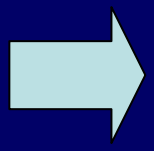
Tokyo International Workshop 2006 on
Earthquake Disaster Mitigation for Safer Housing

Feasible and Affordable Seismic Construction

Toshikazu Hanazato, Mie University
Chikahiro Minowa, NIED

Why comprehensive approach?

- Excellent technologies of industrialized countries can not necessarily improve the situation



APPROPRIATE TECHNOLOGIES

APPROPRIATE means

Affordable and Feasible

We have to learn every aspects of each community such as materials, structures, labor skills, industries, economies & households

Feasible and Affordable Seismic Constructions

Develop appropriate seismic structures and construction practices, which will be expected to be accepted by communities, and to verify them by a series of joint experiments

(proposal by UNCRD (United Nations Center for Regional Development in Kobe) for CB masonry)

Feasible & Affordable Seismic Constructions

2006	2007	2008

(Fiscal year)

Mutual Visit & TV- conference for Discussions

Laboratory test using structural element	Design and construction of model for full scale shaking table test	Shaking table test of full scale model
Field Survey Indonesia Pakistan India (Gujarat) Iran (Bam)		Proposal of Guideline

(Activities of Japanese Team)

Research Activities in 2006

1)Review of available technologies that have been proposed, with collecting information of earthquake-safer housing

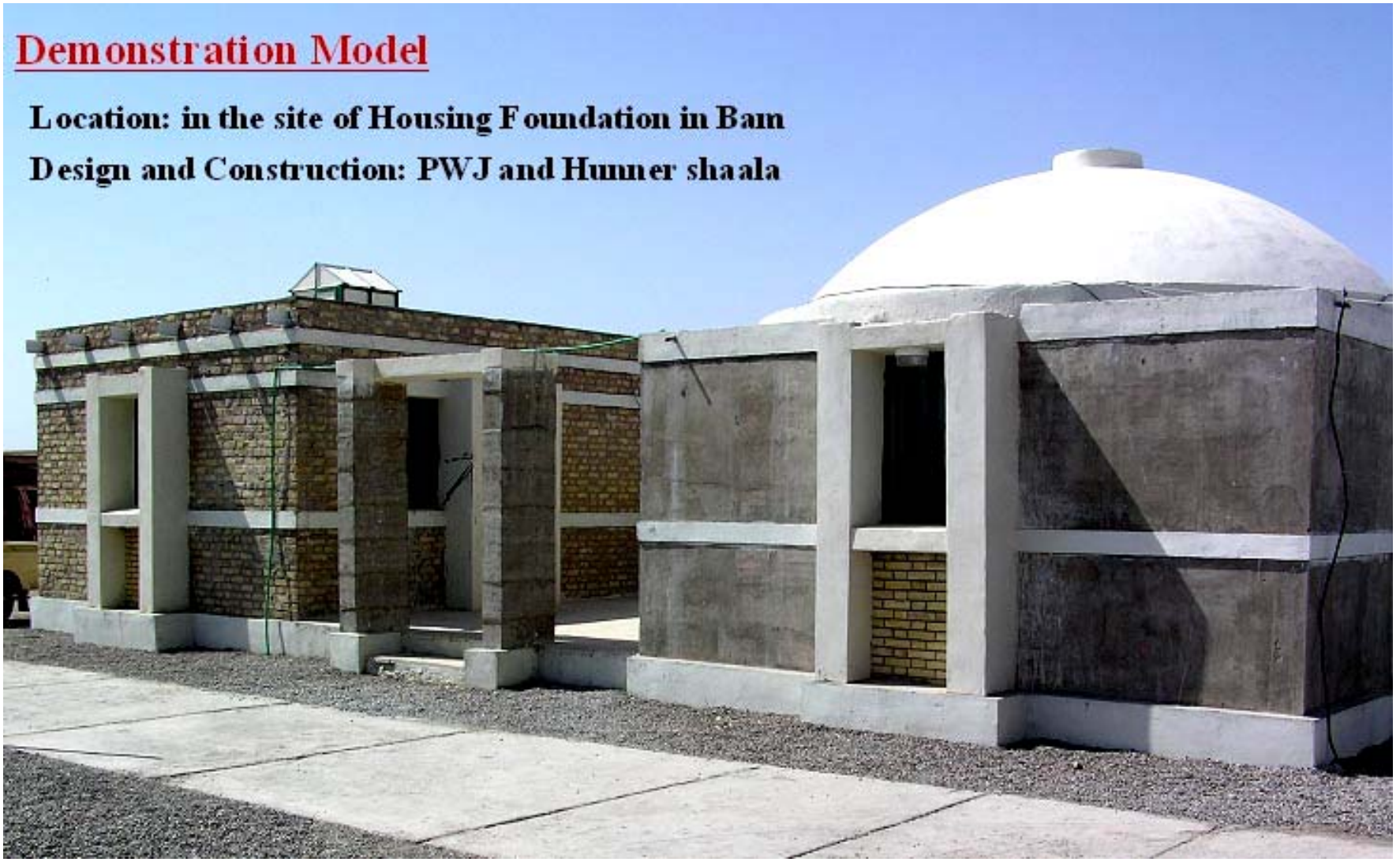
2)Mutual visit to counterpart countries (Inspection of equipment for experimental studies)

3)Field survey of rehabilitation and reconstruction stage in the area where the recent devastating earthquake caused great damage to houses

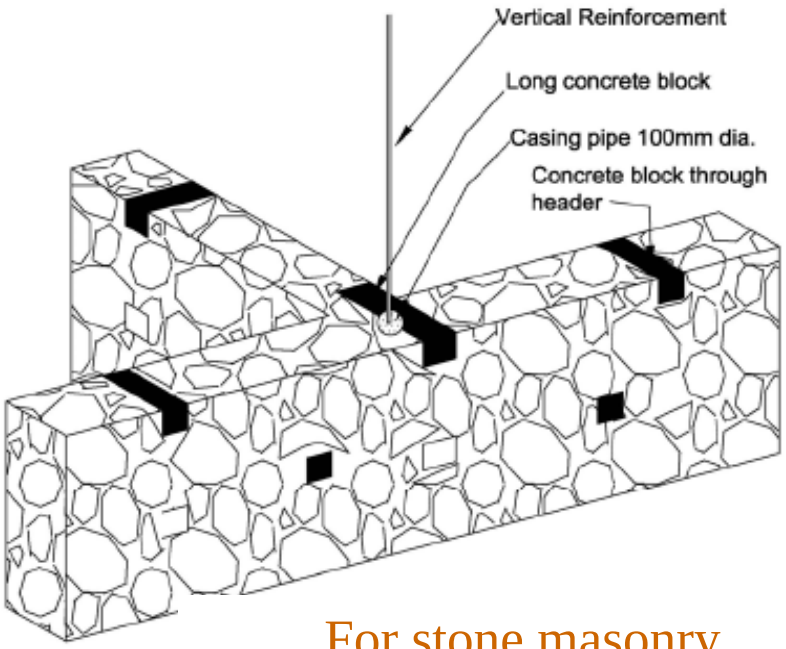
- Iran, India and Pakistan

4)Preliminary study of full-scale shaking table tests that will be conducted in 2008 (Laboratory tests of structural elements)

Seismic bands



Vertical bar



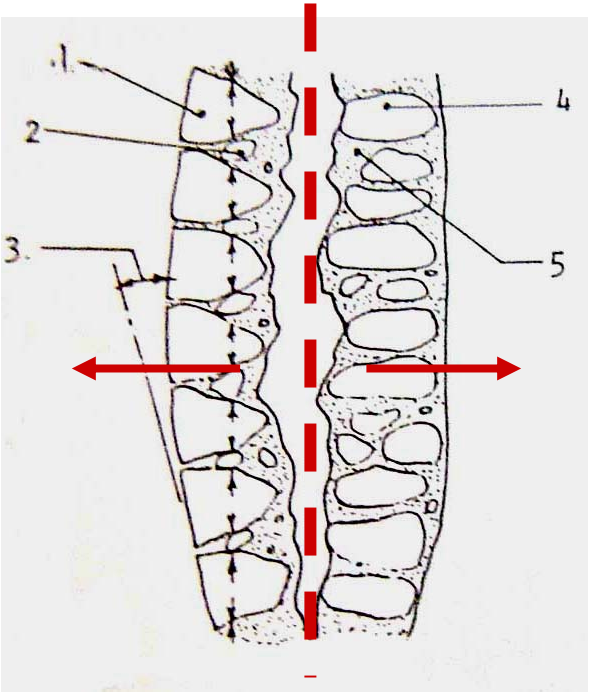
For stone masonry

For brick masonry

For earthquake safety building reinforcing bars (Vertical bar) should be embedded in masonry wall at the corners of all rooms and the side of the door openings. These vertical bars should be connected from foundation to roof band

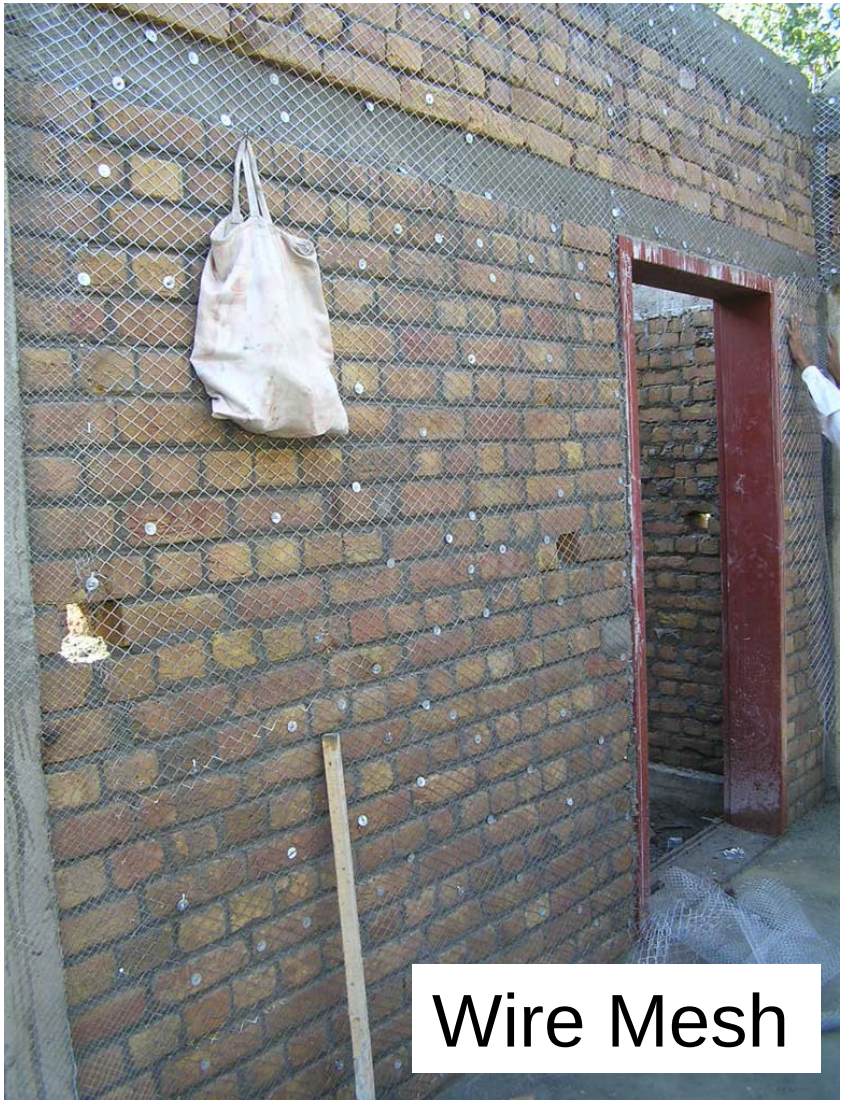
Through Stone

Through Stone is avoiding delaminating of wall



Prototype Seismic Resistant and Barrier Free Basic Health Units in Earthquake Affected Area (JICA's Project in Pakistan)

Rein bar
(Vertical & Horizontal)



Wire Mesh

Survey of Present State of Rehabilitation of Houses in Disaster Areas Affected by Recent Great Earthquakes

Study features of earthquake damage and technologies adopted for reconstruction of houses

Bam, Iran

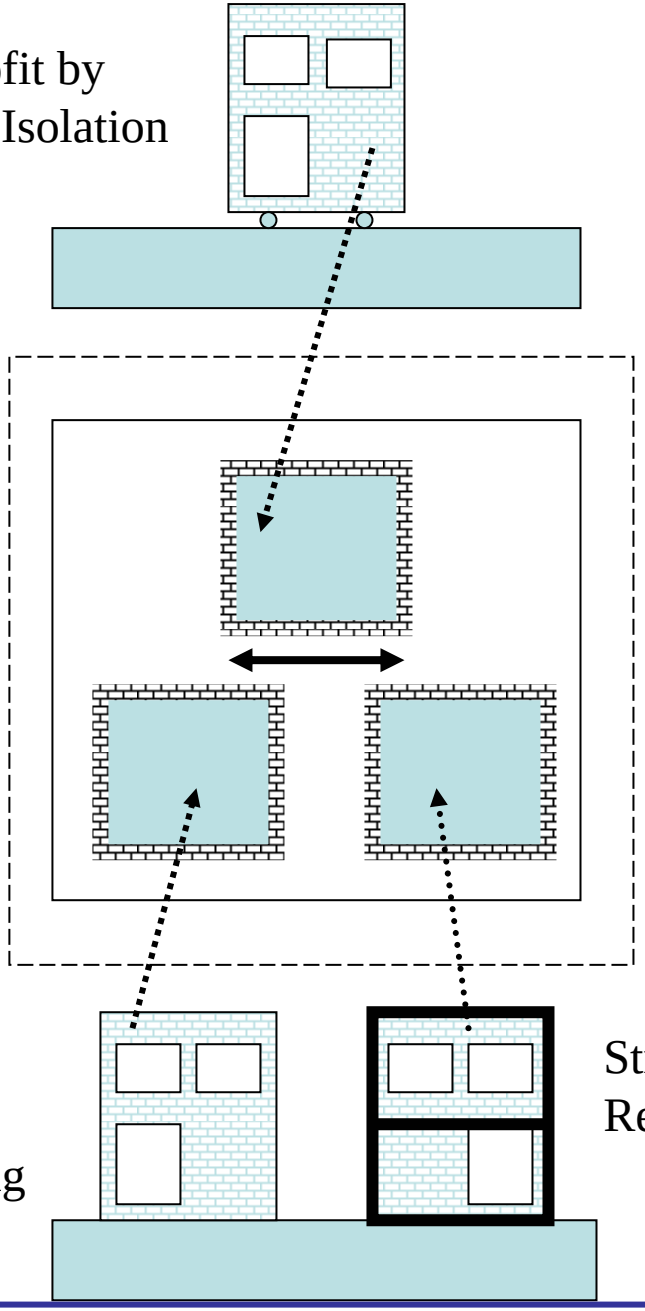


Image of Shaking Table Test
Fiscal Year:2008

Test Specimens:
Masonry Structures of Bricks
4m × 4m × 6m Weight 20tonf

Non Strengthening :Seismic Design
C=0.05? (Collapse by Shaking)
Strengthening : Proposal by participating foreign experts (Standing in Shaking)
Strengthening : Proposal by Japanese team (for example, Base Isolation et. al) (Standing in Shaking)

Input: Bam earthquake: Iran
Bingle earthquake: Turkey

Collaborative Research Project

Comprehensive Approach

Japan  Counterpart Countries

Experimental Studies

Analytical Studies

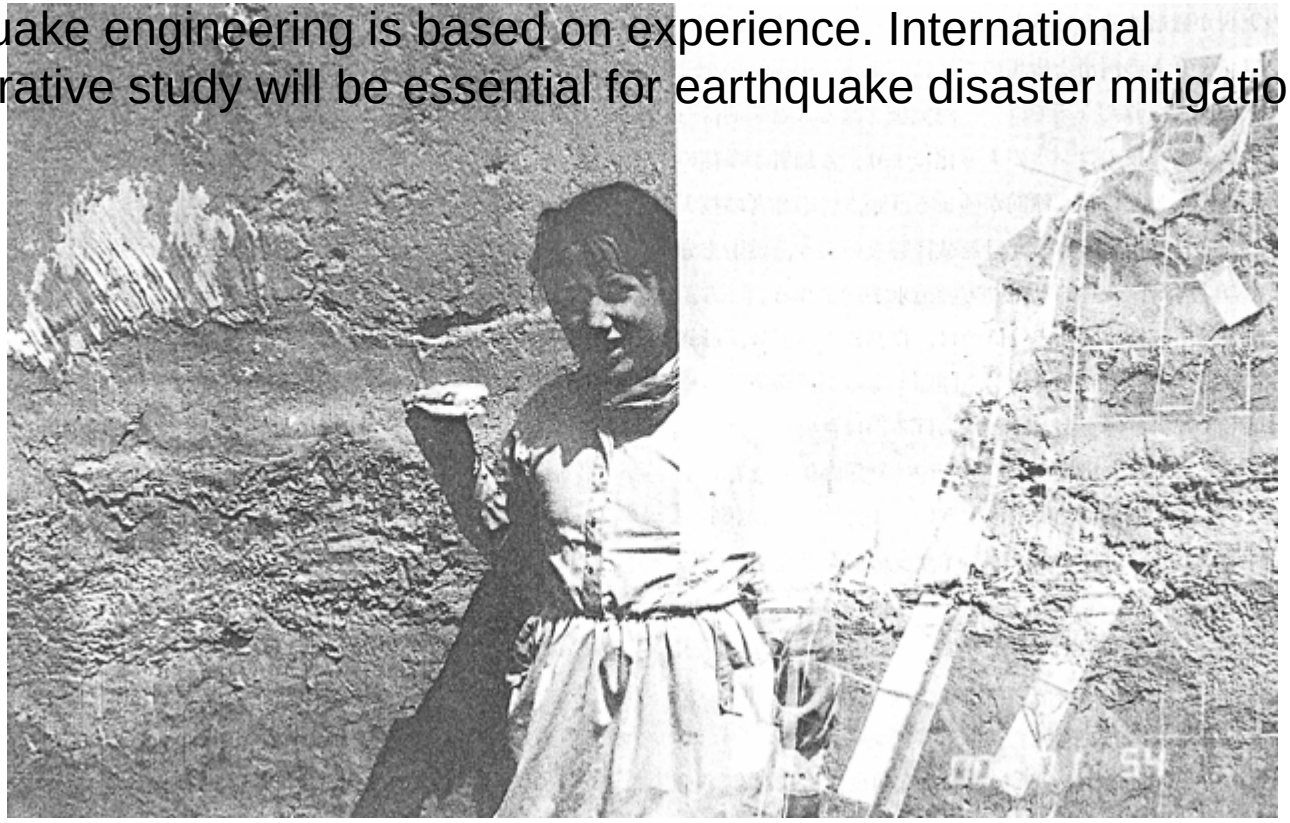
Information & Knowledge Survey

Revision of Guideline for Earthquake Resistant Non-Engineered Construction

A Photo. Taken by Prof. Watabe in Disaster- Struck Area

A girl who looks cheerful even just after the great disaster of the Mexican Earthquake of September 19, 1985,overlapped by a building that collapsed

Earthquake engineering is based on experience. International collaborative study will be essential for earthquake disaster mitigation



Thank you