
CRAFT BEER AND MUD BRICKS. CHALLENGES AND OPPORTUNITIES FOR REAL SUSTAINABILITY IN EARTH BUILDING

Paul Jaquin

eZED, Queenstown, New Zealand
pauljaquin@gmail.com

Abstract

In the 20th century, earth building was repeatedly proposed as a sustainable building technique - during the depression of the 1930s, after both World wars, and during the oil crisis of the 1970s. Each time, excited individuals developed techniques, research and companies to build with earth. But we never really cracked the market.

At the heart of the discussion is where earth building fits within the construction industry. Not necessarily one of the international behemoths such as Holcim cement or Heineken beer, but more like a craft beer industry with many small players providing bespoke beautiful products.

This paper discusses the opportunities to take earthen construction more mainstream, through the prevalence of improved testing and codes of standards. The increased understanding of the need for thermal and humidity control in healthy homes, together with the need for reduced reliance on CO2 intensive cement use, and the potential for more exotic binders such as geopolymers is discussed.

Introduction

Like brewing beer, mud bricks have been made ever since the advent of settled agriculture. Indeed the first mud brick buildings were probably used for the storage of grain (Rosenbery et al., 2020), and beer brewing certainly pre-dates fired pottery and possibly even building (Dineley, 2016).

Over time other drinks and building methods have come along, allowing fine wines and fantastical skyscrapers, but recently there has been a resurgence in both mud brick construction and craft beer. This paper takes a reasonably light hearted look at the two industries and draws parallels between them, to see if earth building can learn anything from the craft beer industry.

Mud brick industry

In this paper I talk predominantly about the earth building industry in New Zealand, but hope that these experiences and lessons are applicable across the world.

Currently in New Zealand there isn't a very big mud brick making industry. Instead there is a reasonable rammed earth industry, in both stabilised and unstabilised rammed earth building. The provision of three New Zealand Standards for Earth Building (Standards New Zealand, 1998) have undoubtedly led to its increased acceptance amongst consenting authorities and the general public.

Having said this, the earth building industry is still a pinprick in the body of residential construction across New Zealand, with two or three contractors in the South Island (population 1 million), and six or seven contractors in the North Island (population 4 million). So New Zealand has around one earth building contractor per half million people.

Being reasonably long and thin, and situated between 34° and 47° latitude (from Corona New Mexico, to the Canadian border), and buffeted by the swells of the Southern Ocean, the climate of New Zealand varies from the winter less north, through Fiordland, with 9m (27ft) of rain a year, over the glaciers of the Southern Alps to arid Otago, which doubles as sets for Western films.

Earth buildings are generally found in the temperate north of the North Island, and, the milder north and drier lower regions of the lower South Island.

The building industry is split reasonably well between owner-builders, who tend to build in mud brick, and contractors who build in rammed earth, with a couple of earth plastering contractors. There are a handful of engineers and architects who tend to specialise in earth construction, and typically those firms concentrate on the more sustainable, low energy, low carbon buildings.

The industry is represented by the Earth Building Association of New Zealand (EBANZ). EBANZ produce the Earth Building Standards, a magazine and organise an annual conference.

Craft beer industry

Brewing beer is almost as old as the mud brick construction industry, with the earliest beer dating from 13,000 years ago, potentially predating settled agriculture (Liu et al., 2018).

Historically, beer was utilised as a source of clean drinking water, with the fermentation process providing a safe beverage in uncertain times.

The modern craft beer industry can appear as a diverse collection of enthusiasts, ranging from the home-brew level in sheds, through internet bought and YouTube learned practices, to not quite, but nearly mainstream. Aside from the shed level home-brew kits, the craft beer is now generally seen as a higher quality and more desirable than the mainstream offering. This does somewhat hide the fact that much of the craft beer is actually owned by mainstream and international corporations, but nonetheless the craft beer industry is mainly comprised of small, local, unique corporations which taken together provide a broad offering across the whole brewing industry. The industry is held to

some standards, particularly public health and well-being standards, meaning that consumers can be sure that whatever the unique taste of their beverage, the product will be at least safe to drink. Within New Zealand small scale breweries have proliferated across the country, with Altitude, Sawmill and Tuatara amongst the almost 200 breweries established since the mid 1990s.

Craft beer brewing in the late 20th century was certainly seen as slightly fringe to the main industry, focussing on a homebrew approach. Since then it has transitioned to become a welcome and accepted part of the drinks industry.

Similarities between the two industries

Both the mud brick and the craft beer industries are constrained by laws, of both science, like gravity and chemistry, and moral, such as the requirement to not kill people with our products. Both products are the very oldest fruits of human labour with many passionate adherents¹.

The ANZ Craft Beer market report (ANZ Bank, 2017) notes the following:

- The Craft beer market in New Zealand is becoming **saturated**, with each geographic location producing sufficient beer for its local area, leading to competition to innovate and driving up quality.

It is interesting to note that, certainly in New Zealand earth building, we haven't quite reached that stage yet, with earth builders having a healthy order book, and not particularly competing with each other for projects. Because of this, each individual practitioner has developed their own unique system, with small amounts of innovation over time.

- **Localisation vs export**, with craft beer producers being able to create an offering for their very local market, but being unable to then break out of the local area and into a regional or national scale.

On an earth building level, we see reasonably local builders tending to stick to their 'patch', though I do know of many earth builders who will willingly travel across the country to undertake a specific project. The provision of expertise and training across the globe has taken off with a small number of the larger rammed earth companies, but this tends to be for bespoke projects, rather than wholesale movement of staff and expertise.

- **Consumers are spoiled for choice** - Once the decision to take a craft beer is made, there is a plethora of IPAs, Wheat beers, Lager, Bitter, Stout and everything to a Mango Ice Tea Sour.

There is the trend within the residential construction industry for 'Stick-on Sustainability', meaning that there is a desire to be seen to be 'sustainable', and this can be achieved through a range of means. The options include, but are not limited to earth walls, green roofs, solar panels, hempcrete, straw bale, compost toilets and living walls. Each of these systems has its merits, but should be judged objectively to achieve the desired outcome.

¹ Especially men with great big bushy beards.

- Craft beer makers are encouraged to make the most of **buying trends**, with consumers lusting after the latest kitsch flavour, driving producers to innovate and produce ever more interesting creations.

The trends within the building construction industry appear to be those for reduced carbon footprint, healthier buildings and a general trend towards more ‘sustainable’ construction. Earth building provides for many of these latest trends in construction.

- **Experience of the practitioners** is key, and difficult to find with “One of the biggest challenges facing the craft brewing industry is a shortage of qualified brewers, cellar hands and packing technologists.

Across the construction industry in New Zealand, it is certainly a good time to be a builder, with a supply of skilled professionals very difficult to come by. In addition to the supply of workers, there is significant material supply chain issues affecting materials such as timber framing, drywall (called GIB board in New Zealand) which will continue internationally for some time to come (Deloitte, 2022).

The mud brick/craft beer is not a perfect analogy, specifically that homes are not something people buy every Friday night for a calm down. But there are the things which, if done right can add to the well being and happiness of the consumers.

Drivers

How has craft beer gone from the periphery to an accepted member of the beverage industry, and how can earth building transition to take a larger share of the market of general construction?

The consumers of building materials are now increasingly interested in sustainable construction, requiring both low carbon forms of construction, and requiring healthy, thermally comfortable, humidity controlled, low energy consuming buildings. This can be measured empirically through systems such as LEED, Greenstar and the Living Building Challenge programme.

We now have a good understanding of thermal mass and relative humidity control, meaning buildings can be designed to be healthy, and wonderful places to live and to work. This should mean that in some geographies earth building is able to compete against more common forms of construction such as concrete frame, fired brick or light timber, to provide the most sustainable form of construction.

Opportunities

Within the craft beer industry, the number of companies increased dramatically in the early part of the 21st century (Krupnick, 2021). Whilst the actual size of individual brewers stayed reasonably small, the increase in market share was achieved by a growth in the overall number of companies. This was likely due to the proliferation of information brought about by the development of the internet, and easier distribution of brewing equipment and resources.

Currently there are independent small, well informed, earth builders across the world, working with

good local information and resources. Mainstream networks and resources are still relatively hard to come by - there are some excellent individual books, but for example, no dedicated mud brick global YouTube channel. If resources are developed and up-scaled then there is a greater opportunity to increase the number of earth builders in the world.

The proliferation and specialisation of, for example, Brewer's yeast allows fine control and personalisation of the beer product; a similar thing does not seem to have happened in the earth building world. While over 100 different Brewer's yeasts are available, formwork, mud brick moulds, and specific binders are not so easy to acquire and are still geographically constrained.

The provision of codes of standards

There has recently been an increase in the provision of codes and standards for earth building. This, combined with a little more available information about how to build with earth means that governments and those outside of the industry can be confident in earth as a building material. This means that Local Authorities can sign off earth buildings as code compliant and the owner can be secure in the knowledge that they have a safe house to live in. The opportunity arises in the further development of the codes of standards, to allow for greater flexibility and increased individuality in the building design.

Geopolymers

Geopolymers are alternative chemical compounds which provide a cohesion between soil particles and act as a stabiliser in an earth mixture. Typically they provide alumino silicate amorphous networks in the same way as more commonly used cement. The search for a geopolymer which would act as binder in earth construction is important because of its lower carbon footprint when compared to cement.

This is a great opportunity because it will enable lower carbon alternative construction to concrete and fired brick across the world. If such a binder can be found, this will enable the use of more locally-based materials for construction projects. Increased scientific research into improved binders such as geopolymers will allow mud bricks and earth construction to meet the market requirement for improved sustainability.

Entering the mainstream market

The growth in the craft beer industry since the early 2000s has been through new players entering the market, rather than expansion of existing breweries. Therefore the assumption is that the barriers to entry are lower than they originally were. In short it is now relatively easy to buy a 'machine' from the internet and start producing reasonable quality craft beer. How has the craft beer industry moved away from the fringe and become a reputable player within the whole beverage market? How can the earth building industry become a larger player in the wider construction industry?

Musings

There seem to be many similarities between the craft beer industry and the earth building industry. The craft beer industry appears to have successfully transitioned to become an integral part of the drinks industry. What lessons can be learned from the craft beer industry to allow the earth building industry to do the same?

Beer and Bricks have been a part of human existence for thousands of years. Within both industries, there are currently many small operators, who abide by the same standards in their own unique ways. They are enabled to do this because they have access to information and a real passion for the construction/brewing technique.

Making earth construction an integral part of the building industry will require an understanding of the barriers to mainstream market entry. Overcoming these barriers will allow earth construction to become more mainstream. This in turn will address two key issues of building design - 1) the requirement for more healthy homes, and 2) more sustainable, lower carbon construction.

Many discussions relating to both craft beer and mud brick construction should ensue.

References

- ANZ Bank. (2017). *New Zealand Craft Beer* (4th ed.) [Industry Insights]. ANZ.
- Deloitte. (2022). *2022 engineering and construction industry outlook*. <https://www2.deloitte.com/us/en/pages/energy-and-resources/articles/engineering-and-construction-industry-trends.html>
- Dineley, M. (2016). Who were the first maltsters? The archaeological evidence for floor malting. *Brewer and Distiller International*, 34-36.
- Krupnick, M. (2021, October 21). There are nearly 9000 craft breweries in the US – but big beer dominates. *The Guardian*. Retrieved June 12, 2022, from <https://www.theguardian.com/environment/2021/oct/21/craft-breweries-face-big-obstacles>
- Liu, L., Wang, J., Rosenberg, D., Zhao, H., Lengyel, G., & Nadel, D. (2018). Fermented beverage and food storage in 13,000 y-old stone mortars at Raqefet Cave, Israel: Investigating Natufian ritual feasting. *Journal of Archaeological Science: Reports*, 21(-), 783-793. Retrieved June 12, 2022, from <https://doi.org/10.1016/j.jasrep.2018.08.008>
- Ministry of Building, Innovation and Employment. (2022, May). *Building and Construction Sector Trends Biannual Snapshot*. <https://www.mbie.govt.nz/building-and-energy/building/building-system-insights-programme/sector-trends-reporting/biannual-snapshots/may-2022/>
- Rosenbery, D., Love, S., Hubbard, E., & Klimscha, F. (2020). 7,200 years old constructions and mudbrick technology: The evidence from Tel Tsaf, Jordan Valley, Israel. *PLoS ONE*, 15(1), e0227288. <https://doi.org/10.1371/journal.pone.0227288>
- Standards New Zealand. (1998). *Earth Building Standards* [NZS4297, 4298, 4299]. Standards New Zealand.
- Wellington Craft Beer Capital. (2020). *Do the Trail — Craftbeercapital.com*. Craft Beer Capital. Retrieved June 12, 2022, from <https://www.craftbeercapital.com/trail>
- ANZ Bank. (2017). *New Zealand Craft Beer* (4th ed.) [Industry Insights]. ANZ.
- Deloitte. (2022). *2022 engineering and construction industry outlook*. <https://www2.deloitte.com/us/en/pages/energy-and-resources/articles/engineering-and-construction-industry-trends.html>
-

-
- Dineley, M. (2016). Who were the first maltsters? The archaeological evidence for floor malting. *Brewer and Distiller International*, 34-36.
- Krupnick, M. (2021, October 21). There are nearly 9000 craft breweries in the US – but big beer dominates. *The Guardian*. Retrieved June 12, 2022, from <https://www.theguardian.com/environment/2021/oct/21/craft-breweries-face-big-obstacles>
- Liu, L., Wang, J., Rosenberg, D., Zhao, H., Lengyel, G., & Nadel, D. (2018). Fermented beverage and food storage in 13,000 y-old stone mortars at Raqefet Cave, Israel: Investigating Natufian ritual feasting. *Journal of Archaeological Science: Reports*, 21(-), 783-793. Retrieved June 12, 2022, from <https://doi.org/10.1016/j.jasrep.2018.08.008>
- Ministry of Building, Innovation and Employment. (2022, May). *Building and Construction Sector Trends Biannual Snapshot*. <https://www.mbie.govt.nz/building-and-energy/building/building-system-insights-programme/sector-trends-reporting/biannual-snapshots/may-2022/>
- Rosenbery, D., Love, S., Hubbard, E., & Klimscha, F. (2020). 7,200 years old constructions and mudbrick technology: The evidence from Tel Tsaf, Jordan Valley, Israel. *PLoS ONE*, 15(1), e0227288. <https://doi.org/10.1371/journal.pone.0227288>
- Wellington Craft Beer Capital. (2020). *Do the Trail — Craftbeercapital.com*. Craft Beer Capital. Retrieved June 12, 2022, from <https://www.craftbeercapital.com/trail>

Paul Jaquin is a structural and geotechnical engineer in Queenstown for eZED, working on Sustainable Building projects around Otago, Southland and wider New Zealand. Paul is also a highly cited academic, with specific expertise in rammed earth construction and unsaturated soil mechanics, and has published a number of books and papers relating to earth construction.