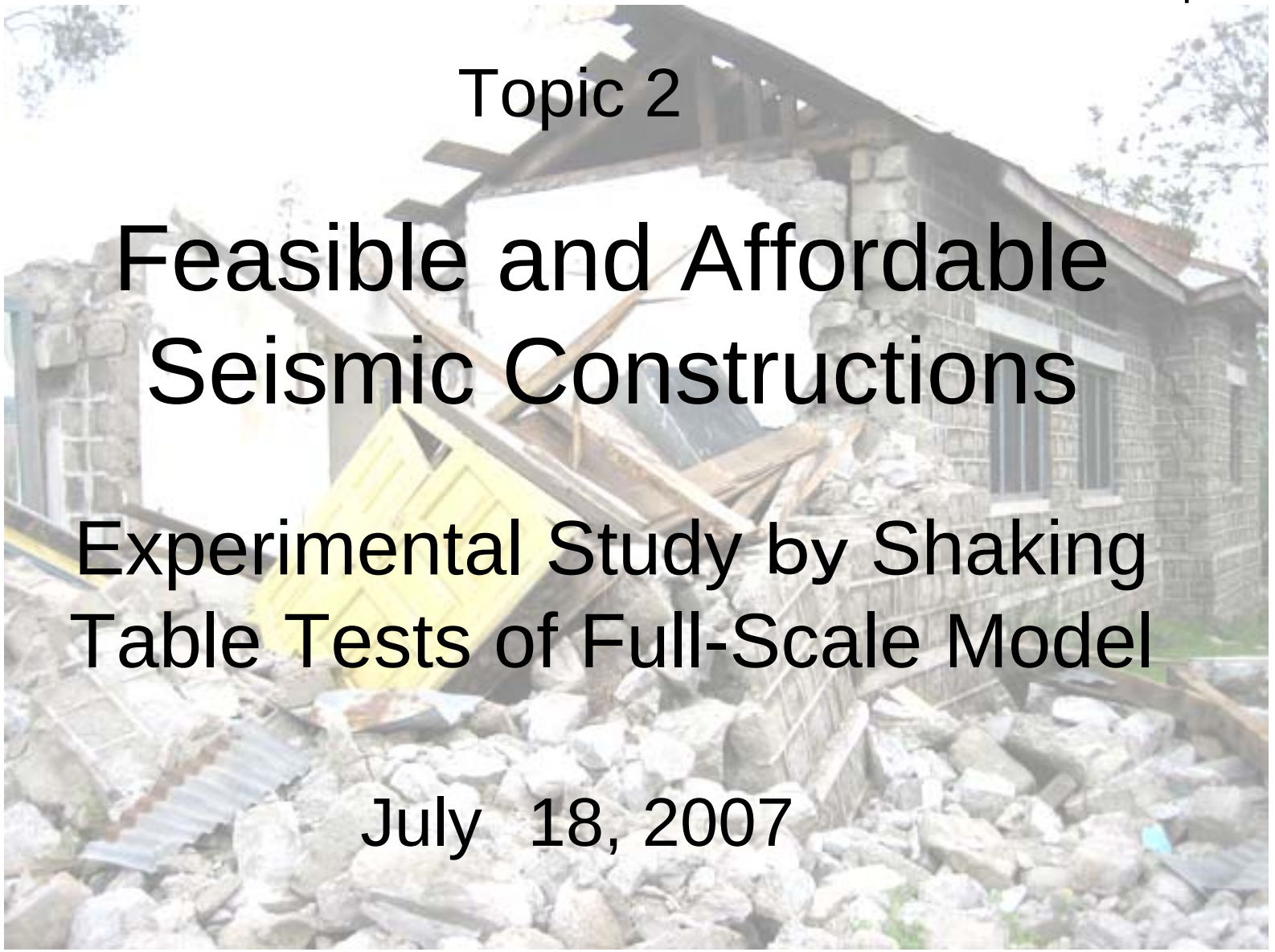


Topic 2

Feasible and Affordable Seismic Constructions

Experimental Study by Shaking Table Tests of Full-Scale Model

July 18, 2007

Toshikazu Hanazato （Mie University)

Scope

- Improve the understanding of performance of traditional non-engineered masonry houses
- Provide scientific basis for turning non-engineered houses into engineered ones of which seismic resistance can be evaluated.
- Enhance the ability of research institutes/universities of each country to conduct research on this field

2-1 Seismic tests on Feasible & Affordable Seismic Constructions

2006	2007	2008

(Fiscal year)

Mutual Visit & TV- conference for Discussions

Preliminary study for full-scale shaking table tests ; Literature survey and laboratory tests

Field Survey
Indonesia,Pakistan, India(Gujarat),Iran(Bam)

Full-scale shaking table tests (1)Phase 1 Basic tests at NIED in JAPAN

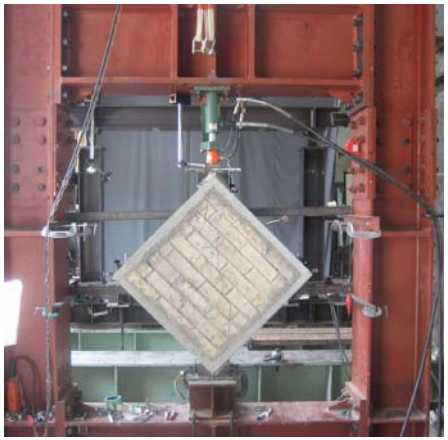
Experimental & analytical studies in each CP country

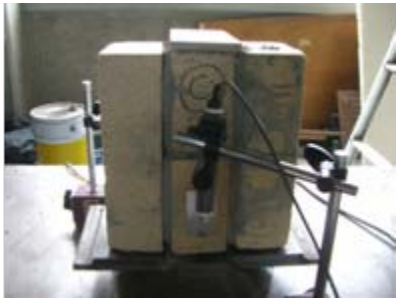
Full-scale shaking table tests (2)Phase 2 Tests at CP country

Recommenda-tion for Guide-line

Collaborative Study for Seismic Structures

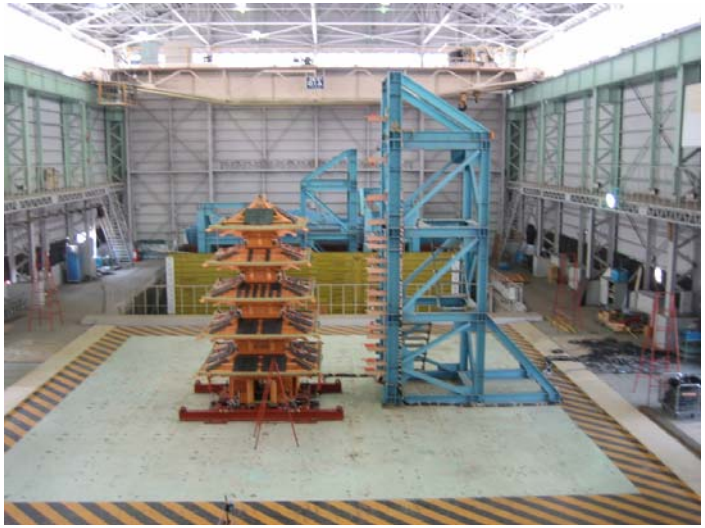
Discussions





Laboratory test of structural element

Field Survey
Recent devastating earthquakes



Full scale shaking table test

Scope of Shaking Table Tests of Full-Scale Model Structure

- Share experimental data of shaking table tests of full-scale model
- Counterpart institutes are expected to conduct preliminary study for the shaking table tests as ;

  Prediction and correlation analysis

  Laboratory tests of elements

  Field survey of construction materials

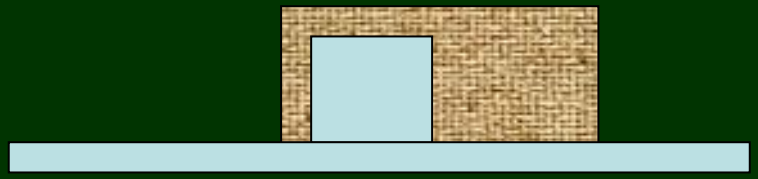
Objectives of shaking table tests in NIED in 2007

- To share data of actual behavior of full-scale model
- To provide available data for research activities at counterpart institutes (to stimulate their research activities)
- To prepare for full-scale shaking table tests at a counterpart institute in 2008 (UET Peshawar)

Shaking Table Tests of Full-Scale Model Structure

In 2007 (FY)

Preliminary laboratory tests and structural analyses in each country



at NIED in Japan

In 2008 (FY)

Comprehensive study of appropriate technologies

Enhancement of ability for R&D in developing countries

In a counterpart country
(UET Peshawar expected)

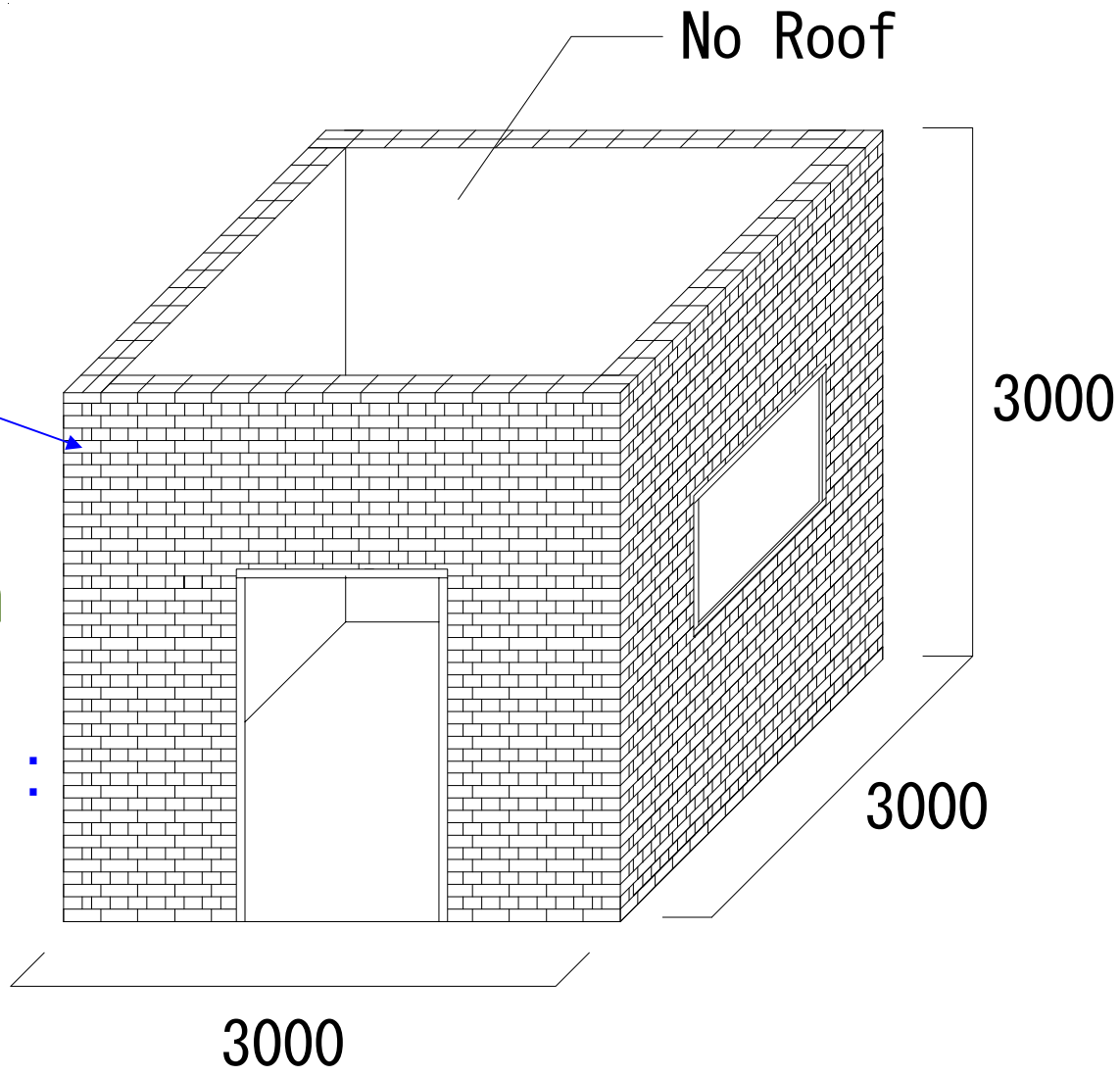
Experimental Subject

- Type 1 : Wall structure houses that have brick walls of more than 20cm in Himalayan region and its surroundings (South Asia = Pakistan, Iran,Nepal et.a.l)
- Type 2 : So-called “confined masonry” houses that have brick walls of approximately 10cm thickness confined by framed reinforced concrete (Southeast Asia = Indonesia et. al.)

Full-scale shaking table tests

	Purpose	Model
2007 in NIED	To share data To prepare for test in 2008	Type 1 = South Asia model
2008 in UETP (Proposal)	To share data To verify strengthening technologies (if possible)	Type 2 = Southeast Asia model

Model structure (2007 model)



English bond

Bricks will be imported from Pakistan

Mortar joint sand : mortar=1:6

Seismic Analyses Methods

Analyses methods proposed by participants so far

1. Detailed analysis

Finite element method (Prof. Ali)

Discrete element method (Dr. Nakagawa)

Equivalent structural frame analysis (Dr. Saito)

2. Simplified Analyses

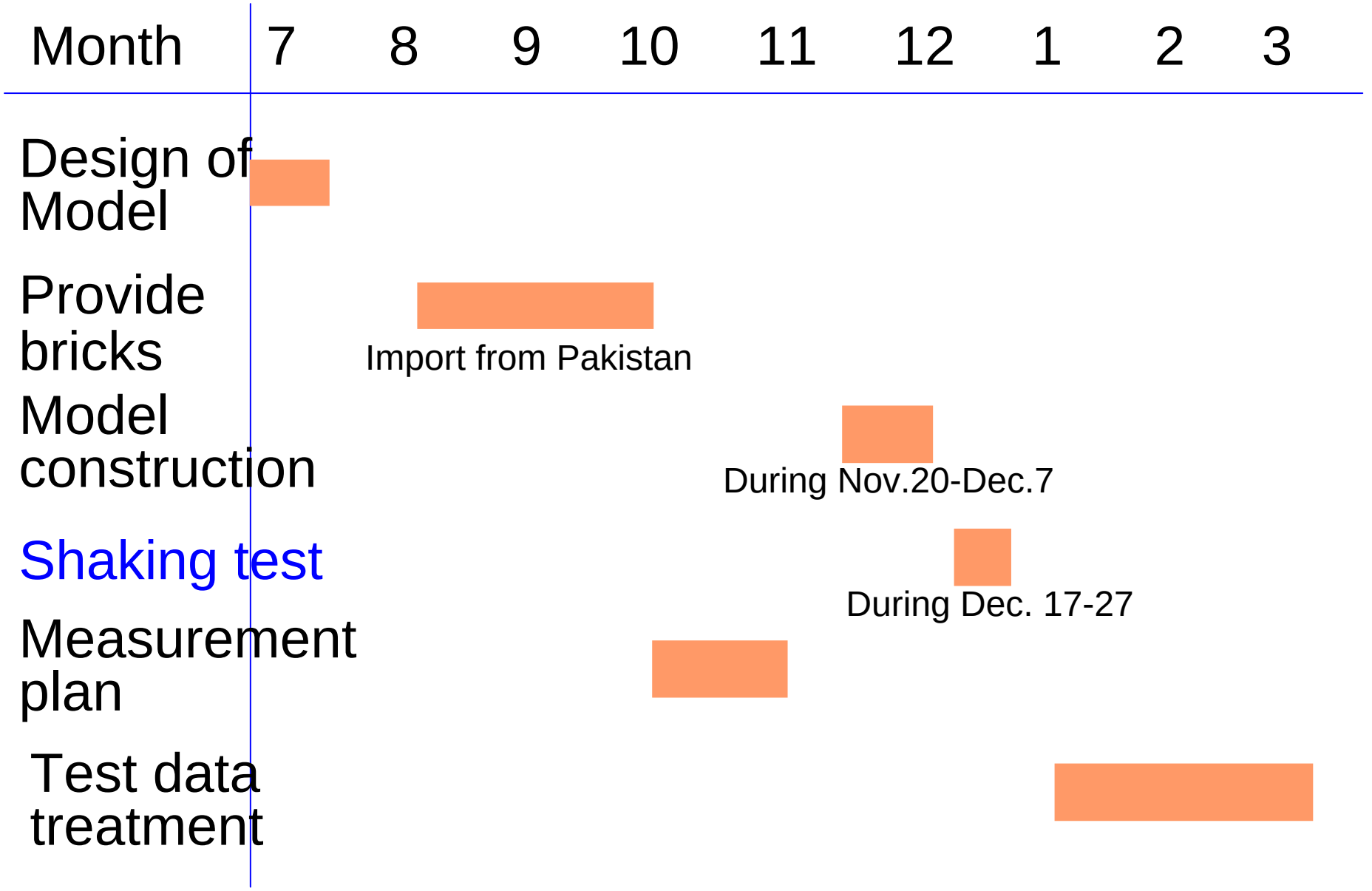
Method combining wall calculation model with estimation formula of seismic resistance of in- and out of plane of masonry walls (Prof. Hanazato)

Wall calculation method for in-plane masonry walls (Mr. Imai)

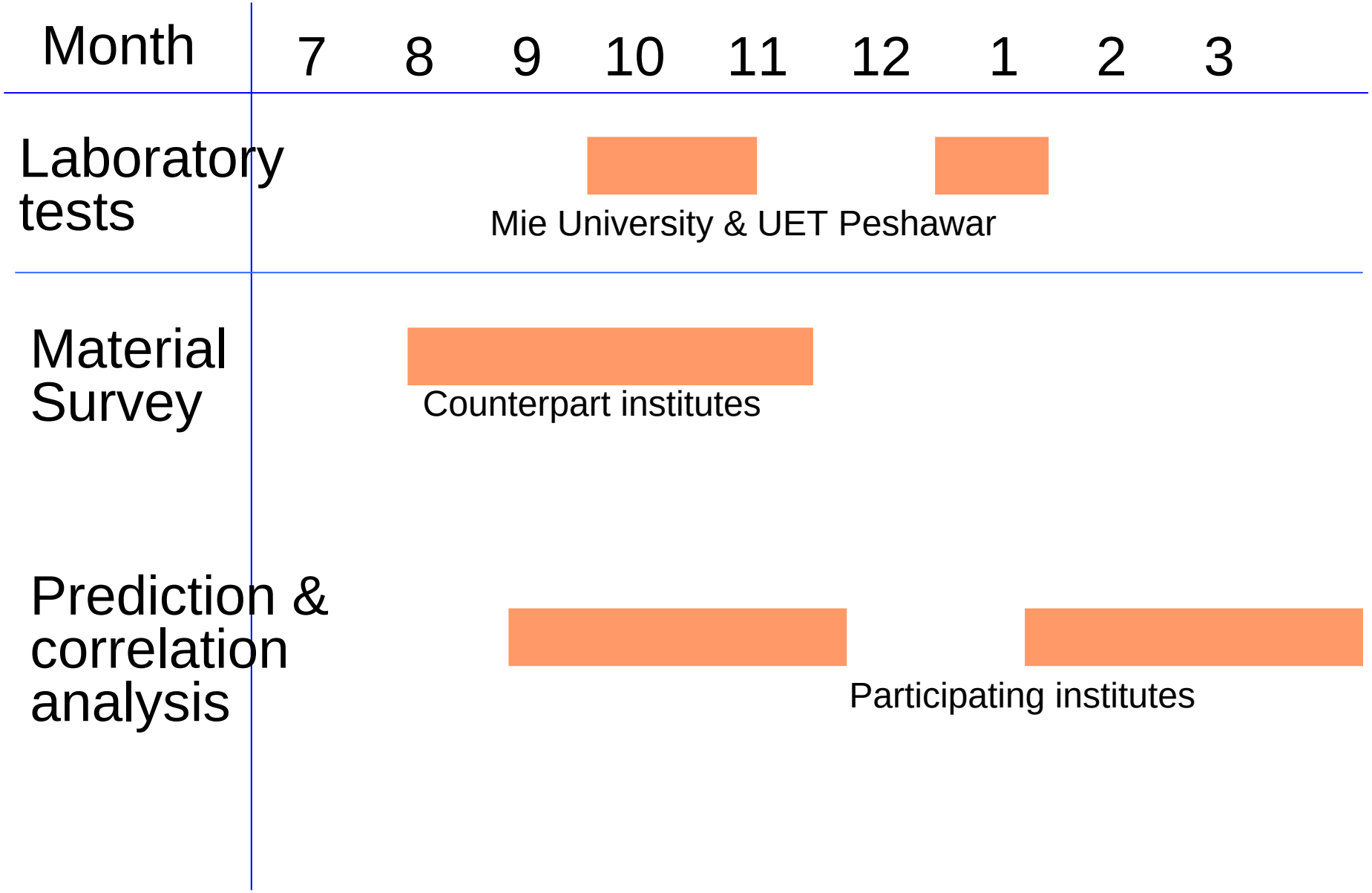
International Collaboration and Expected Role Shearing in 2007

- Japan : Shaking table test preparation and implementation, laboratory material tests, model structure design and fabrication, data organization, prediction and correlation analyses
- Pakistan : experimentation (model wall structure, test pieces) and prediction and correlation analyses
- Indonesia : Survey of mechanical properties of materials and analysis of shaking table tests
- Nepal : Survey of mechanical properties of materials and analysis of shaking table tests
- Turkey : Survey of mechanical properties of materials and analysis of shaking table test

Proposed schedule in 2007 (FY)



Proposed schedule in 2007 (FY)



Discussion and Confirmation

- Role shearing – Japan and counterpart countries
- Analyses, survey of construction materials, mechanical tests of materials of shaking table tests, static shear test of wall model using the same bricks of shaking table tests
- Schedule of activities in 2007(FY)
- Model structure – Is the proposed design approved ? (size of 3m x3m, no-roof slab structure)
- Preparation for next year’s test - Shaking table construction at UET Peshawar