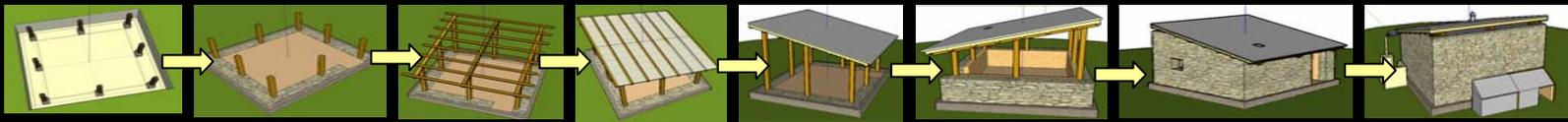

SUSTAINABLE SHELTERS
for post earthquake reconstruction

Harmeet Gill, Jean Li, Zehra Ali

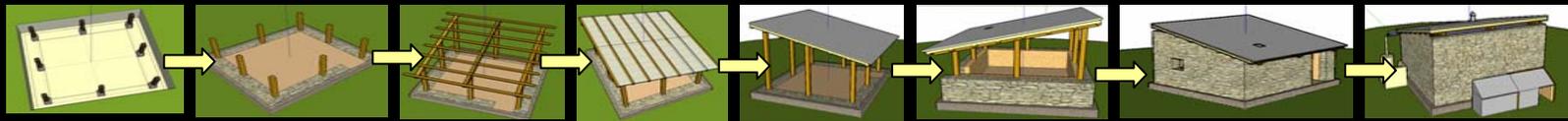


SUSTAINABLE SHELTERS

for post earthquake reconstruction

MISSION

*To **educate** the community in the village of Bana, Pakistan, about improved building practices to assist in the transition towards livelihood restoration and self-sufficiency in the reconstruction process.*

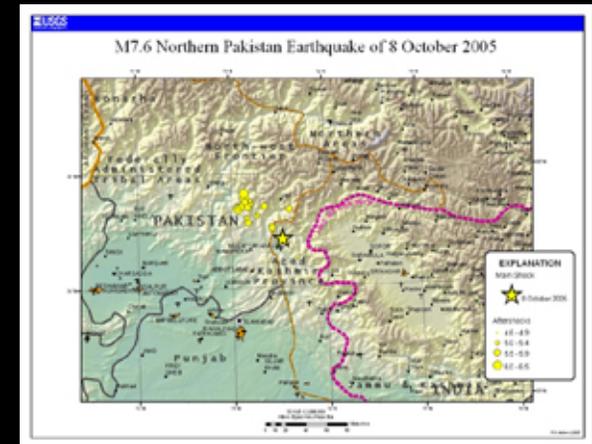


SUSTAINABLE SHELTERS

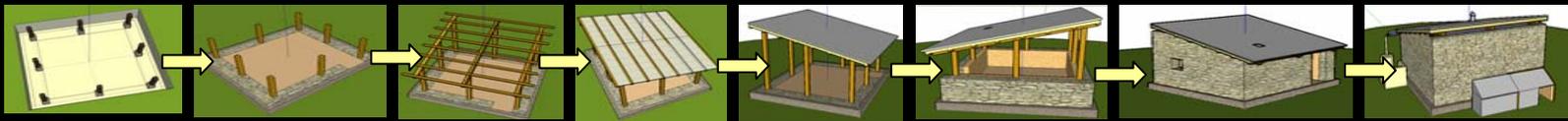
for post earthquake reconstruction

CURRENT SITUATION

- In October 2005, an **earthquake** of 7.6 scale devastated areas of **northern Pakistan**.
- **Bana**, in the remote valley of Azad Jammu & Kashmir (AJK) is one of the affected villages.
 - **Affected population: 2,800**
 - **Damaged Homes: 500**



Courtesy of USGS.



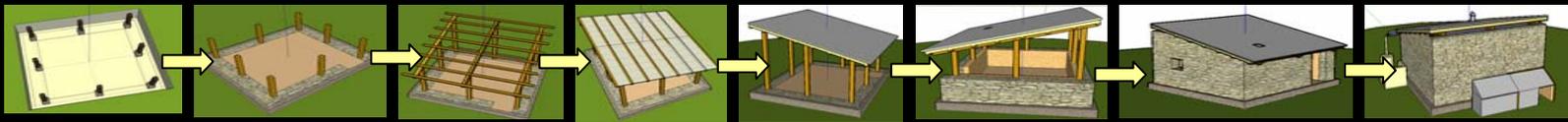
SUSTAINABLE SHELTERS

for post earthquake reconstruction

CURRENT SITUATION

60% of the affected population still lives in **make-shift shelters**, which:

- are not seismically sound
 - have poor indoor comfort conditions
- **Homes** built by NGOs and the Pakistani Government:
 - require expensive manufactured components
 - are not customized to local

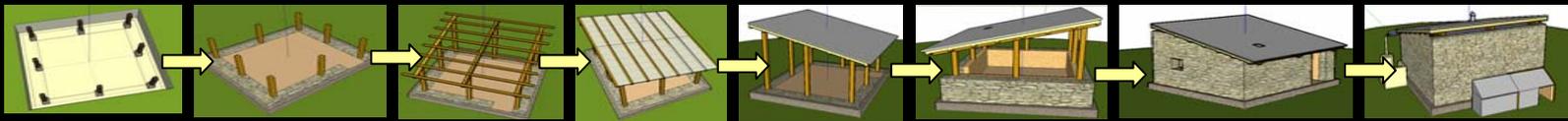


SUSTAINABLE SHELTERS for post earthquake reconstruction

- The need of the hour is to use traditional technologies which will also provide much needed employment to the people of the area, rather than highly skilled techniques, which will marginalize them.

Faultlines in Earthquake reconstruction policies

Yasmeen Lairi



SUSTAINABLE SHELTERS

for post earthquake reconstruction

THE NEED

- Housing needs to be safer and more sustainable:
 - To reduce community's vulnerability to future disasters
 - To improve living conditions that had existed prior to the earthquake
- Education and dissemination of improved construction practices is required:
 - for the residents of Bana to make informed decisions in the reconstruction process.



SUSTAINABLE SHELTERS

for post earthquake reconstruction

OUR SOLUTION

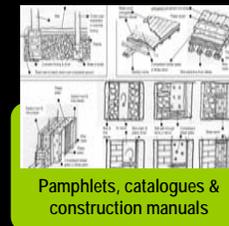
- Based on previous field research, our developed solution consists of
 - 1) constructing a **demonstration home**
 - 2) **training** members of the community in the construction and teaching processes, and
 - 3) disseminating **educational materials** about construction practices that are more :
 - efficient
 - adaptable
 - affordable
 - resourceful



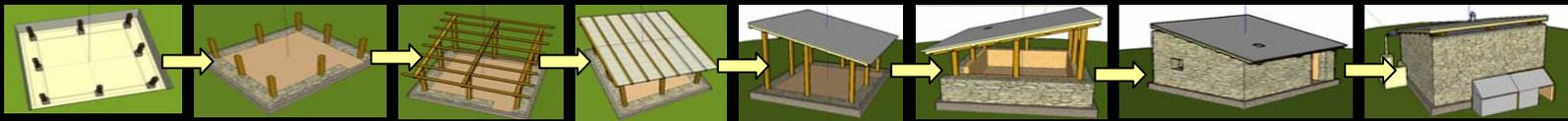
Demonstration Home



Training Sessions/ workshop



Pamphlets, catalogues & construction manuals



SUSTAINABLE SHELTERS

for post earthquake reconstruction

OUR SOLUTION

Time: 2 wks
Cost: \$1,600



Demonstration Home

- Construct physical model of small-scale building improvements
- Constructed by:
 - local mason, 3 construction workers
 - Staff from partner organizations (Packages Ltd. and Kashmir Education Foundation)

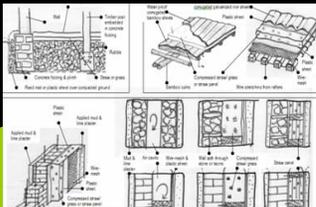
Time: 4 wks
Cost: \$800



Training Sessions/ workshop

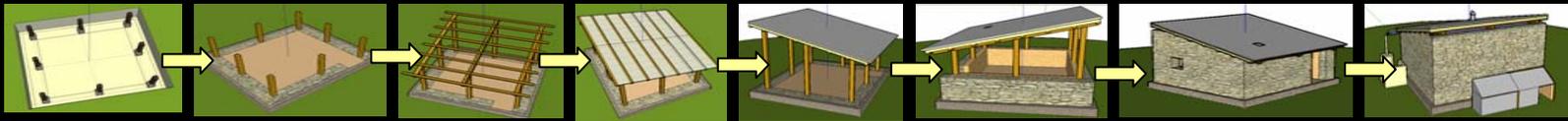
- Educate about the need for improved building methods and how to teach those methods
 - Training staff: community partners & IDEAS team
 - Participants: 30 local residents (men/ women, skilled/ unskilled)

Time: 3 mo
Cost: \$1,500



Pamphlets, catalogues & construction manuals

- Illustrate essential ideas about:
 - Improved seismic resistance
 - Improved thermal efficiency
 - Rainwater harvesting
 - Ventilation & day-lighting



SUSTAINABLE SHELTERS

for post earthquake reconstruction

Image removed due to copyright restrictions.



Traditional House



Improved design



Courtesy Mark Knobil. Image from Wikimedia Commons, <http://commons.wikimedia.org>.

C.G.I Shelter



Key features:

design

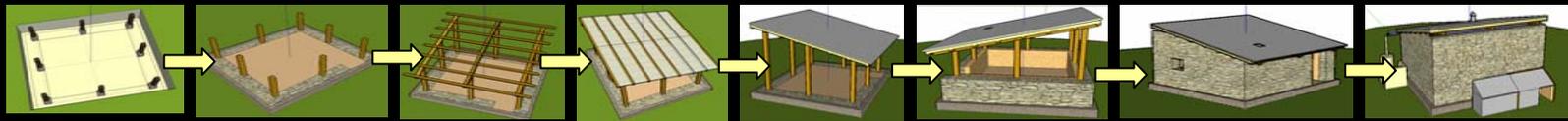
- Improved seismic resistance
- Improved insulation
- Rain water harvesting
- Improved Ventilation

Construction

- Use of local materials
- 2 week staged construction
- Skills to encourage entrepreneurial activities

Priorities for Improvements :

- Efficiency
- Resourcefulness
- Affordability
- Adaptability
- Ease of construction



SUSTAINABLE SHELTERS

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Stake holder participation

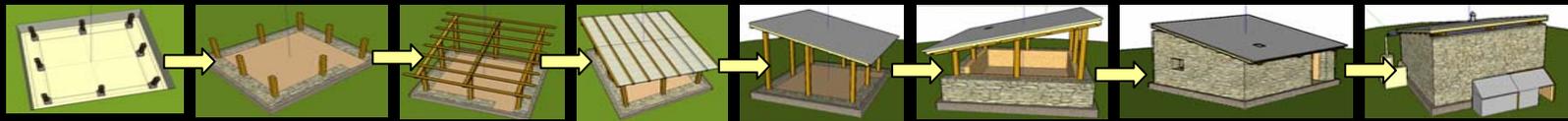
Design & planning	Information sharing
	Consultation
	Collaboration
	Empowerment
Construction	Owner driven
	Participatory
	Subsidized
Maintenance	Local community has skills
	Technical support not needed from organization
	Local entrepreneurs control material supply chain

Materials

Raw	Most materials available locally
	Procured from region in environmentally friendly
	Salavaged from debris
Manufactured	Subsidized by organization
	Obtained through material hub
	Standardized sizes
	Reduced packaging
	Can be recycled / reused
Properties	Light weight roofing material
	Fire resistant interior
	Water resistant foundation & exterior
	Resistant to vectors
	Non-toxic

Design

Attributes	Flexibility- varied use of space
	Livability- accessible & secure spaces
	Sense of community
	Adaptability- easily upgraded
Space Allocation	Cooking
	Sleeping & entertaining
	Cleaning/ washing
	Domestic activities for women
	Livestock shelter
	Storage
Improved seismic resistance	Foundation
	Wall
	Roof
Insulation	Floor
	Wall
	Roof
Indoor comfort conditions	Temperature
	Ventilation
	Day-lighting
General Conveniences	Stove with smoke extraction
	Latrine
	Water source: rain water harvesting



SUSTAINABLE SHELTERS

for post earthquake reconstruction

WHO'S INVOLVED

Local community

phase I (June -August 2007)

phase II (August 2007-)

Local masons

- 1) Recruited during initial consultation
- 2) Learn low cost innovations during demo home construction
- 3) Stipend available for assisting during training session

- 1) Assist members in the community to construct homes (for pay)
- 2) Assist to train other members to locally manufacture innovations for low-cost improvements (stipend provided)
- 3) Distribute pamphlets in training locations

residents of bana (un-skilled)

- 1) Involved in initial consultation for housing design
- 2) Observe improvements articulated in demo home & learn about the sustainability of the design
- 3) Attend morning training session

- 1) Construct own homes
- 2) Hired as skilled labor by contractors
- 3) Involved with entrepreneurial activities (producing insulation panels, reinforcing masonry walls, constructing trusswork for roof, contracting market materials)

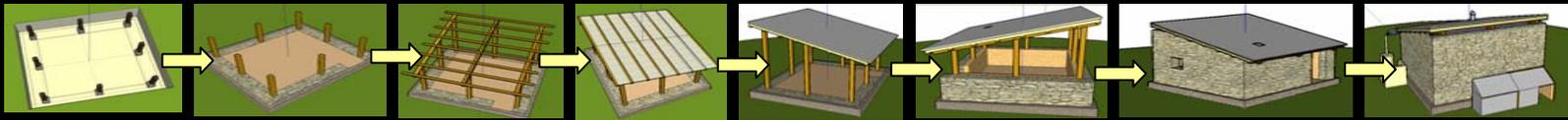
women

- 1) Involved in initial consultation for housing design
- 2) Learn about importance and design for improved indoor ventilation, insulation & plastering of walls, roof rainwater harvesting during afternoon training session
- 3) Attend training session (1 bag of flour distributed per attendee)

- 1) Apply insulation/ plaster/ rainwater harvesting system to existing shelter (subsidized materials available)
- 2) Engage in entrepreneurial activities (insulation panels, water collector for rainwater harvesting, plastering etc)
- 3) Participate in community meetings

persons from nearby village

- 1) Observe improvements articulated in demo home & learn about the sustainability of the design
- 2) Obtain assistance from local community & training staff to upgrade existing shelter



SUSTAINABLE SHELTERS

for post earthquake reconstruction

WHO'S INVOLVED

ideas team
community partners

harmeet gill
(MIT '07) Mech. Eng.

jean li
(MIT '10) architecture

zehra ali (MIT '07) Building Technology

packages ltd.

kashmir education foundation

PHASE 1
June- Aug 2007

PHASE 2
Aug 2007-

construction manager

(arrange meetings, organize procurement & storage of materials, sequence construction with community partners)

dissemination personnel

(design & produce construction manuals, pamphlets and catalogue in collaboration with community partners)

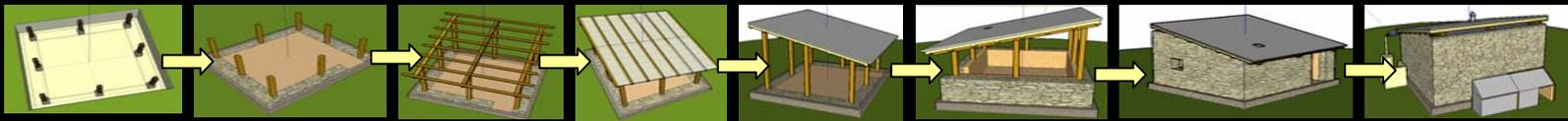
design engineer

(conduct intial consultation and surveying, assist in construction of demonstration home, plan and oversee training session with community partners)

a Pakistani paper-packaging company that has participated in the relief effort in the Rawalkot region, has pledged to fund and manage the reconstruction efforts in Bana

a non-profit NGO, that has established English medium schools and teacher training institutes in rural areas of Rawalkot in the past and is now involved with the reconstruction of shelters in the region.

- 1) Place orders for materials in demand
- 2) Catalogue entrepreneurial activities
- 3) Apply for grants and organize the introduction of local welding and sawing center to assist entrepreneurial activities
- 1) Discuss improved dissemination of ideas with other interested organizations
- 2) Improve design of pamphlets based on community suggestions
- 3) Pitch project to other NGOs and ERRA through website
- 1) Evaluate the popularity and prioritization of construction improvements by local community
- 2) Collaborate with other organizations on design for increased adaptability
- 3) Make design suggestions available online
- 4) Meet with other organizations
- 1) Support entrepreneurial activities
- 2) Subsidize construction materials
- 3) Oversee reconstruction of village
- 1) Dissemination of design through improved educational programs
- 2) Training community members & raising awareness

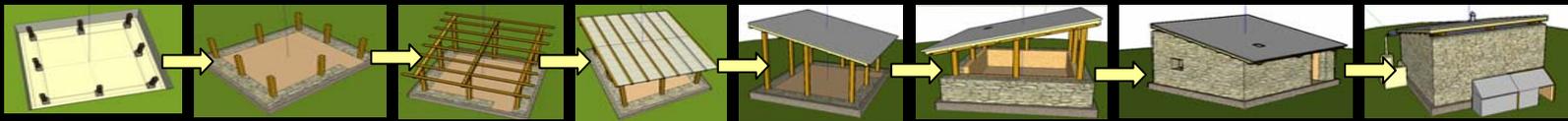


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THE PROJECTED IMPACT

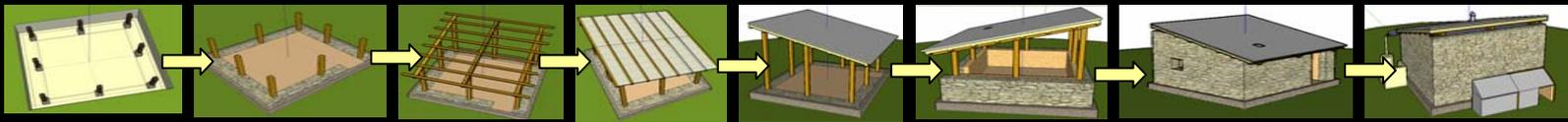
The success of this pilot program will lead to the adoption of our innovative dissemination and reconstruction program by community partner, Packages.



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for post earthquake reconstruction

- From the knowledge gained through this project:
 - **residents** will be able to build and maintain individual homes for families
 - **local entrepreneurs**, with our initial assistance, may create construction businesses and small industries specializing in local materials
 - **women** will be empowered to earn a living using skills in areas of work typically not open to them
 - an **awareness** of basic engineering concepts and long-term sustainability will be created
 - **additional communities and organizations** will incorporate the dissemination solution into the rebuilding of other areas



SUSTAINABLE SHELTERS

for post earthquake reconstruction

QUESTIONS?

MIT OpenCourseWare
<http://ocw.mit.edu>

EC.715 D-Lab: Disseminating Innovations for the Common Good
Spring 2007

For information about citing these materials or our Terms of Use, visit: <http://ocw.mit.edu/terms>.