Solution and Systems for Social and Affordable Housing

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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

<table>
<thead>
<tr>
<th>Emergency Shelters</th>
<th>Transitional Housing</th>
<th>Social Housing</th>
<th>Affordable Rental Housing</th>
<th>Affordable Home Ownership</th>
<th>Affordable Rental Housing</th>
<th>Affordable Home Ownership</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government Subsidized Housing (social housing)</td>
<td>Non-Market Housing</td>
<td>Market Housing</td>
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</tbody>
</table>
# Housing Cost Categories

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

(Todd Litman, 2013)
Available construction systems and options, which can address the affordable housing issue of majority people.
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

**Technology**

**Employment Generation**
- Simple Machines
- Small enterprises
- Local people involved

**Environment Friendly**
- Utilization of agro – industrial wastes
- Substitution of wood by composite materials made of waste and local natural resources
- Top soil preservation

**Energy Efficient**
- Simple Machines – Less energy consuming
- Products – Better thermal comfort
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
• 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
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)


Phuket, Thailand (2006)

Chiang Mai, Thailand (2002)

Min Buri, Thailand (2006)
School Buildings

Primary School, Laos (2004)

German School, Thailand (1991)

Primary School, Nepal (2004)

AIT International School, Thailand (2002)
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)

Health Clinic, Indonesia (1995)

Aquaculture Outreach Office Building, Thailand (1994)

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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