Welcome to

Bamboo-Cob House

Sustainable solution to low cost housing in SE Asia

UTS - Faculty of Engineering - Shake table

Seismic testing 17th December 2008

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Bamboo-Cob House is a contemporary sustainable approach to aid that attempts to:

- **build capacity** - self build and/or creates employment through training
- **maintain self-reliance** - local indigenous materials, no plant or equipment, no transport costs, self build and easily expanded
- **improve resourcefulness** - adds bamboo-cob to palette of materials with necessary new knowledge and skills
- **be practical** - immediate implementation or rebuilding in a tropical climate and considering subsistence lifestyles and/or normal construction timeframes
- **be appropriate** - vernacular design, climate responsive design and sustainable technologies
- **be accessible to as many recipients as possible** - the problem of safe, adequate sustainable housing is both immense and widespread and resources to help are limited

Prototype Bamboo-Cob House
Gingoog City, Mindanao, Philippines 2006

inside view of living room (sala)

Bamboo-Cob House

addresses the housing needs of the Philippines

safe - bamboo-cob with structural diaphragm

healthy - natural materials, dry compost toilet and grey water treatment and reuse

comfortable - climate responsive tropical design

affordable - low cost to luxury, even no cost

durable - robust design and construction and pests built out

desirable - attractive, vernacular design, spacious

Bamboo-Cob House construction system

- **reinforced concrete slab on ground** with edge beams
- **post & beam frame**, 1st floor and attic roof built first
- **vertical bamboo reinforcing** fixed to slab and to 1st floor **structural diaphragm**
- **horizontal bamboo reinforcing** and windows are built in as the walls rise
- cob mixed and lumps of cob are melded into **monolithic walls** encasing vertical and horizontal members and bamboo reinforcing

Monolithic reinforced concrete slab

Min size using 2 levels saves money, resources and fits small sites

monolithic RC slab is very expensive though has many advantages

barrier to termites, protection of earth walls, uses less materials than RC footing and separate RC floor

investment in durability

Post and beam system with structural floor diaphram and attic roof frames

roof on first useful in tropical climate and suits subsistence lifestyle or disaster rebuilding

1st floor is a structural diaphragm with a purpose

attic frames strong and efficient space and materials

dormer windows for space and bracing through valley construction framing

Cob being mixed manually to include available labour and support self reliance

cob material mixing subsoil + water + rice straw + rice hull ash

best mixed as close to the wall as possible

all materials available locally

cobs are lumps of the mud/ straw mixture

The cob is mixed on mats to aid folding the mixture

Cob walls being built manually

- cobs are melded together into a monolithic wall
- the cob wall dries in situ through evaporation
- To optimise strength the system utilises; conservative slenderness ratio, bamboo reinforcing, minimum opening size plus maximum panel length and corner returns

Horizontal and vertical bamboo reinforcing

- bamboo ladder mesh of split bamboo wired together is placed every 400 mm rise (200 in half sized model)

In UTS lab - scaled model 150 mm walls

In Gingoog - 300 mm thick walls

Bamboo-Cob House as I left it first tour

- windows are built in
- bamboo ladder lintel supports the cob walls over windows and doors
- temporary bracing used until cob dries and then earth walls provides permanent bracing

Advantages of the bamboo-cob system

- Monolithic earth walls are stronger than earth brick walls in earthquakes
- Composite of bamboo and cob works like R.C. with earth in compression and bamboo in tension and tying across weak points around openings
- Vertical bamboo connected to a structural diaphragm inhibits movement therefore displacement of centre of walls subjected to horizontal out of plane loads
- Weight of the cob walling resists uplift on the building in strong winds
- R.C. strength but affordable and more sustainable

Future Plans

- construction of small village useful for implementation, display and training of tradesmen & trainers
- publication of a simple to follow basic bamboo-cob training manual using diagrams, photos and sketches
- research and testing of improved post tensioned mudbrick construction systems for seismically unstable countries.