched the flames snake down the ridge and race up the hill toward her

house. Then some light emerged as the approaching flame front illuminated the scene. The sprinklers were on and with protective goggles, mask and gloves Nicole held the line between the fire front and her house, halting the flames on the grass and nearby trees to further protect the water tanks and her house. She heard the neighbours plastic water tank crack and disgorge its contents before the flames engulfed their home; through the trees she could see fire take hold, the brick building eventually collapsing as the structure burnt out. Yet Nicole felt reassured with her back up plan of retreating into the house if she could not maintain the fire hose, as her house was made from hempcrete.

After the event

After about an hour of full-on firefighting the fire front passed. Her house was undamaged, not even any scorch marks on the render. Fruit trees less than 10 metres from her house were not burnt but scorched by the radiant heat and later died. Gum trees and cypress pines on the property had been burnt but all the buildings were undamaged.

The following day there was some rain, not enough to put out all the fires but enough to create a sludge from the ash. With the water from the roof smelling like sewage, the water pipes had to be diverted away from the tanks and the water tanks later cleaned.

Nicole's house survived because of good vegetation management, a defensible area around the buildings and well prepared bushfire defences. The fact that her house was built from non-combustible hempcrete and designed with bushfire risk in mind also helped. If she ever had to build again she would probably choose to build with hemp. ♦

Kirstie Wulf is a building designer (Shelter Building Design) specialising in hemp, natural building materials, Passive House and building in bushfire prone areas. She has documented her own build as well as other hemp builds around Australia. See TOB 197 Oct/Nov 2016 and TOB 198 Dec 2016/Jan 2017.

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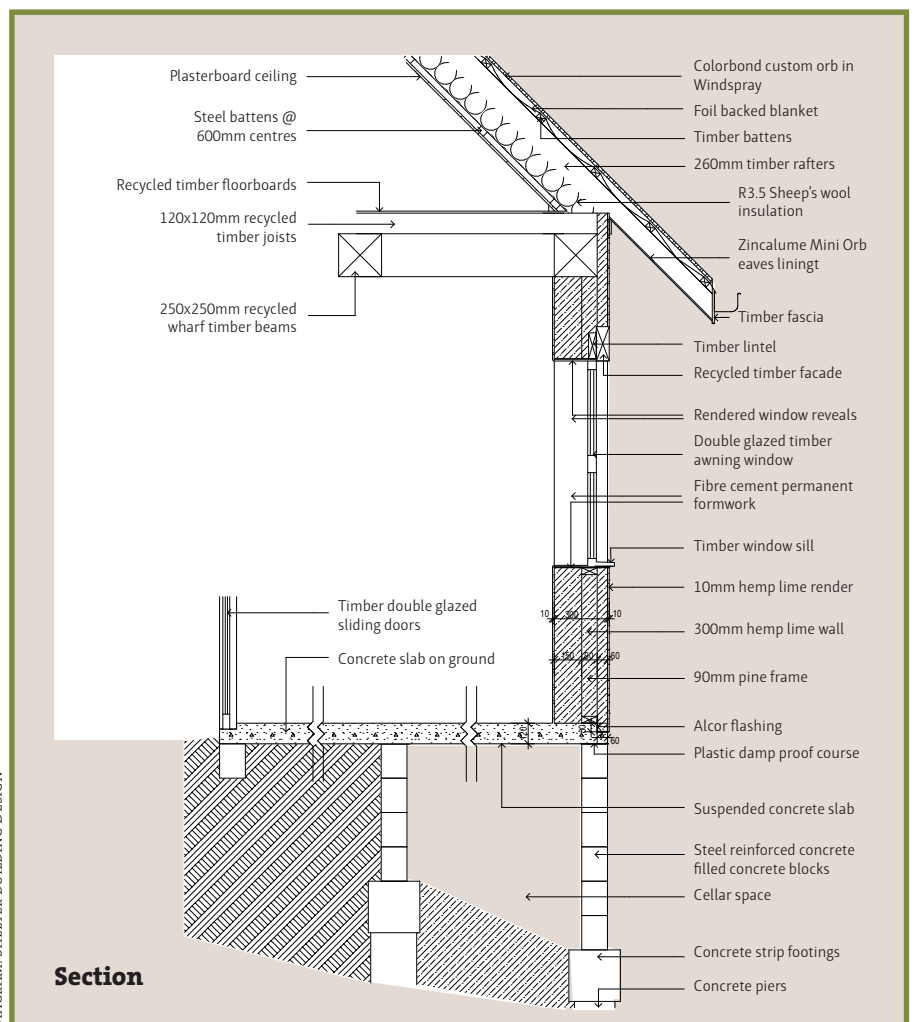


DIAGRAM: SHELTER BUILDING DESIGN

Section



PHOTO: NICOLE



PHOTO: NICOLE



PHOTO: NICOLE





The Bunker

More developments at Mankato, featured in TOB 217 March-May 2020.

BY DIRK KLYNSMITH

When we first went onto the block that was to eventually become our home Mankato, we did not see what the previous owners had installed into the ground. It was not till we met the real estate agent that we knew of the structure. It was terrible but I immediately knew what I was going to do with it. First, some history.

Bunker escape

The Bunker is a prefabricated structure that was dropped into a hole dug into the hill, consisting of a solid floor with walls bolted onto it, and rudimentary waterproofing (as we were to find out). The walls consisted of two 5-8mm concrete sheets sandwiching 80mm

thick foam. It initially had a whirlybird roof ventilator in the roof made of the same materials as the walls. There was one window and a doorway. According to the agent the 'room' was in case there was a bushfire.

My vision from the beginning was to turn it into a room to escape, relax, listen to music and have a quiet drink either with friends or by yourself. I wanted wooden walls to give sound a warm feeling (tone) and an outdoor entertainment area to provide shade from the hot sun or light rain, so it needed an old-style pergola with a vine growing over it, bit like the old Italian villas with tables under grapevines and the like.

Before I could start though, I had to open-up the front of the bunker; over a

period of six months I dug out an area 7m long by 3m wide and at the highest roughly 2m high, with nothing more than a pick, shovel and wheelbarrow. The soil removed went into the area where the fire pit was going to be built.

The verandah and paving were completed first, followed closely by the arbour and a grass tree. A neighbour gifted me a glass sliding door that he had removed from a house he was doing some work at, so it was out with a giant concrete cutter to create a hole in the wall for the door. As I was going to line the outside walls, the existing door was going to be sealed up so no issues there! I can advise that while the construction of this box was certainly shoddy it was some effort to cut the hole out for the doors.





Flood risk

The previous owners had left quite a bit of stuff in The Bunker, so a visit to the tip was necessary. Immediately we saw evidence that it had previously been flooded and so there were alarm bells ringing. We initially used the room as storage and when we received 900mm of rain in a couple of days and it got flooded again, there was an immediate alteration to the game plan.

As I had already built the verandah roof and the harbour area, it was obvious there was an issue with water getting in around the sides. To waterproof The Bunker, I had to dig out around the other three sides and remove many old tyres that had been used to retain the bank. I installed new plastic buffer and agricultural pipe, replaced some of the tyres and then used rocks to hide the tyres and retain the bank. To further help with the waterproofing and create the 'old' look, I sourced some old galvanised sheet and lined the outside walls. Initially I was going to line the walls with recycled timber but opted for the more rustic feel of old metal.

With the waterproofing completed it was time to start on the inside. I searched on various local marketplace sites and found some second-hand plywood; there was not enough so I had to purchase some new to finish the walls and thinner ply for the ceilings. I was able to do all the walling and some of the ceilings but had to recruit my wife, Wendy, to help with the rest.



It was time to install the electricals. During the house construction, we ran a feed to The Bunker so it was simply a matter of extending that inside. As I wanted an industrial look, I was going to run the cabling inside copper pipe. A quick discussion with my electrician about the amount of extra work that would be required to earth the copper piping soon put paid to that. So, it went into standard PVC electrical conduit that I painted to look like copper. Some second-hand fluorescent lights and an old bar heater completed the look, with some power points for the stereo, bar fridge and a fan for summer.

It was complete

BBQ area

As work continued, ideas evolved and the look I was after was coming to fruition, we came up with the idea to create a BBQ area. As some of the bank was still bare and we wanted to tidy it up, we decided to build a wall with a gateway and initially an arch. We wanted to give the area that 'secret garden' ambience. We found someone who had loads of pavers they wanted to get rid of, so we had our brick wall.

The wall had to do a few things. It had to retain the bank, create a defining area, look good and create somewhere to have the BBQ. I wanted it to be 900mm high, but we brought that down to 700mm and opted not to do the arch. The pillars went from 2100mm high to 1600mm and it all looks proportionally better, I feel.



Fundamentally The Bunker is now complete. I still need a second-hand turntable to go with the speakers and amp, as well as a CD player, and to hang some of my nature photos (and some motor racing images as well). The area between The Bunker and the firepit is going to be grassed and then more plants added around the garden. We have already used it for entertaining and it has been quite a hit.

By using as much recycled material as possible and doing all the work myself, except the final connections to the electrical, The Bunker has cost me less than \$1000. The most expensive 'item' was the electrician, bless his soul! ♦

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Reader feedback...

Thermal mass feedback

BY ALAN BURDON AND FIONA KOTVOJS (EDITED TO FIT)

The contesting commentary on thermal mass in the **earthbuilding** section of *TOB 221 March-May 2021*, engaged in by Es Tresidder *How much does mass matter?* and Peter Olorenshaw *Mass matters a lot!*, made for interesting reading. Each approached this subject in very different ways; however, we feel that neither of them offered a full appreciation of the truly subjective nature of home heating and the comfort derived from it.

Lived experience

In our two-story home at Kurrajong Hill, as featured in *TOB 181 February/March 2014*, thermal mass comes in the form of a north wall of 300mm rammed earth, a central east-west wall of the same material and, built against this central wall, the 3 tonnes of our masonry heater.

The remaining walls are of straw bale with internal clay and external lime render. The floors are suspended timber, with a concrete floor in a sunroom on the northern elevation. All of this would have resulted in a perfectly insulated house with good passive qualities, but the other point about house design is that there is always the need for compromise.

We did not seek to build our house to the particular requirements of the PassivHaus standards. Our western view to the Southern Ranges is a stunner, with endless folds of trees and hills; the western wall is substantially of glass so that this view can be enjoyed. Despite double low-E glass, it still needs double roller blinds to shut out the blast of heat from a setting sun on a hot summer's day.

On winter evenings we are never cold, nor through the night and the next day, all due to the thermal mass of our masonry heater. Readers of *TOB* may

recall my articles on this wonderful setup. Briefly, for those not familiar with this phenomenon, a masonry heater burns a full load of wood fast and very hot for a couple of hours. Rather than releasing much of the heat out of the flue into the atmosphere, it circulates it in 4 metres of channels before it reaches the flue, the heat being absorbed into the masonry thermal mass before gently radiating outwards for the next 24 hours or more. One fire a day keeps our home at a comfortable temperature in the low 20s, with minimal labour, reduced fuel use and with very low emissions.

The rammed earth wall comes into play, as we used it as the back face of our heater. This slows the warming up slightly on that face, but once that area of the wall in the room behind reaches the 40+ degrees which it will typically get to, it stays warm for a very long time – all due to its capacity to store the heat. Thermal mass in action.

Australian situation

Beyond these functional issues are those of comfort. The thermal mass of our walls and the use of our masonry heater makes us feel very comfortable. The key is not just the gentle radiant heat, like a rock heated by the desert sun giving its warmth in the night, it is the constancy of its emission. The high thermal mass of the heater and the internal wall gives great stability to the temperature, and that too feeds into comfort levels. Indeed, such is its ability to store heat, we don't need to burn it every day, frequently going several days before the temperature drops to the point where we are inspired to fire it up again. A lightweight house would need heating every day.

An Australian summer brings thermal mass even more to the fore, as Peter illustrated. If we take a daily temperature range of say 15 to 35 degrees, heat will be transmitted inwards through the surfaces of a house for much of the period. There may also be direct solar gain through windows. What happens if that heat gain raises the lightweight house above the desired internal temperature? It has nowhere to go and the house will require energy to be expended in cooling it down. Even well insulated homes may eventually exceed the desired temperature.

The house with high thermal mass will warm more slowly; heat will be stored within its mass, ameliorating the temperature gain. As the day cools, that heat is released to keep the home warm, while the owner of the lightweight home is firing up the heating system.

This is how our home works, with a temperature which remains comfortably within narrow limits over long periods, irrespective of outside temperature fluctuations.

Positive benefits

The clearest example of the stability of thermal mass is found in nature. Anyone who goes deep into a cave experiences a constant temperature. I wouldn't want to try to heat one up, but a blazing fire would give comfort through radiant heat. Perhaps the Stone Age wasn't so bad after all. Give me thermal mass every time. ♦

Alan and Fiona's build featured in issues TOB 177, 181, 202 and 207. They now operate Heavenly Heat, through which they import and sell fully modular masonry heaters.

www.heavenlyheat.com.au



Waterfall house

BY LAURA BONAFOUX

Myself and my partner Simon Brain are a carpenter and builder respectively, who love modern architecture and travel. We had only recently moved to Sydney from Bangkok and were toying with the idea of buying a house or some land when we found ourselves staring up at a 15 metre waterfall, on a vacant block of land on the Central Coast, NSW. We couldn't help but wonder, 'How was it possible that this block of land existed and was actually for sale?' In the middle of a residential street but thick with trees and undergrowth, the waterfall at the back landed in a small pool and fed a stream that flowed through the centre

of the block. We couldn't believe how beautiful and untouched it was. That was it; we scrambled to get our finances in order and put in an offer (before we actually had our finances in order).

Modern minimalist

When the block was ours, we set about reviewing the very basic Development Application (DA) plans that had come with the block. It looked like they had been drawn by someone who had never visited the site and were purely just an outline to get a DA approved for sale. We worked with the council to amend them to something more of our own design

while keeping the footprint more or less the same to avoid having to obtain a new DA. We produced all the new plans ourselves using free software like *Sketchup*. The Central Coast Council were a pleasure to deal with; they were more than happy to take our basic plans and even walk us through exactly what was required in each drawing.

Naturally being carpenters, the first thing we did was change as much of the structure to timber framing as possible. Then we worked on designing a roof shape and gutter system to give the house a modern minimalist look, settling on a butterfly shape roof with a

box gutter through the centre. Despite common fears of box gutters, the key to our peace of mind was designing an oversized gutter with overflow points lower than the roof height at each end to ensure water can never flow into the roof space. Our box gutter ended up being 600mm wide and running the full 16.4m length of the house, meaning that from the front and back there are no gutters or downpipes on show, this was hugely important to us for the look of the house.

Internally, the most important room in the house to us was the ensuite, strategically placed with the best view of the waterfall. We choose to have a bath with a large window looking out to the waterfall that is only metres away. The landscape inspired us to incorporate an element of Japanese design and line the ceiling and shower floor with hardwood battens. We started our planning with the idea for our dream ensuite and worked out from there, taking advantage of the views of the waterfall out back and the views over the bay out front in as many places as possible.

We designed a large open kitchen, living and dining area, where we wanted

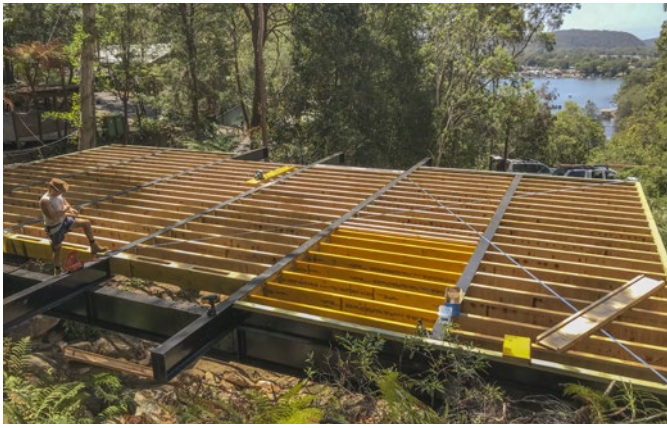
to create a seamless transition between outside and inside. We opted for 5m sliding doors on either side of the living area, each leading onto a deck so that in summer we could bring the outside and inside spaces together and make the dramatic view of the waterfall feel even closer while allowing a cool breeze to travel through the house.

The build process

The only way to build without disturbing the natural water course

and avoid the flood zone was to build a bridge-like structure. We drilled three metres down to rock and used pier liners to form up four huge concrete piers, two either side of the stream. These would be our only connection points to the land. We topped the piers with two 16.4m long, 610mm high steel I-beams that look like they'd be more at home on Sydney Harbour Bridge than a residential project. With the crane at full reach and one of us guiding either end of the beam, it made for one of the most nerve-racking but exciting days of the build.





We had our bridge, on our pier footings, so we set about framing the floor, walls and roof. Day by day the two of us turned up, cranked the radio, put the tool belts on and set about building our dream home. Framing is always one of the most satisfying parts of a build, as you really get to see the design take shape. We were limited somewhat on our choices for the exterior but having already got the block reassessed and

downgraded from BAL 40 to BAL 27, we were happy to have more choices than we originally thought.

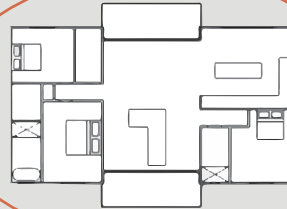
We wanted to keep a simple theme of concrete, Australian hardwoods and matt black throughout the outside and inside of the house. Based on this, we choose to use thin blackbutt battens as a feature on one side of the house externally and clear coated compressed cement sheeting on the rest.

Cladding was probably the most arduous task of the whole build, just dragging the sheets up the mudslide of a hill and into the house was hard enough. Then there was the nightmare of the two of us passing sheets between scaffolding levels, struggling to hold them in place while screwing them off, making slightly wrong cuts and having to pass the sheet back down and start again; we were exceedingly glad when it was done. This is an area I would probably get help with if building again, as two pairs of hands just weren't enough sometimes.

We designed a simple matt black kitchen, which was produced by a joiner friend and installed on site by us. One of the biggest tasks we undertook was pouring our concrete benchtops, both a design and a budget decision (costing a fraction of what a stone benchtop would have). We spent hours researching by watching *YouTube* videos and contacting concreters for advice, finding that everyone had their own method. We mixed and floated the concrete by hand, combining different ideas from our research; we knew that once the concrete dried, it was set in stone.

Size of block: 1003m²
 Internal floor area: 122m²
 External floor area: 21m²

Waterfall

Site plan



16400



9100



Floor plan

 Arrow letters refer to photos

Our own bare hands

Money was always going to be tight on this build and from day one we were both committed to doing as much of the work that we could ourselves. During the build we found ourselves turning our hand to tiling, concreting, roofing, floor sanding, installing our kitchen and pouring our own concrete benchtops. 'With our own bare hands' became the build motto, the longer it was just the two of us on site the more our determination grew to do it all yourselves, with the obvious exception of things like electrical and plumbing where we roped qualified mates and family in to help.

There's a huge sense of accomplishment from knowing every square inch of your house, knowing that every material lugged up the hill, every cut of timber and every screw is your own hard work. There is also a huge sense of responsibility knowing you will eternally notice any mistake or blunder you leave uncorrected, but we wouldn't change any of it for the world. Soon the build was our lives and to avoid the hour and the petrol spent driving to the site and back we started

'camping' on site as soon as we had sarking on the walls and a roof on. As the afternoons ended we would put down the power tools and pick up a paint brush or a broom and continue quiet tasks until after dark, then it was time to put the kettle on and eat some instant noodles for dinner. Despite how it sounds, it really is one of the most incredible experiences we've ever had.

The end result

It took us about a year from getting the footings in to finishing the build. We had Christmas as a deadline and, although it seemed like a continual 'will they, won't they' battle right up to the last minute, we finally put the tools down on the morning of Christmas Eve. It was finished, the pictures were hung, the furniture was in, our home was complete and we had our first day to enjoy it on Christmas Day, and sat in the shade under the waterfall drinking beers.

The end result is a house that we still can't quite believe we built, the waterfall lands about 5m from the back of the house, the stream runs between

the concrete piers that straddle it and flows directly underneath the floor of the house. From the back deck you see the water disappear beneath and from the front deck you watch it flowing out. If you pause anywhere in the house you can hear the sounds of water trickling through the stream directly beneath your feet. When there is heavy rainfall the subdued waterfall becomes a torrent of white water crashing down just metres from our house with spray hitting the windows. We've had some remarks that we are crazy building so close but we just love it, we still stare out at it in awe and wonder how many other houses have a view like this. ♦

Simon and Laura run their building partnership, Simon Brain Building, still working onsite together every day. Operating on the NSW Central Coast and Sydney areas. 0450 130 135, Instagram: @waterfall_house

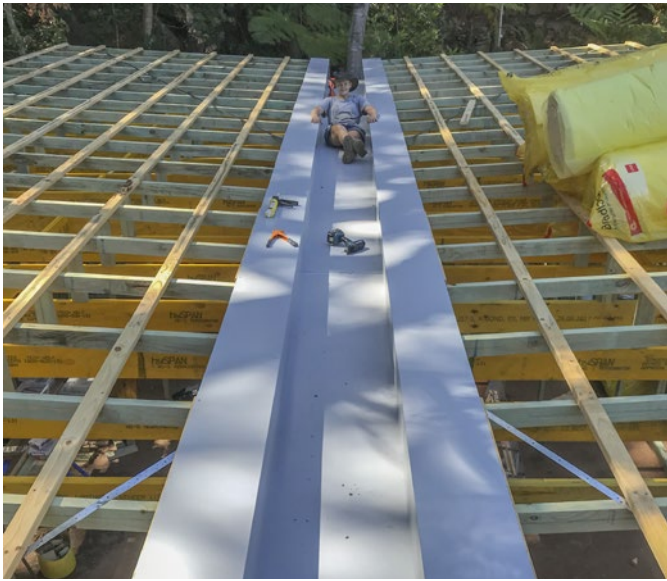
*Anna Franques, photographer.
www.annafranques.com
Instagram: @annafranques*



Reduce reuse recycle

We had a clear aim to produce as little waste as possible for the build. We made simple design decisions working to sheet and timber sizes to reduce waste where possible. For example, 2.7m high ceilings, meaning two 1350mm wall sheets would be used, leaving no offcuts. We also claimed and stored any materials from other job sites we were working on that would be going to waste, such as a large amount of hardwood framing that was left at a jobsite and used to build our landscaped entrance steps. We built our headboard from hardwood flooring offcuts and our dining table out of decking offcuts.

Although we tried to cut down our waste in so many areas and sorted any recyclables, we were stunned at how hard it was to find places to recycle building waste. Having researched online, we knew that plasterboard was 100% recyclable and separated any from our landfill waste. However, after finally finding a site to take and recycle the waste and driving an hour to get there, we were told we are unable to enter as trailers were not allowed. We came to a similar problem after carefully separating all solid treated timber products for the length of the build and storing them, having arranged to have them recycled by a company that makes particleboard. Disaster struck and the company's factory burnt down, we could no longer find anywhere in NSW that would take our waste timber and depressingly ended up having to put it into landfill. We were really shocked at just how hard it was to recycle building waste even when you are willing to put in the hard yards and separate it all.





B

PHOTO: ANNA FRANQUES

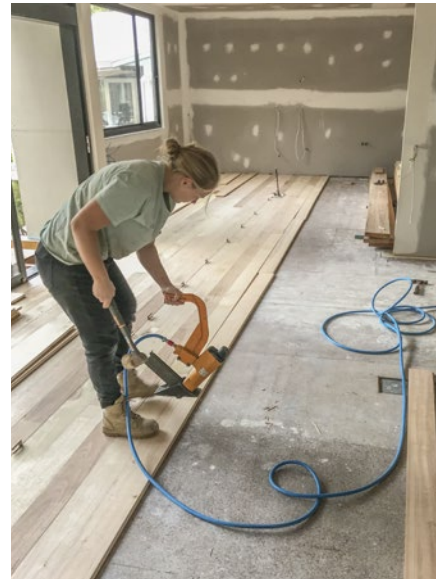


PHOTO: ANNA FRANQUES

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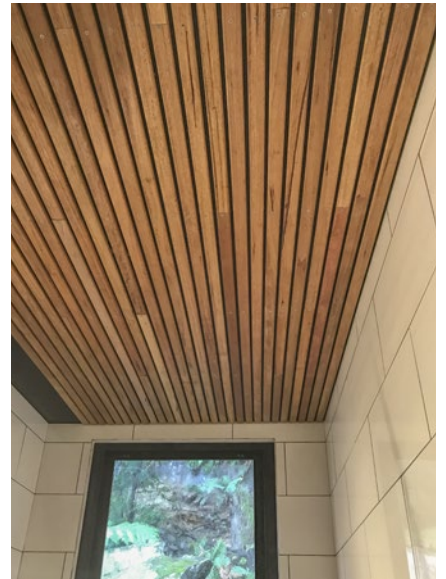
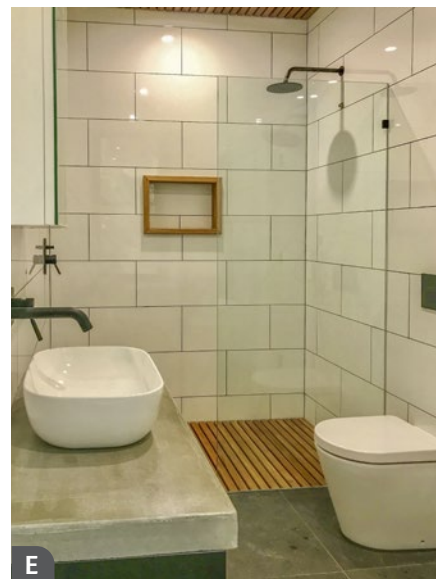


PHOTO: ANNA FRANQUES

D



E

Build budget and costs

Pre build admin (plans, fees)	\$8376
Out the ground (clearing, piers)	\$36,003
Steel (frame, coating)	\$47,609
Framing (floor, walls, roof)	\$23,998
Roof (sheeting, flashing)	\$7513
Windows, doors	\$23,200
Scaffolding	\$4432
Cladding, decking	\$18,035
Plumbing, electrical rough in	\$6212
Plasterboard (supply & install)	\$14,719
Flooring (hardwood, carpet)	\$8525
Paint	\$1034
Plumbing, electrical fit off	\$3718
Bathrooms (fixtures, fittings, tiles)	\$11,672
Kitchen (cabinetry, appliances)	\$14,388
Living (fireplace, plinth)	\$5599
Finishing (arc, skirt, shelves)	\$4140
Outdoor (tanks, stairs, rails)	\$14,687
Driveway (retaining, stairs, surface)	\$1954
General (hardware, waste)	\$1802
TOTAL	\$257,616





A

Timeless 'homestead' style house

Growing up in the Adelaide Hills, I watched on with admiration as my father undertook epic projects on the home or car. For him, DIY wasn't a choice, it was a necessity. Despite having more choice than the generation before me, that mindset seemed to rub off, and I always like working with my hands. I never did a trade, instead studying engineering, where the work was very much hands off, apart from on a keyboard. So I always felt enthusiastic about the renovation or building project awaiting me on the

BY EDDY GRABIS

weekend, and what new tool that might justify adding to the collection.

Over the years the projects got a little bigger including a couple of subdivisions, a *Timbercrete* owner build house and a community title subdivision, finally leaving a full-time city job to be my own boss on another community title

subdivision project – in amongst part time parenting of my three children. I had studied for a Certificate IV in Building and Construction in there somewhere, which taught me more about how little I knew about building! In 2015 I ended up with a vacant 1 hectare block 'next door'. Macclesfield was a nice quiet spot in the Adelaide Hills with a great community, as good as any to spend the time to create a lower cost, more comfortable and flexible home for myself and the kids, then approaching their teens.

Architecture

I wanted a fairly timeless 'homestead' style house from the southern driveway approach, that opened up to the views and sun to the north. A split pitch roof was chosen as it avoids guttering above the external walls, reducing gutter-related fire and overflowing risks. It also reduces the amount of gutter and fascia to install, maintain and clean, as the verandah gutter directly captures water for the entire house. An important design consideration with a verandah is to have the fascia beam clearance high enough to maintain views out of and let light into the house, yet still provide adequate shade from the sun. Fixed verandahs do have their drawbacks for thermal efficiency at times (compared to movable shading) but I'm a fan of a well-designed verandah, as they shield the house from heat, sun and rain degradation, and provide a comfortable transition between the inside and outside spaces to a home that I've always appreciated. And they sound great in the rain.

The north facing full height 'glazed wall' has a 2m overhang, allowing sunlight quite deep into the house in mid-winter, with a partially tiled section to draw some heat into the slab. In summer the sun tracks higher and the glass wall is always shaded, reducing heat gain. The passive thermal aspects of the design seem to work quite well in practice, and the built-in sunbeds get regular use throughout the seasons.

Internal brickwork leafs were used for thermal stability and acoustic damping, and I liked the warmth and texture of the look. Where possible, the design exposed the structural and functional elements into the aesthetic of the house, so the structure doubles as the interior design.

The layout incorporates a very flexible floor plan, that can be configured as a 4 bed + 2 bath + 3 living, or fairly simply reconfigured for semi-independent living with a separate entrance, kitchen, bathroom, living and bedroom

In order to contain the size (and cost) I compromised with smaller wet areas, and had larger living rooms. The house feels larger than it is, due to the vaulted roof. However, all the wet areas and kitchen have flat ceilings with accessible roof voids in the design to accommodate ventilation and possible ducted airconditioning in future.

The house has an attached carport rather than a garage under the main roof, as this reduced the cost; a separate 15x7.6m garage compensated, at a far lower cost per m². I also collapsed the laundry into a more general vanity-cum-utility area.

Design

Longevity and reducing maintenance were part of the design consideration. For example, using galvanised steel verandah posts rather than timber, and extensive use of exposed timber only where it was out of the direct sun and rain.

The design process was iterative, as I kept modifying the design to reduce costs and complex engineering, increase longevity, consider energy efficiency, improve ease of construction and approval, maintain aesthetics and function, include passive solar design, consider noise and temperature zoning, ensure flexibility of floor plan, maximise the views, etc. In design, there are always competing requirements to trade off against each other. I spent four or five months massaging the detailed design, pricing different construction methods and materials, until I eventually ran out of patience with myself and settled on the design.

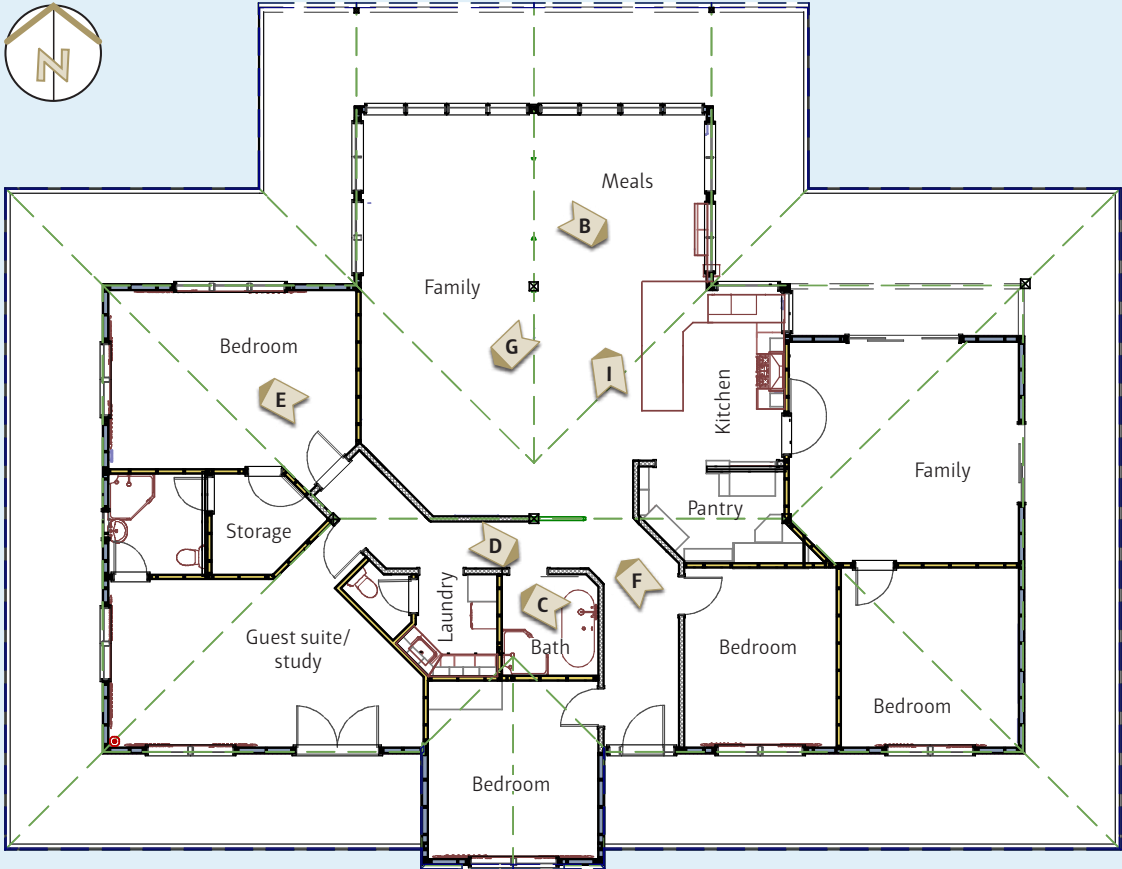
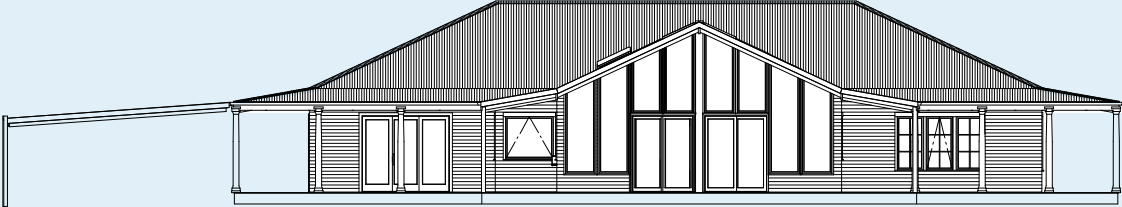
The windows and doors can be changed out over the decades if necessary, without major headaches. For the verandah post bases, I custom fabricated heavy-duty units that were then hot dip galvanised. They are bolted down, not cemented in, so can also be replaced more easily. I tried to consider extending the lifespan, flexibility and performance of the house where I could do so economically.

The exposed heavy timber framing with cypress laminated beams and posts was definitely not economical compared to a standard lightweight trussed roof, but I felt that was the main point of differentiation that made the house worthwhile to build, as an owner builder.

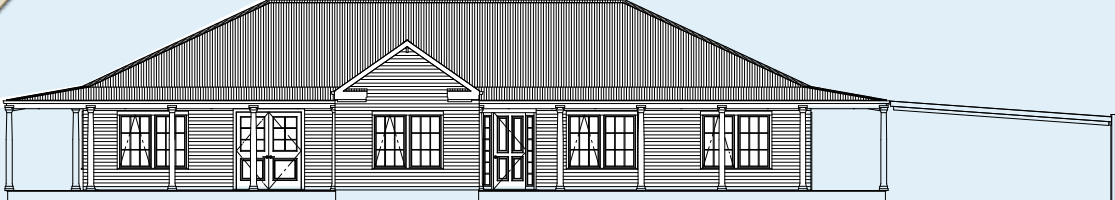
I did all the architecture, design, drafting and engineering myself, using a mixture of basic CAD modelling and structural design software, and much just on graph paper. I had a private certifier tick all the boxes to get the plans and engineering approved. The energy rating was done by a licensed certifier.



North elevation

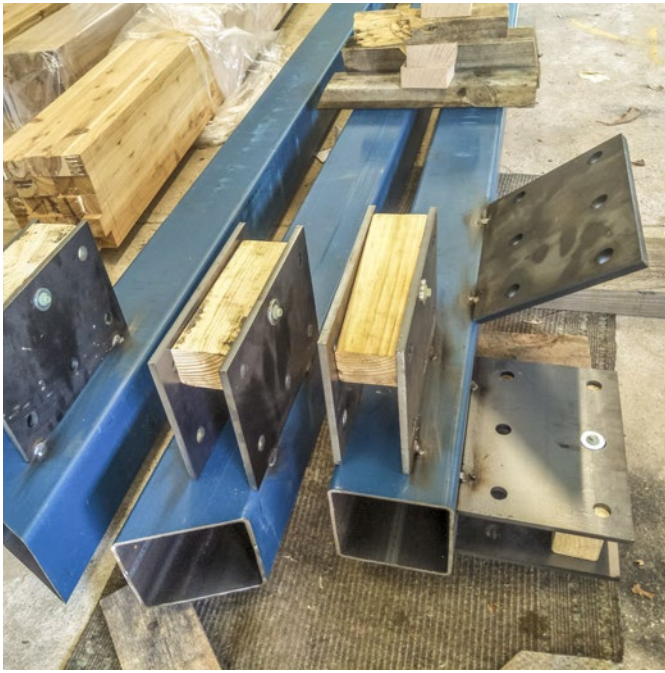


South elevation



Floor plan and elevations

Arrow letters refer to photos



Portal frame

The structure is a hybrid steel and timber portal frame design, with external and internal structural stud wall frames and some non-structural internal brick walls. It was designed to avoid overly complex engineering of the portal structure, by carrying all the lateral wind loadings through external and internal stud wall bracing, which follow standardised designs. The portal frame only really needed to demonstrate it could meet the wind uplift and roof mass loadings, which could also be done using readily available software (e.g. *Spanman*, *SmartFrame*) and the Australian Standard *AS 1684 Residential Timber Framed Construction*. The 90mm square steel posts are hidden in the stud walls, the timber posts are on display.

The glue laminated Australian cypress posts and beams came from Laminated Timber Supplies in Victoria; 200x200mm posts and 85x336mm beams mostly. They are beautiful timbers. I designed and fabricated all the timber-timber and timber-steel connections, including all the component parts on CAD, mostly in 12mm thick mild steel. I had the parts laser cut, then I tack welded everything together and had a professional welder do all the very heavy weld passes as my welder didn't have the capacity; I wanted to be reassured the final welds were rock solid and professionally done.

I designed and had laser cut my own custom 'slotting jig' tool so I could use my chainsaw to 'slot out' the large timber beam ends, as I couldn't find anything affordable off the shelf. I also set up a very long trailer for my ride on mower, to transport the finished beams and posts from my shed, up the driveway to the slab next door, using a car jack to help lift the beams onto the trailer, strapping them on with ratchet straps.

I installed the entire portal frame on my own, with a hired scissor lift and a scaffold that I purchased. A crane with operator would have been \$150-200 per hour, the scissor lift was \$300 per week...

that's the kind of math that matters to an owner builder! The scissor lift was used to lift and position the beams, and could be very finely joystick driven in all directions from the ground, almost by the millimetre, which was absolutely necessary so as to not crash things in the process.

In hindsight I was too tight on my steel fabrication tolerances, one extra half millimetre diameter holes in my steel flanges would have been better. Painstakingly 'opening out' holes in 12mm thick steel plate with a die grinding bit on the cordless drill, at heights, isn't that fun.





Everything was very tight to manhandle together at height, it took me about two to three weeks to get the main beams and posts positioned and bolted, a real juggle with temporary bracing and pulling things together with ratchet straps, trying not to damage anything, and not a single spare post or beam to allow for a mistake. As all the timber fabrication was heavy duty ground level work with one chance to get it right on every piece, and there was no real way to test assemble, it's not something I think I would risk in quite the same way again.

All the cypress beams were about \$15,000 plus transport with *Truckit.net*. I suspect it could have been 50-100% more if I had all the timber slotting, housing and drilling professionally done to my specifications, so self-fabrication on the timber and steel side was the only way it was going to happen in my budget.

Ceilings

I used 133x12mm *Barnback* grade Tasmanian oak ceiling lining boards (Woodley & Co. Tasmania) instead of plasterboard for the ceilings as I could lay

these solo, although it took me around six weeks to complete the job! Fixing edge to edge with no quad or cover strips required a great deal of patience up and down the scaffold, which was certainly tested on a number of occasions. I pre-oiled the boards with a high quality Shipway *Spescoat* clear wood oil. The timber lining does soak up a lot of light compared to a white ceiling but turned out to be a real feature – it's worth the extra LED bulbs. Leftover lining boards from the 300m² I purchased were painstakingly ripped down for the window architrave and various other uses including the bathroom 'barn door' and kitchen breakfast bar cladding. There is still about 2m² leftover in the shed...

Internal brickwork

The internal brickwork (PGH Bricks & Pavers *Manhattan Tribeca* with raked joints) is both functional and aesthetic, grounding the structure and giving it a sense of permanence. The lower nib wall creates an open topped hallway that separates wet areas from the living area. The wood heater warms up the brick

wall at night and the wall is central to the house, radiating its heat back into the house from both sides. The brickwork helps to absorb some noise; the room has a nice acoustic quality for music and speech, it sounds spacious and does not echo as I was worried about.

I had a local stonemason and his son lay the bricks but I did all the cuts and labouring, the set out and raking, and cleaning of the joints. Arend, the bricklayer, wasn't impressed with my speed on the cutting, which was a little embarrassing given he was around 80 years young and showing me how to put some muscle into the brick saw.

Windows and doors

Windows are double-glazed (4mm-16mm-4mm) timber-look uPVC, *Drutex* brand from local supplier Oknalux but made to order in Poland; the specified performance and finish seemed very good and they were relatively affordable. Timber was out of the question for the cost of double-glazed bushfire-resistant hardwood. Similar performance, thermally-broken aluminium was also



very expensive in finishes and brands I liked. I was (still am) somewhat nervous about using uPVC, but since all but one window are protected underneath the 2m verandah overhang, and so out of the brunt of the Australian weather, I thought I would give them a go. They were the single biggest cost of the project at over \$40,000 (supply only) all up, with the textured timber finish, screens and glazing bars.

I built the front door frame with sidelight assembly from scratch, using sawn cedar and jarrah I found on *Gumtree*. That little side project justified my purchase of a basic timber thicknesser machine. That level of joinery was at the limits of my skills and equipment, but I really wanted a solid timber entrance door and frame.

Weatherboard

I choose BGC *Nuline Plus* 14x205mm weatherboards over rendered sheeting, as rendering too commonly seems to form visible cracks after some years when done over a framing system. I ruled out brick veneer as I felt the house

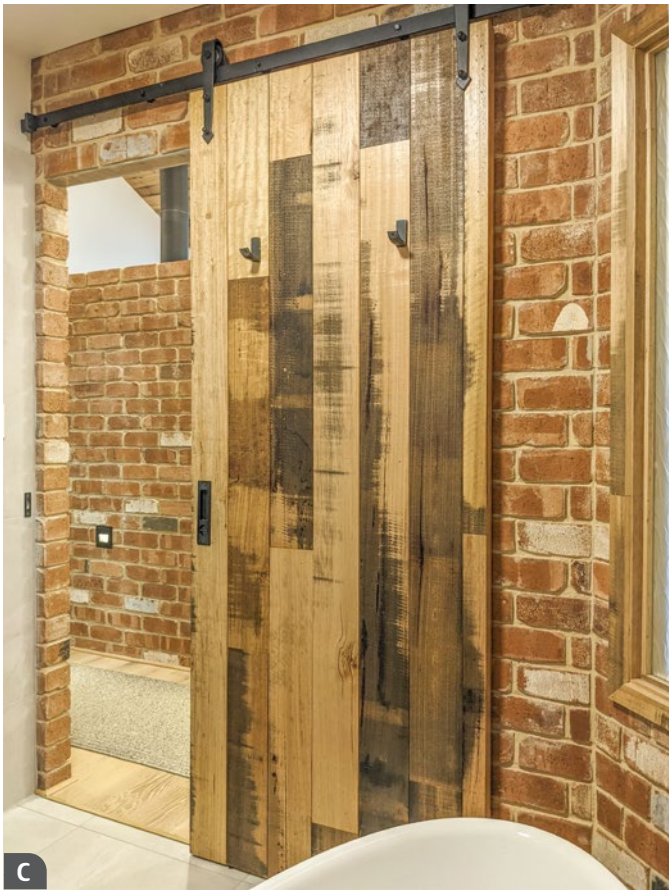
suited weatherboard, plus I could do weatherboard on my own, at much lower cost. I considered *Timbercrete* blockwork construction, as I had successfully used it on my previous owner build, but ruled it out as being too costly for this situation and design.

Bathrooms and kitchen

I gave up trying to find an available tiler and did the job myself, apart from the floor screed. 600x600mm tile is fairly big for an amateur like myself to get right, but with tile levelling clips and some prior experience, I did get through. I made the exposed copper tapware for the bath, buying a pair of pipe bending tools for about \$80 to help me. The soldering was a pain, I'd use the solderless copper fittings next time and buy the necessary crimp tool.

I designed every kitchen carcass and panel individually and had an accommodating kitchen manufacturer produce the whole lot as a flatpack; he never needed to step foot on site. I didn't try anything too elaborate but I'm glad I went for the undermount sink and







E



F

integrated drainer, it looks neat and tidy. There is extensive storage in the large walk-in pantry behind the kitchen to make up for the lack of kitchen wall space. The benchtops were solid surface acrylic, around \$4000, including the bathroom. I prefer granite, but couldn't justify the big extra expense at the time; I didn't want the budget running away from me, defeating the purpose of an owner build.



Contracted work

I contracted out the floor slab, roof sheeting and plasterboard, as I felt these jobs were not something for me to tackle solo and needed a professional.

A precise concrete slab helps greatly and I did set out the slab edges myself, with a new pair of quality metal tape measures to triangulate and square things (fibreglass tape measures have too much stretch over 20-30m distance). I made and set all the threaded rod assemblies into the concrete, for the portal frame to bolt to.

I did participate with electrical and plumbing, marking everything out and labouring with them. I knew a few of the trades from previous work so they knew what I could and couldn't tackle for them; those established relationships proved to be very helpful.

Services

I considered going off-grid for power but decided on a premium 7.8kW grid-connect system instead. Batteries didn't work on the economics (in 2020) and I need enough power for regular welding,

so the supply of a grid connection was appealing. My last two summer bills have been small credits. The incoming power is setup with a changeover switch so that I can run the whole house off a portable generator in the event of a blackout.

Water heating is via a *Reclaim Energy* heat pump. Gas is just a BBQ bottle used for a gas stovetop, reducing heavy electricity consumption in the evening when the solar isn't generating.

With no water mains, the house is supplied by a 78,000-litre polyethylene-lined steel tank. The large steel tank became more economical to buy 'per litre stored' than buying three smaller poly tanks, and it meant I didn't need a dedicated firefighting steel tank as well. For bushfire mitigation I also designed and built a perimeter deluge system with six commercial irrigation type impact sprinklers. Having a little CFS knowledge, I understand there's no guarantee with such a system, but 1000 litres of water output every 2.5 minutes isn't going to make matters worse, against an approaching fire. There is a bore shared with six other houses that provides ample water for the (just started) garden.



G

Reflections

Is it cheaper to owner build? Yes and no, depending on how you price out your own time and what you build. In my experience, it has been cheaper to build a bespoke, quality home as an owner builder, than using a boutique builder, if you can forgo your own hourly rate and survive that sacrifice for the build duration. But on the other hand I don't think I have been able to undercut the price of building a base level, similar size 'spec home' from a volume builder.

At times the project felt very slow, with mostly just myself on site. Ignoring the cost of several thousand hours of my time over four or so years, the project cost around \$270,000 (still counting for garden). Around \$50-60,000 of that was spent outside the footprint of the house (water tank, sheds, underground services, planning, septic, earthworks). So that's both a cheap house, and a fairly expensive one, depending what angle you look at the numbers from.

Regardless, I enjoyed a sense of productivity, purpose, freedom and creativity during the build, and felt appreciative for the opportunity to pursue an owner builder project. I would be happy to live here for a short or long time, and hopefully the house provides shelter and comfort to its occupants for many years to come. ♦



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www.hillsdesigndrafting.com

◆ Peter Meline & Associates

Town planner and building surveyor.

0448 395 299

petermeline@bigpond.com

◆ Above & Beyond Constructions SA

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abcsa@outlook.com



A SURVEYOR'S DREAM FULFILLED

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www.markout.com.au

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A SMALL QUESTION FROM AN OWNER BUILDER GAVE BIRTH TO A REVOLUTIONARY BUSINESS.

It's 2017, standing in the snow covered bush in Kinglake, Victoria, is David, a land surveyor, completing one of 20 surveys he will carry out that week. The client, an owner builder, had many doubts about their design and asked to meet on site and go through the building step by step.

Their main concern was their driveway. Would they have enough room to park their caravan and allow for the turning circle of their four wheel drive? This led to questions about their entrance way, their bathrooms and their kitchen, leading eventually into the backyard. After spending half a day on site, the entire floor plan had been painted and every issue of the future layout analysed and dealt with.

Changing any of these features once construction had begun or was completed would cost tens of thousands of dollars.

The clients were genuinely grateful. They had just saved thousands in revisions and were able to make changes to their design before breaking ground and it started to cost them. The stress of beginning the building process had eased and they were happy to bring in the machinery.

Even more thankful was the land surveyor, who had been given a lightbulb moment. David had begun work on a business that would allow homeowners, builders, architects and designers to be sure of their work before needing to commit to the design and start building.

Markout Australia was born.

Now in 2021 many clients from Adelaide to Sydney, Melbourne to Brisbane have been able to walk through their floorplan, in the exact spot they will build their house and at the exact size it will be built. Being able to change their design and save thousands in revisions by having a **Markout** completed gave them peace of mind at an affordable price.

Now David, the land surveyor, is able to travel Australia helping home builders fulfill their dreams and to sleep at night.



OUR PROCESS

INITIAL PLAN ANALYSIS

Upon receipt of the building drawings, our draftspeople get to work making sure that we can transfer each line, curve and mark at scale onto your property.

LOCATE POINTS ON SITE

Our first site visit involves our land surveyor locating all of the points on site. This can involve anywhere from 150-1000+ points being located accurately with our state of the art robotic total station.

LINE MARKING

We then mark all of the lines to reflect the walls, windows, fixtures, benches, appliances and landscaping features giving our client the full experience of their proposed property.



Covid dreaming

BY ELANA SANDY

This is the story of a house that will never get built. I'd dreamed of building my own house for as long as I can remember. Life circumstances and now my retirement years (and a pandemic!) had forced me to reconsider this and I'd come to realise that it was a project that most likely wasn't going to happen.

It's hard to let go of a long-held dream though. So I came up with an alternative that would let me realise at least some of the components. And maybe even better them! I thought, 'Why not do all the really fun bits – the research, the planning, the designing etc. anyhow?' After all, for me, they're the best part of the project in a lot of ways. By letting myself have full rein to design with no budget or other mundane practicalities (including resale value or bureaucracy!) needing to be taken into account, I'd get all the fun without the responsibility! Sounded like a plan...

Major considerations

Although this was a fantasy house, I still wanted it to be somewhat grounded in reality. So I needed to work out what were the main criteria that would be important to me.

First and foremost, the house would need to perform well and work efficiently and sensibly. So definitely no kitchens designed by a committee that lives on takeaways, for instance... Secondly, it would also definitely need to be energy efficient and kind to the planet in the choice of materials and construction methods. The ability to supply a lot of its own needs for energy, water etc. were important too, as well as the option

to grow some of my own food and medicines. And aesthetically the house needed to be pleasing to my eye as well as a peaceful, comfortable and restful place in which to live.

Site was a tricky one, as of course I didn't have one! But imagination is a wonderful thing, so in my planning I did find the absolutely PERFECT place to locate my home... set on/into a ridge overlooking a spectacular gorge.

So how did I go about it?

Interestingly it all started with me thinking about the things that hadn't worked in houses I'd lived in over the years. Mostly because they'd either not been well planned to start with or because other considerations had seemed more important than functionality at the time. I was determined to have both functionality AND aesthetics.

One of the first things was to decide what functions the house actually had to serve for me specifically. For instance, I'm somewhat of an introvert, so making provision for large scale entertaining wasn't on my radar, but quiet and well-designed spaces for my various solo activities were paramount.

In no particular order of importance I wanted the house to provide space and facilities for me to:

- Sleep
- Store, cook, eat food
- Perform ablutions, personal grooming, get dressed
- Indoor and outdoor exercise
- Meditate, relax

- Study, read, use computer
- Enjoy various indoor hobbies and crafts
- Listen to, or make music
- Have friends to visit/stay
- Safely be a host to a feline friend or two
- Shelter my car
- Grow food and some herbal medicines. Plus a few favourite flowers!
- Enjoy all four seasons outdoors
- Accommodate utilities.

A separate room or space for every function is one way to accommodate these, but I wanted to be a little more efficient than that and have more than one possible use out of a given space. After all, it would only be me rattling around in the place most of the time. And I'd also be the one cleaning it (in theory!). So it made sense to design a smaller home by incorporating multi-purpose rooms, with as little space as possible just sitting there unused most of the time, gathering dust.

What I didn't want or need were:

- Multiple living spaces or a formal lounge
- A separate formal dining room
- More than one bathroom
- A home theatre or TV room
- Gold taps
- Clutter.



Zones and transitions

I found grouping functional spaces into zones helpful and using transitions to either connect different zones or to expand them.

The zones I decided on were:

- Cooking and eating
- Sleeping and grooming
- Self-care and retreat
- Fun, relaxation and intellectual stimulation
- Space for visitors
- Garage
- Utilities
- Outdoor spaces, including food production and processing.

Aesthetics

While I was thinking about the functional aspects, I was also searching out inspiration for visual and design possibilities. My overall preference was for a small-scale, ultra-modern, minimalist look, but with some softening and fun elements – not a stark blanket use of white or brutal concrete. I wanted it to be warm, friendly and comfortable – it was to be a home, not a showpiece or ‘statement’.

As well as some aspects of minimalism, I was inspired by mid-century architecture, Bauhaus and Scandinavian design, as well as Japanese and Middle Eastern traditional buildings and interiors. Plenty of influences there to throw into the mix!

And of course once one goes online there is an absolute overabundance of reference material and a million and one rabbit holes that can be followed. After a while it can actually get rather bewildering – way too many choices – so I found it better to limit myself to only spending short stretches of time at it and to be very selective, by asking myself, ‘Why do I like this? Could I live with it long term? Downsides?’ Otherwise it was just all too easy to go onto overload. And after all, I wasn’t looking to just mindlessly copy other ideas, but to use them to generate my own; fully cognisant of the fact that no matter what I thought of, someone else would probably have already ‘been there, done that.’ And posted it online...

Materials and methods

I'd long been drawn to the idea of an underground or earth-covered home. There are a lot of advantages to this, particularly in terms of climate moderation and bushfire safety. Plus I liked the cosiness and also the smaller visual impact such a house can have on a site, by sitting into it. Technically of course there is a lot to be considered in such a building approach, but in a 'virtual house' design like this, fortunately I could gloss over the construction details to a large extent!

Materials such as glass, metal, stone, timber, lime, earth and hemp all appealed, so I thought it might be nice to selectively include some of these, but without it becoming an overly busy hotchpotch visually. And underneath all this of course, concrete is commonly used for the structural elements of earth-covered construction projects.

Potentially toxic or environmentally unfriendly materials weren't on the agenda. For example, I was thinking along the lines of solid timber for cabinetry, low VOC paints or lime washes for walls, timber or polished concrete floors, natural textiles etc. Quality materials were an important consideration too – my preference was definitely to use the most durable building materials/furnishings etc. available. And if a budget had been relevant, to buy less items/materials, but of higher quality, rather than more of the cheap and nasty variety.

Special features

As I was researching and pondering, I found myself drawn to a few features that really resonated.

On the whole I liked the idea of smooth surfaces, but patterns and textures often caught my eye too, such as middle eastern tiles, Japanese tatami mats and shoji screens, shadows cast by wooden or metal grids, beautiful etched glass, warm timber grain. And colour! Whilst a light monochromatic colour scheme can be restful and spacious, it can also potentially be a little monotonous. So in my opinion, some well chosen contrasting colours in, for example, walls or furniture, could make a room much more interesting.

Rather than just a box-shaped or rectangular footprint, I liked the concept

of the plan having angles that could accommodate various gardens and outdoor spaces. Internal courtyards or atria, especially with greenery and a pond or water feature particularly appealed, due to their restfulness and inward looking aspect. However, I quickly realised this might be tricky to incorporate into the plan.

I also liked the idea of using techniques that could make smaller areas seem more spacious as I didn't want a huge McMansion.

These included:

- Changes in floor level as a way of delineating different spaces, without the need for internal walls in some areas.
- Being able to close off or open up rooms to either the outdoors or internally via the use of sliding doors/screens/windows.
- Mostly open plan, but with a balance of areas where privacy was possible, such as when I had overnight visitors.
- Slightly higher than normal (or sloping) ceilings.
- Larger windows, including floor to ceiling sections.
- Fewer, but better planned, storage and furniture items.
- Use of straight lines rather than curved ones.

Drawing plans

If it was good enough for Frank Lloyd Wright to use a floor plan as his starting point, then I figured that was good enough for me too. The 3-D spaces could then follow or grow up from that. However, this was going to be somewhat problematic for me. Apparently we are either born with the ability to visualise in 3-D or not. So not everyone can do this and I gather it's sadly less common in women than men. Which could go part way to explaining why proportionally there are fewer female architects than male? Anyhow, I learned quite young that I don't have this 3-D visualising capability, but am fine with flat surfaces. So for me a plan was a good starting point and I then referred back to my research material to see if my ideas for spaces might actually

work. After all, how hard would it be to make walls go up vertically and then plonk a roof on the top. Ha ha...

Even just a cursory online search will bring up lots of software options for drawing one's own house plans. They pretty much cater to all sorts of needs and levels of expertise, from high end specialised AutoCAD/3-D applications through to less complex apps which just allow the creation of simple floor plans or room layouts. And of course there's the lovely flexibility and small learning curve of good old fashioned pencil and paper. Which for this project suited me just fine.

The end result?

Designing a house without restrictions (other than self-imposed) was a really fun project. I thoroughly enjoyed researching and planning it. And because it will never be built, it can continue to be a 'work in progress' for as long as I like. I'm sure I will add heaps of tweaks and alterations before I move on to the next 'shiny new thing' – perhaps I could increase the size of my 'site' and design a comprehensive permaculture-based food garden plan? It might need to come with 'virtual gardening staff' though... ♦

♦ Frank Lloyd Wright Foundation

A belief that structure and space could create and convey cultural values led Wright to create entirely new types of architecture.

www.franklloydwright.org

♦ Energy Saver

U.S. Department of Energy's (DOE) consumer resource on saving energy and using renewable energy technologies at home. Interesting section on underground earth-sheltered homes.

www.energy.gov/energysaver

>Design >Types of Homes

>Efficient Earth-Sheltered Homes

♦ Dimensions.com

Useful selection of standard measurements and sizes of everyday objects and spaces of our built environment.

www.dimensions.com

Things I needed to think about...

The more I got into the project, the more factors I realised I needed to consider and plan for in some way. Perhaps not all could be incorporated, but giving them some consideration was definitely a useful exercise.

- What future projects or activities might I like to take up? How would the house accommodate these?
- How to make allowances for the infirmities and limitations that can come with ageing?
- Practical considerations relating to extreme weather events, bushfires, flooding etc.
- Air flow and quality, as well as temperature regulation.
- What would be the best orientation for each space/room?
- Well positioned lighting and power point access.
- Reliable and good access to internet and mobile phone networks.
- Where and how would I spend most of my time? The size of spaces, furniture and storage needed to reflect the frequency of use where possible.
- Ergonomics – particularly in relation to such things as bench heights and storage access. And also in terms of workflows in the kitchen and other activity areas.
- Design of storage to allow living to be clutter-free, but so that items were also readily accessible when needed. But not so much storage that I'd be encouraged to accumulate too much 'stuff'!
- How would I display favourite items? Having absolutely everything tucked away would be a bit stark for me.
- Guests needed to feel comfortable and welcomed, but space for them also needed to be adaptable for when it would be just me at home, which would be most of the time. Some creative multi-purposing would be needed there.

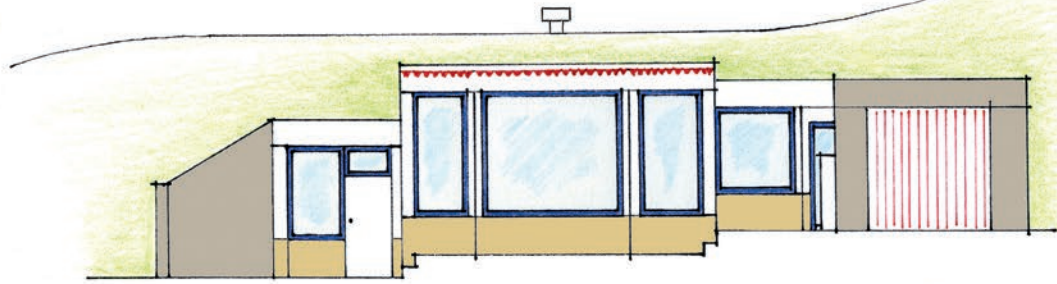
PHOTO: JAMES STEAKLEY (WIKIMEDIA COMMONS, CC BY-SA 4.0)



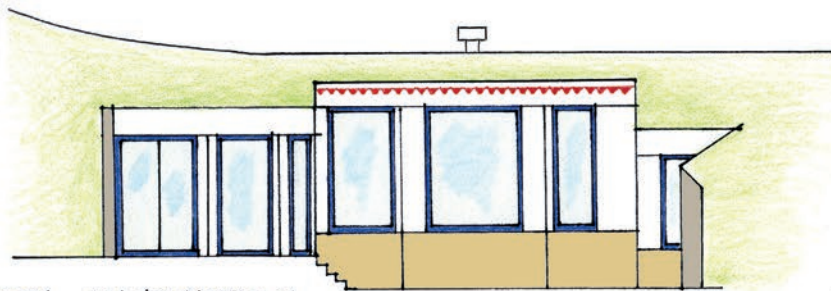
Designed by noted American architect Frank Lloyd Wright, this home in Madison, Wisconsin was constructed in 1937 and is commonly referred to as Jacobs I.

Plan key

- | | |
|--|---|
| A. Wall oven | N. Laundry cupboard. Basin doubles as wash trough |
| B. Opening through to dining area | O. Brooms |
| C. High back bench with under seat telescope storage | P. Japanese-style soaking bath |
| D. Day bed & bookshelf. Converts to guest bed | Q. Telescope patio |
| E. Double-sided wood heater | R. Moroccan-inspired pool & fountain |
| F. Piano | S. Outdoor seating |
| G. Bookshelf | T. Clothesline |
| H. Storage drawers | U. Scented garden |
| I. Art/craft/sewing/puzzles table | V. Medicinal herbs 'Physick garden' |
| J. Computer | W. Outdoor bench & sink for garden harvests |
| K. Drawing | X. Culinary herbs |
| L. Meditation/yoga space with tokonoma | Y. Garden tools storage |
| M. Storage for screens to enclose daybed for guest privacy | Z. Cat toilet & access |



SOUTH ELEVATION

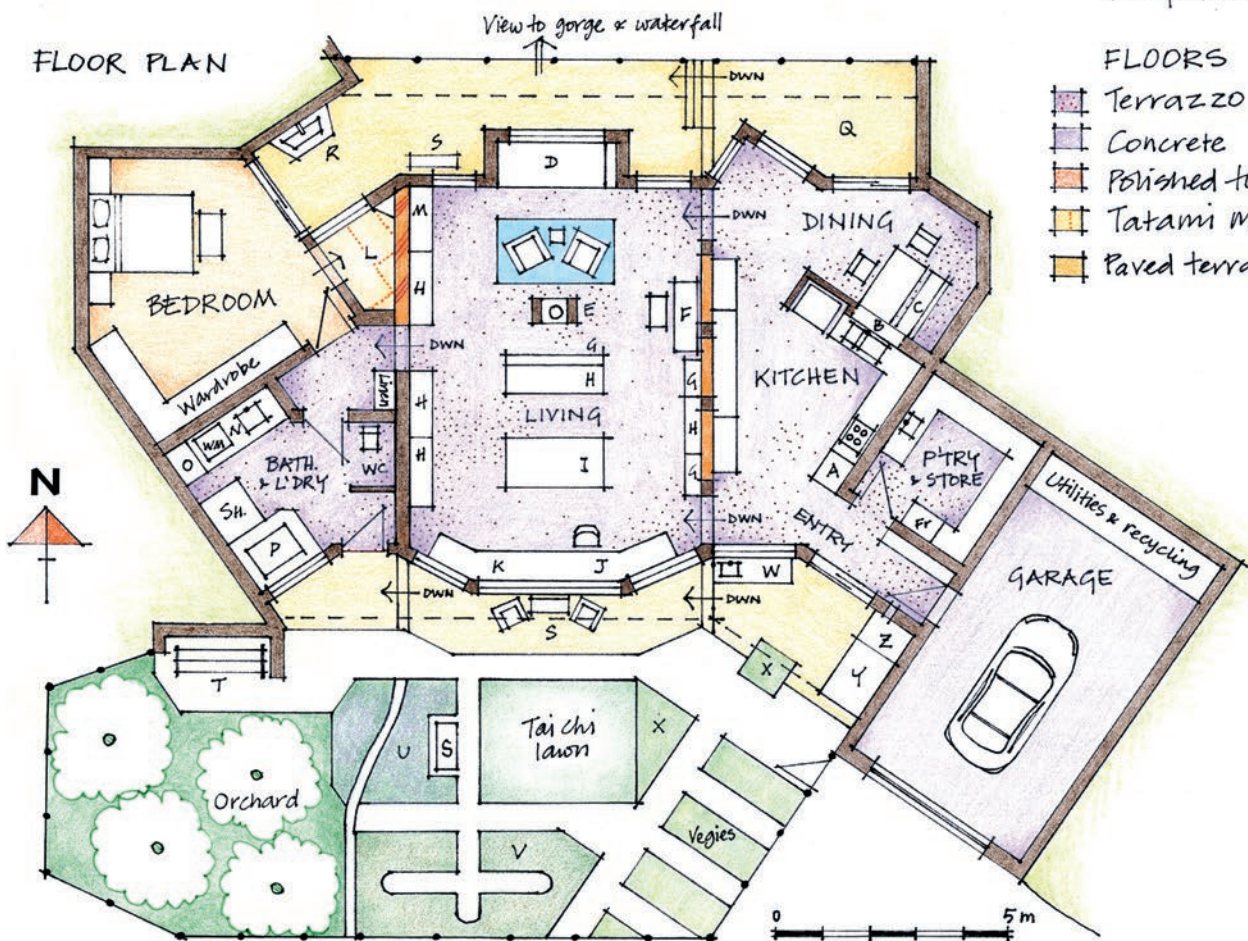


NORTH ELEVATION

- WALLS
- Concrete (rendered)
 - Rammed earth
 - Rammed earth with pattern

- FLOORS
- Terrazzo
 - Concrete
 - Polished timber
 - Tatami mats
 - Paved terrace

FLOOR PLAN



Off-grid cabin with reclaimed logs

Part One: Pre-Construction

BY JULIA MAURUS



We (my husband, Paul, and I) are preparing to build a small off-grid house in the bush near Cairns. Our dream is to create a sustainable smallholding lifestyle within commuting distance to Cairns, on the budget of an entry-level Cairns home. Is that achievable? Well, we're going to find out!

Back in 2017, we looked for an established entry-level property. We are quite fussy about what we want (timber house, usable land for a kitchen garden, no highway noise) and whenever something affordable came on the market it was snapped up by other people keen to secure a move-in-ready lifestyle. We also looked at land, but the only block we liked was over our budget. From my legal background and years of watching disastrous budget blow-outs on *Grand Designs*, I was also reluctant to sign up to build a new house. Nor am I interested in the large, expensive, predominantly concrete houses being built by mainstream builders in our area, with no thought for energy efficiency or environmental impact.

But the idea of Paul building us a house did appeal to us. For me there is the ideal of a self-sufficient home in the bush made from reclaimed, recycled and upcycled materials. In his day-job servicing helicopters, Paul is accustomed to working to tight tolerances, so he has high workmanship standards and attention to detail. He wasn't interested in paying a builder a premium to build us a small home that he could have the satisfaction of making himself.

A year after looking at our favourite block of land, our mortgage broker arranged a bank valuation for it. When the owner dropped the price, we jumped to buy the 17-hectare, unserviced block. The size of the block ruled out all but two banks, and neither would finance an owner builder project, so we borrowed for the land purchase only, and we will fund the project ourselves. Building a small house will hopefully keep our project manageable, and allow us to avoid a large mortgage that would lock us into full-time work for the next three decades.

We chose the area for the food-growing climate, lower humidity than on the coast, and because there is no flood risk to the house site. The bushland provides a privacy 'green screen' from neighbouring properties, and an established habitat that we can work to enrich. The previous owner cleared land for a house and garden and we will minimise any additional clearing to what is required for fire breaks.

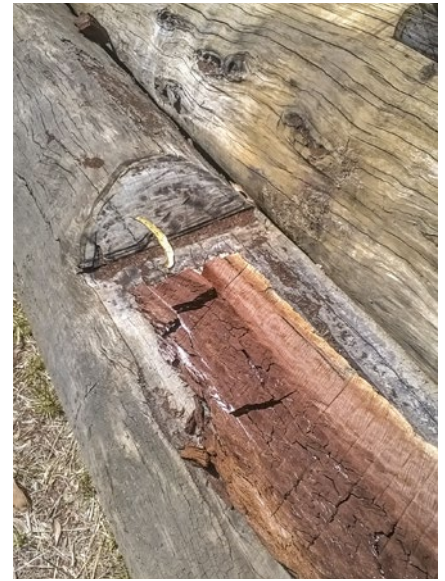
Progress to date

We are stockpiling some salvaged materials and have also been given a second-hand camping solar panel and ride-on mower. Lots of people have taken an interest in our do-it-yourself project and offered to give us things. That's wonderful, but we do have to exercise discretion when accepting this generosity; just because something's free doesn't mean it's useful or part of our vision for our off-grid house, and we don't want our land to turn into a junk pile of other people's donated rubbish.

To date, Paul has hand-built a small materials shed with salvaged roofing and century-old cypress-pine logs from a friend's old shed in the area, for a total cost of less than \$100. He dug and rammed the post holes himself, so the posts are very strong without the need for concrete; it has a huge carbon footprint so we are avoiding it. The frame and roof held up through the lashing wet-season storms.

He also built us a front gate from salvaged materials after some opportunists drove onto our land and stole various lightweight items we had sitting around, including the kitchen sink we were going to use for our house. We had been striking a balance between





taking expensive equipment back and forth between the site and home, and leaving items unsecured on site. We know that site security is a common issue for builders, but we were nevertheless angry to have been targeted.

The game-changer came in June 2020, when Mareeba Shire Council upgraded the 90-year-old John Doyle Bridge in Mareeba and engaged Anton Demolitions to haul away the original bridge logs. Martin Anton, who runs Anton Demolitions and Recycling Yard, was delighted with our plan to craft a recycled log cabin from the old bridge logs he sold us. We had previously visited his recycling yard to select and cost various reclaimed fixtures when we first started planning our project.

We had planned to source logs from a friend who was clearing regrowth ironbark trees for a fence line on his farm, but now we have more timber than we'll need and we don't need to debark them or wait for freshly cut ('green') trees to dry before building. We are thrilled to have acquired hardwood logs – the largest I've ever seen! – with so much character, at a fraction of the cost of purchasing hardwood timber new.

Of course, the bridge logs pose logistical challenges, with the largest weighing four tonnes each and the smallest a tonne each. It took three semi-trailers and two cranes two runs to transport the bulk of the logs to our land. But our land, which has a short, steep hill between the front gate and the house site, was always going to pose logistical



problems (this is one reason why we ruled out relocating an entire house or bringing in a shipping container). We do have friends with machinery we can use to help move the logs.

Paul has completed the obligatory owner builder course so we are ready to go once we have our plans for a building permit. We had a verbal quote from an engineer we spoke to when we first did cost estimates for our project. However, from further discussions with that engineer it was apparent he didn't grasp what we are trying to do. So we are talking to another engineer, this time recommended by Martin Anton for projects like ours.

Design

Our cabin will have two bedrooms, one bathroom, a separate composting toilet, a multifunctional loft space and an 8x4m front deck. The house will be low-set on stumps with a high-pitched roof. Paul's dream cabin is a scribed log cabin, but our reclaimed bridge logs are sawn flat on one side, so he intends to stack them tightly using half-dovetail notches.

Our inspiration came from *Cabin Porn* and the TV show *Barnwood Builders*. The US publication *Building with Logs* (Legacy edition) includes useful technical diagrams. I have studied Cairns Regional Council's *Cool Homes: Smart Design for the Tropics*, modifying our plans to embrace passive solar design. The prevailing breeze comes up the valley so the house will be positioned to capture the breeze across the deck and into the kitchen, as well as directly into the living area. Other passive solar design elements include a high-pitched ceiling, generous eaves and awnings, no passageways, two window openings in the living room and each bedroom for cross-ventilation, ceiling fans (no airconditioning), the first-class insulation of log walls, and shade trees positioned to filter hot westerly breezes and afternoon sun.

I have also taken design ideas from *Small House Living Australia* and *Country Living's Tiny Homes*. *Small House Living Australia* classifies a house of 90m² or less as a 'small house'. Our plan is an inside floor area of 64m² plus a loft of about 12m² (the same size as each bedroom) and a deck of 32m².

Tiny Homes emphasised the importance of carefully selecting fixtures and furniture to make a small space comfortable and liveable and give an illusion of spaciousness. For us, that means incorporating moveable and multifunctional furniture, a folding breakfast bar, and built-ins to maximise vertical storage. The high-pitched ceiling will increase the sense of space.

Services

Paul has built a basic composting toilet for interim use, but we will ultimately install a *Clivus Multrum* composting toilet and greywater system, plus tanks to collect rainwater as well as for firefighting because we are in a bushfire zone.

We included a bore in our budget but a consultant at Serra Drilling advised us that there is a 50:50 chance the water we get may only be irrigation quality. At this point, we are not prepared to make the ballpark \$10,000 gamble. In the interim, we are carting in water.

The house will have solar hot water. Solar power with battery backup is the highest-cost item in our budget.

Challenging factors

The most challenging factors our project present are the unconventional build type, hauling of the logs, difficult access up the short steep hill on an unsealed driveway, bushfire risk, and termite risk management.

And there is the undeniable challenge of juggling parenting, work and a self-build. It is frustrating for me to be unable to do much hands-on work to help Paul on site, but of course someone always has to be watching our baby, and I envisioned my role as more focussed on paperwork and 'project management'. The design and planning is something I can do even while mothering, so I have detailed ideas for planting flowering natives through our bushland, siting our orchard and kitchen garden, swales, fire-breaks and fire-retardant plants, and the utilities.

Grand plan

In the meantime, as part of our grand plan we have started planting an orchard and shade trees. I have been researching permaculture and have a preliminary

garden design. Alongside our work on site and project preparations, we have been working on simplifying our lives and becoming more self-sufficient. We now grow some of our own food, have chooks, work part-time to keep childcare in-house, and consciously consider each purchase we make.

Paul recently sold his *Jeep* and replaced it with a family-size 4WD that we can use to access the house site and haul materials. We have camped overnight on our land a few times, inviting family along and using the campfire remnants as biochar fertiliser for our fruit and shade trees. For a bit of fun we built a trial rocket stove, which we have used to heat water for our makeshift outdoor shower.

We have purchased a STIHL MS 881, the most powerful chainsaw in the world, along with a Granberg Alaskan Mill, and Paul is keen to start milling timber. All going well, 2021 should see us start construction. We need to have the house certified by the end of 2023, but we don't have a formal project timeline. While we want to enjoy the process and avoid the pitfalls of a rush job, we're keen to stop renting and start living off-grid.

Our off-grid project is about investing in what matches our principles, even if it takes much longer to achieve it by doing it ourselves, with what resources we have and fitting it in around our day jobs. What's interesting is how many people are envious of what we're doing, that we're saying 'you only live once' and trying to achieve our dream.

You can expect an update on our project in a year or two! ♦

♦ Diary of an Off-Grid Builder

Julia and Paul's journey to a sustainable, affordable lifestyle.

offgridbuilder.home.blog

♦ Anton Demolitions

Demolition, asbestos removal and site clean-up, quality salvage products.

07 4055 9461

www.antondemolitions.com.au

♦ Cool Homes

Smart Design for the Tropics.

www.cairns.qld.gov.au

♦ Cabin Porn

Inspiration for your quiet place somewhere.

www.cabinporn.com



Big things and little things

BY SUE COULSTOCK

Recently, a guest said to us, 'It's amazing – your floor drains are actually in the lowest part of your floor, so the water goes straight down them. Who did your tiling?'

Well, I did; tiling was one of my solo jobs when one of us had to go back to an office. That, and insulating ceilings, painting, paving, making rustic skirting boards and architraves, building bookshelves and built-in cupboards. I'd never done any of those before, but it's possible to learn on the job and do a top-quality job, if you inform yourself well, think about what you are doing and take your time.

The big things

'Near enough is good enough' is incompatible with getting a great result, but seemed to be the motto of a fair few of the people who'd professionally built the various houses we'd lived in since childhood; significantly uneven gaps in feature brickwork, mortar smeared over bricks and not cleaned off before it set, mortar you could scrape out with a fingernail, garden walls that wobbled, pipes that leaked into walls, gaps left where rodents could enter the house, roof tiles gapping in a new villa after the first summer because the timber used hadn't been dried properly, inconsistent gaps between tiles – and the floor drains never worked properly. Not to mention we were always freezing in winter and boiling in summer.

We owner built to save money while simultaneously getting a better-quality house than the kind usually built by Australia's building professionals. I spent two years writing articles to tell you about the 'big issues':

- Designing your house so that it heats and cools naturally as required – because real energy efficiency is not about making an improved Eski that keeps in artificial heating and cooling – and how to ensure you'll be using less than 20% of average Australian household electricity, fossil fuel and other external energy input to run a comfortable home (TOB 206, 215, 218)
- Going off-grid on an average budget so you're on 100% renewables no matter what the government does, and will never have another power failure (TOB 209)
- Creating a low-toxicity home in with modern minefield of materials (TOB 211)
- Building and landscape design and maintenance for minimising bushfire risk (TOB 212)
- Closing the nutrient cycle with compost toilets that make fertiliser for your fruit trees instead of wasting everything that goes through you and turning it into a pollution problem (TOB 210)
- Minimising building waste, and making items like sheds, compost bins, furniture and picture frames from leftover materials (TOB 213)

- Downshifting successfully so you don't both have to be in full-time work away from home after you've built your house (TOB 214)
- Creatively using recycled materials, like second-hand kitchens from auction (TOB 208)
- ...and last, but not least, stopping your marriage falling apart while owner-building (TOB 216).

These are really important things, but today I'm writing about a comparatively minor matter: how to make a fully functional floor drain smack bang in the middle of the lowest part of your floor. And you can thank our recent guest for that.

Fully functional floor drain

Have you ever pushed water around a bathroom floor with a mop to chase it down the drain, because it won't go there unassisted? Or do you have puddles of water left on your tiled shower floor for hours afterwards? That was our experience in so many houses we've lived in, and I was determined to have my floor drains sitting properly in the lowest part of the floor.

If your house has a slab, this begins with choosing a good concreter and making a point of talking to them about this matter, so that they will do an extra-thoughtful job for you. We were then even offered input in how much gradient we wanted in the bathroom floor. The concrete needs to evenly slope



down to the drain on all sides as a correct foundation for your subsequent tiling. On one of the photos (A), you can see how rain puddles collected in exactly the right spots in the concrete slab for both the shower drain and the centre floor drain to work well.

If you're tiling on elevated flooring your base may be flat and you will need to create appropriate gradients with a screed before tiling if you want your drain to work properly. Research the pros and cons of available materials and techniques carefully, then make your sloped floor.

Your next job is to make sure that your tiling doesn't interfere with the drainage slopes. If you are using those tiny sheet mosaic tiles, this is fairly straightforward because it's easy to get these tiles to follow the slope; then you just need to make sure you apply your tile cement evenly to the floor so you don't undo your concreter's (or floor re-sculptor's!) good work.

It gets a bit trickier though when you are using larger floor tiles, because then the tiles can throw the slopes out as you approach the drain. This would have

happened at our house if I had tiled like our DIY manuals suggested – because all three were more concerned about optimising visual appearances than keeping the floor drain functional.

Most manuals will tell you to use a full tile run against the wall that is opposite the doorway, and to make your cut-down tiles meet the door, where it's not as obvious, so that the pattern will look nicer as you look into the space – or, with larger rooms, to consider where any part-rows will be least noticeable. Their primary concern is about how to arrange the edges of the tiled area – where to place the part-rows to get the nicest-looking effect. This method is not always compatible with a fully functional floor drain. I thought about this before deciding to go counter to the advice in my manuals – by arranging the first four tiles symmetrically (or nearly so) around the floor drains as my starting point for tiling (B). My primary tiling objective was to preserve the functionality of the floor drains; appearance was secondary – but still important.

I dry-laid some tiles before starting, to see how the floor edges would look as

a result of prioritising the drain. In the guest bathroom (red tiles) I made small adjustments that didn't decentralise the centre floor drain too much, but allowed for a full run of tiles against the bathtub edge, rather than having to cut tiny slivers to finish and ending up with a less tidy-looking edge. In the shower recess, in our own bathroom and in the laundry (green tiles), the tiles were dead-centred around the floor drain. There was only one 'funny edge' as a result – a really narrow finishing row against the left-hand side of the laundry – but this didn't matter, because a cupboard and shoe rack were going up against that wall anyway. Had it mattered, I could have chosen different size tiles for that floor (just do the maths).

Plumb better

So here we were with all our floor drains properly in the lowest parts of our floors and working as they should – but one day our laundry flooded when I forgot to attend the washing machine. I was flabbergasted to find water in the laundry and nothing going down the floor drain – how could this be?



We dug the pipework up outside the laundry and found that the pipe from the laundry floor drain was not connected to the main drainage outlet (C). It simply ended in the sand, mere centimetres away from where it could have been connected. We couldn't believe it.

We then found out that the Australian Standard doesn't require laundry floor drains to be connected to the main drain, but permits them to go blind into the sand – which is why we had a flood when my washing machine overflowed and it was such a stupid, avoidable problem... I've now connected the laundry floor drain to the main drain myself, and wouldn't you know it, now it really works and no more floods even if a tap were to run for weeks.

The little things

The same type of floor tiles I used for my wet area floors were also used for my kitchen backsplash, because they were so easy to work with and looked great. When I tiled the backsplash, there was a small twist to really make things glow: I'd collected tiny red glass-and-ceramic tiles and a couple of red feature tiles with gum leaves and lizards on them, which I incorporated into the wall. I spent an afternoon cutting all the inward-facing edges off my field tiles with an angle grinder to make spaces for the tiny red tiles to go in.

One unromantic neighbour passing through that day thought this was a crazy waste of my time. In fact I think it was one of the best uses of a couple of hours

of my time in our entire build, because I smile every time I look at the pretty red counterpoints in my backsplash. A thing of beauty as a joy forever.

Which is also why you can try your hand at doing a little mosaic somewhere in your tiling, or in your garden, out of your leftover tiles. There's clever people who cover whole outdoor benches in decorative tiling – if you're after a project, you could look that topic up! ♦

Sue has a B.Sc. in Environmental Science and Biology, and worked in land management research and education before tree changing. Red Moon Sanctuary produces small scale organic beef, honey and heirloom vegetables for sale and has farmstay rooms for visitors. www.redmoonsanctuary.com.au



Gresham Pub

I stumbled upon this whimsical outdoor entertainment area during my travels.

BY LYNDA BRIGHTON

Russell built the house in 1986, then the garage later. Over the years, a small shed and outdoor area was added to the collection of buildings.

The outdoor area came about as a result of inviting neighbouring friends over to enjoy a few beers around the firepit, instead of heading into town by car. When the new shed was built, the 'pub' needed to relocate; it was the perfect opportunity to expand, as Jenny's collection of memorabilia had outgrown the space.

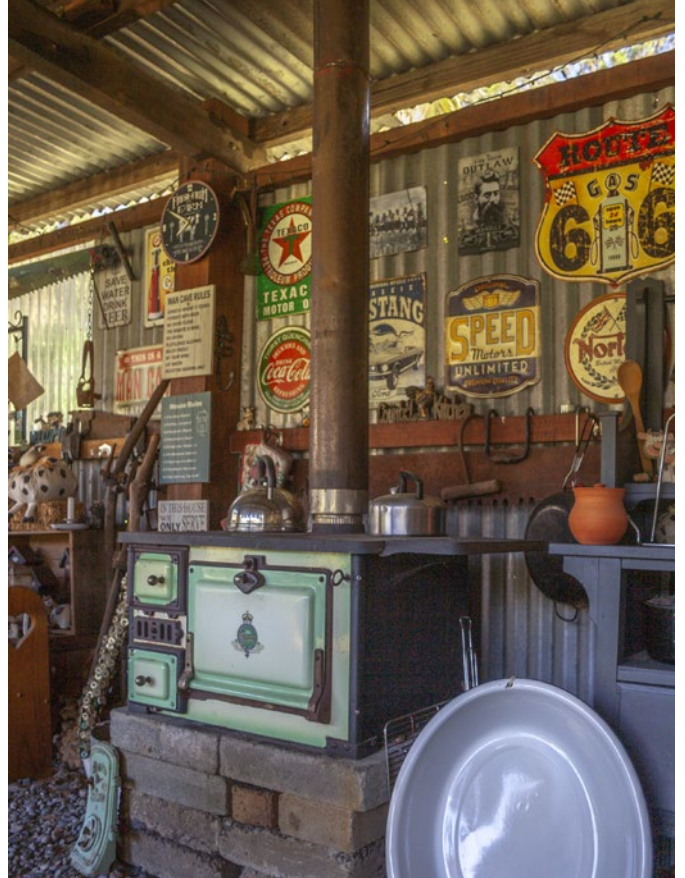
The original structure had used round posts, but they were pretty rotten by this stage. A friend with a farm near Nymboida said 'you need nice square posts' – he had the ironbark timber on his property and a swing saw to mill it himself. Roof timbers from the original structure were reused, while some new timber for the rails was bought from a local mill.

Russell built it all, with 'a little help from my friends'. A mini excavator was used to dig the holes, then the posts were

rammed in, no concrete used at all. The metal cladding was all salvaged, mostly as the result of damage from a hailstorm. An opening window hatch was fabricated on the northern wall from timber offcuts and a piece of clear sheeting.

A friend donated the Gresham Pub sign. They collected bits and pieces as they went – a lot from the side of the road, and friends have donated finds – all have a story behind them. As a result, although it was completed just over two years ago, it looks 200-years old!







A few of the special items that caught my eye were:

- Door from Russell's mom's house
- Ladder from a friend now used as a display and storage rack
- Lagerphone, a homemade musical instrument with beer bottle tops
- First aid suitcase from a Hunter District Ambulance bought at a garage sale, still has the tag 'Maternity Kit Car No 15'
- S&S Rockford wool bale stencil, which has a family connection
- Firepit given to Russell by the grandkids as a birthday present.

The area is well-used, summer and winter, with friends and family or by just Russell and Jenny. And this is certainly not a 'pub with no beer'... Cheers! ♦





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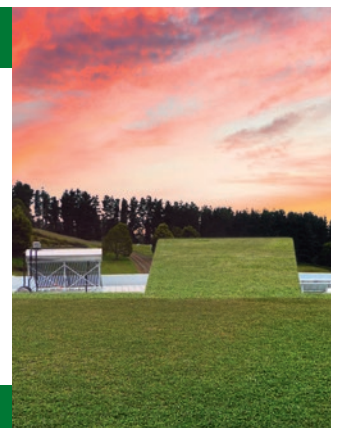
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Torbay hempcrete

*What's better than building an energy efficient, solar passive, low impact home?
Telling everyone about it!*

BY BEN WHITAKER
PHOTOS: ALEXIA JANKOWSKI

Alexia and I wanted a home to blend in with the landscape, taking full advantage of the view while at the same time being low impact and energy efficient. We wanted a strong sense of connection with the outside when inside.

We did a lot of research to come up with the design, with some help along the way; for us minimal, functional and natural were key aspects we wanted to

incorporate. We had initially hoped to build a two-storey house with a vaulted living room ceiling to create a sense of space inside. However, due to budget restrictions and solar passive design principles, we had to compromise and change our design.

Solar Dwellings is the company that helped us with design ideas, specifically the solar passive nature of the design.

We attended their Sustainable House Day tour in Perth, which took us to visit a number of stand-out sustainable designs and helped us in drafting what we wanted. Griff Morris was very helpful in assisting us despite our budget restrictions as he wants to see solar passive house design being a low budget option, not only for those at the high end of the market.



Building two-storey can add a significant cost. Guidance from Solar Dwellings was to avoid high ceilings if you want to maximise solar passive heating/cooling performance. Therefore we created our 'second storey' in the roof attic as a master bedroom loft room with a magnificent view. We kept ceilings in the house at 2.7m high (slightly higher than average); following this advice we have already noticed, through a summer and winter, how effective our house is at regulating inside temperatures.

We also wanted to build a house that was bushfire resistant (as much as possible), and that factor played a big part in our selection of hempcrete for the external walls. The best thing was that hempcrete helped in making the build carbon negative. We had planned on rendering the interior walls but once we saw the natural beauty of the hemp, we just couldn't do it.

Considering constraints

The hill gives us great views but also needed some clever planning with retaining and clearing, the earthworks was huge to take on ourselves. We wanted to keep as many trees and natural ground levels as our Bushfire Attack Level (BAL) rating would allow. Leaving the trees made it difficult and added extra work but worth it. Every truck driver told us to cut down the marri tree in the centre of the driveway making it difficult to turn but we didn't, as we had spotted ringtail possums feeding in it one night, short term pain for long term gain.

Upslope of the house on the cut side we constructed a terraced retaining wall which also doubles as tiered garden beds up the hill. Downslope of the house on the fill side we mulched and planted the sandy banks with local pigface plants (*Carpobrotus*) that stabilised the sand and is also a fire-tolerant. We spent 12 months slowly snapping bits off the pigface and replanting them, effectively farming it to spread across large areas. Alexia has become the professional 'Pigface Farmer'. With the beautiful surrounding bushland the key aspect was to create level areas for the house, driveway and garden without scaring the natural landscape or creating views a lot higher than natural ground level, this intern created less retaining and helped the place blend in.





The other challenge we had was that the view is to the east (downslope) while the sun is to the north, therefore it was a trade-off between views and solar passive performance. We had to design the rooms and house layout so that we could maximise the north-facing windows to heat the house while eastern windows allowed access to the view. We limited the number of windows on the south and west faces to reduce heat loss potential. Initially we had plans for underfloor heating and slab insulation, but with research and understanding of the solar design we realised we didn't need these extras with the climate of our region.

Materials and techniques

Leftover hemp and lime was sourced from a local hemp build – Deco-Village in Denmark – as well as their expertise and knowledge of Paul Llewellyn. We used the traditional hemp and lime install with a timber frame encased in 250mm of hemp built in situ. The hemp plant product originally came from Europe as this was the most cost effective solution at the time. OzHemp, a local seller in Perth, sourced the remainder of the product we needed, as the leftover hemp we sourced was not quite enough for the whole build.

Our builder Brendan Kelly (New Earth Living) used a timber frame encased in

hempcrete on the lower level and cement sheeting weatherboard exterior cladding on the top loft storey. We embedded large jarrah limbs into the hempcrete walls for textural detail. Hempcrete is naturally termite resistant. However, as our house is structurally timber framed, we had a *Termimesh* barrier installed around the house to prevent termite ingress.

The hempcrete does crack slightly but this is not an issue once rendered and does not affect the structural integrity, we are okay with the cracks showing and there are ways to fill and prevent them. Using lime mixed with the hemp can dry out the skin and be dangerous to inhale or get in the eyes, it is messy doing the installation and precautions must be taken by wearing the correct PPE.

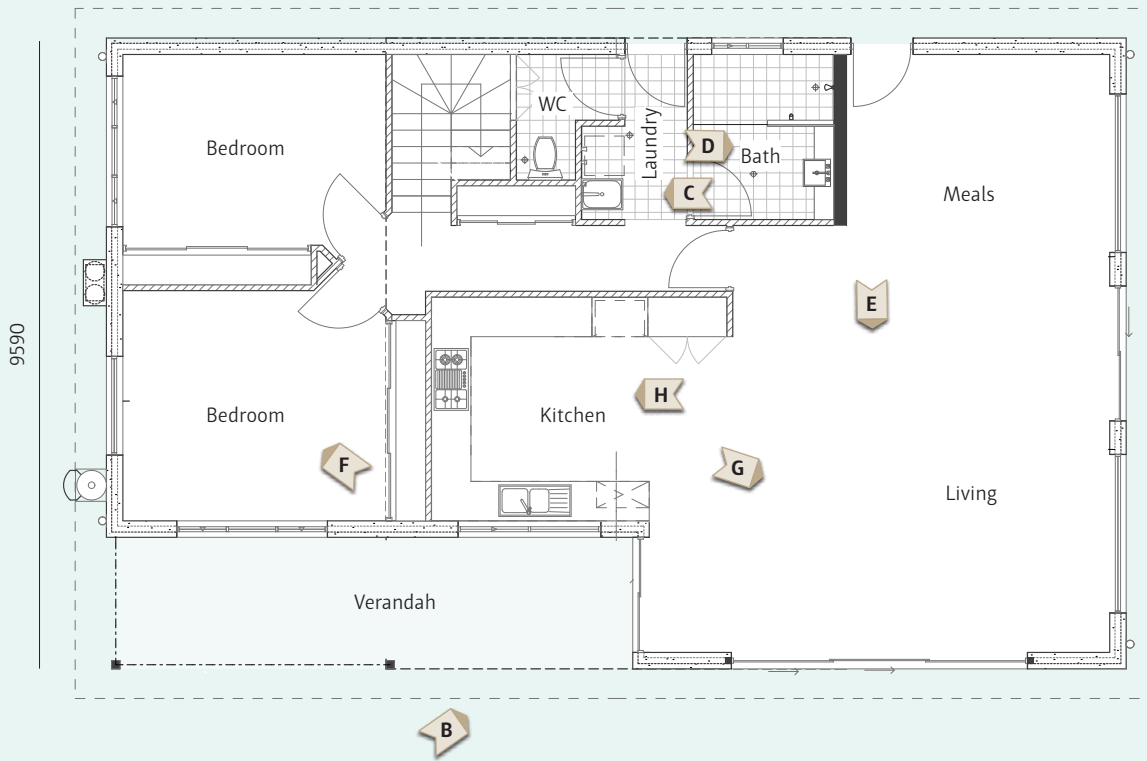
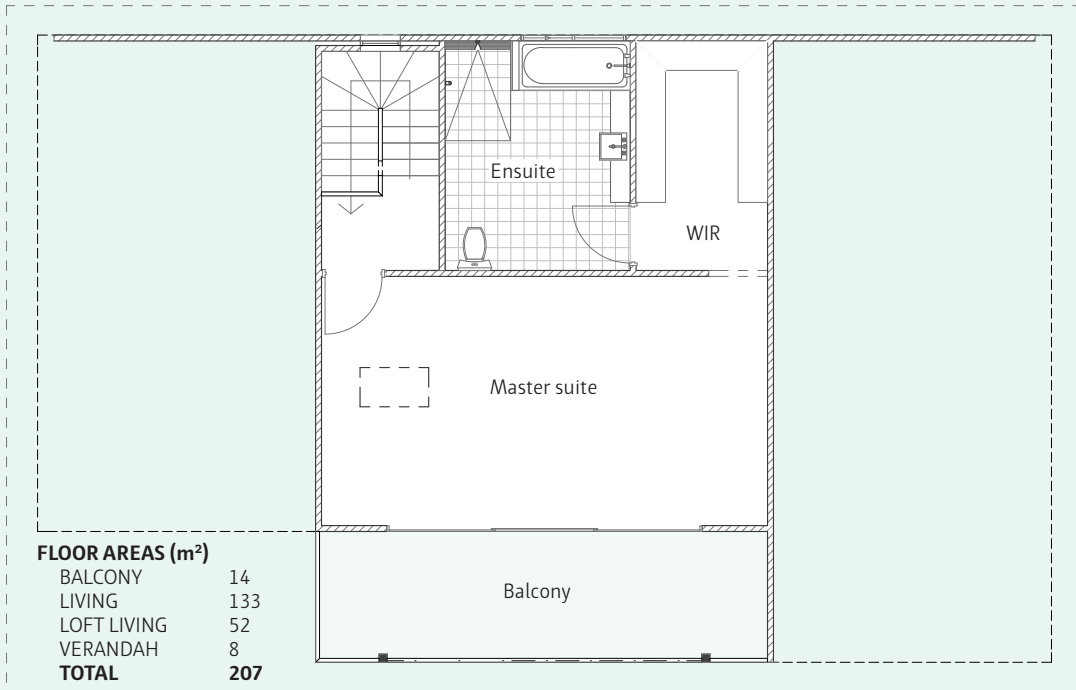
Windows are double-glazed, low-e, argon-filled uPVC throughout, apart from those on the northern side that are double glazed but not low-e or argon-filled. The window placement was a key aspect in the build. We polished the concrete slab as our final floor finish and chose a dark coloured tint in the concrete to maximise solar heat retention. Marri timber bench tops feature throughout.





A

15500



Floor plan

Arrow letters refer to photos

Approvals process

The usual approvals were required for planning and engineering. As our council was unfamiliar with hempcrete, the certification process was more complicated than we expected, with certification required to be carried out by someone with experience of building with hempcrete.

A large part of the planning approval required us to demonstrate we would meet a BAL-29 rating, so we enlisted the services of a BAL assessor and local fire volunteers to advise on how to plan our build with this in mind. Being located in a high risk bushfire area does play on your mind and we will be putting a lot of time and energy into preventing the worst by burning off, maintenance and low fuel zones with minimal impact to the flora and fauna.

Given the slope and long-unburnt vegetation on the block, we had to work very hard to clear the necessary buffer zone while still keeping isolated trees in place. If we had simply hired a contractor to clear the buffer area it would have been easy, but we would have ended up with a 30m+ barren zone around the whole house, which would lead to erosion, weeds and other impacts we wished to avoid. Instead we hired an excavator and painstakingly removed individual trees and branches to achieve our BAL rating with minimal environmental impact.



Services

WATER

As there is no town water, we have a 110,000-litre tank, with a filtration system, for collecting water from the roof. We created a first flush system ourselves from PVC, with the overflow connected into the garden reticulation. We have no dams as the hill we live on is steep in places and fully vegetated. Natural groundwater does get exposed in winter through heavy falls but it quickly dissipates.

We have a 220-litre *Chromogen Midea* heat pump hot water system, which was recommended for reliability and price. The easy-to-use interface is great, and using the timer means it only runs when the solar is active.

Currently our waste water goes to a basic septic system. However, we have installed a valve and separate plumbing piping to divert all greywater away from the septic in future and onto the garden.

POWER

We are connected to the grid but also have a 3kW solar system. This was the largest we could install due to the limitations of our 300m cable feeding into the grid; any more kW and it would create a bottleneck down the line. We are looking to go off grid completely when we can afford batteries. Including an inverter, the cost was around \$4500 to supply and install.

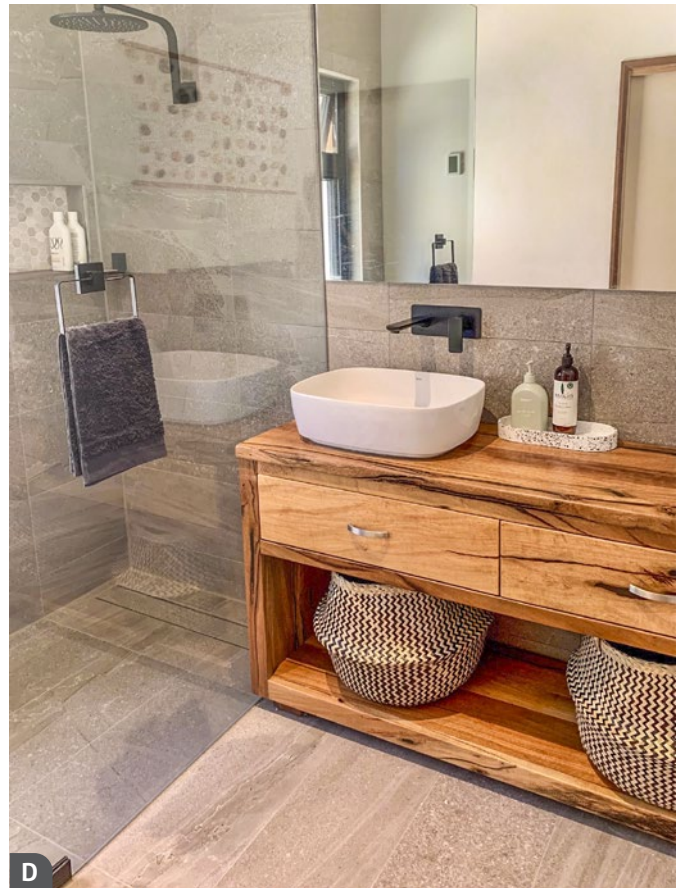
HEATING AND COOLING

First and foremost we constructed our house so that we would not require energy intensive heating and cooling systems. Having lived in Perth, we found it incredibly frustrating that houses were built with no regard for their surroundings or climate and therefore reverse cycle airconditioners were operated 24 hours a day. The solar passive design meant we would be comfortable most of the year round. This included horizontal (concrete floor) and vertical (internal brick wall) thermal mass to absorb the sun entering through northern windows and then slowly release it through the night, double glazing to hold heat in, and hempcrete walls to act as insulating material all year round.

We installed a fireplace (with inbuilt oven) as a back-up plan and were advised that we would likely only require it for warmth a handful of times a year, even in the Great Southern region of WA! So far we have lit it a few times for warmth, but mostly for ambience. There is no other heating in the house. Ceiling fans provide a cooling effect through air movement.

Other than that, we rely on our solar passive design: eaves to the north, hempcrete walls, window design considering summer sun angles reducing heat gain inside and keeping the house cool, and windows that allow the sea breeze in summer to cool down the interior naturally.







Build process

I am a landscaper by trade, currently working in surveying. Alexia is an Environmental Advisor working in the Pilbara region of WA on a 2 on/2 off roster. Both of us had to juggle FIFO rosters, copious amounts of driving and no time of our own to complete this project alone. Brendan, from New Earth Living, completed the structural parts of the build including the hemp installation and dedicated himself to the build.

We had intended to outsource a lot of the internal works post lock-up however after COVID struck there was a significant shortage of local tradespersons to assist. We took on a number of jobs ourselves, like decking, painting, kitchen design, treatment and installation of the natural edge marri benchtops, and all the floor-to-ceiling tiling of the wet areas. We had Rainbow Kitchens install the kitchen cabinetry and a concrete polisher to finish off after lock-up.

We love our hidden cupboard under the stairs. We wanted to make the most of every space for storage and this hidden cupboard hides our solar controller, meter box and house cleaning gear. The natural timber branches from trees we removed, cut in half and placed in the hempcrete wall, was an inspired move. There are

also shells inlaid in the walls. Aggregate, whales teeth and shells were added to the concrete floor. The simple sleek design has no skirting or cornice and makes a feature of the hard wearing concrete floor, while maximising on the beautiful landscape and having the connection with nature by well-placed glazing.

We spent over a year sourcing second-hand or second grade items for the house including vanities, toilets, basins/sinks and appliances and we are proud of the sustainable nature of this choice (despite how much work it is!). The design of the wet areas centred around our second-hand, solid recycled marri timber vanity; the bathroom, laundry and toilet were all planned off this piece that we scored for a bargain. Initially on our plans we had two empty spaces either side of the master bedroom in the loft ceiling void. These became two rooms that can be used as storage, rumpus rooms or an office, by changing the design mid build to include floors over the ceiling below.

Guarinup View is located at Kronkup on the south coast of WA, approximately 800m from the beautiful beaches overlooking Cosy Corner area. Unusually in WA, our ocean views are east-facing due to our location on West Cape Howe Peninsula. This means we get to watch the sunrise over the ocean but we are

protected from the brunt of south-westerly storms and weather, as we are on the leeward side of the hill.

As the hill has environmental protection, no crops or stock are permitted by our council and the title only allows for a limited building envelope in a rural residential area. It is difficult to live residentially in Albany and make a living locally, with the ideal location we are considering the possibility of Airbnb in the future.

Building is not for the faint hearted and takes huge commitment and sacrifices over a long period of time. We are lucky to have family and friends who supported us as well as our jobs, which helped us with even time rosters to work on break and keep earning money for variations and fit out. As hard as we tried to keep under budget around \$300,000 for house and slab, we did go over by around \$50,000 but we are happy with the end result and you can't put a price on that. We can't recommend hempcrete enough for all its qualities! ♦

Alexia and Ben can be contacted by their email addresses or on LinkedIn:
whitakerb1@gmail.com
alexia.jankowski@hotmail.com

On Instagram, see the build journey in pictures. Search for #torbayhempbuild



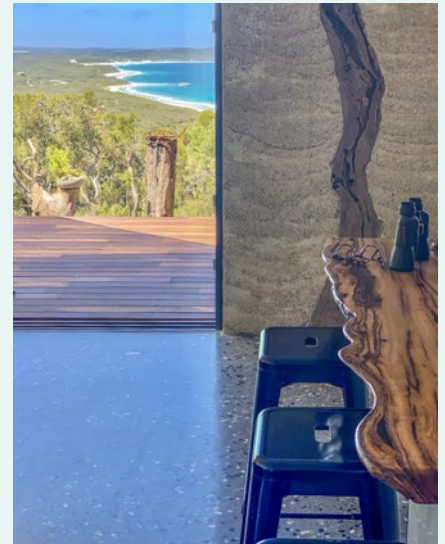
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Tips of the trade...

Derek Sallans is a home designer and craftsman, providing a sense of timelessness which is hard to come by in a new home.

BY DEREK SALLANS

Cooling tubes

Most homes in Australia rely on some form of active cooling through airconditioning and, if they don't, the most widespread alternative is passive cooling through night breezes. When you're thinking about design, another option to consider for passive cooling is to install underground cooling tubes.

A 100-200mm pipe, running for around 90m at 1m underground, will cool incoming air to the ambient ground temperature of approximately 16°C. Air is drawn through the cooling tube either by actively drawing air out of the home, or through using the stack effect in a multi-level home.

With a small extractor fan in the ceiling of a living room or bedroom, you can create the right level of suction through the cooling tube to allow the air time to cool as it is pulled through the tube. In a two storey home, opening upper windows or skylights in the highest part of the home will use the stack, or chimney, effect of the warm internal air to achieve the same result.

A great advantage for areas that are also cold in winter, is that if you run an internal fireplace, you can use the cooling tube to create warm make-up air. Outside temperature -5°C? The tube will warm that air to the ground temperature of 16°C!

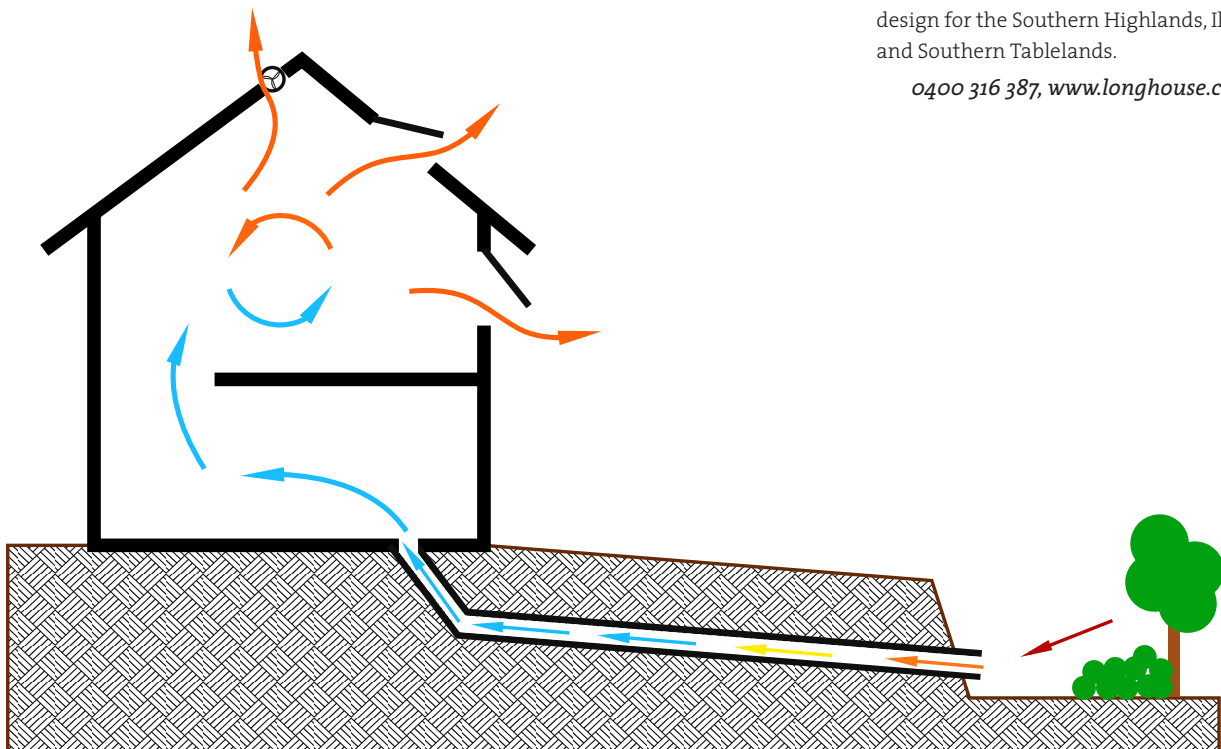
An important consideration when trenching for the tube is that humidity in the air will condense inside the pipe as it's cooled. Make sure you have a fall of 1-5° on the pipe, towards the intake point so that condensation can drain, or you may get mould issues down the line.

It's a nice idea to have a landscape feature at the intake end of the pipe as well to create a microclimate that will pre-condition your air. A small pond can help cool and humidify the air, or a perennial flower garden with species that flower across the whole year will give you both cool and perfumed air. ♦

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Handy hints...

Stefan Nechwatal always has projects on the go, many of which relate to building, engineering and landscaping. He believes that an owner builder is, by necessity, a master of many talents.

The mobile generator

As a new homesteader, relocating from Melbourne to rural Daylesford in 1987, one of the first things to learn was that the power went out frequently. Needing to be as self-reliant as possible, the first step, apart from ditching the old electric stove for a new bottled gas stove, was to research new petrol engine home generators.

Cameron's Welding & Industrial in Ballarat advised me on a suitable unit from their catalogue. I had decided that my best option was the biggest of the small generators available. Ideally, it needed to be riding on a wheeled trolley, to transport it wherever needed on our rural property. A 6.5hp engine, rated at 3.5kVA, would perform many tasks, powering a wide range of electric appliances from house to workshop.

The *Scorpion Silent Series*, producing a maximum of 2800W,

had a Honda copy engine and was imported by Austech Industries. Considering that the *Scorpion* model DY3000L weighed in at more than 50kg including the tubular frame, designing a trolley with handles would allow the package to traverse any sort of terrain. Balloon style pneumatic tyres on 150mm rims, two at the front being swivel and the rear two being fixed, meant that I would have a mobile electric supply anywhere on the property, well away from power points.

FABRICATION

The horizontal tray base is 3mm flat sheet, framed with 45x45x3mm angle. The rear vertical frame is 30x30mm and 40x40x2.1mm RHS (rectangular hollow section). Below the tray base are two strong outriggers made from 100x50x3mm RHS, allowing a wider stance for the wheels for better stability on sloping terrain.

A general purpose toolbox, made from 12mm exterior ply, is bolted to the vertical frame and the two handles provide a retainer for a 4m extension cord. Secured to the front of the ply box are two swivel floodlights to create permanent draw, plus they are handy at night when wheeling the unit across the paddock.



The concrete mixer

I had done many concreting jobs at my Kew country cottage and realised that, moving to a homestead, there would be many uses for my own concrete mixer. At that time, Wesbarrows in Burwood were agents for quality *Carpenter & Grosvenor* concrete mixers made in South Australia. I chose the *Tradesman* model with large pneumatic tyres, a drawbar and full sheet-metal weather cabinet, which protected the electric motor and pulleys. It came with a larger capacity motor, as I believed I could work it harder. Over the 30 odd years since purchasing it, this machine has not missed a beat. Jan and I have used it to perform an amazing array of concrete and mortar tasks.

The design of the manufactured concrete mixer proved to be cumbersome and unsafe, due to the centre of gravity being upset when tilting the drawbar to push it to the job; if you were not alert, it could easily fall over backwards, causing quite a scare. When pushed/pulled across a paddock, it was tiring. A re-design was needed so that I could tow it behind a vehicle.

FABRICATION

The factory drawbar was 60mm diameter pipework that came as a vertical from the barrel, curved 45 degrees and extended about 1.5m with a handle and footstand. That had to be removed to install a typical trailer style drawbar and hitch. In my main workshop, I cut away the curved pipe drawbar. The new drawbar was fabricated using a length of 65x65x3mm RHS with a right-angle turn reaching upwards, strengthened with a heavy triangular steel gusset. Some diagonal struts of 12x12mm steel rod braced the drawbar back to the axle and a 200mm heavy-duty jockey wheel, which swung away, was fitted, together with a new tow ball coupling and safety chains. I also upgraded the axle by welding some 25x25mm angle to stiffen it against heavy loads.



The steel weather cabinet was rebuilt and strengthened, with a new hinge flap fabricated and heavy-duty hinges. This alteration protected the motor in a better way than before so sand or gravel could not enter. I always like to keep my equipment well painted to protect it from the harsh Highland weather, so the whole unit was prepared and spray painted in the original factory colour.

You will notice two wooden crates under the wheels. This is a recent addition. Each side is lifted onto these low boxes, which secures the unit from slipping around as the base is rubber. The main benefit is that, because the mixer is elevated 50mm, it is easier to tilt the mixing barrel into the waiting tradesman's wheelbarrow, without the rim fouling the sides.

The modified mixer is a dream to use, to pull it out of the shed or tow it with a vehicle to any work site on the property where, in conjunction with the mobile generator, Jan and I can create any project.

A few months ago, we took delivery of a new slimline 3000-litre tank to hold potable water piped under gravity to a single tap in the kitchen. This has required extensive work to create safe passage of excess rainwater into the garden, through two 90mm overflows. The mixer and generator made the tasks so much easier and safer.

The final part happened today, this time with labourer Les, who assisted with laying mortared split blue slate in a flat U-shaped open drain. We were using my three-piece trowel set from 1966, which consisted of two small pointed trowels and a round edge one. These had been engraved, made in Czechoslovakia and are today in as-new condition. We were also using my old faithful, short handled spade which is devoted to concrete work.

I look after my tools! ♦





◆ **Paradiso Arts**

Stefan Nechwatal often sends us snippets of the amazingly creative work he does, and we have featured his projects in many issues.

Paradiso Arts features a gallery, workshop, sculpture courtyard and garden. Daylesford, Victoria.

03 5348 6600,

www.paradisoarts.com.au



Review...

A Complete Guide To Straw Bale Building

Rikki Nitzkin & Maren Termens

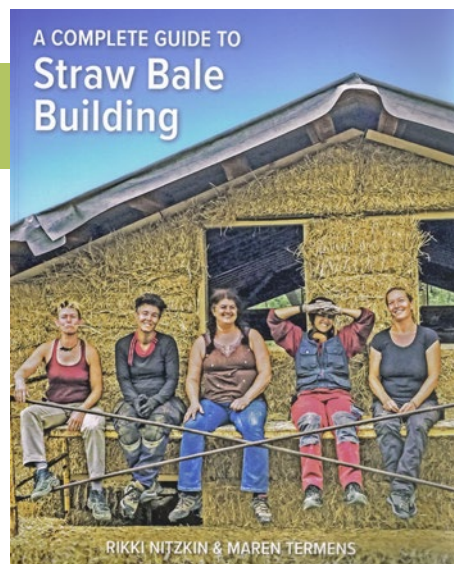
RRP AU\$67.95

320 pages, soft cover

Permanent Publications (2020)

ISBN 9781856233132

www.permanentpublications.co.uk



REVIEW BY GRAEME NORTH

Rikki Nitzkin translated this book (from Spanish) that she and collaborator Maren Termens wrote, and it is a vastly updated and improved version of a book they wrote several years ago. This new book states it is a complete guide, and it really does live up to its name. To cover nearly everything about straw bale building in one book would be an horrendously difficult task, but this book really does come very close to pulling it off. Its contents are well backed by many years of wide ranging practical experience, collaboration and research by the authors, with the results presented in a clear and enthusiastic way.

This book is aimed primarily at the owner builder, creating a wonderful resource for someone looking to build for themselves, by giving good advice and self-confidence. It covers nearly every aspect of building with straw bales you would need, and answers or addresses nearly every question that is often asked. The text is supported by a series of good photographs and clear line drawings. In so doing it also becomes a very valuable resource for professionals, practitioners, and decision makers alike when dealing with virtually any aspect of straw bale building.

The many different ways that straw bales can be placed in walls, either fully loadbearing or within a variety of structural frames, are well covered. Various hybrid or prefabricated wall systems are also included. The wide range of methods of compressing the straw within any partial wall system are given great coverage, including various options and sensible advice. There is a mixture of good general advice ('build small'), the importance of careful assessment of the site and its weather exposure, along with sensible comments about dealing with moisture, and finishing. You are given guidance about when it's a great idea to go and seek further advice.

Inevitably a few areas are barely touched on. For example, the excellent resistance of straw bale walls to earthquakes in seismic areas is noted several times, but the section on various ways to build footings to support straw bale walls, although dealing with moisture and construction issues really well, does not mention the critical need for footings in seismic areas to resist earthquakes as well as the walls they support. This may be considered a fairly

minor niggle as most seismic areas will require some specific engineering advice. However, engineers often need help with understanding a range of ideas based around natural building.

There are very good chapters on surface finishes, with earthen and lime plasters getting a chapter each. In line with the rest of the book, there is heaps of good advice and guidance on selecting and preparing materials, and on their application. There are trouble shooting guides and tips on how to avoid several common mistakes. The vexed question of whether to use lime plasters over earthen plasters is discussed and the difficulties of achieving a reliable result are explained. 'Based on the mixed results using lime render over earthen substrates has given, we cannot recommend that professional builders apply lime over earth. It is risky, and you may just have to return to the building later on in order to make modifications or repairs'. ♦

Generally I think that this is an impressive book that will prove to be great benefit to natural building, and I can thoroughly recommend it to all owner builders and natural builders everywhere, and especially those contemplating or embarking on straw bale building.

Graeme North is a New Zealand architect. He chairs the Standards New Zealand Technical Committee for earth building standards, and managed to wrangle the inclusion of an advisory appendix on straw bale building in the recently revised NZS 4299:2020 Earth buildings not requiring specific engineering design.
www.ecodesign.co.nz

Taller Con Co (Rikki Nitzkin) promotes straw bale construction to create sustainable, efficient and ecological houses.
www.tallerconco.org

CHAPTER 5

The Bale of Straw: Everything you Need to Know

Advice for ordering custom made bales

Ask the farmer to take the following precautions:

Harvesting

- Use a tangential harvesting machine.
- Regulate the harvesting machine so that it cuts a little higher than usual. This helps avoid baling weeds that are close to the ground.
- Make evenly sized rows of straw.
- Don't leave the straw in the field very long (more than two weeks) before baling.

Baling machine

- Service the baler before use. Make sure it is well oiled/greased.
- Tighten the tensioning screws to maximum (but uniformly).
- Try installing something to narrow the baling chamber. This can augment the density.

Baling

- Choose the longest straw available.
- Bale in the morning, but not so early that it is still wet from the morning dew. It can be a bit damp (from dew not rain), but not wet. If the straw is too dry, it won't compact as well.
- Regulate the speed of the tractor, it should be at a fast but steady pace.
- Make sure the feeding mechanism is always full (and that there is enough straw in the row).
- Adjust the length to your design.
- Don't leave the bale in the field to get rained on!

A construction quality bale: factors to keep in mind

Humidity

- The drier the bale is, the better, as there is less possibility for fungal growth or mould to occur. It is easy to identify mouldy straw by its rotten smell and discolouration. Healthy, dry straw smells good, like sunlight!
- You should never build with straw that has over 15% relative humidity. If you are using your physical senses to make this judgement, only use straw that presents no signs of humidity. If you like, you can buy or borrow a moisture meter to be sure. These meters should be designed for using with straw or grains, and have a spike long enough to reach the centre of the bale, which is where the measurement should be made.
- Bale recently cut straw. If the straw is sitting in the field too long, it can be damaged by rain or excess sun. If possible, bale immediately after harvesting.
- If buying pre-made bales, make sure you inspect them well for signs of water damage (from a leaky roof, for example). If you have any doubts, open up a few bales and check them out inside.
- Make sure to store the bales properly, so that they stay dry until used.

Pre-order your bales for maximum quality.
Order at least 10% more bales than your design calls for.
Go to the field to supervise the process and load the bales onto transportation for adequate storage.

A Complete Guide To Straw Bale Building

Extract from **A Complete Guide To Straw Bale Building**

By Rikki Nitzkin & Maren Termens

Published by Permanent Publications (2020)

Choose the System According to Bale Quality

If you can't find dense enough bales for load-bearing construction, you can choose between using an infill system or recompressing the bales manually.



Moisture meters have digital screens which tell you the precise amount of relative humidity in the bale. Stick the spike into the centre of the bale to take the reading.



Is it hard to get your fist below the string?

Density

- Building quality bales will have a density of at least 80kg/m³ (more for loadbearing walls). If the bales have less density, they can be used as infill in columns, but are harder to handle without deforming.
- For a quick, simple check: test the tension of the strings. If you can fit a fist under the strings easily, the bale is not well compressed.
- If you cannot find sufficiently dense bales, you can build a simple machine to re-compress them individually, although this is only recommended if you have lots of volunteers available to do the work. Usually, it is easier to choose a system which works with the density of bale you have available.
- If you want extremely dense bales (up to 130kg/m³) find one of the more modern baling machines mentioned earlier.

Calculate the Density

You must divide the weight of the bale by its cubic metre. You should also determine how many kilograms. Subtract the weight due to water (humidity level). If you don't have a moisture meter, you will have to guess (at 10-15% if bale seems dry to the touch).

Example – where bale measures:

$35 \times 50 \times 90\text{cm} = 0.35 \times 0.5 \times 0.9\text{m} = 0.1575\text{m}^3$
and weighs: 19kg

Density without including water content:
 $19 \div 0.1575\text{m}^3 = 120\text{kg/m}^3 =$ a very dense bale!

Density including water content: 10% humidity
 $19\text{kg} \times (19\text{kg} \times 10\%) = 19 \times 1.9 = 17.1\text{kg}$
 $17.1\text{kg} \div 0.1575\text{m}^3 = 108.6\text{kg/m}^3 =$ a good density.

As you can see, if you don't include the weight of the water, you will get a higher, but inaccurate result.

Test the Structural Integrity of the Bale

Cut the strings of the bale. If you can separate the flakes easily, and lift one between your thumb and index finger without it falling apart or losing its shape, the straw is long enough.

Quality of the fibre

- Long straw: avoid using bales consisting of chopped straw. Long straw means fibres which average more than 15cm long; the longer the better! This is especially important if using the bales structurally, if you want to notch them, or if you use a system where they are stacked like bricks. If you only have access to bales with very short straws, use a system that places the bales in columns the same width as the bale. Even if the bale is dense, if the straw is short it depends entirely on the strings for structural integrity, and it also burns more easily. Usually, the bales have a 'cut side' and a 'folded side'. If the straw is too short, it doesn't have the chance to fold. These bales are less solid and resistant.
- Avoid straw whose grains have not been well harvested. Seed heads in the bales can attract rodents.
- Avoid too many green plants (like weeds) getting into the bale. They have a higher humidity content which can lead to rot. This can be done via the height of the harvester.

How to measure bales

It is important to know the size of your bales before making the final plans. Each baling machine produces a slightly different size bale, and this affects the measurements of the stem wall, and the height of the posts. It is always good to measure 10 bales, and then make an average to be sure. Be careful to choose bales from different parts of the pile, as the ones on the bottom will be somewhat more compressed and measure less height than the ones on the top.



Measuring the length of the bale.

Measuring the length

Before measuring the length of the bale, it is important to 'dress' it (process described later in this chapter). There will usually be 10-20cm difference between the shortest and longest bale made by any given machine so measuring just one will not be accurate.

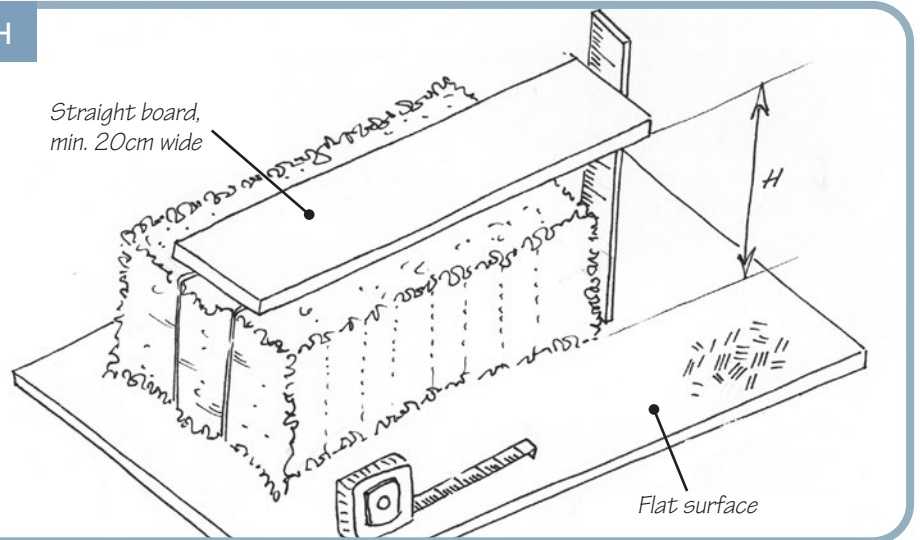
Once the bale is dressed, you can press it up against a wall, place a wide board at the end of the bale, and measure between the board and the wall. Place the pressure on the board in the centre of the end of the bale, so it stays as vertical as possible. Measure as close to the surface of the bale as you can. If no wall is available, use two boards (and two people) to make the measurement. Another option is to take 10 bales and line them up end-to-end, measure the full length and then divide this measurement by 10. This will give you the average length, but not the length of the smallest/largest bale, which can be a useful knowledge to have.

Measuring the height and width

This process is easier than measuring the length. All you need is a flat surface and a straight board at least 20cm wide and 60cm long (bigger is fine). If the board is too narrow, place it diagonally over the bale, to be sure it doesn't sink into the bale. Press the board on top of the bale, placing the pressure in the centre of the board, and measure between the inferior surface and the bottom of the board. Measure the closest to the surface of the bale as is possible for maximum accuracy.

MEASURING THE HEIGHT AND WIDTH

To measure the width, just do the same process with the bale turned on its side



Placement of the bales

Bales can be placed in the walls in three ways: laid flat (with the strings up), on edge (with the strings to the outside, along its long side), or upright (the bale on its short side, strings to the outside).

The bale laid flat

Advantages:

- More stability for the wall, especially if the bales are placed like bricks (in a running bond).
- Easier to change the shape of the bale for opening angles at windows and doors.
- Makes notching the bale to fit a post inside possible.
- Easier to get the first layer of plaster to penetrate deeply into the straw.
- Slight increase in insulation (compared to on edge): U-value $0.12W/m^2K$.

Disadvantages:

- Wider foundation and stem wall than the bale placed on edge. You will also need a slightly larger roof, as the walls are about 10cm wider than bales placed on edge or upright.
- You need an average of 30% more bales than if placed on edge.

The bale on edge

Advantages:

- About 30% less number of bales needed.
- Narrower walls means less material for foundation and roof.
- You will NOT lose insulating capacity. Although the walls are narrower, the fibre of the straw now runs up/down instead of side-to-side. This means the air/heat flows through the wall slower. This results in a similar insulating capacity as the wider, flat bales.

Disadvantages:

- Not recommended for use in loadbearing constructions, or infill systems, which use bales laid in a running bond (instead of in columns).
- More difficult to penetrate the first layer of plaster in the bale (due to the orientation of the fibres).
- If compressing the bales in a column, more likely to form 'bellies' in the wall.
- Slight decrease in insulation (compared to on edge): U-value $0.14W/m^2K$. ♦

Get the design right first...

in an underground home

BY BRIDGET PUSZKA

When Mike rang me, he said he was doing 'due diligence' for his plans to purchase land for his future underground home. He was interested in buying a block of land in Queensland that he said 'had a mountain on it'. Mike later admitted it wasn't so much a mountain, but a hill, in what he described as the 'most beautiful part of the world'. For Mike, living in the uncertain time of

COVID-19 meant that he had a survivalist approach as his plans for his future underground home developed.

Grace, on the other hand, already lives in an underground house that I designed for her, built into a Gippsland hillside, surrounded by trees with a gorge behind her home. At the time Grace told me that she felt her home was going to look like an 'underground bunker'.

So here are two people at two ends of their ideal home journey. Mike, at the start with a dream of an underground home living independently off the land like his grandparents. And Grace at the end of her home journey, living her ideal life, growing fruit and nut trees, vegetables, harvesting rainwater and producing her household energy needs in her underground dream home.





Not long after Grace moved into her underground home, a massive ancient mountain ash tree fell over the creek bed down the hill from her new home. It was a reminder of the powerful force of nature. We want our homes as safe from these forces as possible, whether it be sun, wind, snow, floods, earthquake or bushfires; these forces can be fierce.

What we can do is check that our house insurance will cover us for these natural events. So, Mike's 'due diligence' includes a call to his insurance company before he buys his land to make sure they will provide insurance for the house he wants to build.

Constant temperature

An underground house will be cooler inside in summer because the surrounding earth remains at a constant 14°C, which helps to keep your home cool in summer. For example, it made sense to build dugouts or underground houses to keep cool in Coober Pedy, South Australia, where temperatures are regularly in the high 40°C. These dugouts stay around 23°C all year round, without relying on electricity or airconditioning.

You might think underground houses are like caves. Is Grace's underground home cold and dark and damp? No – the home is light and bright with a north-facing façade allowing the winter sun to warm her home. She has skylights in the rooms without windows, which provide natural daylight and ventilation. Grace's home is designed for cross ventilation with natural breezes providing her with good indoor air quality. Besides, she can relax in her home knowing that the design means that it will not leak or get mouldy from condensation.

Fire safe room as last resort

In bush fire prone areas, each locality will have different Bushfire Attack Levels (BAL). Of these different levels of BAL, there are various compliance requirements to meet the Building Code of Australia. These regulations influence what materials you use, the construction details of your home, as well as how far from trees you can build.

You can check with your local council if they allow you to clear trees in your area and what building requirements you need to meet the BAL for the site that you plan to build on. Building an underground home means that there will likely be no gaps in walls and roof covered by soil. If your home has no gaps, it helps you meet the compliance requirements for bushfire safety regulations.

If you build a home in the Flame Zone (FZ) BAL, in Victoria you need to get approval from the Rural Fire Service before your Planning Permission or Development Application is approved. The FZ is the worst-case BAL when building a home. Grace's underground house is in the flame zone.

In the event of a bushfire, always the safest option is to leave, ideally the night before a Code Red Fire Danger Rating day. During days of extreme bushfire danger, we all need to put safety first, be alert, observant and take precautions.

We all know we should prepare for the worse case. But do we? Grace's underground home has a fire safe room in case she gets stuck in a firestorm or bush fire front and finds that she can't safely leave her home. It is a room of last resort. The fireproof walls, fire-resistant glass and an emergency hatch are there to keep her safe for a short period.

Design solutions

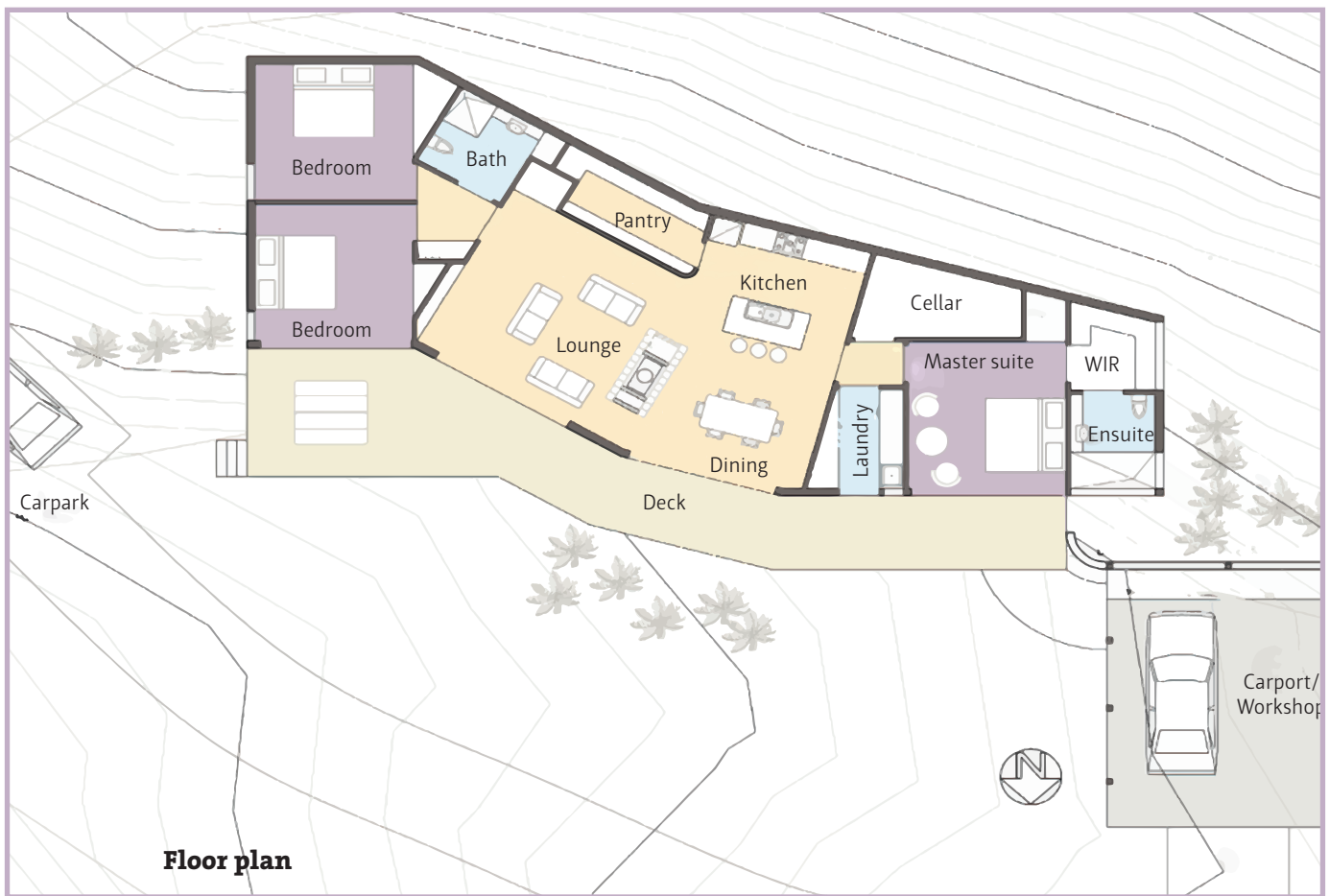
There are many things to consider when planning an underground house, to ensure you end up with a beautiful, liveable, healthy and bushfire safe home. If you don't get the house design right, you can end up with a dark, damp home with musty air that is not healthy.

Doris James MizBejabbbers writes about her 'experience, and not advertising hype', in her article *The Pitfalls of an Underground House*. She identified leaks as one of the biggest problems. Doris said, 'I think the design of the house is part of the problem'. These are the nine problems that she identified:

- Leaks
- Floods during heavy rains
- Limited landscaping
- Cracks during earthquakes
- Difficult and expensive repairs
- Constant mould
- Depreciating value
- Pests
- People invade our privacy.

These problems are hard to fix afterwards; water leaks can do a lot of damage. Identifying potential problems with an underground house allows you to design a solution before you build.

For example, leaks in any house need to be identified and fixed quickly. Water finds the most straightforward path of travel to leak through a building. It may not be apparent where a leak originates from. In an underground home, it is critical to find the leak quickly. Installing a water detection electronic mesh over the waterproof membrane of a roof before you cover it with dirt allows you to locate the source of the leak.



Design considerations

There are three critical issues when designing an underground house.

CONDENSATION

We know that the earth surrounding an underground house has a constant low temperature of 14°C. This temperature is lower than that considered comfortable inside a home, which is temperatures between 20°C and 25°C, so there could be a 10°C difference between indoor air and outdoor surrounding soil temperatures.

A common place to see the impact of a temperature difference is on bathroom windows, after a shower on a cold morning, when moisture beads form on the inside of the glass as the warm moist air inside the house hits the cold surface of the window glass. Because of the temperature difference, the inside lining of walls in an underground house can become damp from condensation, unless you design your home to avoid this problem. Condensation is the reason why some underground houses smell damp and mouldy.

Concept underground house floor plan.

The trick to avoiding condensation is to mitigate this warm moist air meets cold surfaces phenomenon. Insulation is one part of the solution. Keeping the cool internal surfaces warmer means that the temperature difference between the inside air and the surfaces is lower. This means that the air is less likely to be cooled to produce condensation. Along with good ventilations and cross flow through the underground house, this reduces the chance of condensation.

SOIL PRESSURE

In the case of an underground house, the soil surrounding the underground house exerts pressure on the external walls of the house. You don't want the external walls of a house to collapse under ground loads. Exterior walls of an underground house require reinforcement to act as a retaining wall, or a separate retaining wall can be used to hold back the pressures of the soil.

GROUNDWATER

Groundwater seeps through soil naturally. This groundwater needs diverting away from an underground house to stop water seeping into the home. There are two steps to managing groundwater to stop it from becoming a problem.

Firstly, the external walls of an underground house have to be waterproofed, with a membrane painted or sprayed on the exterior surface to form a waterproof membrane. Waterproofing agents can also be applied to concrete during construction to prevent the ingress of water. A simple mistake in the application of a waterproof membrane can cause water to seep into an underground house.

Secondly, you want to divert the groundwater away from the underground house so that it does not become a problem in the first place. In Grace's house, a slotted subsurface drainage collection system is fixed to the outside walls to drain groundwater away from her home.

So whether you are like Mike, at the start of your ideal underground home journey or further along, these three critical issues are worth avoiding, so you don't experience the problems that Doris had in her underground home. Getting help with your home design before you build is well worth it in the long run. Mould issues, water seepage issues and structural issues in a house are expensive and difficult to fix once you have the problem, not to mention the impact on your health and lifestyle. In Doris's underground home, she found it was cheaper for her to walk away from her problems and her underground home than to have them fixed. ♦

Bridget Puszka is a Registered Architect and founding owner of BP Architects. Bridget is an expert in best-practice home design of healthy homes that have good indoor air quality, maintain comfortable indoor air temperatures all year round and have low energy bills. Bridget works closely with her clients, so each home design is different, reflecting her clients' aspirations for their home-life.



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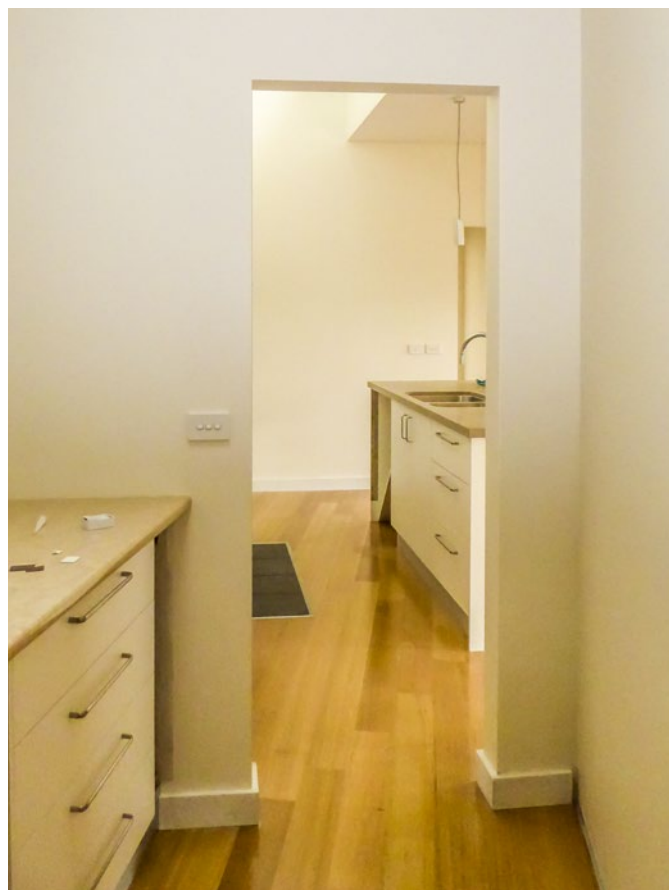
'Why We Don't Like Our Underground House' by Doris James MizBejabbbers.

www.dengarden.com

Above: Large north-facing glazing allows plenty of light into the house, with the concrete slab acting as a thermal sink.

Below left: Include smaller areas of glazing in unusual areas, like in a walk-in robe.

Below right: Clerestory windows and skylights bring natural light into internal areas that don't have windows.



A place called home

BY SUE COULSTOCK

The 40th Anniversary edition of *The Owner Builder* gives us a great reason to reflect on what we mean by 'home'.

The Concise Oxford defines 'home' first and foremost as 'the place where one lives' – a nicely broad and inclusive definition which includes houses, villas, apartments, homesteads, sheds, castles, towers, barn conversions, dugouts, igloos, yurts, teepees, vardos, camping caravans, houseboats, RVs, tiny houses, old railway carriages, and geodomes. Perhaps even tents. Don't laugh, my favourite comedian, Bengt Washburn, lived in a tiny camping tent for a year in order to have a shot at making it on the comedy circuit. Whether a place can be your home depends on what you bring to it and I don't see why a tent can't be home if you fill it with love, self-respect and a bit of your own personality. And when you consider the beautiful, legendary tents of the nomadic people of the Arabian peninsula, how could you even argue.

Status symbol

However, if you were to believe modern mainstream advertising, your home is a building someone else has built, and the building and location you choose are about convenience, comfort and investment – but also about the image you want to project of yourself. Other potential status symbols besides one's dwelling, interior décor and furnishings include one's upwardly mobile job, car, clothes and accessories, yacht, swimming pool, exotic vacations, etc. In that mindset, a home is just another consumerist accessory with which you declare an image to the world.

You and I know this isn't what a home is, that life isn't primarily about things but about relationships and community, creativity and imagination, cooperation and collaboration, love and stewardship, beauty and wonder. The mainstream dream isn't working even for the mainstream. Happiness doesn't correlate eternally with owning more stuff, or with being on an endless hamster wheel in order to own this stuff. Materially we all need food, clothing, and shelter – and once we have good basics, things get flexible. But in much of the West, good basics are increasingly out of reach for large numbers of people, as much of a nation's wealth increasingly transfers into the hands of a tiny few.

The erstwhile Great Australian Dream of home ownership now eludes a growing proportion of our population who are struggling to find and afford even rental accommodation or share housing, or who are already homeless. Marginalised people on the fringes of Sydney pay over \$300 a week – a third more than we pay for the mortgage interest on our owner builder loan – to live in a small demountable in a 'village' of identical ill-built pitiful garden-tool sheds for humans.

Obstacles and action

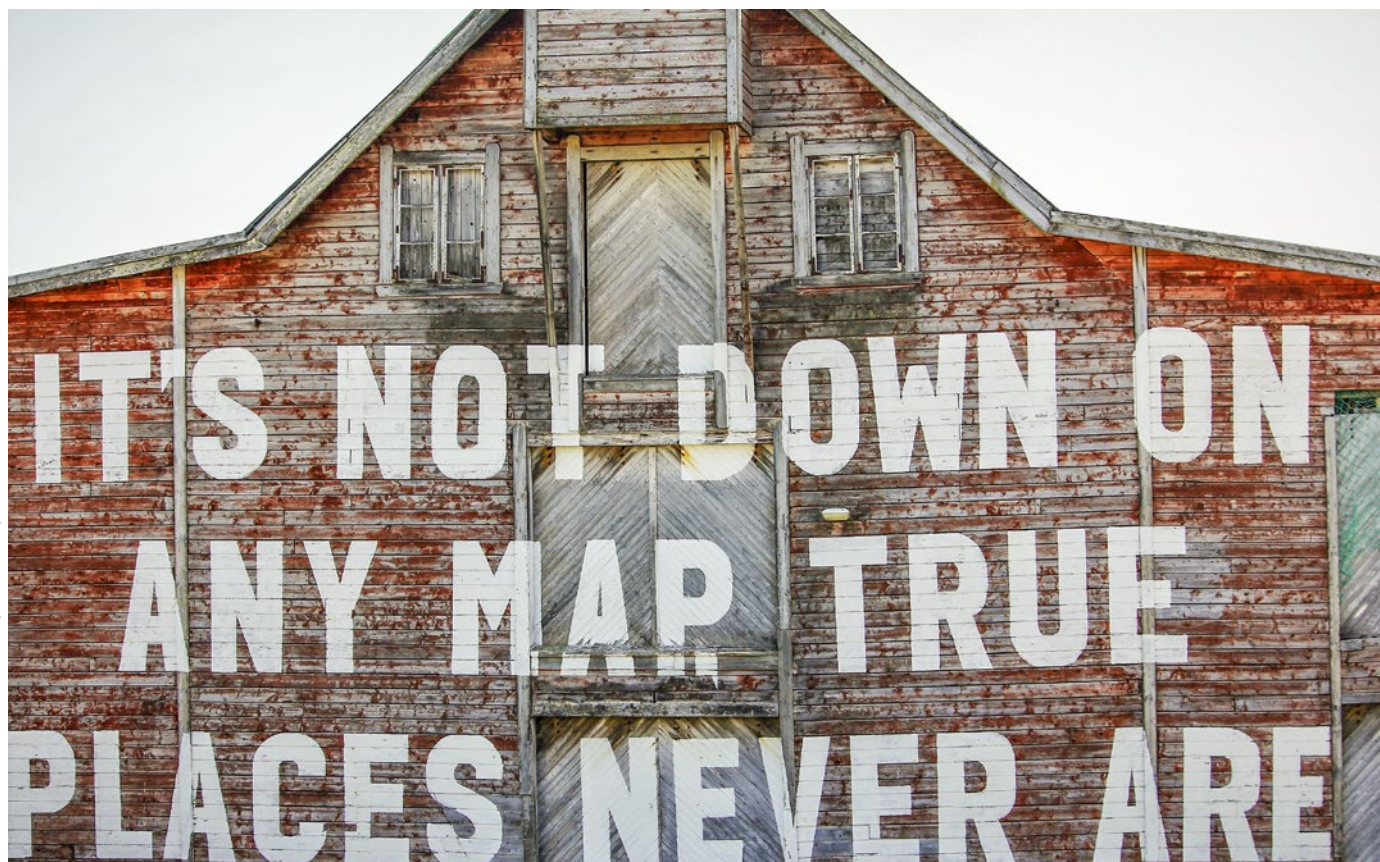
At the same time, all sorts of bureaucratic obstacles and regulations are thrown in the way of alternatives like 'tiny houses' which would let motivated people without deep wallets have the chance to own something of their own, something that they could take pride in and construct themselves, and make

comfortable, creative, individual, and more energy-efficient than the average suburban house.

But can people buy a block of land and put a tiny house on it? Depends where you are. Many councils consider this 'camping' and don't permit even landowners to do it on their own blocks, because there goes the neighbourhood, not to mention the income of the caravan park chain they would like you to use. Can people sub-divide their suburban blocks? It's not unheard of. Can they host tiny houses on their suburban blocks in return for payment, or even for free? No, that's camping again.

What can you do, in defence of a place called home, for yourself and the people you love, and the average Joes and Sallys in our community? Well, you're obliged to vote, and though our political system is well and truly broken, your vote can still make a difference, you can get involved in grass roots organisations for change, you can volunteer for worthy causes.

And while our consumer society railroads us from birth, you can wake up and say no with your wallet wherever possible. You do have choices, such as buying local, buying quality second-hand, buying from small businesses and directly from farmers' markets or your local greengrocer. You can bank with a community bank instead of a for-profit and shift your superannuation to ethical investment. You can grow your own food if you have a garden or are near a community garden, and use heirloom seeds instead of corporation-marketed seeds. You can care about farm animal welfare by asking questions and refusing to buy industrially farmed produce.



Build your own

If you're practical, enjoy learning and persevere with difficult tasks, you can build your own dwelling. We owner-built our first-ever house and intended long-term home, in midlife. This gave us the freedom to spend what is most ordinary people's biggest-ever sum of money on local contractors who took pride in their work, materials that were as local, recycled, eco-friendly and non-toxic as we could get, and to have compost toilets and our own off-grid solar-electric system, instead of the standard flushing toilets that waste nutrients and create pollution and an expensive hook-up to the partly coal-powered grid – and all as part of a careful building budget, which was at the low end of average thanks to the years of work we put in with our own hands.

I quite like to watch *Escape to the Country*. You get to see so many owner-involved hands-on builds, because historically people did this: ordinary people used to either build or assist with the building of their own dwellings, and as a result there's so much earthiness and character and visual delight in vintage houses. Local materials and

labour were used, the climate was carefully considered, practicality and beauty mattered.

A house was meant to last for more than a human lifetime, and many of them did – you routinely see dwellings hundreds of years old in Europe. Our carpenter doesn't think the average Australian suburban house constructed nowadays will be around in a century – he says their construction is too flimsy, is the minimum necessary rather than solid and truly durable.

Building has in many ways become like fast food and fast fashion – a cookie-cutter, production-line approach that churns out inferior products at a cut price. Consumers must share the blame, since they often favour flashiness, low effort and low cost over quality, durability and reparability across so many of their purchasing decisions. But, if this is what goes for 'normal' in our society, many are swept along – and often there's not much choice, when the majority of products offered aren't of a very high standard.

There's often only an illusion of choice – just like at the supermarket where you can look at 20 different tomato sauces and find none with a sugar

content below 20% (unless they're full of saccharine instead). Even in the fresh produce section, you're unlikely to find decent tomatoes for making your own tomato sauce. Fruit and vegetables sold in supermarkets are bred for appearance and shelf life, not taste and nutrition. The sugar content bred into many fruits has gone up considerably. You're likely to have better luck at a passionate greengrocer's who has contacts with local growers, some of which may still be farming heirloom, pre-industrial varieties – I shopped at a wonderful place like that when I lived in Hobart.

These days, we grow much of our own fruit, vegetables and meat, produce our own honey, and source our eggs and fresh milk through acquaintances. We know these products are quality, local and nutritious, and we know the environmental, social justice and animal welfare standards of production. We buy stoneground wholemeal flours from a farm with organic practices. So that's about half our food intake covered – we also need cheese, yoghurt, legumes, nuts, grains, etc. We're careful with what we buy, but there's still room for improvement. It's taken us years to even

get to this point, and it would be very hard to do if both of us worked full-time jobs as we used to.

We're opting for good basics, rather than luxuries and frivolities. If we'd had a house built, we'd have chosen a built-to-last, basic, small 2-bedroom house over and above a poorly built standard 4-bedroom, 2-bathroom family home. But that option didn't exist where we live. If you want a solid house that lasts, if you want to use materials like stone or mud brick or rammed earth or straw bale or earthbag, you generally have to build it yourself, and employ people to help you – unless you have very deep pockets and can engage a specialist builder.

We were always inspired by programmes like *Grand Designs* and publications like *The Owner Builder*. Because of them, we could see for ourselves what could be done instead. Instead of building depressing industrial boxes out of questionable materials and window-dressing them after the fact. Instead of outsourcing to the big building companies who were responsible for the various modern houses my husband and I had lived in since we were children. Houses in which we'd baked in summer and shivered in winter, houses with poor workmanship like mortar smeared all over face bricks or able to be scraped from joints with the fingernails, houses with tiles cracking and shifting in the wet areas, houses in which rodents could enter kitchen cupboards and wall ovens through gaps in external walls, houses with garden walls that wobbled and pipes that leaked into interior walls, houses in which you could smell the formaldehyde and plasticisers in the materials and wondered about hidden asbestos, houses in which the floor drains were never at the lowest point of the room, even a house in which gaps opened between the roof tiles in the first summer because the roofing timbers used had been green, etc. etc. – all built since the 1970s.

Site specific design

In my 40 years in Australia, working in various states, I have lived in exactly one house which was well-built – a Federation era house in Hobart – and all the houses I personally know which are true quality constructions are either historical or owner-built. That's not to say all historical

or owner-built constructions are quality, but that modern Australian production-line housing doesn't stack up well, not in construction methods or workmanship, and not in terms of environmental impact or bushfire safety.

Proper passive solar design is the exception in modern Australian housing, not the norm, and true energy efficiency by getting the important details right for your site and climate is almost unheard of. It's so much easier to construct a one-size-fits-all energy-star system that's like a C-grade high school physics project, and rate houses primarily as eskies for artificial heating and cooling that's taken for granted, than to rate houses for their ability to self-regulate internal temperature, using the sun as the chief source of winter warming, and shading and good cross-ventilation to keep cool in summer.

To do that requires appropriate orientation, glazing, eaves, thermal mass, insulation, consideration of surface area to volume ratio, building depth from the north face, sun angles, surface reflectivity, facilitation of effective natural ventilation – all for a particular site and climate. It's rather more complicated than what the mainstream building industry wants to deal with. It's so much easier just to build your business-as-usual boxes with additional insulation and double glazing, than to redesign from the ground up.

Quality of life

Why are an increasing number of people in Australia getting interested in shopping at farmers' markets, cooking from scratch, celebrating slow food, giving the finger to fashion, thinking for themselves, making careful purchasing decisions, and generally DIYing – including when it comes to building and renovating?

For our household, it's to do with quality of life, good health, ethical considerations, good use of resources, and the satisfaction of thinking things through and being creative and constructive, instead of just earning money and outsourcing various aspects of your life. When you have to eat what you cook, you might actually ask more questions and take more care, and experiment to improve things, over and above commercial standards, than if you

cooked vocationally and formulaically for people whose faces you never see.

What would you rather eat – gluggy tinned soup from a commercial food company, or a decent minestrone cooked up by one of your Italian-Australian friends with a vegetable garden? Packet '*Pasta Carbonara*' or the real thing you've made from scratch and properly, with bright orange-yolked eggs laid by pastured hens?

Likewise, owner-building is people building houses that they actually have to live in themselves – not people building in order to make a buck and then move on. It's true that there are tradespeople who take exceptional care and pride in their work – we got to employ some of this rare breed on our owner build – but the reality is that many people cut corners, get blasé, don't really care that much – and we've met those as well, and had to clean up after them.

Lynda's editorial in *The Owner Builder* 220 December 2020-February 2021 cited an Australian architect who believes owner building should be outlawed, writes about it, and probably lobbies for his cause. Enough is enough. Let's defend and celebrate the beautiful, quirky, comfortable, liveable houses ordinary people have built for centuries around this planet.

Last time Brett and I were in our regional centre, we drove past long stretches of faceless post-60s suburbia. You can tell the different decades by the styling of the boxes people live in. But if you drive to the old parts of town, you see tiny colonial stone cottages that have lasted, jumbled together with larger historic houses made mostly of sandstone and granite with brick accents. You see timber-board cottages, and infill housing from recent decades. Some of the infill housing is the same industrial boxes you can see in the recently built suburbs, but much of it isn't. There are quirky new houses, quirkily renovated older houses, high-end architect-designed buildings, and the odd owner-build.

There are quite a few owner-builds in the hinterland and in neighbouring Denmark, and they mostly look marvellous, just like those we see in *Grand Designs*, *The Owner Builder*, and similar forums for owner building. They will continue to look marvellous as long as they are cared for, because

like the traditional buildings we see in countrysides all around the world, they are usually timeless buildings not stamped by the fashions and fads that will be tomorrow's eyesores. They are dreamed up and built with love, and it shows.

Joy and authenticity

I'm turning pages of *The Owner Builder* and reflecting. The photos make me happy. The buildings look warm, inviting, cosy, quirky, beautiful – even the ones made mostly with modern materials. Love and care always show – it's not trendy, not fashionable, not something you can fake. The details make me catch my breath – little details, big details, practicality and beauty.

So much beauty and character, beginning in the materials – floors of earth, of stained concrete, of earthy tiles and polished wood, of rustic pavers and dark slate, and hand-made tile mosaics. Walls of rammed earth, of plastered straw, of natural and meticulously fitted together stone, of rustic tin or bold-coloured new tin, of logs, of boards, of mud brick and handmade brick, of poured concrete – and still it looks good. Houses look earthy, natural materials shine. The work looks solid and well-made, and you know it's going to last. Interior spaces are filled with light and air, through thoughtful design. Insulation is often way above current standard.

Reading the building stories, you nod and smile in recognition, and wince when the tale turns to the unexpected curveballs and problems, things that needed doing after midnight or for ten straight days in a row without time off, and how there was a time you didn't think you'd ever finish your house. Because you've been there, and because you read so many of these stories before you commenced your own.

There's a joy and an authenticity in many of the photos of homes featured in *The Owner Builder* that you just don't see in big-builder photographs, or in home styling magazines. A house doesn't make a home, even if it's professionally decorated. A home is a safe place you've made special, and filled with love.

Thank you to all the owner builders out there who used their imagination, creativity, persistence and love in the

marathon task of making an inspirational dwelling, and then shared their story – and in doing so, encouraged others to do the same. Thank you Lynda, for collecting and beautifully collating the stories and photographs for 18 long years, and getting them out there and talked about. We're all passing it on, like organic gardeners pass on heirloom seeds to others starting out, and like that special recipe you've got that was passed down through generations and gets made when you're celebrating. Because it's worth it. Because it's about a place called home. ♦

Sue has a B.Sc. in Environmental Science and Biology, and worked in land management research and education before tree changing. Red Moon Sanctuary produces small scale organic beef, honey and heirloom vegetables for sale and has farmstay rooms for visitors. See the house and farm at www.redmoonsanctuary.com.au



Recommended resources

Reading

- Iain de Botton, *Status Anxiety* (Penguin, 2005)
- Tim Flannery, *The Future Eaters* (Grove Press, 2002)
- Naomi Klein, *No Logo* (Picador, 1999)
- Naomi Klein, *This Changes Everything* (Simon&Schuster, 2014)
- Marion Nestle, *Food Politics* (UCP, 2013)
- Larry Olmsted, *Real Food / Fake Food* (Algonquin, 2016)
- Eric Schlosser, *Fast Food Nation* (Houghton Mifflin Harcourt, 2001)
- Rick Smith / Bruce Lourie, *Slow Death By Rubber Duck* (UQP, 2009)

Online

- Bernie Sanders, *The rich-poor gap in America is obscene. So let's fix it – here's how* The Guardian, 29/3/2021
www.theguardian.com
- Mridula Amin, *The Hidden Park Of Last Resort* ABC News Website 11/4/2021
www.abc.net.au

Documentaries and podcasts

- *Super Size Me*, Morgan Spurlock, 2004 documentary
- *That Sugar Film*, Damon Gameau, 2014 documentary
- Bengt Washburn TED talk, *How We Form And Defend Stupid Opinions*
- *Energy efficiency: Not in Australia mate!* ABC Background Briefing, 8/4/2012
www.abc.net.au
- *Energy efficiency: How does your house rate?* ABC Background Briefing, 1/4/2012
www.abc.net.au

Music

- A Spotify playlist created by Sue
<https://spoti.fi/3dQdnA2>

Home for the Hills

BY BOHDAN DORNIK

Construction

This home in the Adelaide Hills has taken into account the high temperature fluctuations of the area and appropriate construction detailing is to be considered.

FOOTINGS AND SLAB

Due to the sloping land and unstable reactive soils, the engineer suggested a waffle pod slab. This has a positive effect on both floor insulation and thermal mass; the lost formwork consists of an upturned prefabricated box which has an air space that provides insulation.

WALLS

Highly insulative rendered straw bale walls built and rendered to comply with the BAL 12.5 rating. The detailing needs to comply with the latest Bushfire Code and AUSBALE has the relevant Bush Fire Report to enable a quick turnaround for council approvals.

Internal walls are to be 90mm stud walls, all insulated with R2.7 insulation.

WINDOWS

Windows have been selected as double glazed.

ROOF AND CEILING

The roof framing is trusses for the flat ceiling areas and an I-Beam (plywood web with timber flanges) for the raked areas. This allows for fixing of ceiling lining and also for a high level R6.0 insulation in the ceiling.

Design comments

SOLAR ORIENTATION AND SPATIAL LAYOUT

Many new builds largely overlook the benefits of an optimised solar orientation. This home considers its Hill surrounds with a northern orientation, allowing the building to make use of passive solar heating without harsh solar heat gains evident with a west orientation. The building welcomes northern sun into the main living areas in winter, with a deciduous plant covered pergola filtering and shading the eastern glazing in summer.

The deck acts as a courtyard area that creates a sense of privacy and screening to the east and west windows. Windows on the western facade have been kept to a minimum to reduce the effects of negative solar heat gain.

MATERIALITY

In addition to the orientation, what makes this building ideal for sustainable living is the material selection. Straw bale is the main construction material used for the walls and at 500mm wide, straw bale provides excellent insulation and thermal properties – not to mention is highly cost effective in the long term.

The concrete slab delivers further benefit; the thermal mass of the concrete is able to slowly release absorbed heat during the cooler months, reducing the need for active heating. The light coloured roof consists of high quality insulation to further insulate and prevent thermal imbalance.

LIFESTYLE

The home has lots of amenity on offer with glazed sliding doors that act as a threshold from main living spaces to decked pergolas, achieving a highly desirable indoor/outdoor living space. A natural stone fireplace adds to the atmosphere of the open living space.

The 3.7m raked ceilings allow for plenty of light to bounce around the natural straw bale rooms, creating a comfortable and warm living interior. The home is of a modest size, comfortable but not too big with all the essentials.

Consideration in the design has been given to provide a liveable house for all ages with wide doors and corridors and easy access to the home from outside. Flexible spaces are important for families; if second living spaces are not required, opt for multipurpose rooms that can grow with your needs. The second bedroom can, for example, act as a guest room, children's playroom or media room. ♦



Architect...

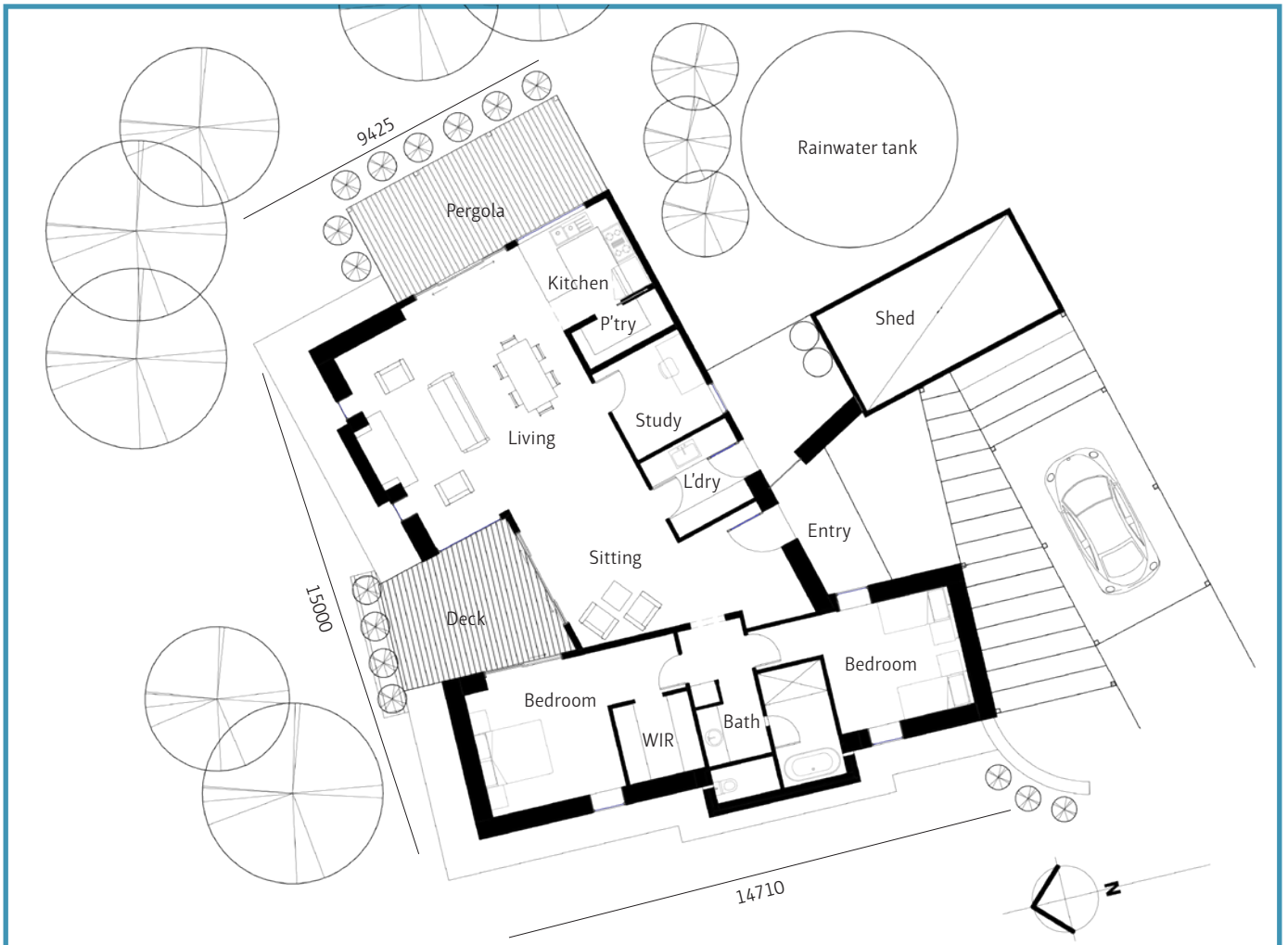
BOHDAN DORNIK & CO.

Adelaide, South Australia

08 8344 8170

www.bdcoarchitects.com.au

BOHDAN DORNIK is a founding member of the Australasian Straw Bale Building Association (AUSBALE). He has designed a large variety of projects with a focus on environmentally sustainable design, including many straw bale homes.



NOTE: This plan is not a finished working drawing, but it is yours to use and modify as required to suit your needs and site. The author accepts no liability for any such use, and recommends the designs be prepared by a professional Architectural Designer or Registered Architect.





AUSBALE

AUSTRALASIAN STRAWBALE BUILDING ASSOCIATION

Looking back, looking forward

BY SCOTT GOLDIE

On behalf of Ausbale, I would like to congratulate and commend *The Owner Builder* magazine on 40 years of service to the owner builder and natural building communities. This has been an invaluable resource for those creating and building their own homes. Not only has it helped the owners but it has been an absolute asset to natural building communities by spreading the word and supporting the various associations. I know there have

been others before her but for the last 18 years, Lynda has done a magnificent job in facilitating and growing the magazine with her tireless time and efforts.

With *The Owner Builder's* 40th anniversary and Ausbale's 20th next year, I thought it would be an opportune time to look back on Ausbale's achievements, and what the future is looking like.

Forward thinking

Ausbale was formed out of the 2002 International Strawbale conference held in Wagga Wagga, with some forward thinking individuals coming together with a common goal to promote strawbale building in Australia and New Zealand. John Glassford, founding president, led the charge for the association, with other forebearers including Per Bernard and Bohdan Dorniak, to name only a few still active in Ausbale.

Up until that time there had been a few individuals operating and experimenting with strawbale building in Australia, from the first building in 1993 by Bill Mollison to John Glassford performing structural, wind loading and creep testing prior to the formation of Ausbale. In 2000, Alan Gray of Earth Garden reported on strawbale buildings in his travels around Australia, in the handbook *Strawbale Homebuilding*.

Viable alternative

Since the formation, the committee of volunteers has passionately strived to push strawbale forward as a viable building alternative. One of the first items for the newly formed committee was to have strawbale buildings fire tested. Many members put invaluable time, effort and money into having the first CSIRO test performed back in 2002. This has been an ongoing agenda item for the past 19 years as standards have changed, leading to the current acquisition of suitable fire reports for members to purchase. This is definitely not the conclusion as, looking into the future and the ever changing requirements of the building industry and National Construction Code, we envisage that more fire tests will need to be conducted.

The Australian Strawbale Construction Guide is another more recent and evolving project that Ausbale has taken on. Released back in 2018, we will be looking at continually updating this guide with more details. An offshoot of this is a more condensed specifications document for architects, designers and engineers to have access to.

After that, there was the release of an insurance report, brought about because of the demand expressed by owners that they were having trouble with insuring strawbale and natural buildings. We have also got



the ball rolling in a couple of other areas expressed in the forums; these are areas of finance/bank lending for natural builds and a database of strawbale buildings that people can view. Both will hopefully be of great use to potential owners wanting to live the strawbale dream.

Ausbale continues to address current issues that arise from building regulation updates to maintain the currency of the strawbale building process. In most cases we know that strawbale construction meets the regulations but we have to have it documented and follow the processes.

Versatility

Looking back and looking forward, strawbale building has many faces, ranging from the owner builder creating their own unique home to homes being totally built by professional services. The former was probably the main market in the earlier days but now, as people look to have homes that perform extremely well in a changing climate and store carbon as well, there has been an increase in professionally built homes with high quality finishes, including in inner city living spaces.

Strawbale building has much versatility: from stacking bales and rendering them yourself, to hiring professionals to do it for you; from earthy organic or fine polished lime plaster finishes revived from days gone by, to expressive artistic sculptures. More recently, experienced Australian strawbale practitioners have developed prefabricated walling systems that arrive ready-made to site.

Ausbale currently have a fantastic mix of people on the committee with lots of experience. With the agenda and projects that we have in the pipeline we are always looking for people to contribute and become involved.

Happy Baling! ♦

Scott Goldie is the current President of Ausbale.



Become a member of Ausbale

If you are interested in straw bales as a building material, then Ausbale membership is invaluable. As a member you will receive:

- Access to the Members Only area of the website, including support.
- Corporate members can create a listing on the professional page, weblinks listing and photo gallery access.
- Discounts at Ausbale conferences.

♦ Ausbale

A group of building industry professionals, researchers, owner builders, and interested people who share knowledge and experiences of strawbale building.

www.ausbale.org

To enjoy a log house, you must love wood

BY MARIAN GANZVELD



PHOTO: PETER HADLEY

Shelters built from trees have been around for ages. Trees provided an instant, natural source of wall material that did not need much preparation such as moulding or drying. The only tool needed was an axe. The oldest surviving log building stands in Russia and was built around 800 BC. An American log structure, Nothnagle Log House, was built in the mid-1600s by Finnish immigrants. To this day it has needed only one log replaced – that one damaged by ivy.

Log construction originally involved laying posts one atop the next and filling gaps with wood chips or mud. Later, logs were squared off for a better fit, and corners were shaped to interlock. Over time, fitting became more sophisticated: interlocking dovetails added strength to corners; the Scandinavians gouged rounded gaps so intersecting logs could be fitted by scribing and trimming. Machinery made things simpler by shaping each log to an identical, consistent diameter and shape. This style makes fitting much easier but does use more energy and wastes a small proportion of the timber.

The log cabin may have started as a one room shelter, but it has evolved into massive, complex structures. The largest commercial log structure, the 100-year-old Fairmont Château Montebello in Québec, Canada, has 211 rooms.

Become a member of LBANZ

The Log Building Association of New Zealand exists to oversee log building standards and monitor building code revisions, while being the source of information about log buildings to those interested.

Members enjoy sharing their log building stories and dreams. A quarterly full colour newsletter 'No Problem!' is either posted or emailed and is highly appreciated among the group. Every two years we get together to renew friendships and view local log houses, with a biennial conference.

We also offer an annual 14-day active hands-on log building course, which has become extremely popular.

◆ **LBANZ**

Up to date information on what's happening on the log building scene in New Zealand and around the world.

www.logbuildingnz.org.nz



PHOTO: MAT RUSHER



PHOTO: ANDREW PACKER

Left: Japanese cedar built by Peter Hadley.
 Above left: Show home under construction by Aspiring Log Homes Ltd.
 Above right: Our great room.

Log buildings offer an amazing array of benefits beside just looking good. Something not considered even 100 years ago is their favourable carbon footprint. Throughout its lifetime, wood stores carbon. When a tree is harvested and a new one planted, the growing young tree sequesters even more carbon than its predecessor did. If a building ever needs removal or dismantling, the timber can be reused or repurposed; the carbon remains locked up. The greatest proportion of the carbon in a log is retained when that log is kept in its natural shape (i.e. in a log structure). Furthermore, energy is not consumed in converting the log into dimensional timber and the logs are transported less (only from the forest to the building yard and/or building site), whereas machined timber also has to be shipped to

and from a mill. All construction timber requires some form of preservation, but log homes need only a nontoxic preservative on the exterior and none on the interior.

Solid logs have excellent thermal performance. With its cellular structure, wood is a natural insulator; no further wall insulation is needed. Also, wood has substantial thermal mass: it absorbs heat when heat is abundant and releases it when the temperature drops at night. Wood moderates humidity in the same way. Due to variation across different species of timber, when and how trees are grown and the style of the log walls, R-factors are difficult to assess. But anyone who has lived in a log house will attest to the stable, comfortable interior temperature. The stability of temperature and humidity further improves the log house's carbon footprint, as the energy demand for heating and cooling is reduced.

Finally, log homes can withstand whatever Mother Nature can deliver. The interlocked nature of the walls

makes the homes very safe during an earthquake; the walls do not collapse. The threat posed by fire is real, but the logs themselves are actually very difficult to ignite. That being said, if a fire is hot and ferocious enough, anything will burn. We know of two log homes that were destroyed by fire in a recent inferno – but the neighbouring conventional homes fared much worse.

To enjoy a log house, you must love wood. But if you do, there is no safer, more comfortable, relaxing and natural home to have. ♦

Marian Ganzeveld is secretary of the Log Building Association of New Zealand.

Sources

- Green by Nature, International Log Builders' Association, www.logassociation.org
- 8 Unbelievable Facts You Didn't Know About Log Cabins, Log Cabin Hub, www.logcabinhub.com



EBANZ

EARTH BUILDING ASSOCIATION OF NEW ZEALAND

Technical Tidbits

Prefabrication with natural buildings

BY MARTIN ULENBERG

With all the talk on prefabrication in the building industry I started to think about how we could incorporate this approach into our own natural buildings.

Masonry brick technology must be one of the earliest forms of prefabrication and it was such a great concept it is still very prevalent today. Light earth can be formed into pre-made masonry bricks, reducing the drying time compared to walls formed in situ.

Typical in situ light earth walls, at 300mm thick, have to dry both ways i.e. to the inside and to the outside. This means that cladding cannot be installed until the light earth is fully dry and a 10mm clay plaster is applied to the outside face of the wall (as the air barrier). This will take months and will slow down the building schedule. During this time the walls must be protected from wet weather with tarps.

The use of light earth masonry bricks allows the cladding and joinery to be installed first, which means the building can be 'closed in' before the earthen work begins. If the building can be 'closed in' first, the owners could lay the light earth masonry bricks and apply the internal clay plaster themselves without having to worry about the weather. This would save costs and allow them to focus on the fun, earth building elements of the build. If they were not comfortable

framing the house themselves and the light earth bricks were made to suit conventional light timber framing, they could contract the frame and shell construction out to a conventional house builder.

To achieve high performing walls, the external light timber frame could be composed of 140mm stud work without nogs (noggins), with an infill layer of light earth bricks laid between these studs set into 20mm rough clay mortar.

The walls could then be braced with 25mm rough sawn diagonal timber boards, nailed to the inside face of the outside structural studs (08) or with multi-brace steel straps instead. If the timber braces go on the outside face of the outside studs they will interfere with the cavity. A second wythe/leaf or veneer of light earth masonry laid on the inside face of the walls with an interior clay plaster applied would provide a beautifully finished surface.

This construction method, as illustrated, could be on either an engineered suspended timber floor or earthen floor on grade.

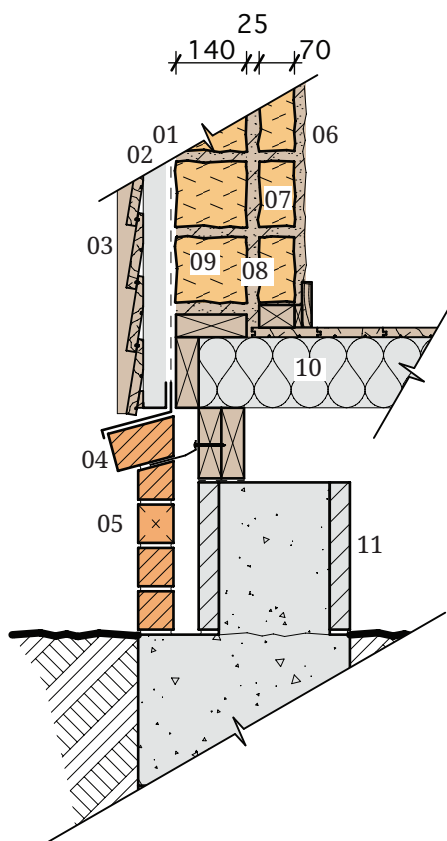
If the light earth bricks were made to 800kg/m³ density it would comply with the thermal performance section of the New Zealand Building Code as 'high thermal mass construction'. At this density, the system as illustrated achieves R 1.5 thermal insulation

for the whole wall assembly. This easily complies with the code in any region of the country. Code requirements range from R0.8-R1.2 depending on the location for 'high thermal mass construction' under the schedule method in *NZS 4218:2009*.

To make the bricks to this density I have used heart cypress wood shavings (which can often be sourced free from a suitable timber mill) and barley straw. I used plenty of clay slip (quite a wet mix) and compressed the bricks 1/3 of the height of the mould.

If using a timber mould, wet it first and the bricks should slide out immediately. It may take approximately one month for the bricks to dry in summer and you should be able to turn them onto their edges after about one week to help them dry better. At this density the bricks can be easily cut with a simple timber hand saw. ♦

Martin Ulenberg is the current treasurer of EBANZ.



- 01. Highly vapour permeable building wrap air barrier
- 02. Drained and vented cavity
- 03. Rainscreen cladding
- 04. Subfloor cladding
- 05. Subfloor ventilation
- 06. Finished clay plaster
- 07. 70mm light earth masonry
- 08. Timber bracing, infill with cob
- 09. 140mm light earth masonry between studs
- 10. Suspended timber floor
- 11. Pier footings

Become a member of EBANZ

EBANZ is a network group for those interested in sustainable and environmentally responsible built environments, with the purpose of promoting the use of earth and other natural building materials in Aotearoa/New Zealand.

It is the aim of EBANZ to facilitate as much networking between members and interested people as possible. If you are an architect/designer, engineer, builder, educator, building official, earth building contractor, student or are interested in building a new home and wanting to find out more about using natural materials, come join us!

EBANZ membership offers

- New, reduced membership fee if you choose to have an electronic magazine instead of paper!
- Three high quality, colour magazines per year covering many aspects of earth and natural building.
- Annual conference and house tours at discounted price.
- Opportunity to network and get in touch with earthbuilding professionals.
- Discounted advertising rates in the magazine.

EBANZ fees (NZ\$)

\$40 for a membership with an electronic magazine

\$65 for membership with paper magazine with a NZ address

\$75 for membership with paper magazine with an overseas address

◆ EBANZ

Natural building methods and techniques for those interested in natural building.

www.earthbuilding.org.nz



EBAA

EARTH BUILDING ASSOCIATION OF AUSTRALIA

The future with earth

Earth Building is the practice of building using unfired earth material. Earth is used to construct walls, floors, roofs and even furniture, fireplaces and ovens. It is a building technology with an 11,000-year-old history and tradition, which is utilised worldwide. Today it is estimated that between one third to one half of the world's population are housed in earth homes.

The common feature in all earth building techniques is that the earth material is subsoil that is composed of clay, silt, and sand where clay is the binder or cementing ingredient and that the drying process is through the evaporative effect of sun drying.

The methods and techniques used are as varied as the people of the earth, the resources available to them and the climates in which they are used.

There are at least 12 methods of earth building used and these can be further divided into a total of at least 18 techniques. The best known methods include; earth brick (mudbrick/adobe), rammed earth (pise), cob, pressed earth brick, poured earth, wattle & daub, earth bag, light earth and earth renders.

It is flexible because it can be moulded and shaped when wet, rammed and pressed when moist but hardens in the sun so that it is durable.

Earth building is an appropriate, renewable, sustainable technology; one could say the ultimate green building material. It is a technology that is ancient yet still most relevant. We believe it is exactly what the world needs now, to provide safe, durable, comfortable and desirable homes. Those who have owned or lived in an earth home would know and appreciate this.

EBAA is actively involved and seeking new industry partnerships with universities. We encourage students interested in sustainable building. EBAA awards a small scholarship each year to a worthy PhD candidate. ♦

Become a member of EBAA

Everyone is welcome to join EBAA, either as an Individual member, as a Business member or as a Friend.

EBAA membership offers

- Discounts on conferences.
- Bi-annual membership magazine 'Dirt'.
- Business membership includes use of logo and practitioner listing.
- Participate in workshops, conferences and other events.

EBAA fees

\$70 for an Individual membership
\$175 for a Business membership
\$25 for a Friend membership

- ♦ **Earth Building Association of Australia**
Build of earth for the Earth.
www.ebaa.asn.au



NMA

NILLUMBIK MUDBRICK ASSOCIATION

The magic of mud!

Older earth and wattle and daub buildings in the Nillumbik area hark back to the brief gold rush days in Warrandyte, Queenstown (Saint Andrews), Smiths Gully, Panton Hill and Hurstbridge. Earth building was later discarded as a medium as it was historically considered a temporary structure to be replaced by a more 'substantial' timber or brick structure as soon as funds could be found.

Justin Jorgensen, at the expanding Monsalvat, (with its many mixtures of European architectural styles), John Harcourt (a local builder who erected homes along classic French provincial lines close to the town centre) and others in the 1930s and 40s began the revival of earth building into its modern form.

Alistair Knox popularised and legitimised mud brick buildings in

mainstream society. This acceptance spawned the next generation of builders and designers – John Pizzey, Clifton Pugh and his mates around the Dunmoochin area in Cottlesbridge, Rose and Bateman, Robert Marshall, Barry Wilde and countless gifted craftsmen, and inspired owner builders.

This drove a demand for specialist trades, suppliers and finishers, all who brought an energy and creative can-do culture along with genuine interest and technical expertise to the area. The Nillumbik area has a substantial stock of beautifully designed, built and finished earth buildings which form a pivotal part of the Nillumbik heritage.

In this age of conformity, mass production and ever increasing standardisation of building practices, mudbrick has retained

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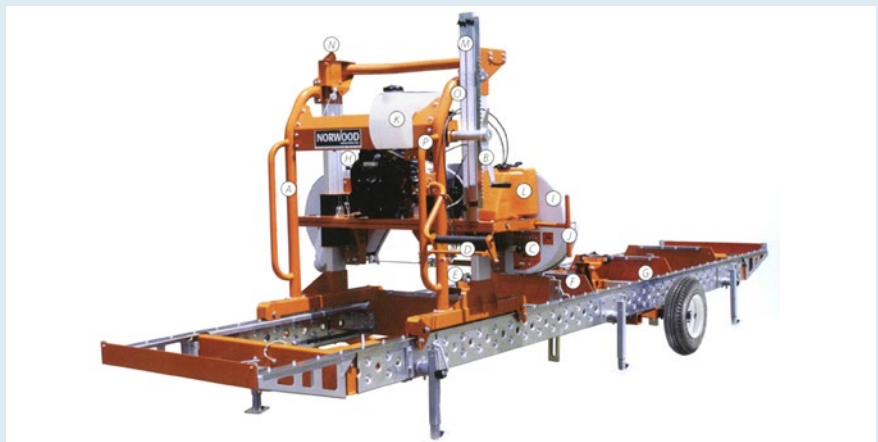


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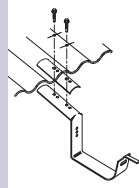
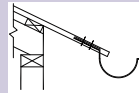
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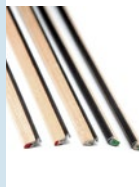
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From the back porch...

That's all Folks

It feels a little like a Looney Tunes cartoon around here at times!

Regular readers may remember that I announced the magazine was up for sale in *TOB 215 October/November 2019*. My personal circumstances have changed and the opportunity to follow my dream of doing some long-term travelling has presented itself. COVID has put a temporary hold on my plans to head overseas but it has not stopped me from spending time on the road, right here at home in Australia.

While I have been approached by a few interested parties, none of them felt it was the right fit for them. Publishing the magazine is a full time job, not a weekend hobby. Ideally, it needs someone who can do the design work themselves, and who has an interest in developing the digital offering. More than anything else, it needs 'new blood'; after 18 years, I'm no longer 'Speedy Gonzales' when it comes to getting the work done!

It is therefore with a very heavy heart that I have to say this is the final print issue. I had so hoped someone suitable would show up, as I would love to see the magazine continue. I absolutely HATE closing down; it feels as if I'm letting John and Gerry, Russell and Valerie – and myself – down! However, it is time for me to move on.

I'll keep the website and blog going for a while, to share the more common useful information, like regulations, association contacts, etc. The full archive of issues in digital PDF format is available through the online shop. I have also uploaded all back issues to the National Library online archive, as I don't want this wonderful record of owner building in Australia to be lost forever.

Subscribers, please check the address sheet that came with this issue.

See you around.



MARTIN ULENBERG, ULENBERG ECO-ARCHITECTS

I think *The Owner Builder* has been a great vehicle to promote interesting DIY builds; in this ready-made age, a bit more self-reliance is exactly what people need!

I appreciate the struggles with journalism and printed media, now that the advertising market has been consolidated into the realm of the online juggernaut.

You and the stories you have presented have been a great inspiration!

CRISPIN CALDICOTT

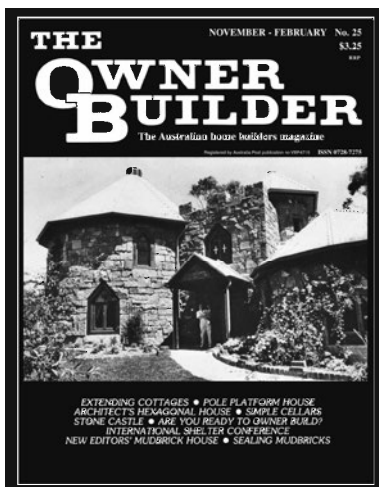
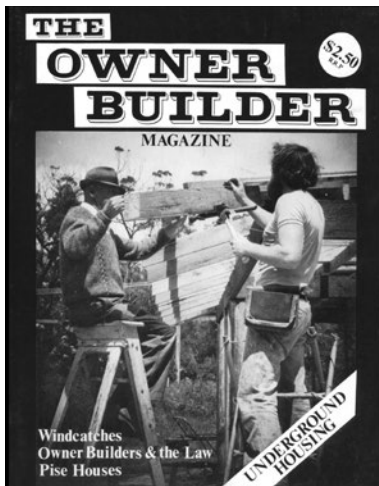
This is very sad news all round, and in common with many I will say 'Don't beat yourself up over it'. People don't realise how much hard-work and chasing goes into a magazine.

GARY MCGUIGAN, FORMBLOCK

I still have my copies of *TOB* that I purchased way back in the 1980s when I was beginning to think about building my home. I know many who have retained their copies as keepsakes. *The Owner Builder* has been one of the publications that transcends the usual ephemeral digest nature of most magazines, to becoming a valuable reference library for many people.

FAITH GOULD

How sad but what an amazing achievement! I must say, EBANZ's *earthbuilding* magazine was my first ever magazine subscription and *The Owner Builder* was my second. It really is one of the best magazines around and it is such a shame but I understand, it must be an immense effort for you and times are changing. Great job though!



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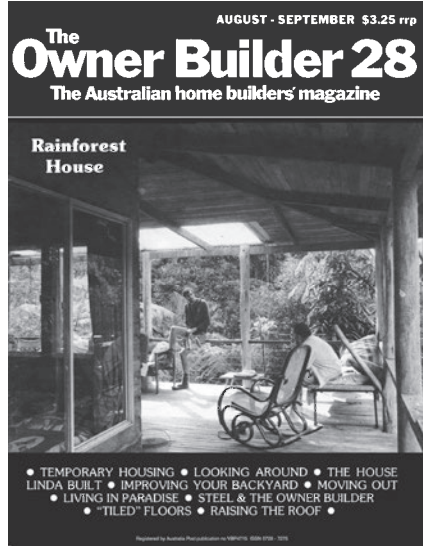
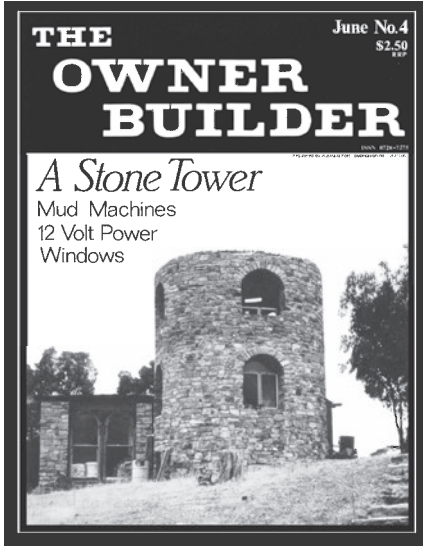


Jo Smith Local Engineer

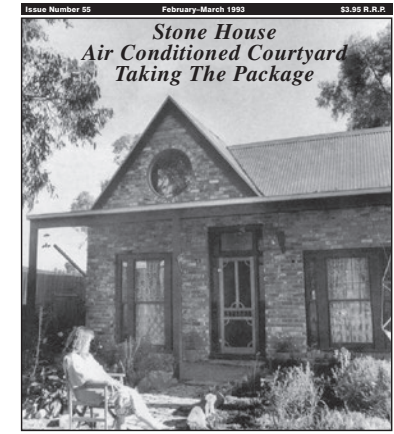
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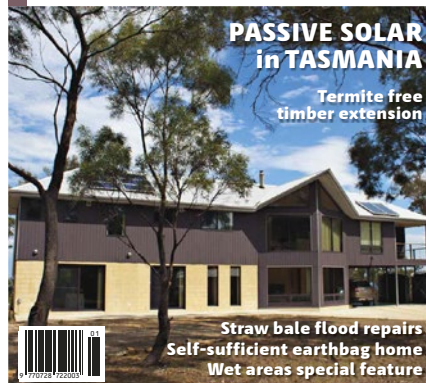
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