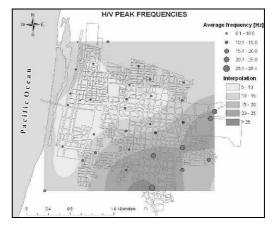
#### A RECONNAISANCE REPORT

#### ON

#### THE PISCO, PERU EARTHQUAKE OF AUGUST 15, 2007







Jörgen Johansson

**Tatiana Torres** 

**Edwin Leon** 

Paola Mayorca

2007 Pisco, Peru Earthquake Reconnaissance Team

by

Japan Society of Civil Engineers (JSCE),

Japan Association for Earthquake Engineering (JAEE)

and

University of Tokyo

With the collaboration of

**CISMID**, National University Engineering (For ambient vibration observations in Pisco)

October 2007

# CONTENT (page)

Preface Executive Summary

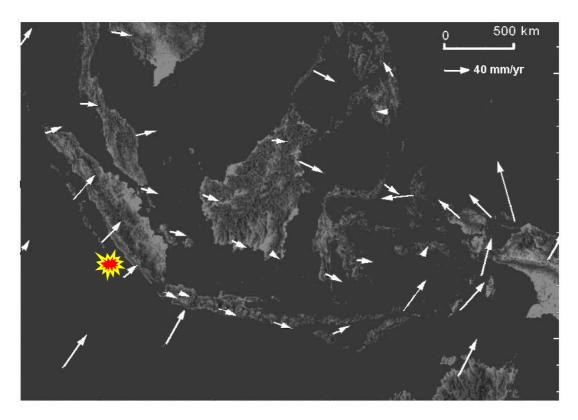
1. INTRODUCTION	(1-7)
1.1. Affected area	
1.2. Economic Impacts	
2. SEISMOLOGICAL ASPECTS	(8-16)
2.1. Tectonic and Seismological background	()
2.2. The August 15 earthquake	
2.2.1. Intensities	
2.3. Seismic network	
2.3.1. Number of organizations and stations	
2.3.2. Earthquake Records and Strong Ground Motion amplification	
2.4. Finite Fault solutions	
2.5. Recommendations	
3. GEOTECHNICAL ASPECTS OF THE EARTHQUAKE	(17-55)
3.1. Introduction	. ,
3.2. Large soil cracks in San Luis	
3.3. Foundation aspects	
3.3.1. Health center in Huytara	
3.3.2. Adobe foundations and ground humidity an example from Guadelupe	
3.3.3. Good performance by two liquefaction resistant buildings in Pisco	
3.4. Tambo de Mora	
3.4.1. Damage	
3.4.2. Geology and liquefaction	
3.4.3. Microtremor measurements	
3.5. Pisco	
3.5.1. Overview	
3.5.2. Geology	
3.5.3. Early studies	
3.5.4. Overview of damage distribution	
3.5.5. Microtremor measurements	
3.5.6. Discussion	
3.6. Conclusions and recommendations	
4. BUILDING DAMAGE	(56-86)
4.1. Background	
4.1.1. Structural types in the earthquake affected area	
4.1.2. Housing statistics	
4.1.3. Building code	
4.2. Building damage	
4.2.1. Statistics	
4.2.2. Housing damage	
4.2.3. Damage to public facilities	
4.3. Mitigation initiatives	
4.3.1. Retrofitting of existing adobe houses	

<ul><li>4.3.2. Construction of new earthquake resistant adobe houses</li><li>4.3.3. Evaluation of the seismic performance of reinforced houses</li><li>4.4. Final Remarks</li></ul>	
5. ROADS AND BRIDGES	(87-99)
5.1. Background	
5.1.1. Peruvian road network	
5.1.2. Concession system of transport infrastructure	
5.2. Road Damage	
5.3. Bridge Damage	
5.4. Summary	
6. DISASTER RESPONSE AND RECOVERY/RECONSTRUCTION	(100-107)
6.1. Response	
6.2. Recovery/Reconstruction	
6.3. Summary	
7. RECOMMENDATIONS	(108-110)

#### A RECONNAISSANCE REPORT

### ON

#### THE BENGKULU EARTHQUAKE OF SEPTEMBER 12, 2007



Ömer AYDAN Fumihiko IMAMURA Tomoji SUZUKI Ismail FEBRIN Abdul HAKAM Mas MERA

**Patras Rina DEVI** 

2007 Bengkulu Earthquake Reconnaissance Team

by

Japan Society of Civil Engineers (JSCE)

and

Japan Association for Earthquake Engineering (JAEE)

With the collaboration of

Andalas University and KOGAMI

October 2007

## CONTENT (Page)

i) ii)	Members of Reconnaissance Team Purpose	
1 II	NTRODUCTION (Prof. Aydan)	(1-2)
2	EGIONAL GEOGRAPHY AND GEOLOGY (Prof. Aydan) .1 Regional Geography .2 Regional Geology	(3-5)
	ECTONICS, CRUSTAL DEFORMATION AND SEISMICITY (Prof. Aydan) .1 Tectonics, Crustal Deformation and Seismicity of Indonesia .2 Tectonics, Crustal Deformation and Seismicity of Sumatra .3 Tectonics and Seismicity of the Earthquake-affected Area	(6-17)
4 4 4	HARACTERISTICS OF THE EARTHQUAKE (Prof. Aydan) .1 Fundamental Characteristics .2 Aftershock Activity .3 Strong Motions .4 Casualties	(18-27)
5	ROUND SHAKING INDUCED DAMAGE (Prof. Aydan) 1 Buildings 5.1.1 Mosques 5.1.2 Masonry Buildings 5.1.3 Wooden Houses 5.1.4 RC Buildings 2 Geotechnical Damage 5.2.1 Liquefaction and Lateral Spreading 5.2.2 Slope and Embankment Failures 3 Transportation Facilities 5.3.1 Railways 5.3.2 Bridges 5.3.3 Airports 5.3.4 Lifelines 4 Industrial Facilities	(28-36)
	SUNAMI (Prof. F. Imamura) 5.1 Generation of the 2004 Banglahulu Tsunami(South Sumatra) 5.2 Effect of the Tsunami in 2004 and 2007 5.3 Field Survey in the Damaged Area 5.4 Type of Damaged Due to a Tsunami 5.5 Fffects of Tsunami on the Coastal Environments 5.6 Comparison between 2006 SW Java and 2007 S Sumatra 5.7 Pagordad Tsunami	(37-46)

6.7 Recorded Tsunami

<ul> <li>7 EARTHQUAKE SOCIAL IMPACTS: TSUNAMI PANIC IN PADANG (Prof. F. Imamura &amp; Prof. Aydan)</li> <li>7.1 Example of Information on the Tsunami Response in Padang</li> <li>7.2 Tsunami Information and Evacuation in the Damaged Area</li> <li>7.3 Earthquake Social Impacts: Tsunami Panic in Padang</li> </ul>	(47-51)
<ul> <li>8 CONCLUSIONS AND RECOMMENDATIONS (Prof. Aydan &amp; Prof. F. Imamura)</li> <li>8.1 Conclusions</li> <li>8.2 Recommendations for Padang against Future Mega-thrust Off-shore Ea</li> <li>8.3 Earthquake Social Impacts: Tsunami Panic in Padang</li> </ul>	(52-58) rthquake
REFERENCES	(59-60)
<ul><li>APPENDIX</li><li>1. Questionnaire at Serangai</li><li>2. ImamuraField note in Japanese</li></ul>	(61-76)