AIT Technology Event

Solution and Systems for Social and Affordable Housing

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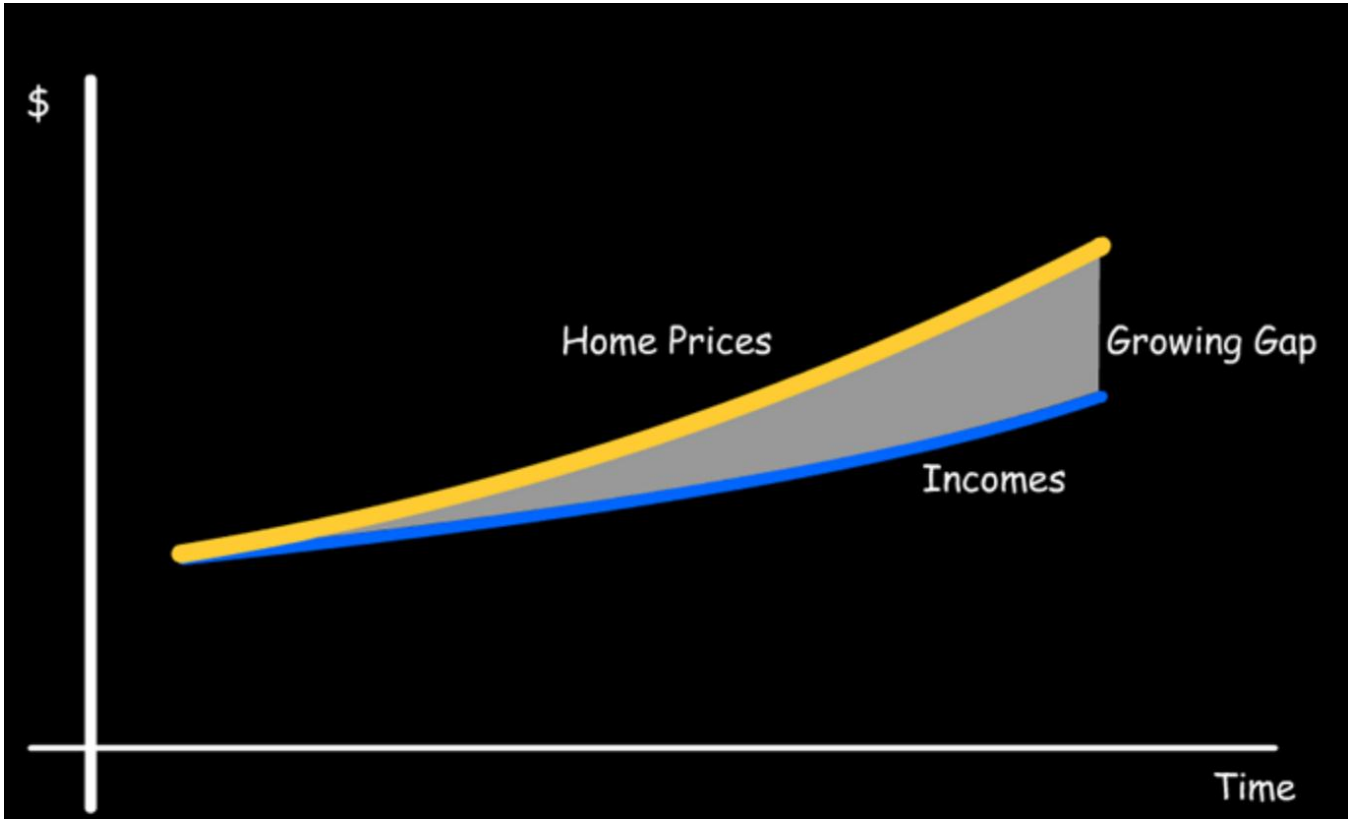
Habitech CENTER BUILDING SYSTEM

AIT Asian Institute of Technology

Growing Needs

The Gap…



(Rick Jacobus, 2007)

Housing Solution Paradigms

- Housing Paradigms
  - Affordable Housing
  - Public Housing
  - Social Housing
- Common Denominator
  - Low-cost
  - Appropriate technology

Solution may be in Affordable Housing

- **Housing that is affordable ensures:**
  - Diverse population
  - Retention of current residents
  - Recruitment and retention of companies/employees
  - Reduction in commute times and transportation costs
  - Reduction in traffic congestion
  - Land preservation
- **Affordable Housing needed by**
  - Teachers, Police Officers, Firefighters, Nurses, Corporate Salesperson
  - Restaurant Staff, Retail Employees, Service Workers
  - Senior Citizens, Recent College Graduates
  - ….

Affordable Housing Continuum

Emergency Shelters	Transitional Housing	Social Housing	Affordable Rental Housing	Affordable Home Ownership	Affordable Rental Housing	Affordable Home Ownership
Government Subsidized Housing (social housing)			Non-Market Housing		Market Housing	

Housing Cost Categories

Category	Description
Land	Raw land costs
Development costs	Costs of preparing land and providing services, including roads, sidewalks, water, sewage, electricity and other utilities, and municipal development fees
Construction	Costs of constructing houses
Parking	Costs of building driveways and garages
Finance and transactions	Costs of financing development and ownership, plus profits, taxes and fees
Operation	Maintenance, property taxes, condominium or resident association fees, and basic utilities (electricity and heating)

(Todd Litman, 2013)

What We are Looking for....?

Available construction systems and options, which can address the affordable housing issue of majority people.

sushi
sustainable social housing initiative

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SUSHI in Thailand | The Project | Partners

Social housing projects in Thailand are mostly run by the government through public sector organizations such as the National Housing Authority (NHA), Government Housing Bank (GHB) and Government Saving Bank (GSB), which provide services such as sales, marketing, financing and project administration.

Thailand's expanding social housing sector presents significant opportunities for improved resource use both during construction and in the use stage of buildings. To capture these opportunities, the SUSHI project team focused on developing tools and approaches to include minimum sustainability considerations in the design, construction and operation of social housing units. In addition, the team aimed at stimulating the local supply of sustainable construction materials and technologies.

The final objective is not only to improve resource use, but also to support sustainable urban management and socio-economic development at the local level.

More about the project

Elements of Low Cost Construction

Various aspects for cost reduction

- Optimization of land use
- Functional design of buildings
- Optimum use of building materials
- Rationalization of specifications
- New construction materials and techniques

Reducing Construction Cost

- Locally available materials
- Improved skills and technology
  - Without sacrificing the strength, performance and life of the structure.
- Construction Techniques
  - Recycled Materials
  - Energy Efficiency Materials
  - Extensive Planning
  - Modular Construction
  - Infilling

Low Cost Local Materials

Bamboo Mat Veneer Composite

Coir Composite Board

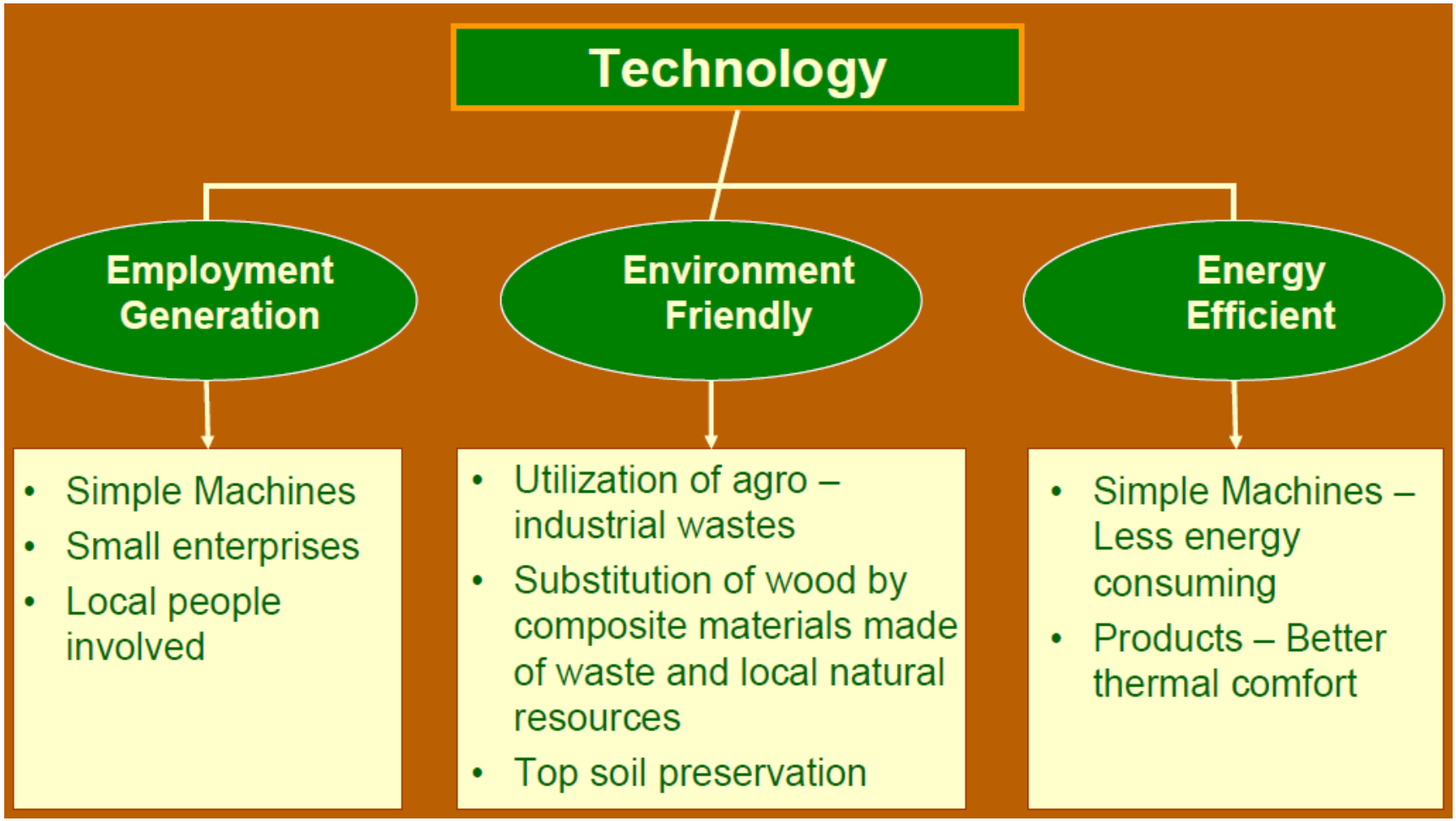
Jute Polyester Composite

Bamboo Laminated Composite

Cement Bonded Particle Board

Bamboo Mat Board

Promotion of Technology for Low Cost Housing Materials – the Collaborative Effort



Low-cost Building Components

- Precast Solid Cement Concrete Blocks
- Precast Concrete Stone Masonry Blocks
- Hollow & Solid Light Weight Concrete Masonry Units
- Precast Reinforced Concrete Door and Window Frames
- Ferrocement Door Shutters
- Ferrocement Roofing Channels
- Precast Ferrocement Water Tanks
- Precast Concrete Manhole Covers & Frames
- Bamboo Mat Corrugated Roofing Sheets

Low-cost Building Technologies

- Precast Channel Unit for Flooring/Roofing
- Precast Reinforced Concrete Joist & Plank system for Flooring/Roofing
- Thin R.C. Ribbed Slab for Floors and Roofs
- Precast Concrete Waffle Units for Floors and Roofs
- Prefabricated Reinforced Concrete L Pans for Roofs
- Precast Doubly–Curved Shell Units for Floors and Roofs
- Precast Reinforced/Prestressed Concrete Ribbed or Cored Slab Units for Floors & Roofs
- Reinforced Brick and Reinforced Brick
- Concrete Slabs for Floors and Roofs
- Prefabricated Brick Panel for Floors/Roofs

Some of Traditional Building Systems

Adobe house

Bamboo house

Timber house

Burn clay brick house

Some of Advanced Building Systems

Concrete frame structure building

Building with precast concrete wall panels

Prefabricated Readymade House

Prefabricated Steel Structure House

Buildings with composite Structures

Habitech Building Technology

A cost-effective solution and an alternative option for Affordable and Social Housing

Habitech Center (established in 1989)

A Research and Development unit for the

Housing and Building Components

School of Engineering and Technology

Asian Institute of Technology (AIT)

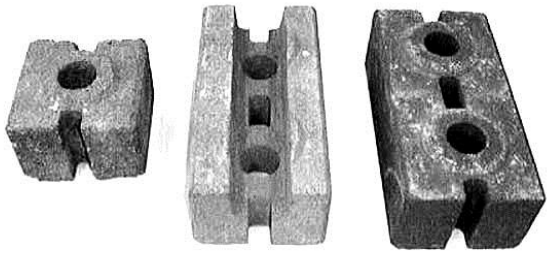
Habitech Center - Mission

- Research construction technologies that can provide affordable housing and social infrastructure buildings to communities;
- Develop building materials, equipment and techniques for the construction sector that can sustain life without polluting the environment;
- Disseminate the results of research and development activities through demonstration projects, educational programs, trainings and publications

Habitech Building Technology Components

- Interlocking Bricks – for Walls
- Concrete Door Frame – for Walls
- Concrete Window Frame – for Walls
- Concrete Joist – for Floors
- Concrete Pans – for Floors
- Concrete Stringer – for Staircase
- Concrete Treads – for Staircase
- MCR Tiles – for Roofing

Interlocking Bricks



4 Types of Bricks (by size)

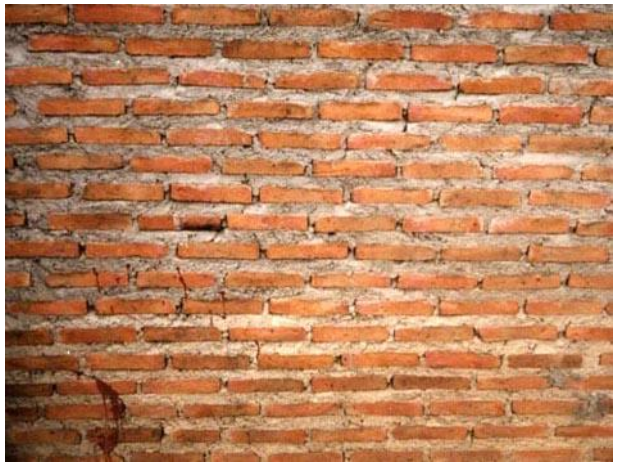
Regular	- 15 cm x 30 cm x 10 cm
Half	- 15 cm x 15 cm x 10 cm
U-shape	- 15 cm x 30 cm x 10 cm
U-half	- 15 cm x 15 cm x 10 cm

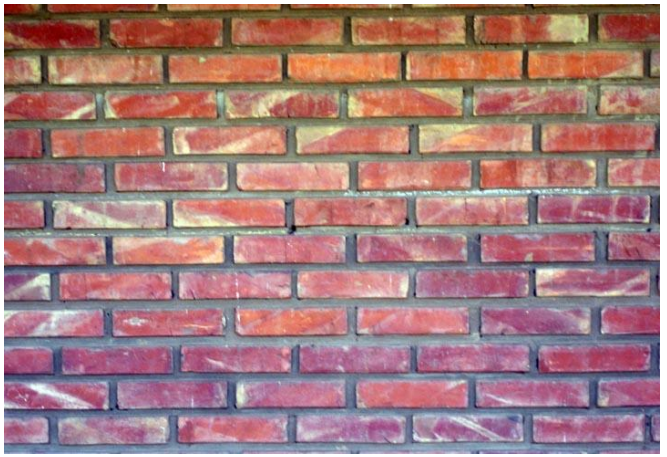
2 Types of Bricks (based on Raw Materials)

- Soil-Cement
- Concrete

Masonry Walls - Traditional

Brick Masonry Wall



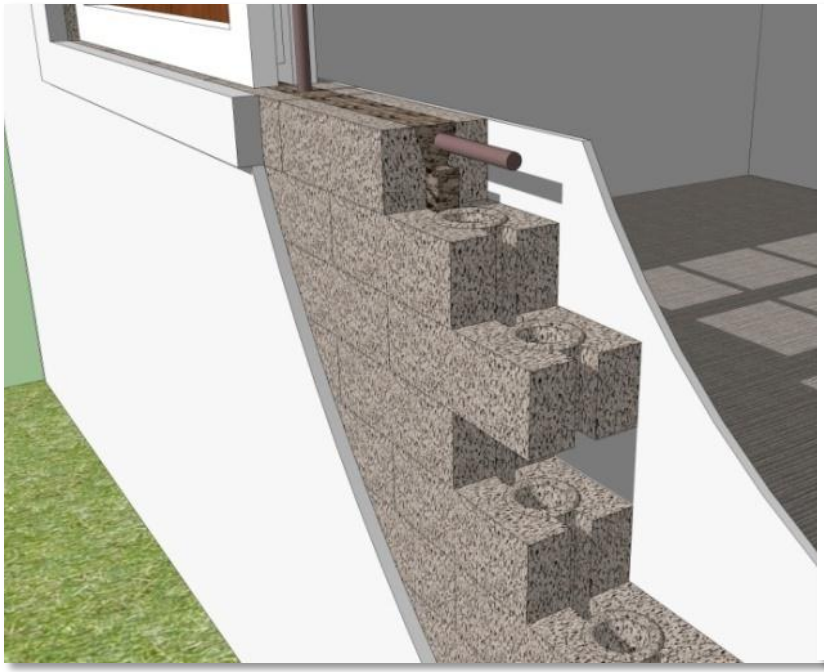


Masonry Walls

Interlocking Brick Masonry Wall

Sill and Lintel

U-channel interlocking bricks with horizontal reinforcement



Sill level Detail

Lintel level Detail

Why Interlocking Bricks?

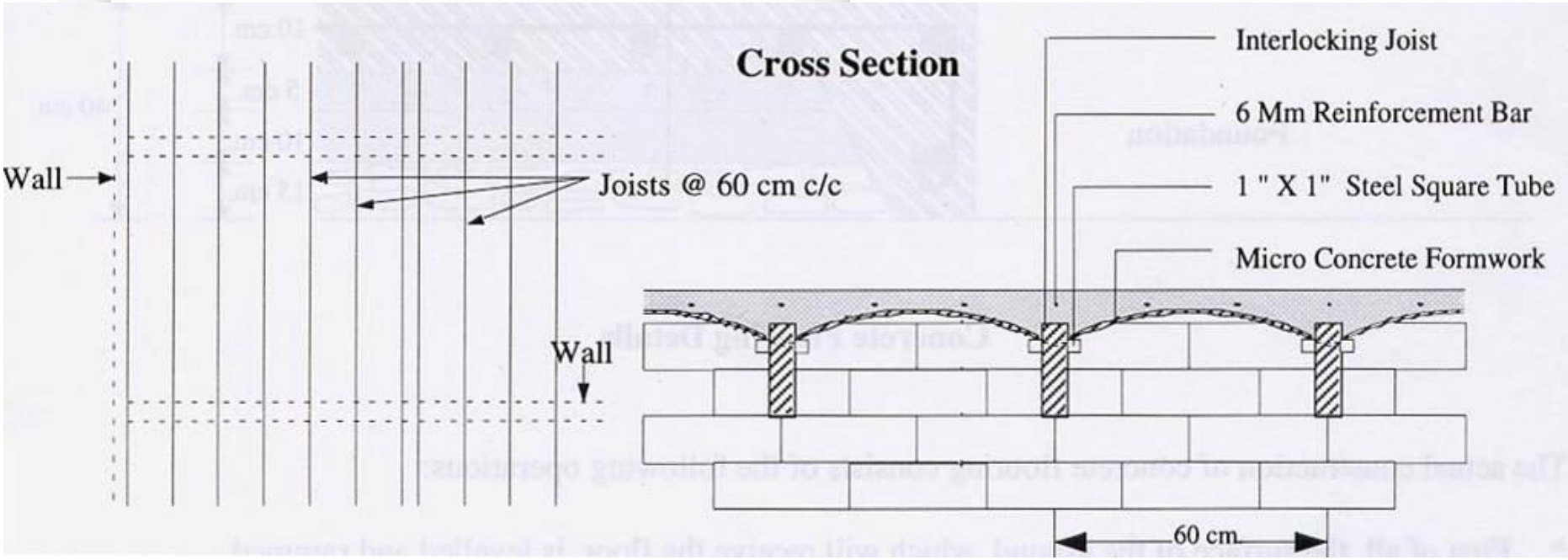
- Can be produced at or near the site – reduced transportation cost
- Uses local available materials
- Reduces the need for skilled labor
- Creates local employment
- Faster to build - shortens construction time
- Environmental friendly as no need to burn during production process
- Energy Efficient – No need for electricity, wood or any type of fuel for production
- Permanent Structure
- Permits self-help construction or community based projects
- Can be used to build all types of buildings

Construction with Interlocking Bricks

- Load bearing construction system
  - perfect for up to 2 ½ storey buildings
- No need for mortar between 2 layers of bricks
- Reduces reinforcements
  - eliminates concrete lintels, beams and columns
- Cement based and Reinforced wall
  - resists fire, wind and earthquakes
- Modular
  - No material wastage
- Simple construction
  - with little training unskilled labor can be used to build the buildings
- Cost-effective construction system
  - Thailand: 20-40%; Bhutan: 40-50%; Nepal: 13-30%)
- Can be used to build all types of low-rise buildings
- Can also be used as composite structure

Construction with Interlocking Bricks

- The Joists are basically reinforced pre-cast concrete beams, which are used to support floor and roof structures
- The Pans are basically arch-type thin concrete slab, which are used to support floor structures.

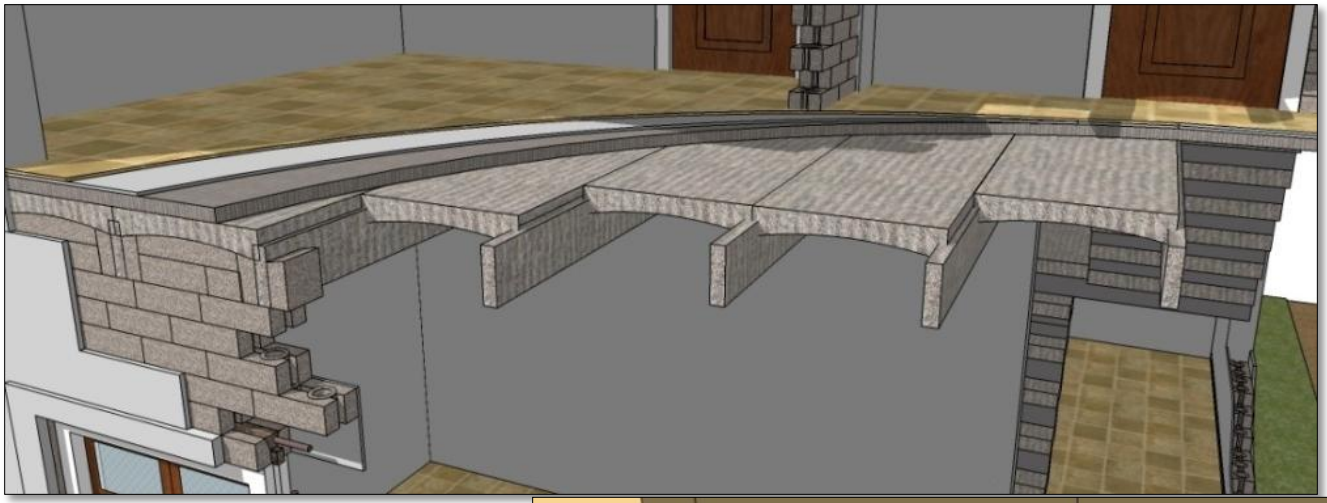


Floor Slab Construction using Concrete Joists and Pans



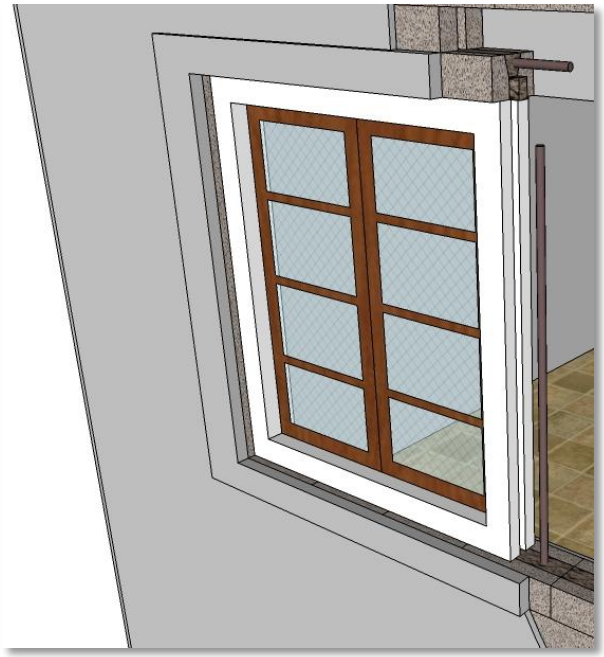



Joists can also be used together with prefabricated concrete slabs or hollow panels with cast-in-place Concrete & Floor Finishing



Concrete Door and Window Frames

- Concrete frame can be cast to form complete pre-assembled units with panels and hardware already in place
- Frames are grouted to interlocking bricks

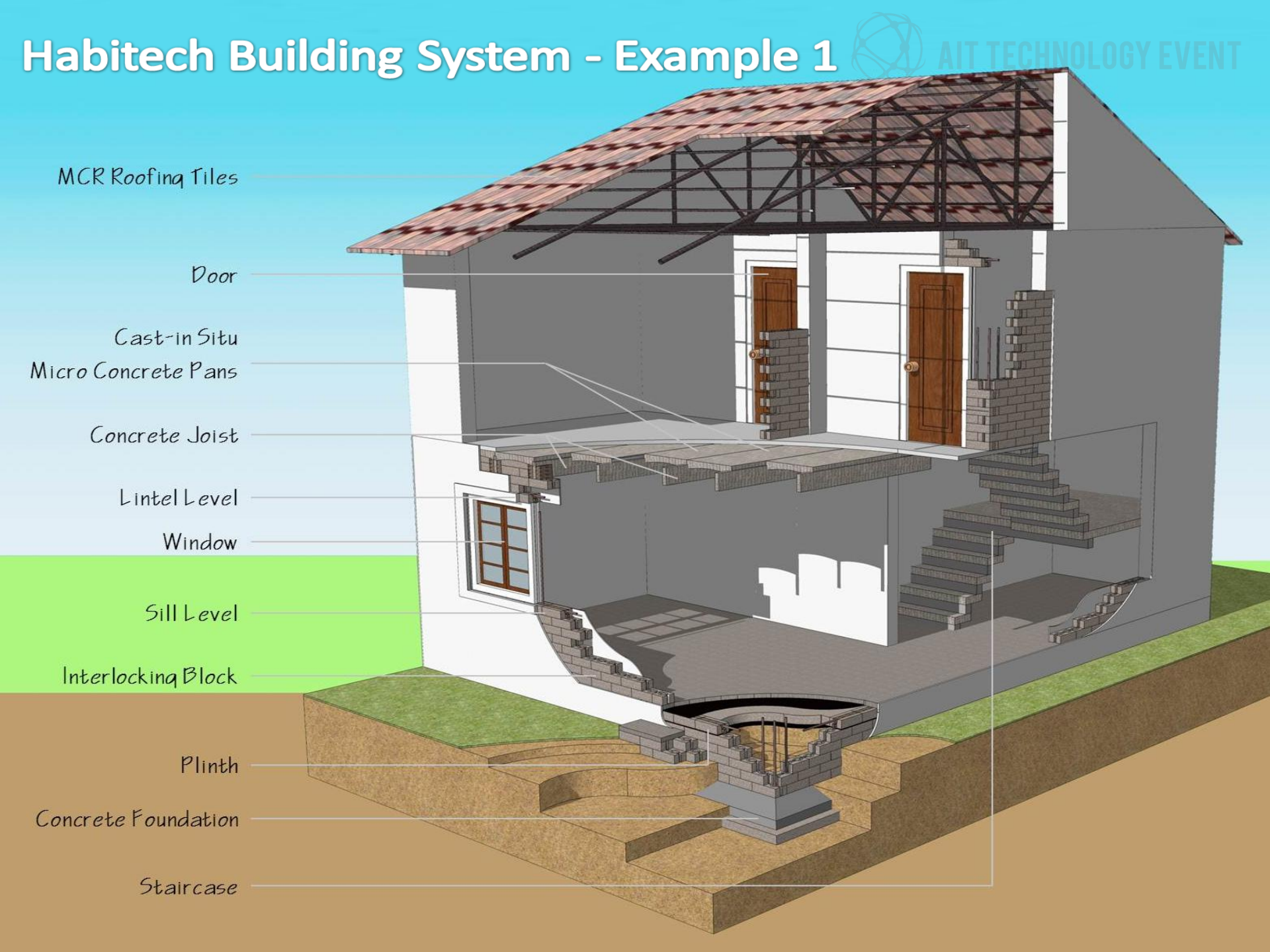


Concrete Staircase (Stringers and Treads)

Micro Concrete Roofing (MCR) Tiles

Thickness: 8 mm
Minimum load: 50 kg
Minimum Nib load: 20 kg
Weight: 2.2 kg

Habitech Building System - Example 1



Where can we use it?

- Residential Buildings
- School Buildings
- Health Clinics
- Office Buildings
- Resort Villas
- Self-help Social Housing projects

Residential Buildings

Chiang Mai, Thailand (1992)

Baan Nam Khem, Phang-nga, Thailand (2008)

Chiang Mai, Thailand (2002)

Phuket, Thailand (2006)

Min Buri, Thailand (2006)

School Buildings

Primary School, Laos (2004)

German School, Thailand (1991)

Primary School, Nepal (2004)

AIT International School, Thailand (2002)

Primary School Construction for Cyclone Nargis victim children of Myanmar

No. of Schools built:
4 Schools (2009) - by Oxfam-Novib
3 Schools (2009) – by Sitagu International Buddhist Association
45 Schools (July 2009 – June 2010) – UNICEF Myanmar
3 Schools (2010) – Metta Foundation

Place:
Villages of Delta Areas of Myanmar

Health Clinics, Office Buildings, Hotels etc.

Malaria Center, Laos (2004)

Aquaculture Outreach Office Building, Thailand (1994)

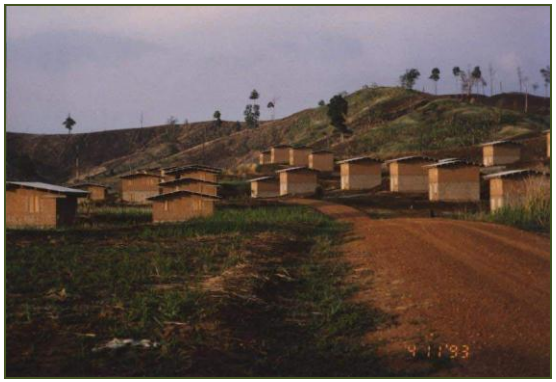
Health Clinic, Indonesia (1995)

Chumphon Cabana, Resort (3 storey), Thailand (1998)

Khao Lak Resort (8 buildings), Thailand (2005)

Social Housing Projects

Khao Kho Resettlement Project, Phetchabun Province, Thailand



- Year: - 1990/91
- Location: - Phetchabun Province, Thailand
- Total no. of houses: - 150 units
- Floor area: - 32 sq.m. x 2 storey = 64 sq.m.
- Area of the Plot: - 400 sq.m.
- Construction cost: - approximately US$ 20 / sq.m. (500 Baht/sq.m.)
- Total construction cost: - approximately US$ 1,300 (excluding labor cost)

Social Housing Projects
Post-Tsunami Rehabilitation Project

- Implementation Year: 2007/08
- Location: Baan Nam Khem Village, Phang-nga Province, Thailand
- Number of Houses: 56 units and 1 Community Center
- Sponsors: 32 units (EU) and 24 (Rotary)
- Plot Size: 120 sq. m.
- House Size: 74 sq. m. (Two Storey)
- Cost per Unit: 256,200 Baht (~ US $ 7,500)
- Cost per sq. m. 3,462 Baht (~ US $ 100)
- Wall Construction: Interlocking Brick Technology
- Project Duration: 10 months

Complete House

Complete House

Awards and Achievements

Award

In 1994, Habitech Center was awarded the **Matsushita Memorial Prize** by the Japan Housing Association "**in recognition of excellent achievements in improving human settlements in Asian countries by promoting research and development related to technologies for low cost housing as well as providing educational programs and facilities to disseminate the results of their research efforts** ".

Recognition

The Habitech Building System has been recognized by the **United Nations Human Settlement Program and the international community as contributing to housing and economic development through the transfer of technology** and has been compiled on the **Habitat Best Practices database for others to learn from and incorporate in their own work.**

"Post-Tsunami Rehabilitation Project" in Thailand was awarded **"Best Community Housing Project"** for year 2008.

Thank You

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