Applied Research Partnerships with Developing and Transition Countries Swiss Universities of Applied Sciences and Universities of Teacher Education

## **Project title**

Dhajji, a traditional earthquake resistant building technique: Scientific verification through lab testing and development of training material

Year

2009

### **Thematic focus**

Earthquake, construction, local seismic culture

### **Project location**

Kashmir mountains, Pakistan

### **Swiss Institution**

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# Description

Objectives

- Lab verification of earthquake resistance of dhajji structures.
- Preparation of scientific documentation.
- Preparation of training material for technicians and artisans.

#### **Partner Institution**

Prof. Dr. Qaisar Ali, drqaisarali@nwfpuet.edu.pk, NWFP University of Engineering and Technology Peshawar, Pakistan

## Results

- Lab tests and numerical modelling have been done.

- Results will be presented at the 9th US and 10th Candadian Conference on EQ engineering in 2010.

- Construction manual has been prepared and is about to be printed by the National Disaster Management Authority, UN-Habitat and UNDP in Pakistan.

- PowerPoint lessons for training have been prepared and will be made available on a relevant website.

## **Development relevance**

GOAL 7: ENSURE ENVIRONMENTAL SUSTAINABILITY, Target 1: Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources: The traditional Dhajji building method has been officially accepted by the government as an appropriate technique for dwellings in remote areas, a serious achievement for a country striving for modernity.



Reduced scale model of a Dhajji house on the shake table of the Earthquake Engineering Centre of the NWFP University of Engineering and Technology Peshawar, Pakistan

## Target 4:

Achieve a significant improvement in the lives of [...] (slum) dwellers: The Dhajji techniques allows for a great number of disadvantaged people from remote areas to live in a safe and comfortable house.



Highly illustrated 40 page construction manual for the training of technicians and artisans



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Swiss Agency for Develop and Cooperation SDC

Rektorenkonferenz der Fachhochschulen der Schweiz Conference des Recteurs des Hautes Ecoles Spécialisées Suisses Conferenza dei Rettori delle Scuole Universitiarie Professionali Svizzere Rectors' Conference of the Swiss Universities of Applied Sciences

# Main features of the project

The Dhajji project has certainly succeed in raising interest for the surprising performances of vernacular seismic engineering knowhow, not only among humanitarian aid and development organisation but also with some farsighted engineers and engineering companies (e.g. ARUP).

The lab research and numerical modelling, through the ensuing publication in relevant journals and conferences, provide a tool that will allow engineers to use this technique for further applications like for instance school buildings or health centres in remote area. Up to now this has not been possible for lack of reference material permitting engineers to back up their decisions with consolidated facts.

The manual on the other hand, will allow to bring this knowhow to technicians and artisans in a concise and durable manner. Up to now training was based on approximation and happened on a one off basis. Trainees had no material to take away and use as a reminder (reference tool) when the information received during training starts to vanish.

The project has generated international attention as proved by the enthusiastic interest expressed by several important organisations (UN Habitat, UNDP, UNESCO, even the China Earthquake Administration). The usefulness and urgency of a well-documented reference manual on dhajji construction has also been confirmed by various actors involved in appropriate building methods.

It is not a coincidence that our technical guidelines will be printed within few months of the publication of the ground-breaking book 'Don't tear it down: Preserving the Earthquake Resistant Vernacular Architecture of Kashmir' by the well-known Randolph Langenbach. As recently as last month during the Haiti earthquake, traditional timber-frame houses with stone infills (known as Gingerbread houses) have once more proved to survive heavy shaking with little to no damage in the midst of widespread destruction.

International interest within the earthquake engineering community for this kind of techniques is growing rapidly. We can safely affirm that this project is perfectly situated in time as it responds to concerns of safety, ecology, economy and cultural identity all at once. The rediscovery and active promotion of traditional earthquake engineering knowhow today is an unexpected consequence of the current identity crisis of an economic system which has not been able to keep its promises of increased wellbeing (including protection from natural disasters) for all.



A demo Dhajji house (offered to a particularly vulnerable family) built to train artisans in NWFP, Pakistan, by the Swiss Agency for Development and Cooperation in 2007.



Different ways to subdivide Dhajji walls, as presented in the manual developed for the training of artisans.