

ENHANCEMENT OF EARTHQUAKE AND TSUNAMI DISASTER MITIGATION TECHNOLOGY IN PERU: A SATREPS PROJECT

Shoichi Nakai¹, Fumio Yamazaki¹, Carlos Zavala², Zenón Aguilar²
Shun'ichi Koshimura³, Taiki Saito⁴ and Saburoh Midorikawa⁵

¹ Professor, Graduate School of Engineering, Chiba University, Japan.

² Professor, CISMID, National University of Engineering, Peru.

³ Associate Professor, Graduate School of Engineering, Tohoku University, Japan.

⁴ Senior Researcher, Building Research Institute, Japan.

⁵ Professor, Center for Urban Earthquake Engineering, Tokyo Institute of Technology, Japan.

INTRODUCTION

A new international research program named “Science and Technology Research Partnership for Sustainable Development (SATREPS)” has started since 2008 under the joint sponsorship of Japan Science and Technology Agency (JST) and Japan International Cooperation Agency (JICA). Our proposal “Enhancement of Earthquake and Tsunami Disaster Mitigation Technology in Peru” was selected as one of the projects in the field of natural disaster prevention in April 2009. The Record of Discussion (R/D) was signed on 15 January 2010 by JICA and National University of Engineering (UNI) in Lima, Peru. This paper describes the overall objectives and research plan of the project.

BACKGROUND AND OBJECTIVES OF THE PROJECT

Peru is located in the circum-Pacific seismic belt with high seismic and tsunami risks. It is understood that both Peru and Japan are located in a similar seismic environment and are frequently hit by damaging earthquakes and tsunamis. In this region, large plate-boundary earthquakes occurred recently in the offshore of Atico ($M_w=8.4$, 23 June 2001) and in the offshore of Pisco ($M_w=8.0$, 15 August 2007). A large number of buildings and infrastructures were collapsed, hundreds of people were killed, and tsunamis were also generated by these events. Thus, earthquake and tsunami disaster mitigation draws considerable attention in Peru.

RESEARCH PLAN AND ORGANIZATIONAL STRUCTURE

In this research project, a comprehensive research towards earthquake and tsunami disaster mitigation in Peru will be carried out under strong collaboration among researchers of Peru and Japan. Fig. 1 shows the organizational structure of this five year projects. The joint research will be carried out in five main research topics: G1) Strong motion prediction and development of seismic microzonation; G2) Development of tsunami countermeasures based on numerical simulations; G3) Enhancement of seismic resistance of buildings based on structural experiments and field investigation; G4) Development of spatial information database using remote sensing technology and earthquake damage assessment for scenario earthquakes; G5) Development of earthquake and tsunami disaster mitigation plan and its implementation to the society.

Fig. 2 shows the research topics and items of the project. Based on the research outputs from the four groups (G1-G4), the disaster mitigation plan group (G5) will propose and implement earthquake and tsunami disaster mitigation plans to case study areas in Peru. Three case study areas will be decided soon after preliminary surveys. A part of Metropolitan Lima including Callao has already selected as one of the study areas. The other two areas are still in discussion. Other than these areas, the affected areas due to the recent earthquakes, Pisco (the 2007 event) and Camana, Arequipa etc. (the 2001 event), will also be considered in developing hazard and damage assessment models.

RESEARCH AGENDA OF G1 GROUP

The seismic motion and geotechnical group (G1) is responsible for constructing fault models for large scenario earthquakes along the subducting plate and deep and shallow soil models to come up with microzonation maps. In order to construct the fault model, surveys of historical seismic activities will be conducted and strong motion observations will be carried out by installing seismometers in a number of

locations (see Fig. 4). For the construction of deep and shallow soil models, the group will conduct geophysical and geotechnical surveys including borehole and PS loggings as well as surface wave and microtremor measurements. The analysis of earthquake data from small events will also be carried out. The agenda for constructing the microzonation maps includes strong motion simulation based on the fault models and the deep/shallow soil models, estimation of amplification due to surface soils and estimation of slope failure.

IMPLEMENTATION AND PROSPECTED OUTPUTS OF THE PROJECT

The Japanese Detailed Planning Survey Team organized by JICA visited Peru from August 5 to 13, 2009 had a series of discussions with the Peruvian organizations led by CISMID/UNI. The team and the Peruvian organizations agreed on the matters referred to in the document (JICA, 2009).

The agreement is that the objective of this project is to develop technologies and measures for assessment and mitigation of earthquake/tsunami disasters caused by large-magnitude inter-plate earthquakes occurring off the coast of Peru. It is further envisaged that such technologies should be widely used in Peru, and also disseminated and applied to pacific-rim countries, especially to neighboring countries, facing the risks of large-magnitude inter-plate earthquakes and tsunamis. In addition, the project is expected to contribute to the enhancement of capacity as well as the advance of research for both Peruvian and Japanese research institutes involved in this project.

The progress of the project will be presented in the near future.

REFERENCES

Japan International Cooperation Agency (2009), Minutes of meeting between JICA detailed planning survey team and the National University of Engineering.

CISMID (2004), Estudio de Vulnerabilidad y Riesgo Sísmico de Lima y Callao APESEG/ CISMID-EVR-LYC-Informe Final, Asociación Peruana de Empresas de Seguros APESEG, Centro Peruano Japonés de Investigaciones Sísmicas y Mitigación de Desastres CISMID, Lima, Perú.

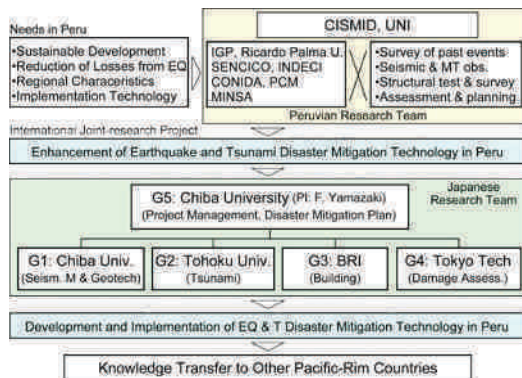


Figura 1. Organizational structure of the project

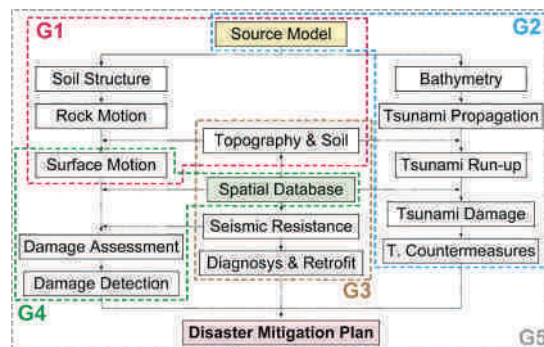


Figura 2. Research topics of the project

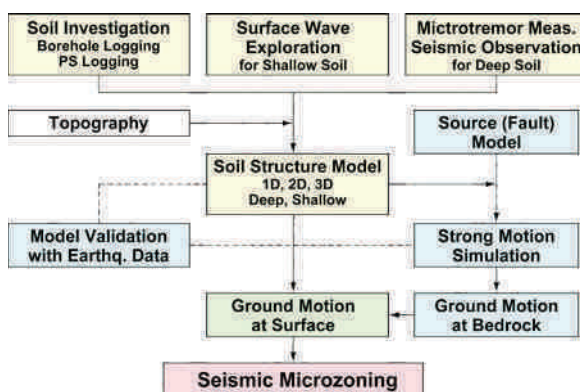


Figura 3. Research agenda of G1 group

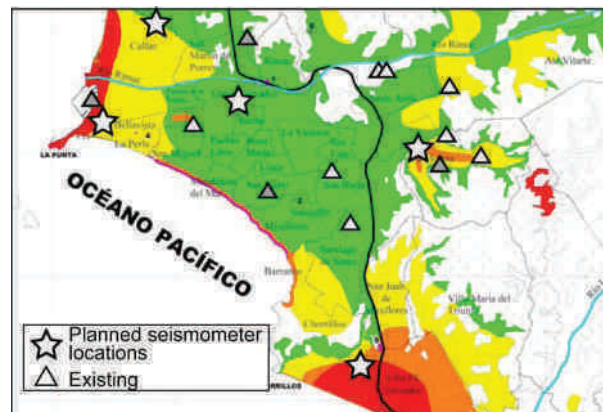


Figura 4. Locations of planned seismometers (added to CISMID (2004))