Appropriate Construction Technologies for God's People, their Animals and Grain

There are many appropriate building technologies available. How environmental friendly are they? Earthquake resistant? Typhoon resistant? How can we introduce new materials to a traditional construction culture? Why would we want to produce our own materials? How can we make production accessible to women? In what cases does it make sense to use a new technology? We'll consider interlocking compressed earth blocks, micro concrete roofing tiles, rice husk ash cement, bamboo and more.

A large ship is steered by a small rudder. Where do we want to go? What are our goals/ ideals/ principles? Good Stewardship takes us toward the Kingdom of God. Deciding to use Appropriate Construction Technologies is like turning the rudder to point more towards a green world that reflects Good Stewardship.

If you don't need it, don't build it. Let's be good stewards of our resources. Sustainability means Permanence or Renewable materials.

Let us try not to use resources on a community church building but,

Let us try to use resources for building a church community.

Jesus never built a church. I can find no where in the New Testament where any apostle ever constructed a church building. Today there is a growing house church movement; people worship in homes and not churches.

Making a permanent building takes time. Make a good plan on paper. Imagine (visualize) people using the building. Take time to raise funds; don't rush and end up with something unsatisfactory. A good building takes time to plan. Find an architect who understands your needs and desires. Good architects will know how to design some passive solar heating and cooling that is appropriate to your climate. They'll know how to design a staircase that is comfortable to a human. They'll know how that if you have window area greater than 10% of your floor area you can read without turning on a light during daylight hours. A good architect is worth his weight in copper. Consider working on projects that might take more than your life time to complete. Be far sighted; you'll be blessed.

These are some photos of the Blessing of the Animals on the Feast of St. Francis -- first Sunday in October, animals are blessed at the Cathedral of St. John the Divine. This impressive Cathedral is said to be the world's largest Gothic Cathedral and has been a work in progress since 1892.

(2011) Blessing of the Animals - Sammy and the City | Events, Things to do in New York City, Activities, Central Park, Guide. Retrieved 13 September 2013, from sammyandthecity.com/2011/10/02/blessing-of-the-animals-feast-of-st-francis-cathedral-of-st-john-the-divine-attraction/

Beauty and Permanence are virtues

Church Street School -Tupelo USA built in 1937

Build with permanence in mind.

. . . as part of an effort to rebuild the damage from one of the worst tornadoes in American history. Both Presidents Roosevelt and Truman visited the school, and a model of it was displayed at Chicago's Century of Progress World's Fair exhibition.

Some Roman aqueducts are still used

"We believe sustainability begins with preservation, that building for permanence is sustainability. Rather than create new buildings using valuable resources, we maintain, rehabilitate, renovate and modernize our existing structures. Let us keep embodied energy in buildings through careful maintenance, as opposed to disposable architecture." Stephen T. Ayers, Architect of the Capitol of the USA

There is far too much demolition happening.

Vitruvius: Utilitas, Firmitas and Venustas

firmitas: the ability of a building to endure based on its own material strength and soundness of construction. Put Firmitas into schools and other civic buildings = They'll be disaster resilient and serve as storm shelters.

Firmitas re-visited: Permanence in Contemporary Architecture by Katrina Touw
A thesis presented to the University of Waterloo in fulfilment of the thesis requirement for the degree of Master of Architecture in Architecture Waterloo, Ontario, Canada, 2006 ©Katrina Touw 2006

Renewable Plants in Construction.

If we can’t build permanently, lets build renewably.

On the left, notice the floating home with thatched roof and walls floating on bamboo rafts.

Even the church is bouyed by rafts of bamboo.

Biomass materials are **sustainable**: although they need to be replaced every few years, they are made from fast-growing plants.

There are now 1 Billion bamboo houses. Bamboo structures resist earthquakes: when a powerful 7.6 magnitude earthquake hit Limon, Costa Rica in 1992, all of the 30 bamboo houses in the epicenter remained intact. Most of the surrounding concrete homes and hotels around them collapsed.

Thomas Singer, of Meribah water pumps is a good example: He saw that villagers built with bamboo but that it only lasted 2-3 years before beetles ate it. He researched ways to preserve it. Through desire + knowledge + diligence he overcame problems, innovated **and** disseminated. His article was published in 2010 ECHO Notes – you can still download it.

With borate treatments, bamboo can reportedly last 15 to 20 years or longer.

ACTs dissemination strategies: centers, advocate for adding to school curriculum.

WATTLE & DAUB WALLS

- Stabilized Mud plastering over woven bamboo slats.

Cost-effective
Good finish

There are wattle and daub traditions in Lao and Indonesia

Habitat Building Center, Kerala India

Bambooroo offers training in Northern Thailand

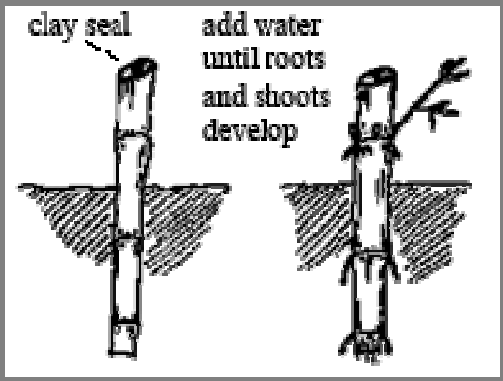
TRAINING CENTER AT HABITAT COMMUNE

Habitat Technology Group offers training in Bamboo and earth blocks in Kerala, India

The Center for Vocational Building Technology trains in reinforced bamboo concrete in Udon Thani, Thailand

Concrete can be reinforced with bamboo.

PLANT MORE BAMBOO



Bamboo is propagated by taking pieces from a bamboo plant and keeping them alive for long enough to for them to grow and form new plants. This can start almost immediately, though may take as long as a year or two, depending on the bamboo species, the method used and the environmental conditions. Some bamboo species are very easy to propagate, and others are difficult and require great attention to detail. It is important to select well-grown healthy material of the right age and state of development for the propagation method used. It should be free from pests and diseases and protected from drying during transport and storage. Careful balance of moisture and drainage in the propagation medium, and high humidity are essential for good results in all but the easiest to propagate of bamboo species. Warmth and good light levels are also required.

Bamboo Against Emissions: BAMBOO GROWING & PROPAGATION. Retrieved 20 September 2013, from baghg.blogspot.com/p/links.html

Bamboo is easy to grow and can be harvested annually from about the fourth year after planting. The hollow stems are light, easy to handle and can be split with a large knife. There are many stages of processing between raw material and finished product, and much of the processing can be done by the communities that grow and harvest the bamboo, so a large proportion of the value addition can be retained with them.

(1) it's fast growth enables it to sequester significant quantities of carbon dioxide (CO_2) in a relatively short time period, and (2) the harvesting of selective culms does not kill the tree but rather stimulates further growth.

2.3.1

Soil rehabilitation

Bamboo protects steep slopes, soils and water ways, prevents soil erosion, provides carbon sequestration and brings many other ecosystem benefits.

A second benefit of bamboo as a resource is that it can thrive on pieces of land where wood may not (e.g. degraded land on slopes), and due to its extensive root network may help to prevent erosion and facilitate the restoration of a healthy water table, potentially diminishing the environmental effects of erosion, landscape deterioration and desiccation relating to the environmental problem of ecosystem deterioration (see table 1.1).

Many value added processes can be done by local communities.

International Network for Bamboo and Rattan. (2012) Retrieved 14 September 2013, from en.wikipedia.org/wiki/International_Network_for_Bamboo_and_Rattan

Before: A wooden school in Lao

This school is noisy and unattractive to teachers. Although not ghosts, students can walk through walls.

Wood is the traditional choice for construction in many cultures – but there is not much left.

We need to plant more trees than we cut down. To offset green house gas emissions, individuals and companies are buying carbon credits which reflect an investment in activities that lock carbon in the environment. We can take individual responsibility to plant trees to take the place of ones we use to build with or wood used in paper we consume.

At the CVBT we are distributing up to 2000 seedlings each year at the beginning of the rainy season.

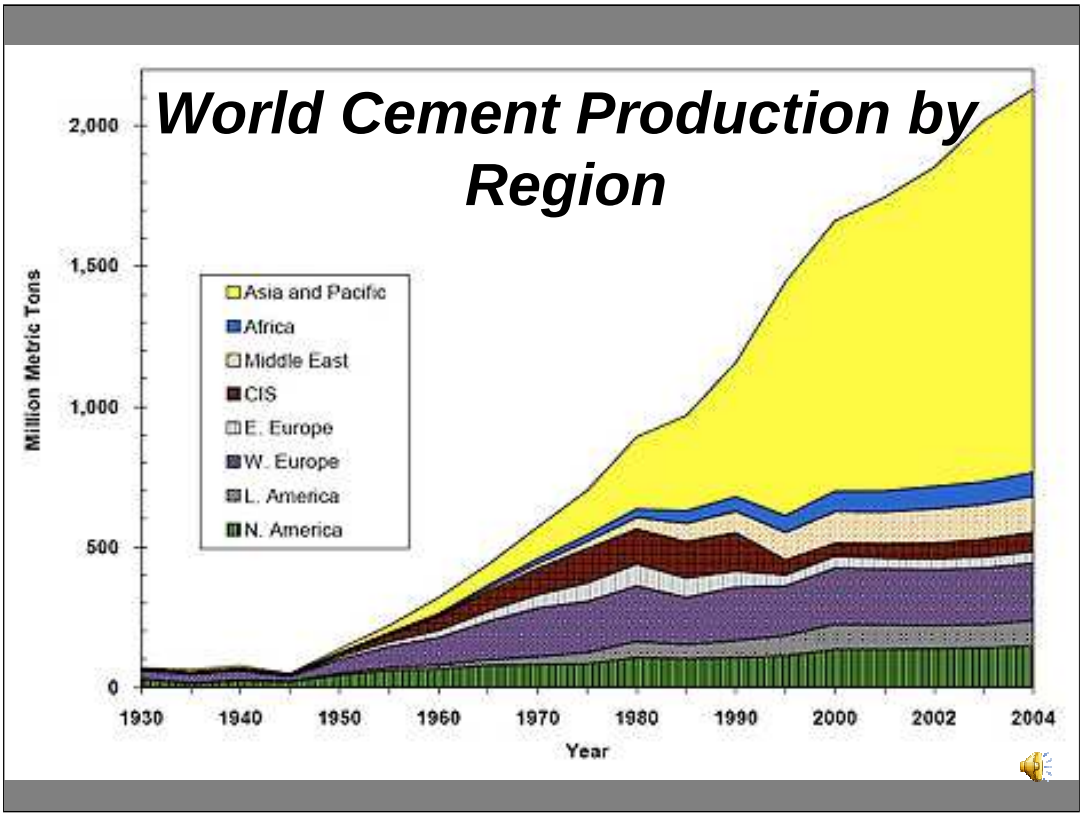
After: Interlocking Compressed Earth Block School in Khummuan, Lao

ICEBs are a wood Replacement for walls.

An interlocking compressed earth block school in Lao with no wood in the walls.

The roof structure still uses a lot of wood. We can replace it with bamboo or steel.

Thin gauge galvanized steel has a life expectancy of 70 years. It is light weight and strong. It is a very durable replacement for wood.



Let's look at our Carbon Foot Print.

"This single industry accounts for around 5% of global carbon dioxide (CO_2) emissions. It produces a material so common it is nearly invisible: cement. Cement is the primary ingredient in concrete. Concrete is the second most consumed substance on Earth after water. On average, each year, three tons of concrete are consumed by every person on the planet." Rubenstein, Madeleine

(2012) Emissions from the Cement Industry – State of the Planet. Retrieved 11 September 2013, from blogs.ei.columbia.edu/2012/05/09/emissions-from-the-cement-industry/

"Due to the large mass of concrete consumed annually and its associated resource and environmental impacts, reducing the use of concrete is a critical problem. . . . [building material] **product choice and concrete mix design are the important factors for more responsible consumption**"

Low, Man-Shi. (2005) DSpace@MIT: Material flow analysis of concrete in the United States. Retrieved 12 September 2013, from dspace.mit.edu/handle/1721.1/33030

- graph -

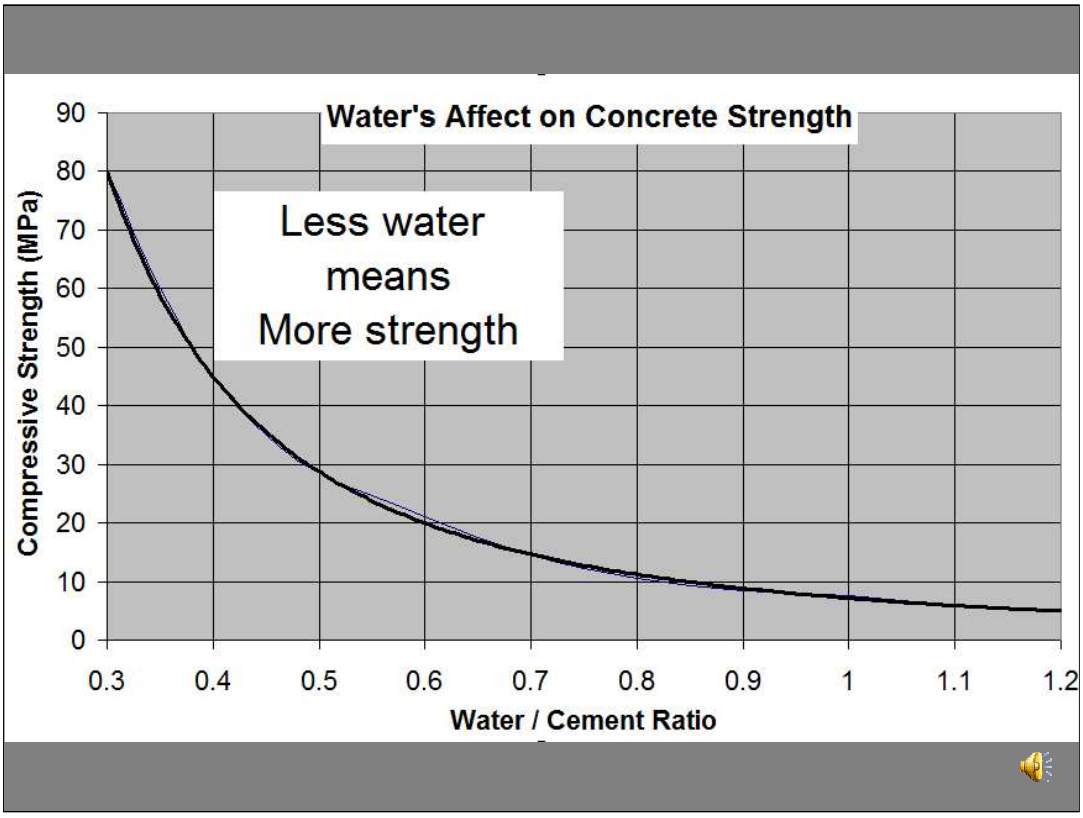
Tim Plaehn Comments (938. (2008) For Those Infrastructure Plays, Everything You Ever Needed To Know About Cement - Seeking Alpha. Retrieved 12 September 2013, from seekingalpha.com/article/91539-for-those-infrastructure-plays-everything-you-ever-needed-to-know-about-cement

Flow is important to place concrete. More flow needs more water.

We use cement in concrete to glue sand and stone together.

Cement is a chemical: We add water to make a glue.

About .25 kilograms of water is needed to completely react with one kilogram of cement. Additional water decreases the strength of the concrete.



Additional water is needed to increase the flow of concrete. Villagers like to use about .60 kilograms H2O/kg cement. If we can decrease the amount of water we can increase the strength.
Half the water gives 4 times the strength

A super plasticizer such as Sika F2 gives flow with less water.

For 1 cubic meter of 24 MPa strength concrete, 3 liters of Sika F2 + 6 sacks of cement = 7 sacks of cement.

It has the same strength <u>because</u> it uses less water.

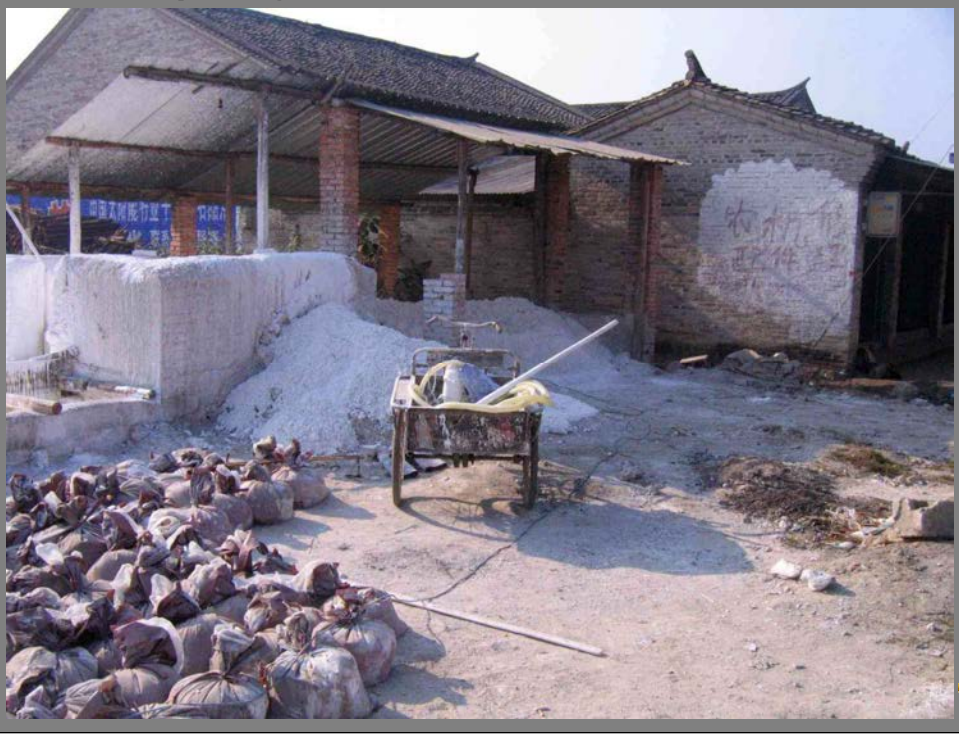
A mechanical mixer is needed and an electric wiggler (hand-held vibrator) is needed.

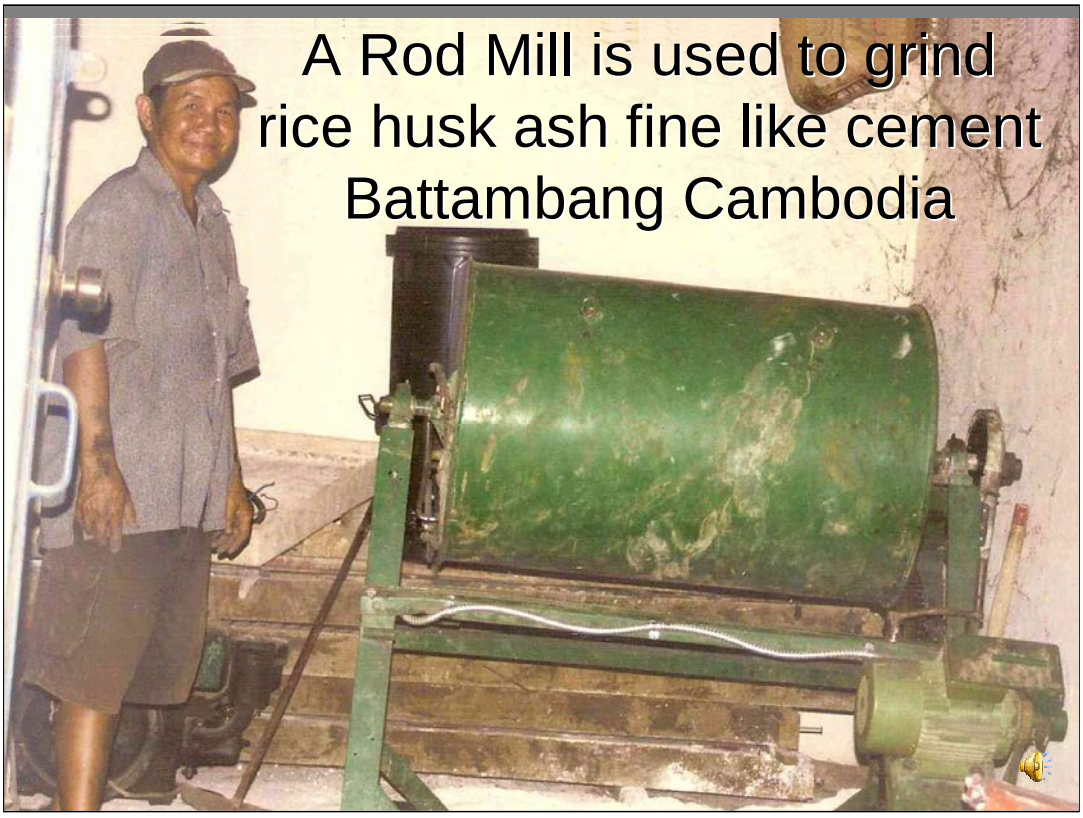
We can reduce our carbon foot print by using a cement appropriate for our work.

A high-lime cement can be used for mortar and plaster work. It is less refined and uses less energy to produce.

Lime putty can be used instead of cement.

Lime putty for sale -Yunnan China

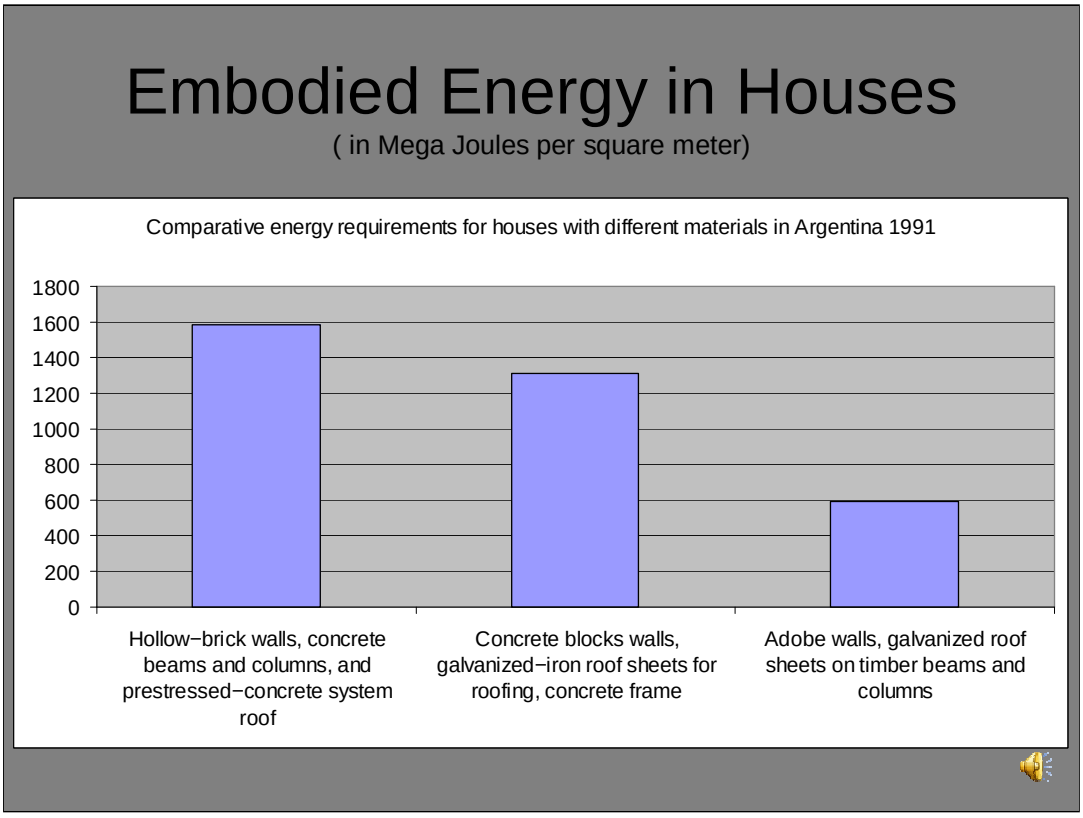




Rice husk ash cement uses waste ash from brick kilns and power plants. It has a smaller carbon footprint than ordinary Portland cement.

When burnt below 600 degrees Celsius it yields amorphous silica. When ground fine it can be used to blend with ordinary Portland cement or lime in a ratio of 30% rice husk ash to 70% cement.

This technology needs more development before it is commercially available.



Double brick walls take even more energy. ICEBs and CEBs embody more energy than adobe but less than concrete blocks. Stone has a low carbon foot print like adobe.

Consider the number of people per house when thinking about carbon foot prints. Also consider the life of house.

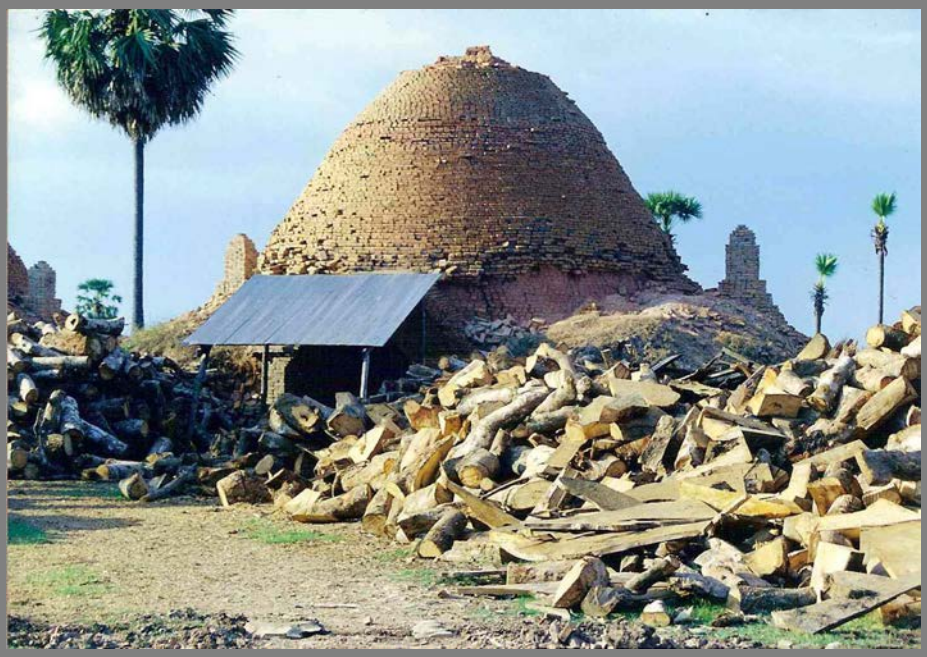
Wood has low embodied energy but it is scarce – please use as little as possible. In Southern Lao log hauler trucks come down the mountains all day long. It is a sad story of how people have scalped mountains for lumber.

How to reduce greenhouse gas emissions, save money and maintain quality of life Rose, Ben J 2006

In many instances, builders in developing countries have a choice between a house made partly or wholly of manufactured materials or one using well developed traditional building systems which can provide living standards of the same level. The house made of manufactured materials may be no more expensive, because the traditional construction process makes extensive use of manual labour. Table 3.12 shows a breakdown of the energy costs of three houses in Argentina. All three are of the same plinth area (80 m 2) and are single storey. The first is entirely built using manufactured materials: hollow−brick walls, concrete beams and columns, and prestressed−concrete system roof. The second replaces the bricks with concrete blocks in the walls, and uses galvanized−iron roof sheets for roofing, but with a concrete frame. The third uses largely local materials: adobe walls, galvanized roof sheets on timber beams and columns. The house of manufactured materials has an embodied energy per unit of floor area of about 1600 MJ/m 2 , very similar to the two−storey house shown in table 3.11. Changing the roof construction lowers the energy by 17 per cent; the energy can be lowered by a further 25 per cent if local aggregates are used. Using adobe and timber in place of brick and concrete makes a very large difference to energy costs. The total now comes down to under 600 MJ/m2, only a little over one third of the energy required for the most−energy−intensive house, with a further 25 per cent reduction possible if local aggregates are used. These comparisons show that very large reductions in the energy requirements for essentially the same building are possible if traditional earth and timber−based materials are used. Conversely, it shows that as the pattern of housing construction in developing countries changes from one based largely on low−energy rural materials to one based on manufactured materials, the energy requirements rise very steeply.

Energy for Building − Improving Energy Efficiency in Construction and in the Production of Building Materials in Developing Countries United Nations Centre for Human Settlements (Habitat) Nairobi, 1991 HS/250/91 E ISBN 92−1−131 174−8

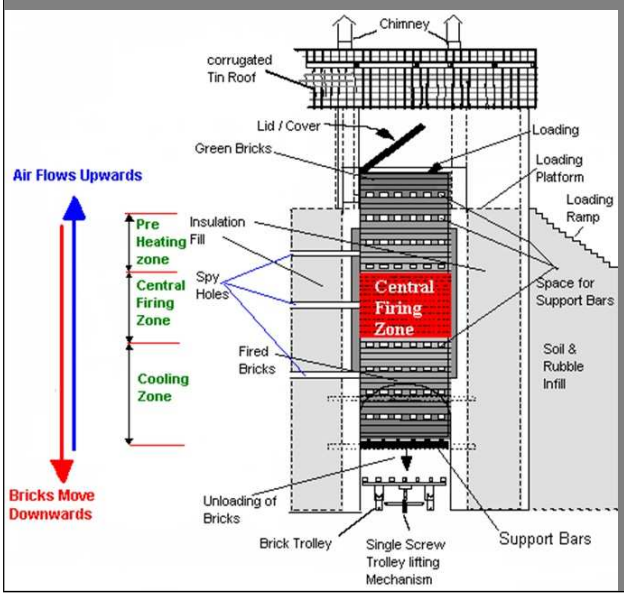
Inefficient brick production



There are many ways to burn clay bricks inefficiently and environmentally unfriendly such as with wood here.

Wood is also used as fuel for brick kilns in Luang Prabang, Lao. This makes smog.

Efficient brick production with vertical shaft brick kiln



In Nepal, A Swiss NGO introduced an efficient way to produce burnt clay bricks. They invited me to a conference in Katmandu and took me to see a VSBK. It's very good. Bricks and coal are loaded in the top and, by a clever mechanism, are taken out the bottom. This moves bricks down the shaft and into the firing zone. I asked my Swiss friends, why don't you just introduce ICEBs, they use far less energy.

By Skat in India or Nepal

Interlocking Compressed Earth Block (ICEB) pump room Prey Veng Cambodia

Embodied Energy of Concrete Blocks is 60% more than ICEBs.

Fired bricks have 500% more embodied energy than ICEBs. Rat trap bond bricks still contain 300% more embodied energy than ICEBs.

Adobe with mud mortar has got to beat all these.

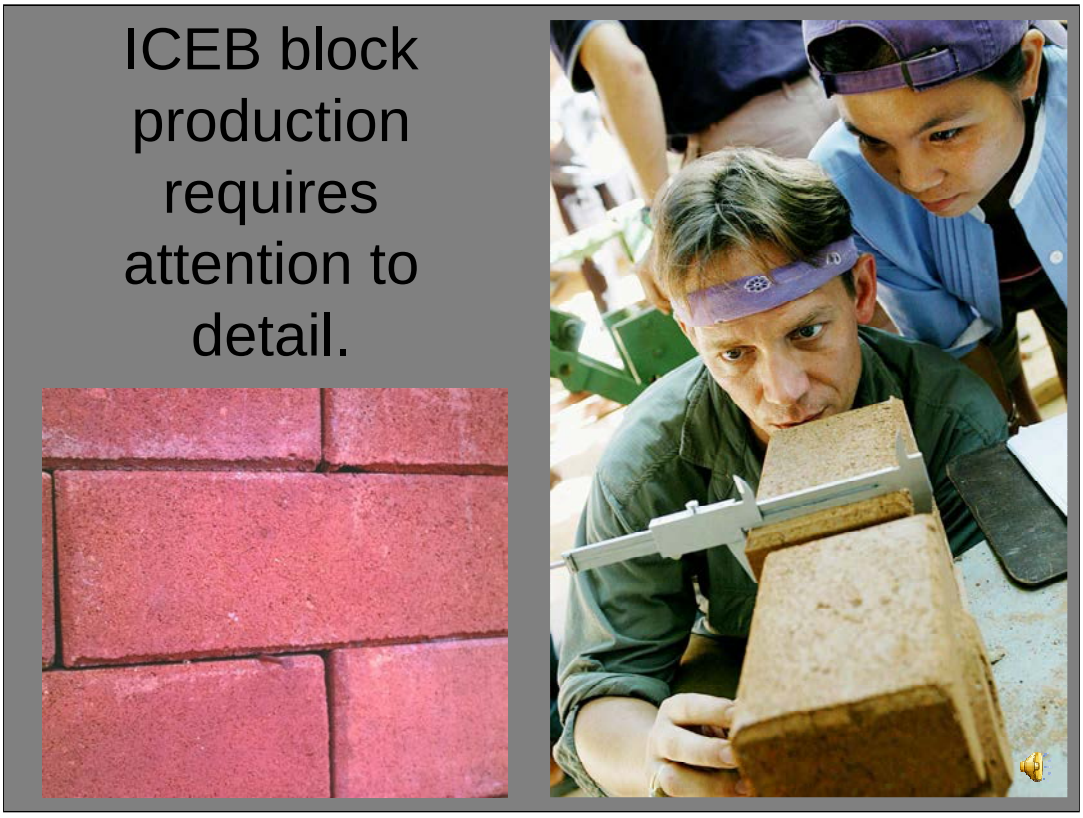
The Swiss sent 2 Nepalese architects and a civil engineer to study embodied energy at our Center in Udon Thani. They did the calculations and found out that: (above)

100% 1) ICEB =106.4MJ/M^2

152.65% 2) CHB =162.42MJ/M^22 (8" BLOCK WITH BOTH SIDES ½" PLASTERED)

329.98% 3) RAT TRAP BOND =351.1 MJ/M^2 (NOT PLASTERED)

495.95% 4) NORMAL 9" ENGLISH BOND =527.7 MJ/M^2 (NOT PLASTERED)



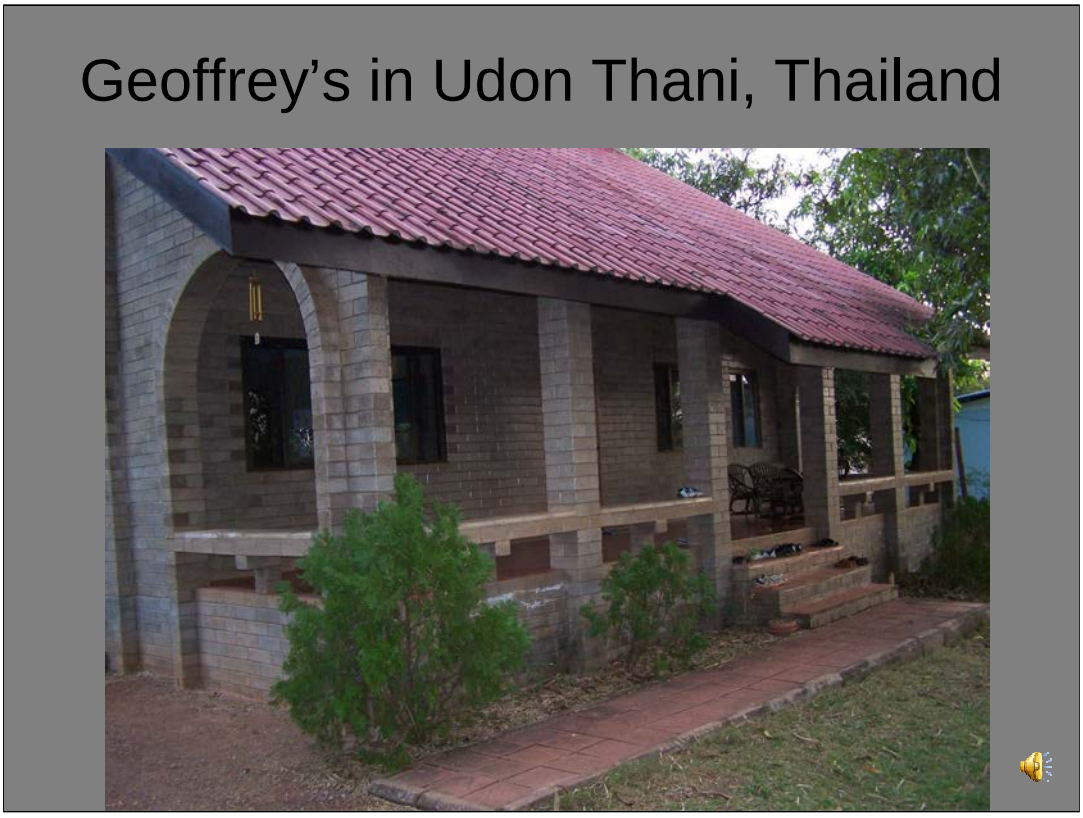
Why do interlocking compressed earth block walls have such low embodied energy.

* They don’t need mortar between blocks.

* No plastering required. Saves on cement and labor.

* Quicker construction - no waiting for cast posts or beams to harden.

* No moldboards for cast posts or beams. Internal holes allow for steel reinforcement without mold wood.



ICEB homes are beautiful and give a warm earthy feeling. My friend Jack Blanchette at Habitat for Humanity says he feels like our home hugs him when he walks inside. It has load bearing walls with arches. The design is culturally adapted with a veranda.

New technologies need good examples for dissemination along with publications. Todd Pruet's team in Phang Nga Thailand and Vaughn Thomas' team in Banda Aceh both built buildings with arches based on instructions from my construction manual.

Traditional Isan homes are on raised on pillars with the under – house open for day use and socializing. Interlocking compressed earth blocks are a load-bearing wall technology. It is not usually practical to build them on stilts. I built my home with a veranda in place of the under-house space. It works nicely to keep us integrated in the social fabric of our community. Last month my neighbors had wake at their home that overflowed onto my veranda.

School built on a former mine field near Battambang Cambodia.

The ICEBs and concrete roof tiles were made on site with no mains electricity. ICEBs have been used for 30 years in Southeast Asia.

A library in Prey Veng, Cambodia

Some Advantages of ICEBs are:

•STRENGTH - Blocks are high density and stabilized with cement.

•They have a compressive strength suitable for two or even three story buildings.

•Grout poured in holes permanently bonds blocks together.

* They are DURABLE- With a good foundation and roof, ICEB buildings can last 200 years or more.

Primary School – Vientiane, Lao

They can create local employment from both production and construction.

This school was built with both ICEBs and MCR.

Home in Chiang Mai
no windows for music room.

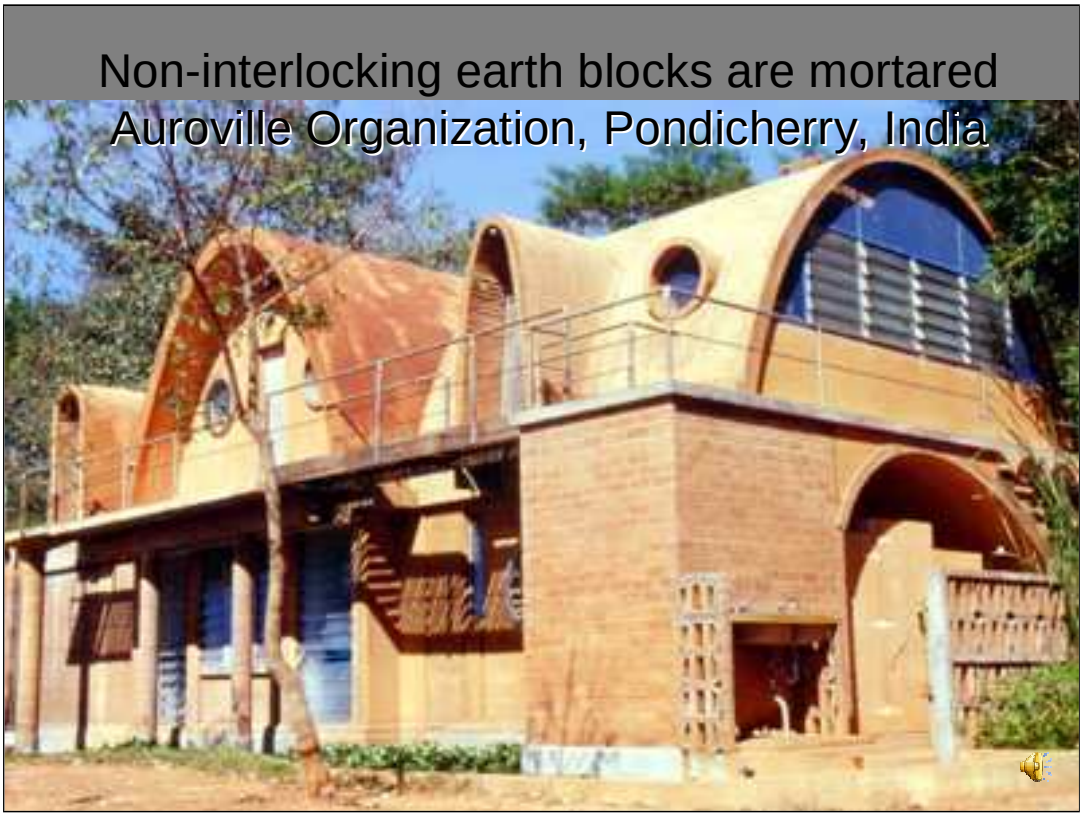
•The 15-cm (6-inch) thick block provides thermal and sound insulation. A building is comfortable and quiet.

Moo, a musician, built his home with no windows in the second floor – for the rehearsal room for his band. The neighbors have never complained.

Tsunami survivor home - Thailand

ICEBs can :

* Use soil, a locally available material. Mining soil creates fish ponds; it does not destroy mountains like quarried stone for concrete.



Non-interlocking Compressed Earth Blocks are more forgiving but laying them requires greater skill. They are used a lot in India where they are called mud blocks. They produce more green house gases than interlocking blocks but their carbon foot print is still close to adobe.

200-year-old Adobe Mission

This mission building in San Luis Obispo California has low embodied energy per person per year. It and the mission in San Francisco have never been damaged by an earthquake. Many of the California missions have been damaged by earthquakes. They have been repaired and are still in use today. They have Good Firmitas.

An earth building (be it interlocking compressed earth block or adobe) needs **good boots and a good hat.**

This simple adobe building has a well laid and mortared rock foundation providing an anti-capillary layer to protect the adobe.

It’s simple gable roof has enough overhang to protect it from direct rainfall on the top of the walls.

It has good Firmitas.

Safe House Residents Make Blocks

Why produce your own building materials? Why not just buy them? Some reasons are:

- Social Concerns
- Cost reduction
- Income Generation
- Production for disaster reconstruction
- Projects in remote areas

Here’s an interesting example: On the Thai - Burma border, residents of a Safe House produce blocks as a daytime activity.

The Education for Development Foundation wanted a high quality building material certifiable on-site; they found it in interlocking compressed earth blocks.

This is Ban Saeng Alun Laos. Six men here made blocks for an EDF school. They worked from dawn to dusk, drink herbal tea and hold the world record for the most number of blocks from one hand press per day. 1000 blocks.

Hydraulic presses are available but manual presses are simpler to maintain and repair. The Education for Development Foundation has built about 30 interlocking compressed earth block schools in the past 20 years.

We are their 3rd supplier of manual block presses. After they had bought presses 4 or 5 times to replace worn ones I finally refused to sell them more and asked for some back to repair. We rebuilt them for 1/3 the cost of a new press. In rural development, reparability is more important than efficiency.

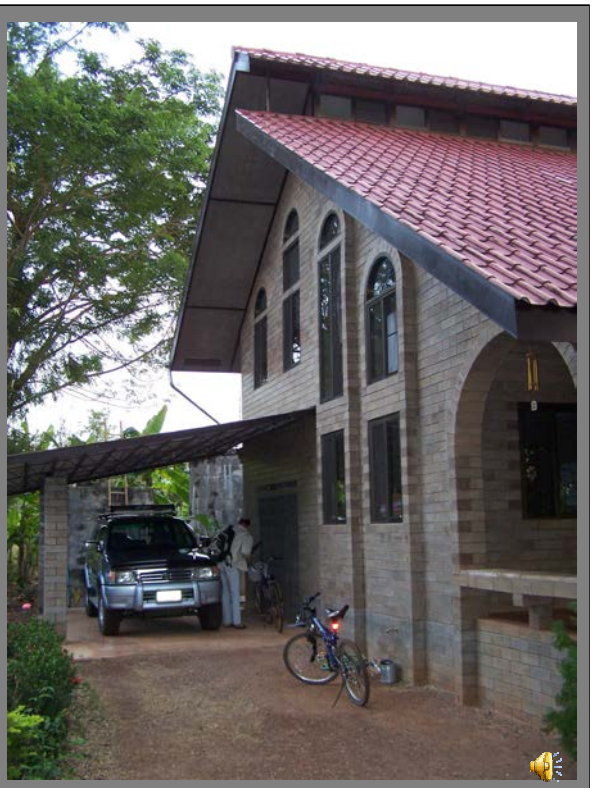
Pulverizing laterite Pakse Lao

We can make a compressed earth block almost anywhere. We want a soil with a little bit of clay, not a lot. Women can make blocks too.

A penetrometer is used for testing green density of blocks. Along with the scale it is a good friend for making consistent blocks and preserving the life of the press.

Parry roof tile making equipment has been around for 35 years.

Geoffrey's ICEB house with nice arches and MCR



What's good about Micro Concrete Roof Tiles?

They're Attractive: They can be pigmented for a dull matte finish or painted with acrylic paint for a glossy shiny finish.

Thailand tsunami reconstruction MCR roof with CVBT's winged ridge

This neat ridge tile system on this home was developed at our Center. It works at any angle and is more beautiful than the one that came with the tile equipment set.

Concrete roof tiles are good:

They're Cool in hot weather

They're Durable: they'll last 50 years or more

They're Quiet during rain At the Ban Vinai refugee camp, the corrugated galvanized iron roof sheets required a special mode of teaching when it rained.

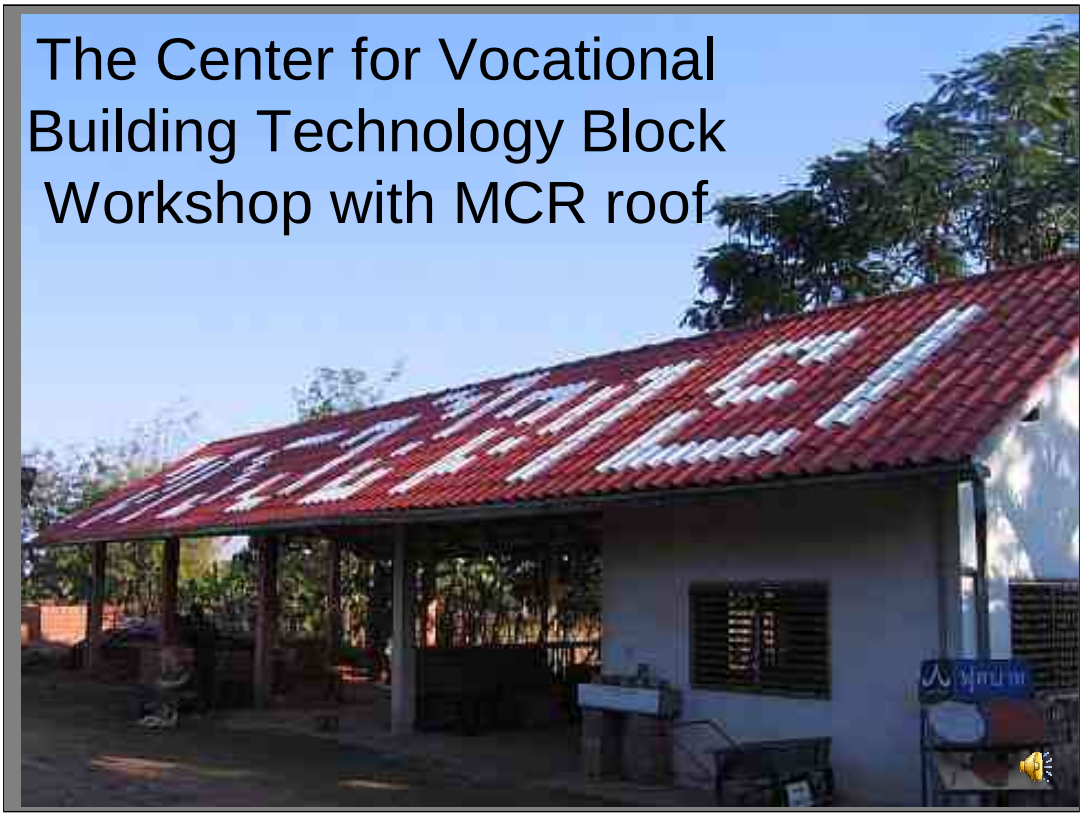
Appropriate construction technologies are often accessible to villagers.

Khumpong received training through World Vision, bought a used block press and received subsidized MCR equipment from the CVBT. He built his own home, a school library and several other homes and buildings.

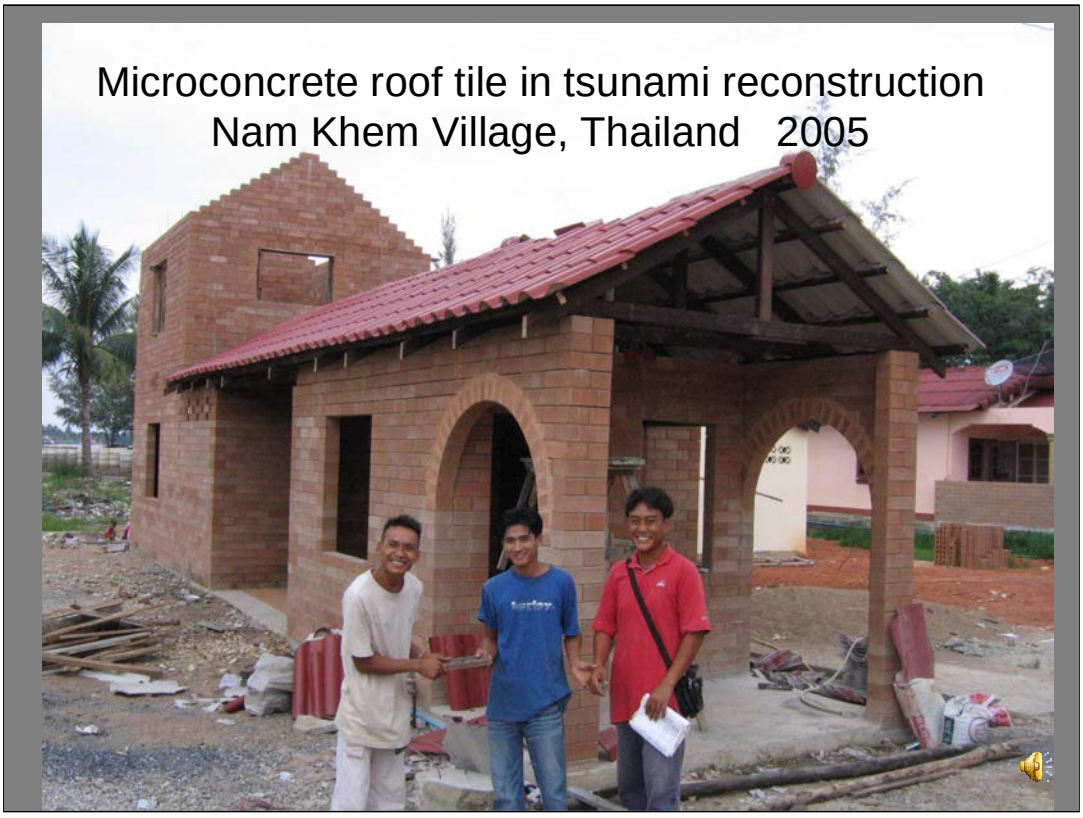
MCR roof tiles use a Simple Production Technology: 12-volt or hand-powered vibrating tables are easy to maintain. Solar curing is also environmentally friendly.

Appropriate construction technologies are Development Friendly: NGOs and community groups use MCR production for an income generation activity or to meet development goals.

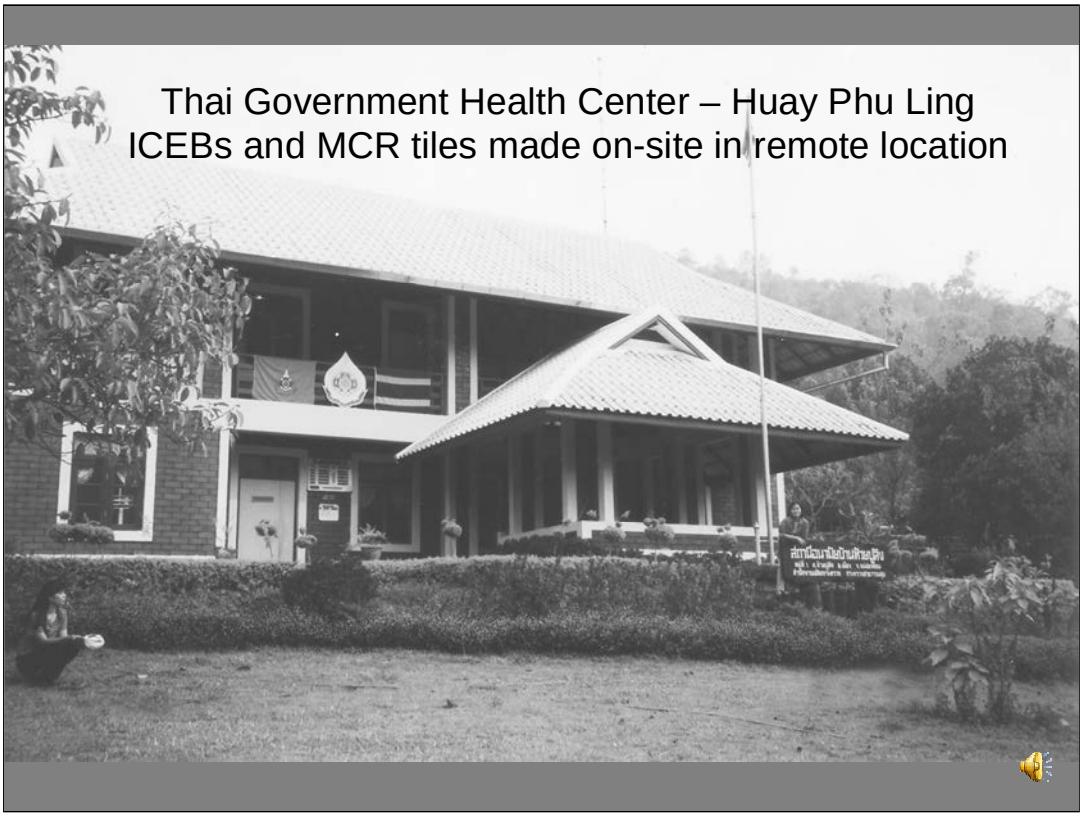
They're Worker Safe: No asbestos fibers or other hazardous materials needed. Say NO to asbestos-cement roof tiles. There are many alternatives. Concrete Roof Tiles are Stronger than Asbestos-Cement Tiles. The tiles made by villagers at the CVBT have been certified as meeting an industrial standard. What's more they meet village standards – they withstand slingshots while asbestos cement tiles receive large holes.



They endure hailstones better – a customers home with MCR suffered no damage while his neighbor's home with asbestos cement roof panels received large holes.



They endure 100 km winds better. We surveyed tsunami survivors who received MCR tiles made by villagers trained by the CVBT. They were even happier 3 years after they received the tiles because their neighbors, who received asbestos cement tiles, had to replace their roofs because the asbestos cement (and non-asbestos cement) tiles broke in high winds that the area receives every year.



What do we need to make and use micro-concrete roofing?

Roof tile laying training is a must for rain-proof roofs.

Good packing and careful driving are needed for tile transportation.

How do we make roof tiles?

Concrete roof tiles are made from a mix of cement, sand and small stone. Coconut husk, kenaf or sisal fibers can be used but require more cement. The mix is weighed on a scale for accurate and consistent thickness. A hand-powered or 12-Volt machine vibrates the concrete for around 45 seconds. This makes the concrete dense and strong.

Lampang, the women in the photo, is making roof tiles for her own home. When ever we do development work we must ask if the technology that we are introducing is accessible to both men and women. The vibrating table was imported from England. It had been designed for Africans. When we received it we cut its legs down to make it easier for Asian men and women to use.

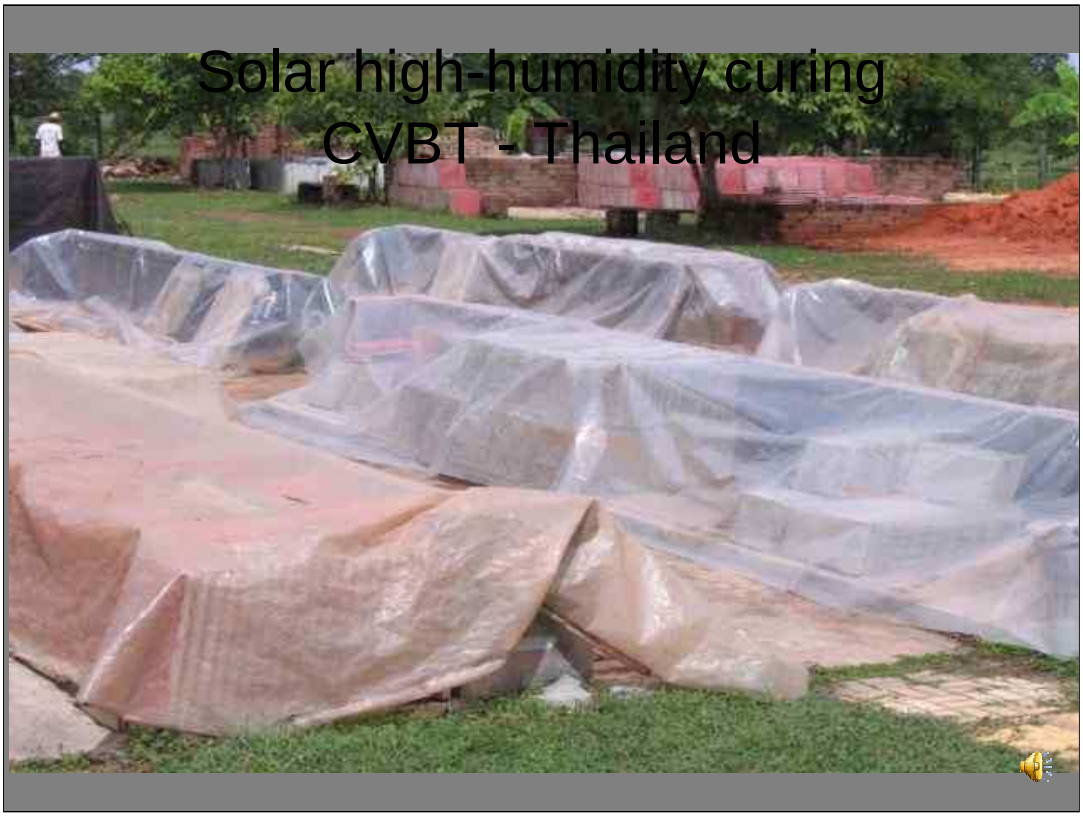
Watch a video "Tile Making in Butempa, Zambia - Build It International"

http://www.youtube.com/watch?v=heOyba9hlzI&feature=relmfu

The flat screed of vibrated concrete is moved to a mould.

Our Parry Roman II molds have lasted more than 20 years.

The tiles are cured in the molds over night.



Curing continues for 7 days in a solar high-humidity curing chamber.

The tiles are covered with the clear plastic tarp.

The tarp catches the suns energy heating the tiles.

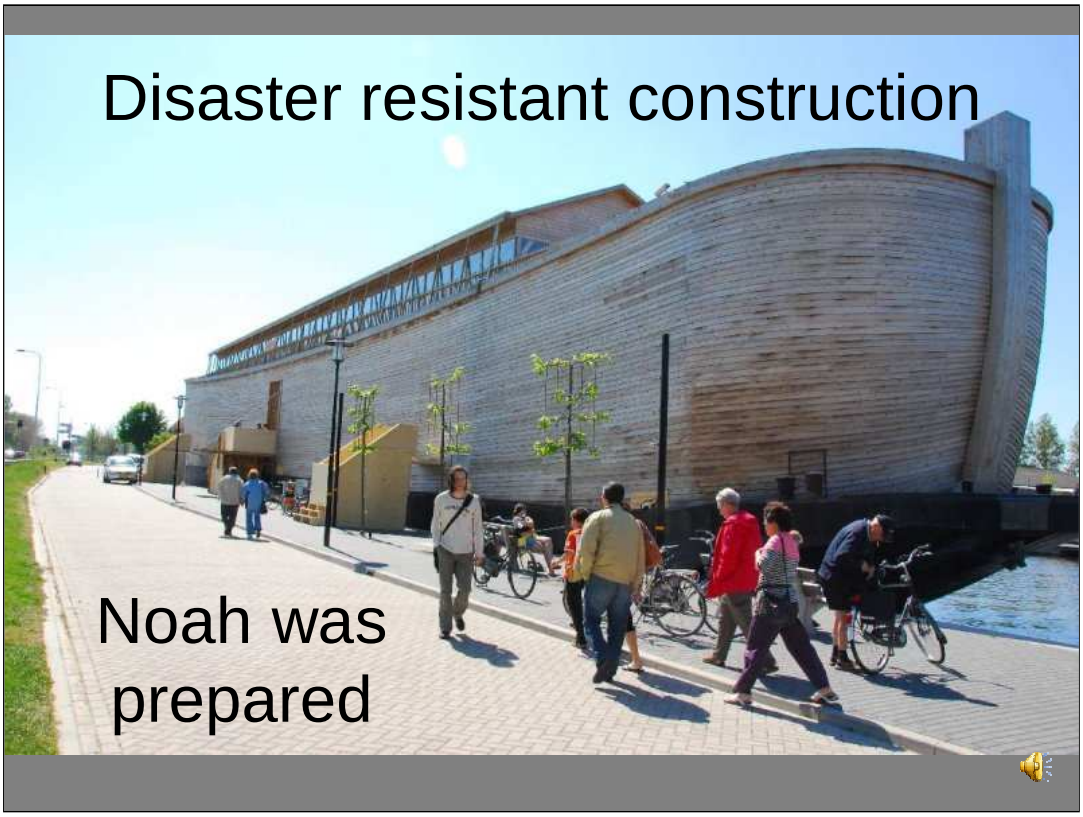
The water in a trough under the tiles evaporates providing moisture for the chemical reaction.

Production training and maintenance are a must to ensure good quality tiles.

Good molds and vibrating tables are needed for quality tiles. – we recommend Parry.

Parry equipment can be used by men and women to make strong beautiful roof tiles.

There are many distributors of Parry equipment all over the world – I am one of them.



a) Earthquake Resistant Construction
b) Typhoon Resistant Construction
c) Tsunami Resistant Construction
d) Flood Resistant Construction
e) Fire Resistant Construction
f) Conflict Resistant Construction

The fewer buildings we have to rebuild, the less cement we'll use, the smaller our carbon foot print will be.

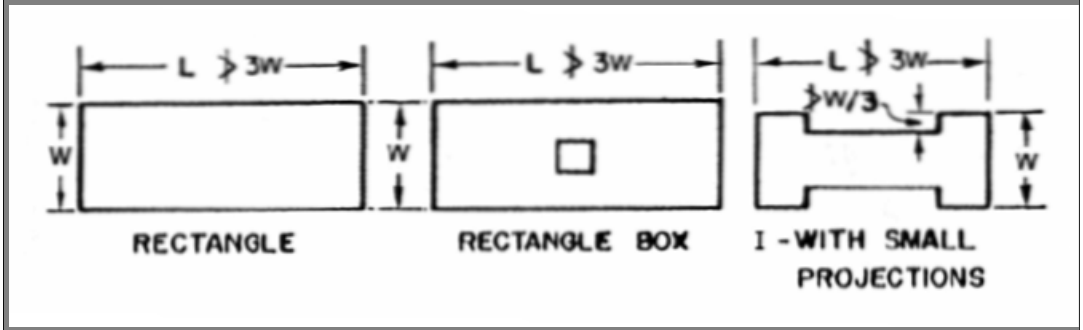
Hollow concrete block buildings collapsed in 2011 Earthquake in Ying Jiang China. The walls were only one block thick and had no reinforcement.

Traditional Adobe and unreinforced brick structures stood up because of good configuration and good bond patterns 2-3 layers thick.

This **simple symmetrical rectangular** configuration resists earth movement with 5 solid shear walls with no openings to.

Stick with local traditional materials, technologies and architecture where practical. They've lasted because they're tried and true.

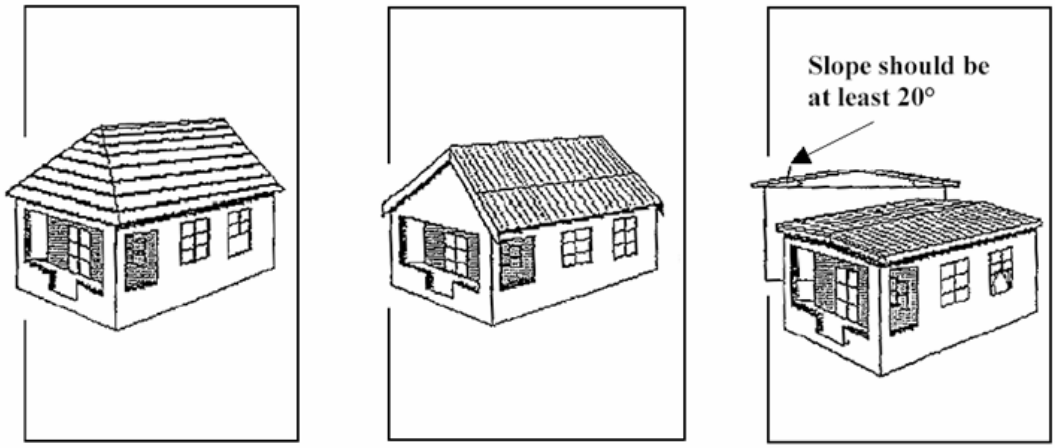
Rectangular Buildings are Earthquake Resistant



There are a lot of resources available on how to build disaster resistant buildings. “Ask and you shall receive.”

Build Change is a good source of information on constrained masonry construction and timber construction. Their aim is: “permanent change in construction practice”

Make roof shape typhoon resistant

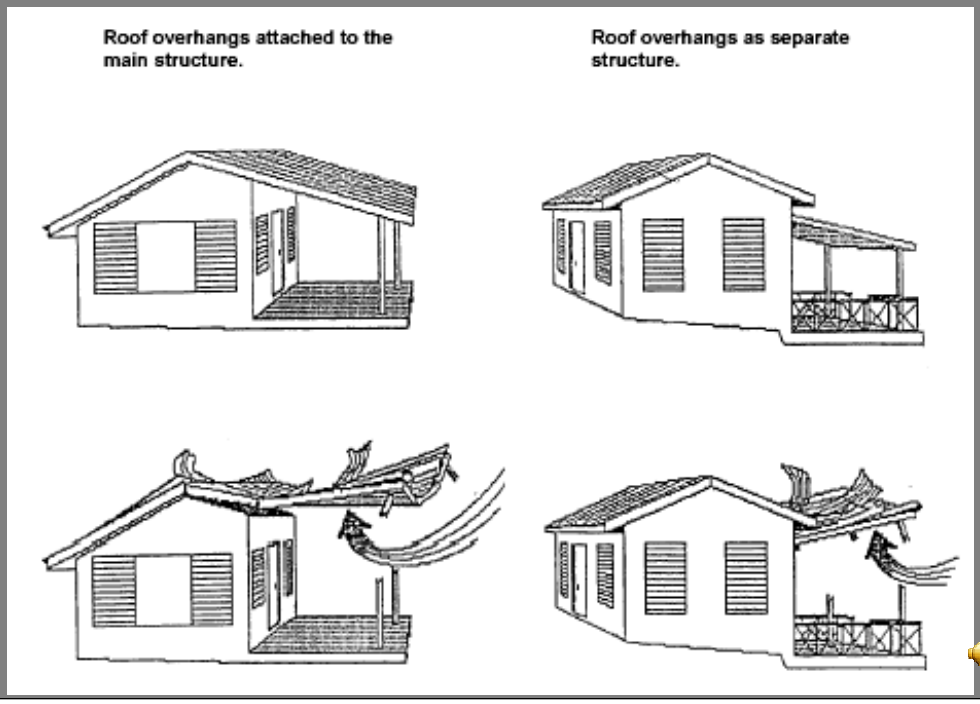


Hip roof **Gable roof** **Flat roof**

Safest Roof → **Least Safe Roof**

Increasing Vulnerability to Wind Forces

Typhoon resistant verandas



An 18” overhang is the maximum we want for typhoon resistant construction.

Dry Composting Toilet Prey Veng, Cambodia

If you are going to build a disaster resistant building, the first one you build should be this one. What other building can boast of producing fertilizer?

Flush toilets are such bad news. Please don't build any more.

This technology is so needed. No disease is put in ground water No water is needed. From a macro point of view with 2.6 Billion people without sanitation we cannot afford to introduce flush toilets; it will put too much strain on fresh water supplies (46,800,000,000.0 litres H2O/day). From a micro point of view we don't want to create more work for women and children who would have to should-pole carry or head load all that water for the toilet. This dry composting toilet is good news: it produces 2 kinds of fertilizer.

Dry Composting Toilet De Hong, China

The Kachin and Chinese love them. This one was designed by women (2 Cal Poly engineering interns) and built by men. It's proven – it works. We can use it now. It can be built out of hollow concrete blocks, interlocking compressed earth blocks, bricks or most any material. Check on our website for some adaptable plans and other information.

It takes time to introduce but it is worth the effort.

Take the DCT challenge:

Plan to use one yourself on a regular basis

Get your organization to commit to DCTs.

Off-grid 12 V DC LED lighting systems

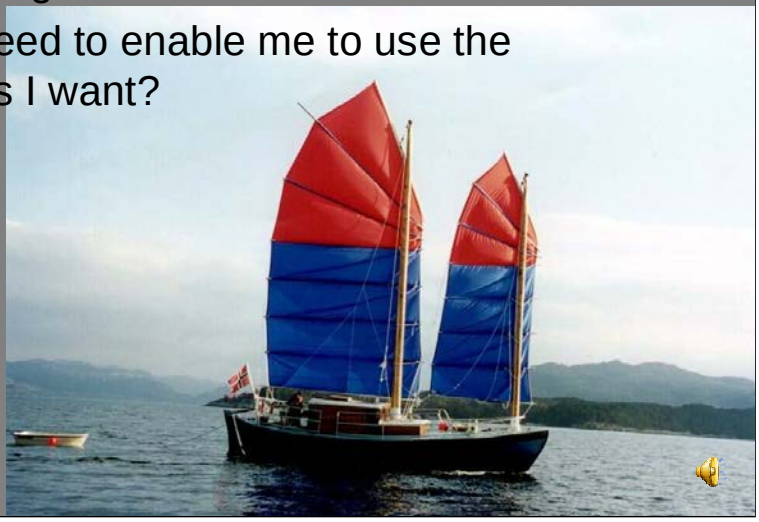
Whether we build with conventional materials or appropriate construction technologies, we can use off-grid 12 volt DC LED lighting system. It is simple. It does not require an AC inverter but does need a regulator to charge a battery. It requires separate wiring. It works with or without mains electricity. It is inexpensive and the bulbs last a long time. The light is warm and good for use in a home.

Please remember

- Where possible - don’t build something new, renovate.
- Build sustainably: use permanent or renewable materials. Choose materials that use less cement. Mix concrete lean with Sika F2 to reduce water.
- Build disaster resistant buildings: The fewer buildings we have to rebuild, the smaller our carbon foot print will be.
- Use Appropriate Construction Technologies wherever practical - help redeem the world

What will we do now?

- What construction technologies have I used?
- Which appropriate construction technologies would I like to use? Why? How do they fit with my development goals?
- What do I need to enable me to use the technologies I want?



Thanks to

- Danny Mostrales - Illigan Institute of Technology
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- Sika Cement Additives
- Blue Scope Steel
- The Timber Research and Development Association (TRADA)
- Gopal Shankar - Habitat Technology Group
- The Bamboo School
- Ross Eisenberg of Build Change
- Thomas Singer of Meribah Ram Pumps
- Dr. Thanad Katpradit of Engineo

These are all resources available to you.

Resources

The CVBT is a not-for-profit organization. We have served projects in Laos, Vietnam, Cambodia, Thailand, China, Philippines, Indonesia.

In 2005 and 2006 we helped with tsunami reconstruction in Phang Nga and Phuket in Thailand and in Aceh and South Nias in Indonesia.