Natural Disaster Reconnaissance and Its Role in Disaster Reduction and Mitigation

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1. Reconnaissance Teams
2. Selected Examples of Natural Disaster Reconnaissance and their role in disaster mitigation and recovery

Reconnaissance Teams

Many institutes involved with natural disasters establish reconnaissance teams after each large natural disaster worldwide. The author involved with many reconnaissance teams. These are

ADEP: Association for Development of Earthquake Prevention, Tokyo

TDV: Turkish Earthquake Foundation

JSCE-EEC-EDIC JSCE-EEC-EDIC : Japan Society of Civil Engineers – Earthquake Engineering Committee – Earthquake Disaster Investigation Sub-Committee

EWB-J: Engineers Without Borders – Japan

UR-DPRCIR: University of the Ryukyus – Disaster Prevention Research Center for Islands Region

JSCE-RMC-RDC: Japan Society of Civil Engineers – Rock Mechanics Committee – Rock Dynamics Sub-Committee

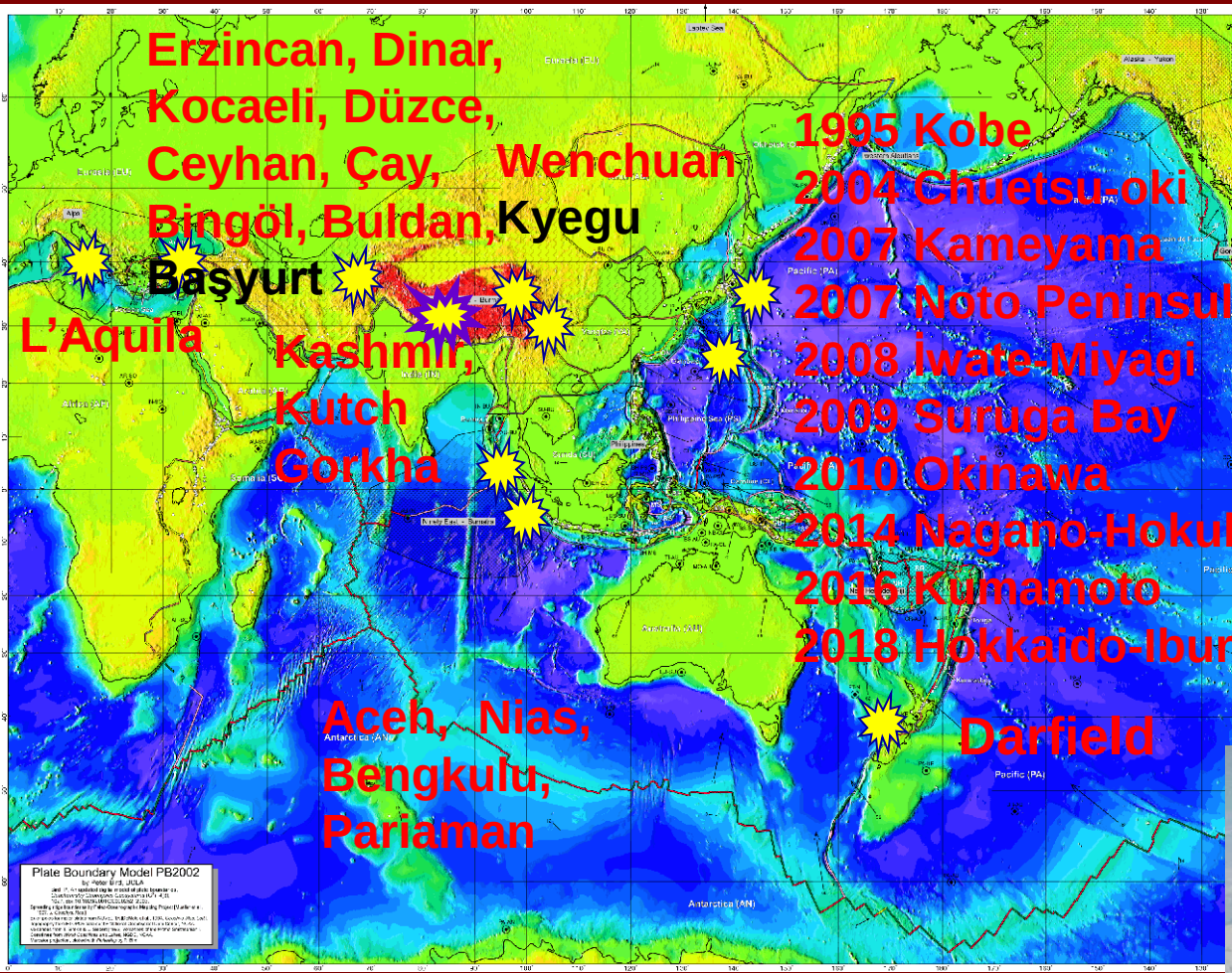
Some earthquake-tsunami disaster reconnaissance involve joint reconnaissance teams with Architectural Institute of Japan and Japan Earthquake Association

Examples of Earthquake-Tsunami Disaster Reconnaissance

By

Ömer Aydan

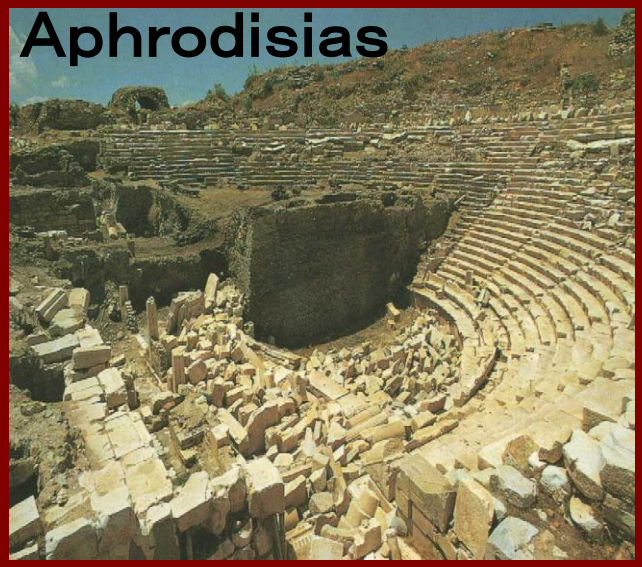
(Tokai University, University of the Ryukyus)

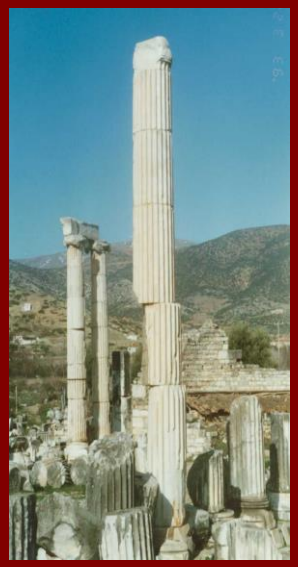


Picture from TA Plane over Erzincan

Since 1992 Erzincan Earthquake

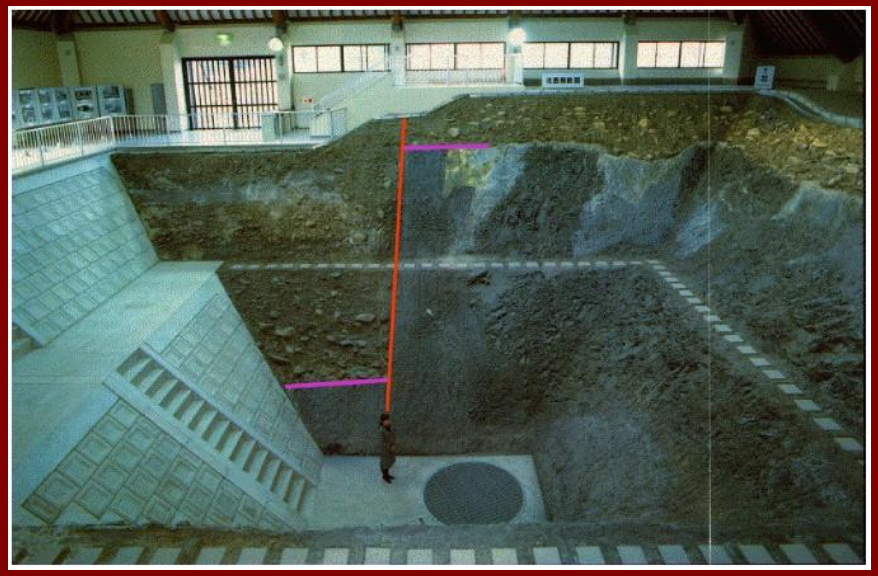
The records of earthquake disasters dated up to 3800 years





There are many monuments with records engraved onto stones particularly in countries around Mediterranean Sea

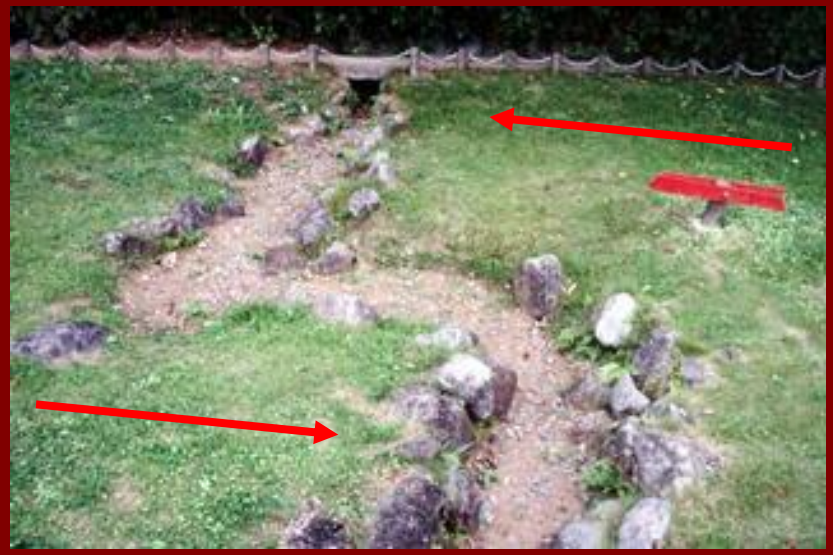
1891 Nobi Earthquake (M8) of Japan

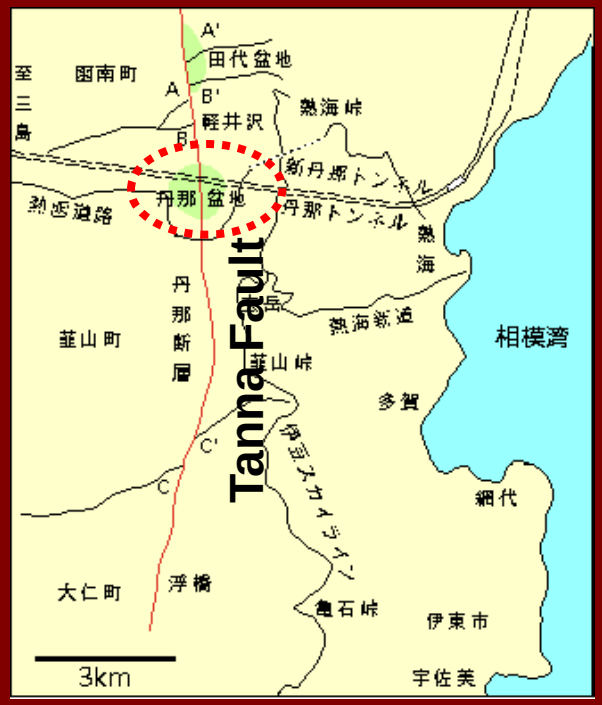


J. Milne (Mining Engineer, Lecturer at Tokyo University in 1890s)

His reconnaissance visit led to the development of seismometers

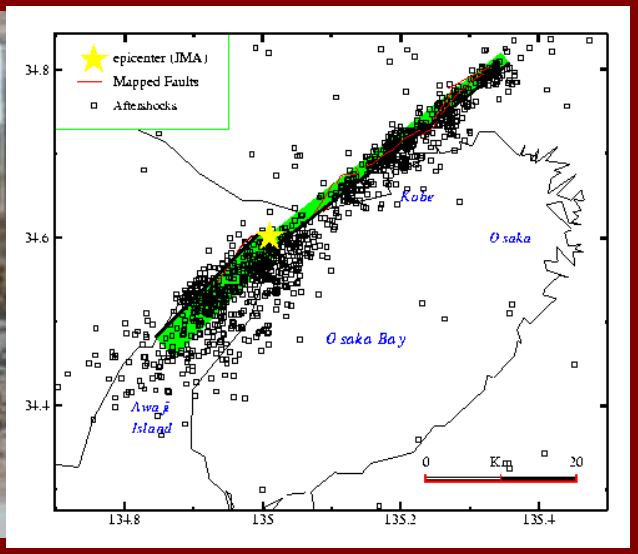
1930 North Izu Earthquake

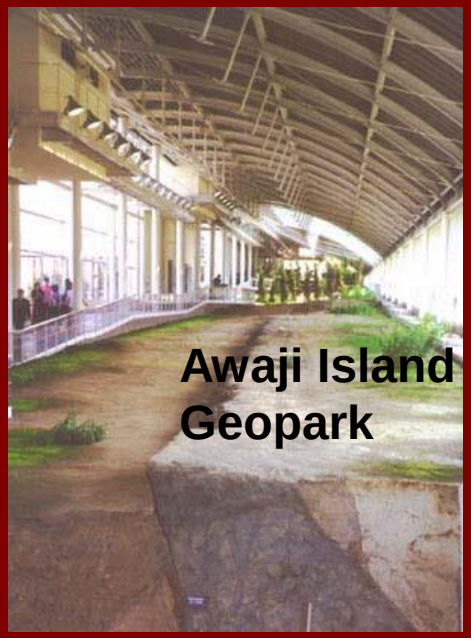




This earthquake led engineers to consider effect of faults crossing tunnels

1995 Kobe Earthquake





Seismic Design Code Modified

Japan established K-NET, Kik-NET Strong motion networks following this earthquake

1999 Chi-chi Earthquake

Chelungpu Fault Geopark

Effect of faults on structures and large scale slope failures

Collection of Reconnaissance Pictures of Important Events in Civil Engineering by JSCE

土木貴重写真コレクション

10. 地震 Earthquake

関東大震災 橋梁～山崩れ、その他 **Related Disasters: Bridges, Slope failures**

151.熱海線不動山隧道南口付近線路上二大石ノ墜落

152.寒ノ目隧道南口

153.石橋隧道北入口先△石焼岩ノ山崩線路ヲ埋ム

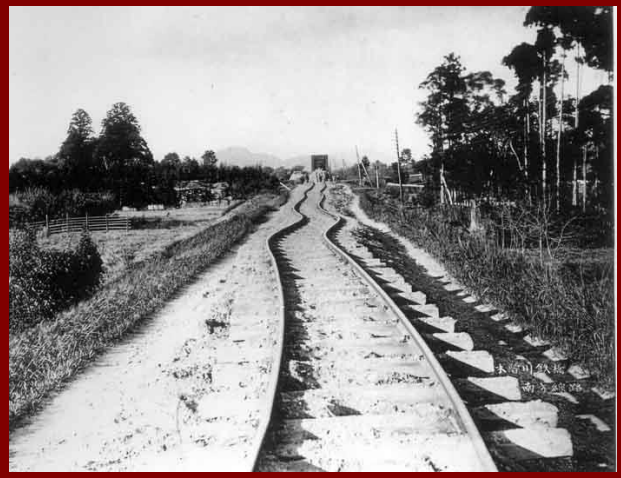
156.下曽我駅ノ破損

157.下曽我駅ノ惨状

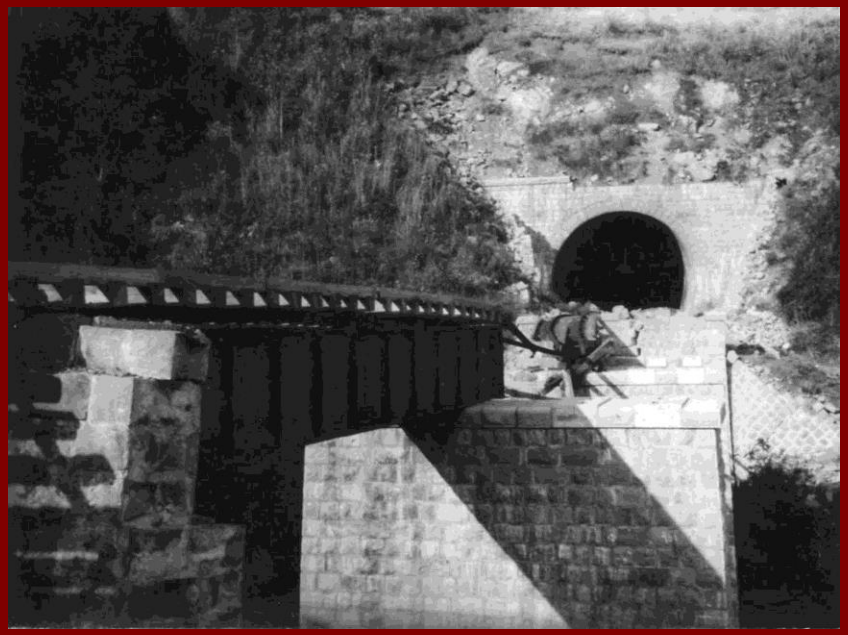
158.記載事項なし，線路

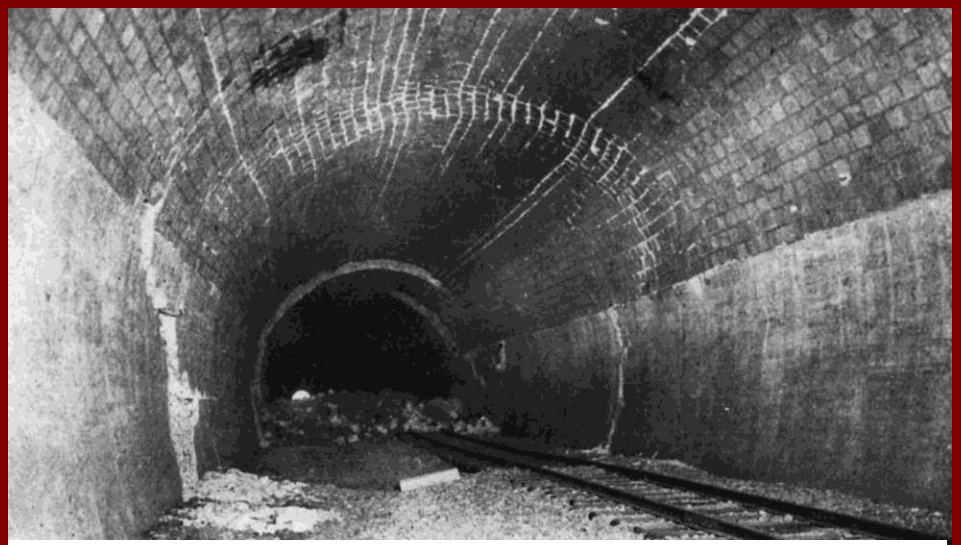
JSCE Digital Archive

1891 Nobi Earthquake (M8)-(Nagasaki University and JSCE Archives)



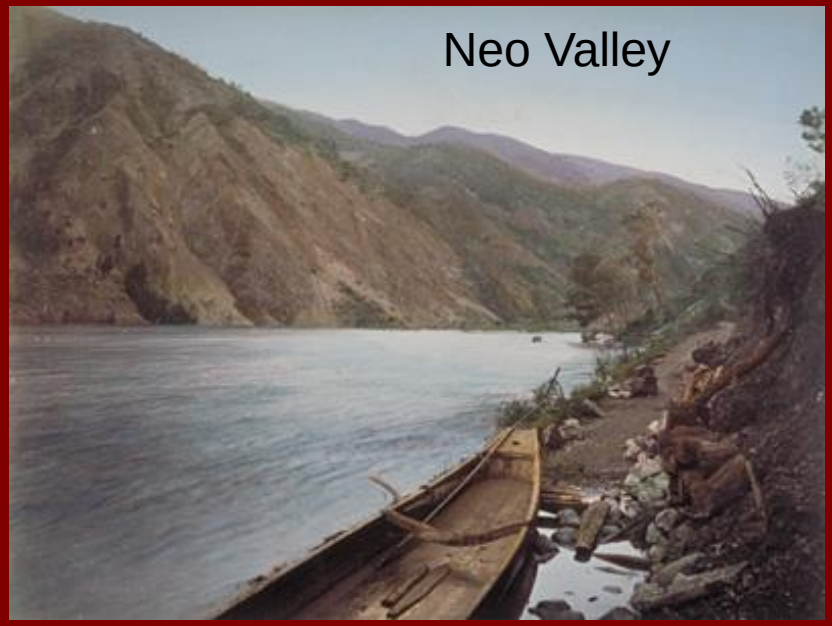
Tunnel Damage - 1923 Kanto Earthquake (JSCE Archive)

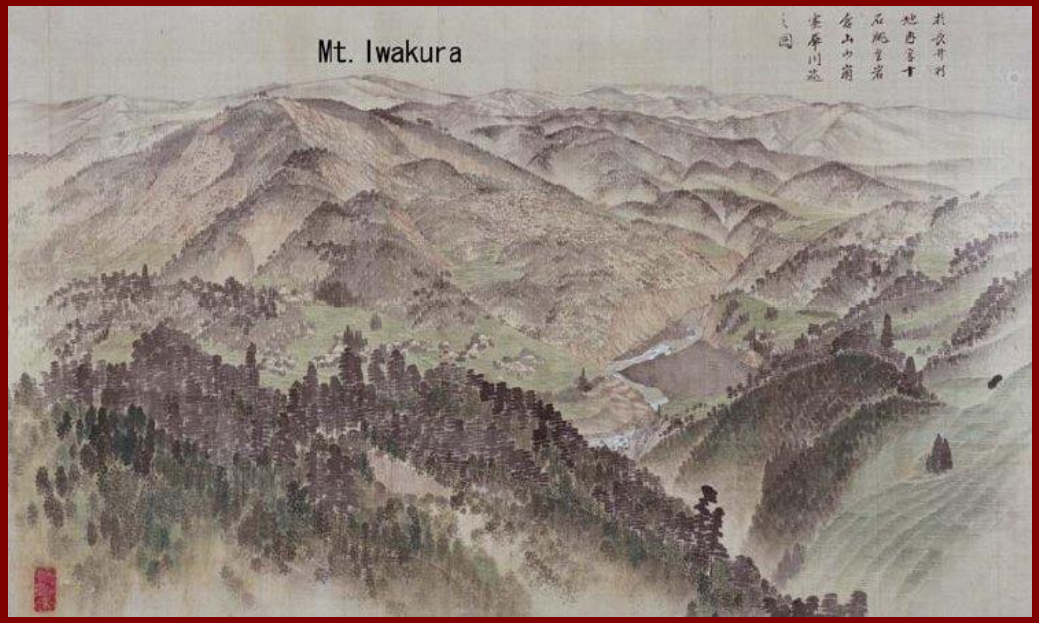




These data are still of great importance for the seismic vulnerability of tunnels

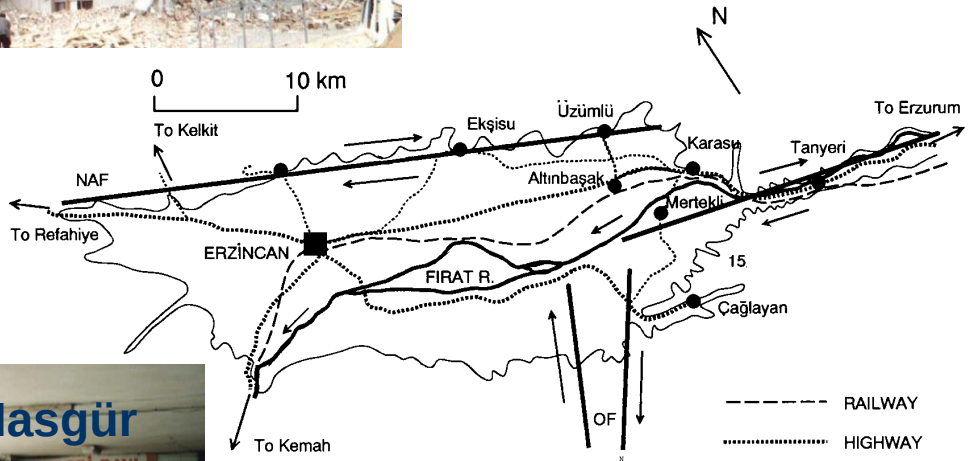
JSCE Archives – Landslide Debris Dams

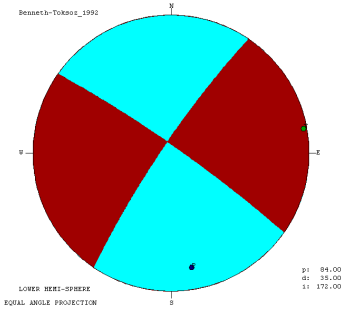




In other words, the records of past damaging earthquakes are very important to convey past experiences to the next generations although the media for archiving may differ in time.

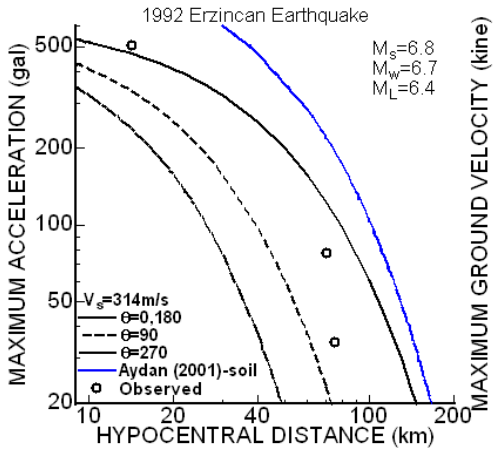
1992 Erzincan Earthquake

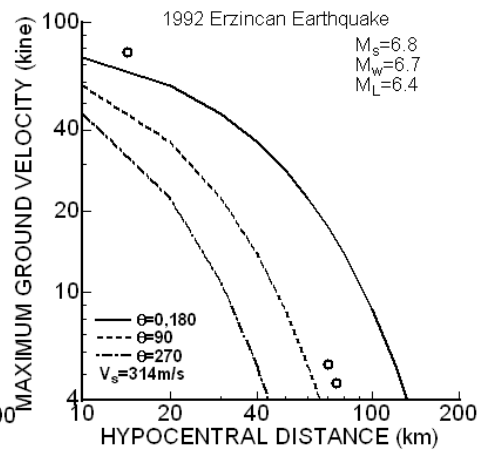


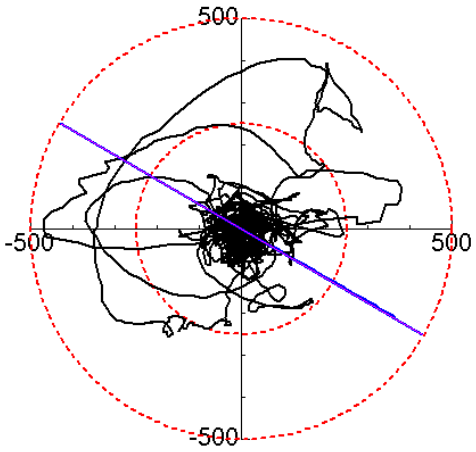


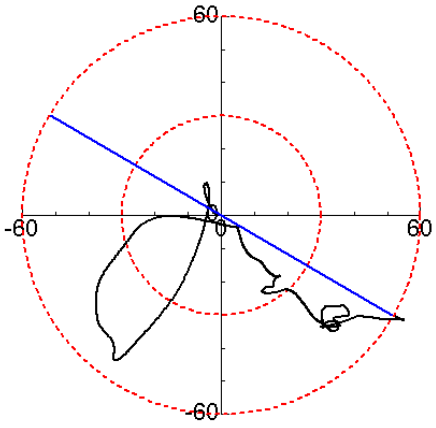
The report of the ADEP Reconnaissance team initiated liquefaction studies in Turkey, which was ignored until then

1992 Erzincan Earthquake – Strong Motions Studies

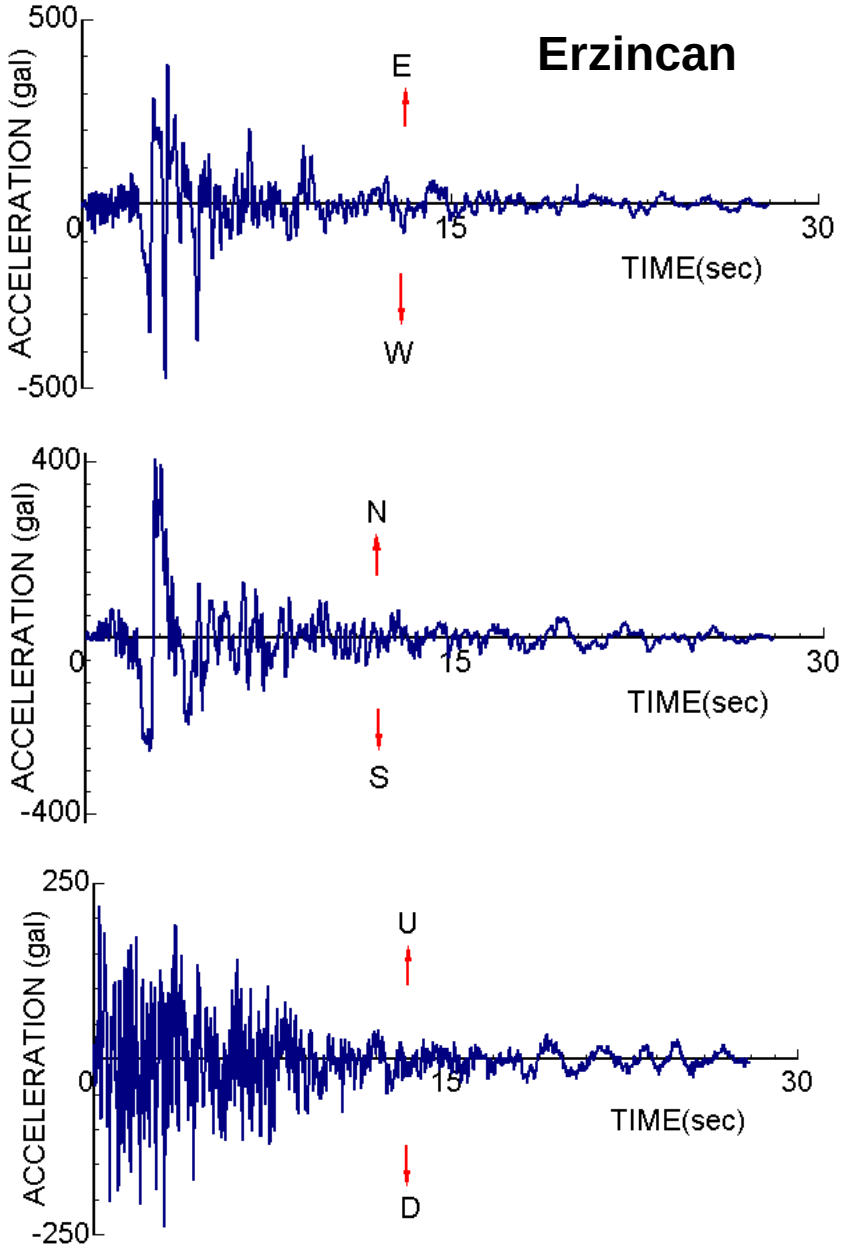






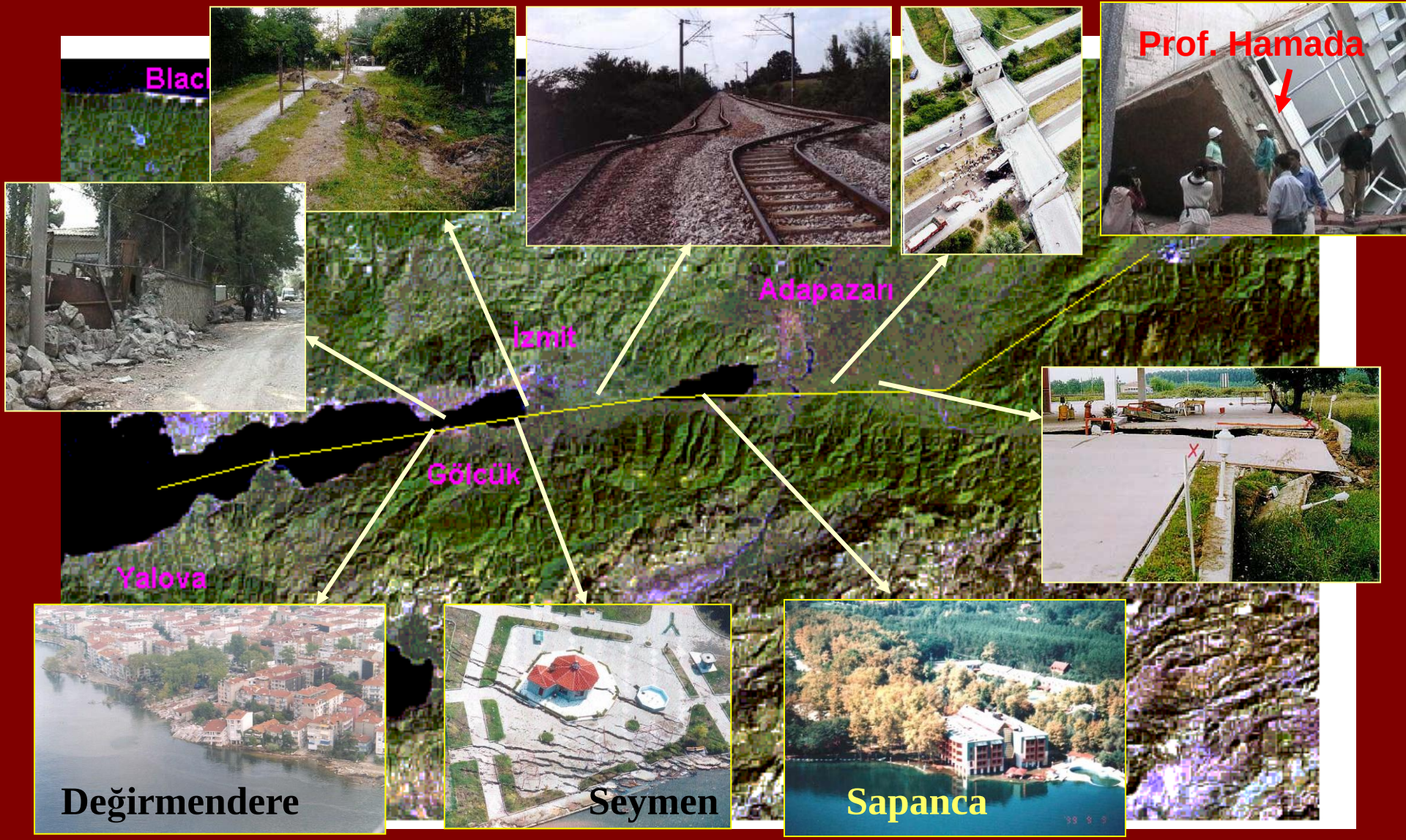


This earthquake was also instrumental to initiate studies on the directivity effect and near field of strong motions. Furthermore, some attenuation relations were developed for Turkey first time.



Turkish Strong Motion Network

Earthquake fault induced damage by 1999 Kocaeli Earthquake



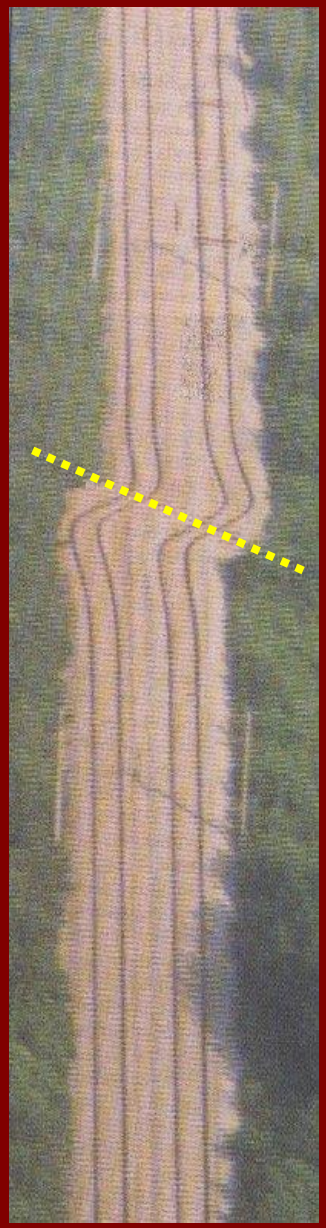
Kocaeli, Düzce and Chi-chi earthquakes were instrumental for many studies on the effect of faulting on structures in urbanized areas worldwide.

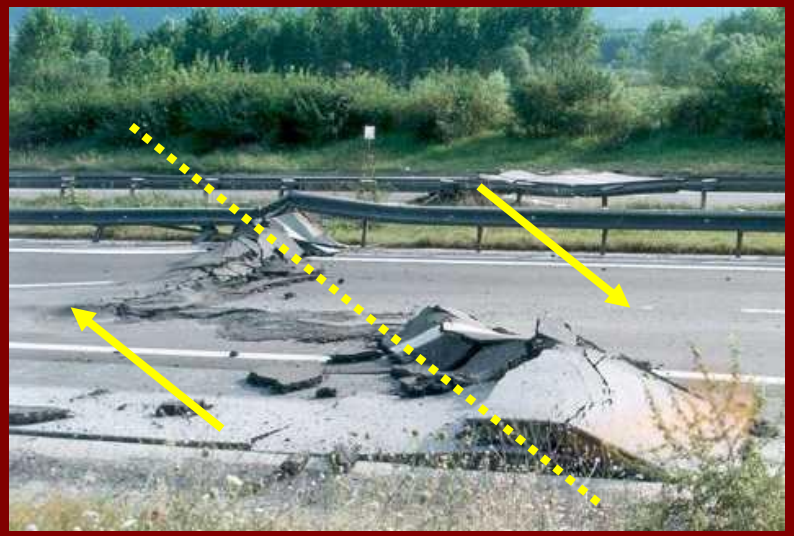
Building damage by faulting

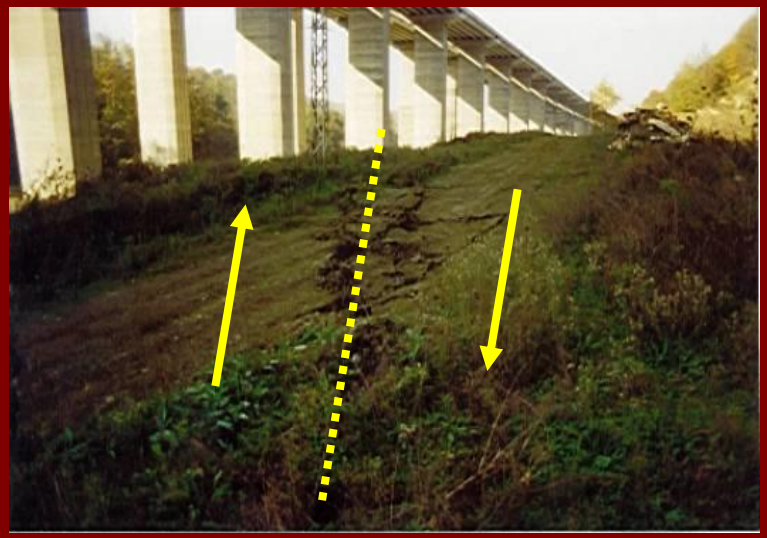
1999 Kocaeli and 1999 Düzce earthquakes

Fault Induced Damage on Transportation Facilities

1999 Kocaeli & Düzce (Turkey) - Chi-Chi (Taiwan) Earthquakes







Steps in Establishing Natural Disaster Reconnaissance Teams

(1) Information Gathering

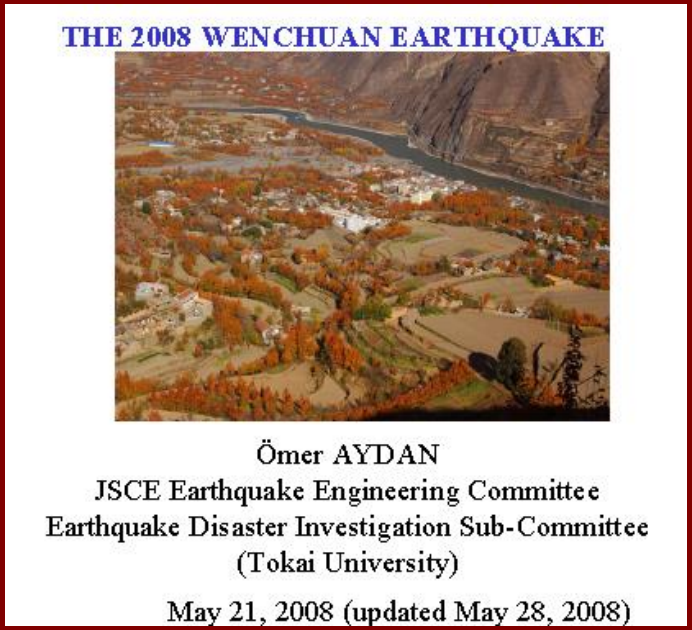
(2) Dispatching Reconnaissance Teams and Their Organization

Provided that each natural disaster related institutes has manpower, financial funds and the will to investigate

Information Gathering

At the initial stage, information gathering (Mass Media, Pictures, videos through internet sources about the location, nature of event, casualties etc.) is essential. For example, if the natural disaster is earthquake: epicenter, mechanism, rupture propagation.

A quick report based on information from different sources including mass media and internet would be quite useful and may be a guidebook for the reconnaissance teams to be dispatched to the natural disaster site.

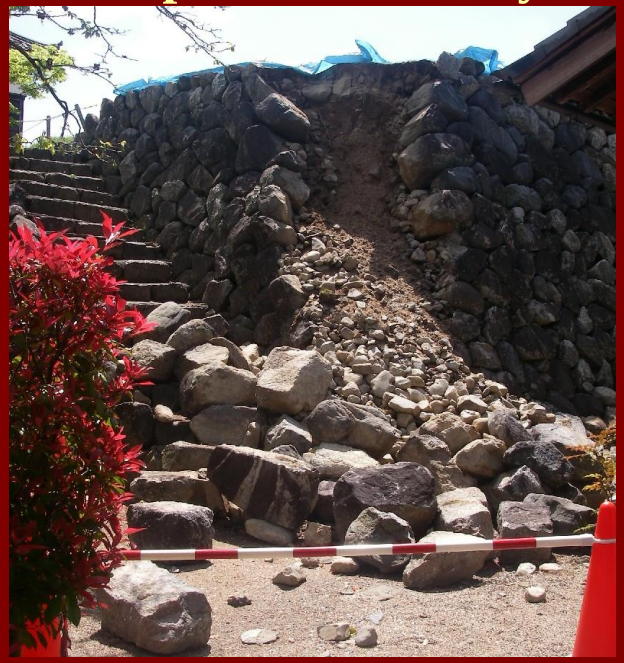


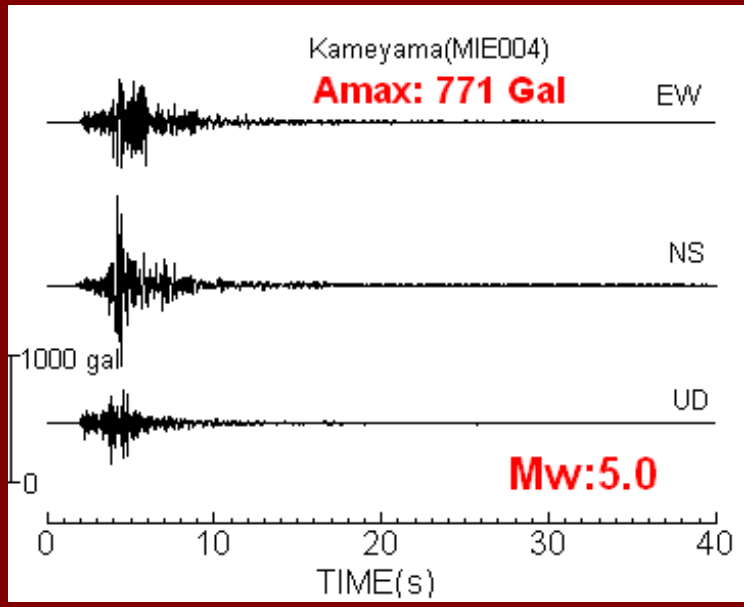
Dispatching Reconnaissance Teams and Their Organization

The dispatch of reconnaissance team is a critical issue and the magnitude of the earthquake is one of important criteria. For example JSCE-EEC considers that the magnitude should be 6 or more.

However, the damage level and its character should be also another criterion for dispatching reconnaissance teams

Example: 2007 Kameyama earthquake



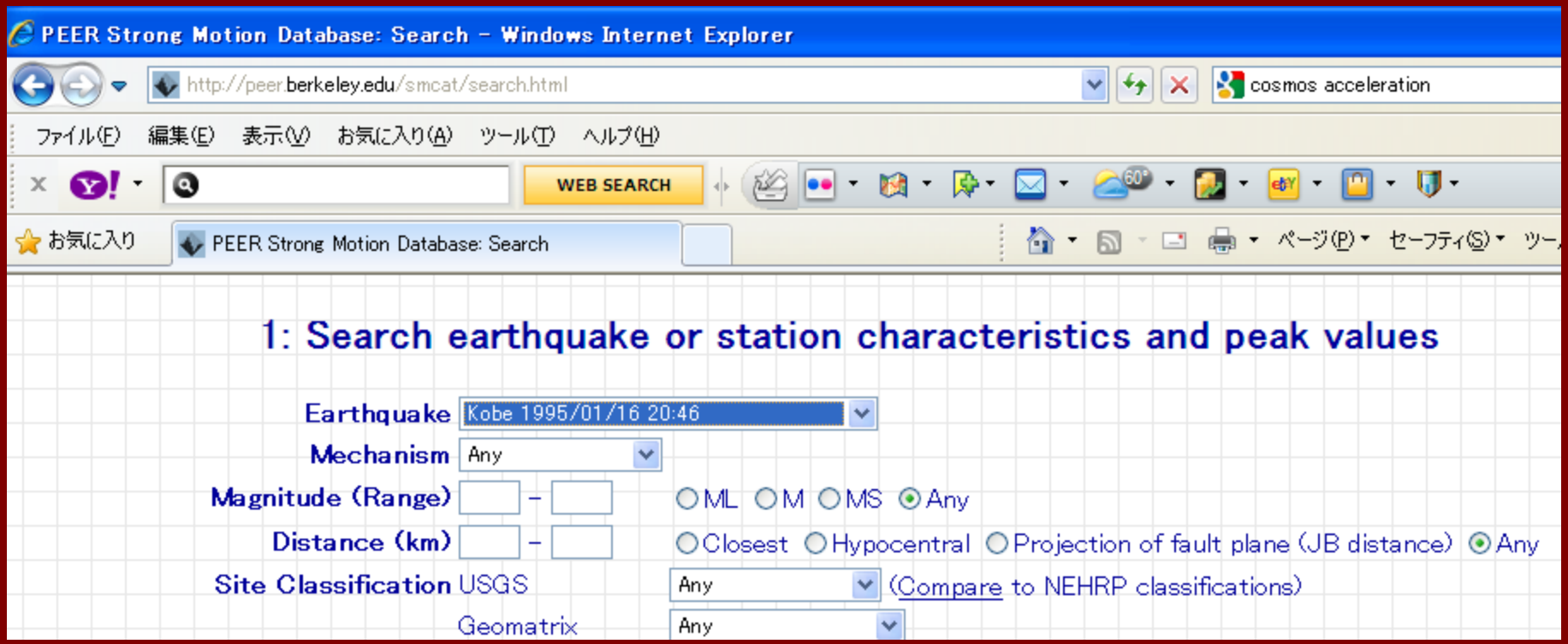


It was a small earthquake. However, the vulnerability of suspended ceilings was highlighted in this earthquake. Furthermore very high acceleration

Besides large events, some intermediate scale earthquakes should be put on records if they have particular damages.

In such cases, a systematic approach for archiving reports compiled and prepared by teams with a background of earthquake science and engineering is necessary. Such information should be easily accessible as done by JSCE.

Strong motions of major earthquakes can be easily accessible in some well-known websites such as PEER



K-NET and Kik-NET networks established after 1995 and Turkish Strong Motion Network are also accessible if some registrations are done.

How to relate the results of reconnaissance to international contributions

- Reconnaissance
- Technical support for restoration, recovery as well as mitigation plans
- Educational Support

Another purpose should be to convey proper and true information about the natural disaster to next generations as the politicians may influence and restrict information release as seen in some countries.

During the reconnaissance period, communications with local and international authorities and related establishments, quick reports and preparation of recommendations could be one of the important contributions.

JSCE Reconnaissance Team at the UN Head Quarters in Aceh

2004 Aceh earthquake

Establishment of EWoBJ

Flight over the proposed roadway between Banda Aceh and Meulaboh investigated by JSCE reconnaissance team as an OCHA operation

RECOMMENDATIONS ON NEW ROAD CONSTRUCTION BETWEEN BANDA ACHE AND MEULABOH

By

JSCE Reconnaissance Team

to

Aceh Provincial Government

(1) Concrete Bridges with shear keys

(2) Design of long steel bridges against lateral force and uplift force

(3) Soil improvement of soft foundation ground for embankment

(4) Construction of alternative bypass routes for important sections

(5) Measures against slope sliding in newly aligned routes in mountainous area

It is of great importance to provide some advices and recommendations to the authorities and related establishments as quickly as possible for recovery from natural disasters and mitigation

Discussions and exchanges of opinions with the officials of NESPA of Pakistan

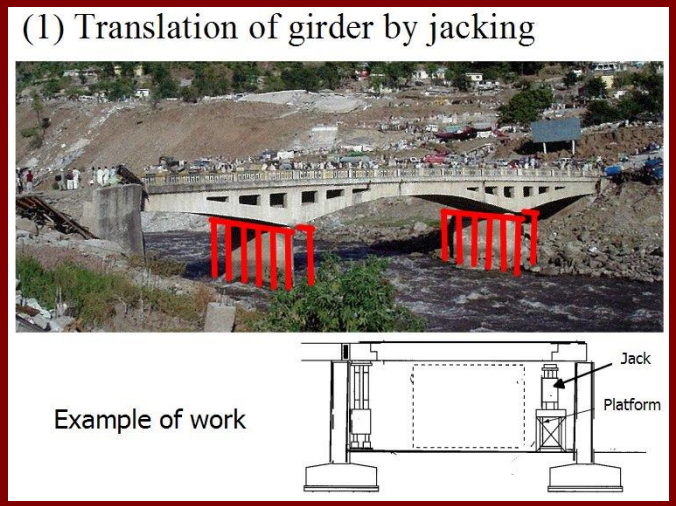
2005 Azad Kashmir Earthquake

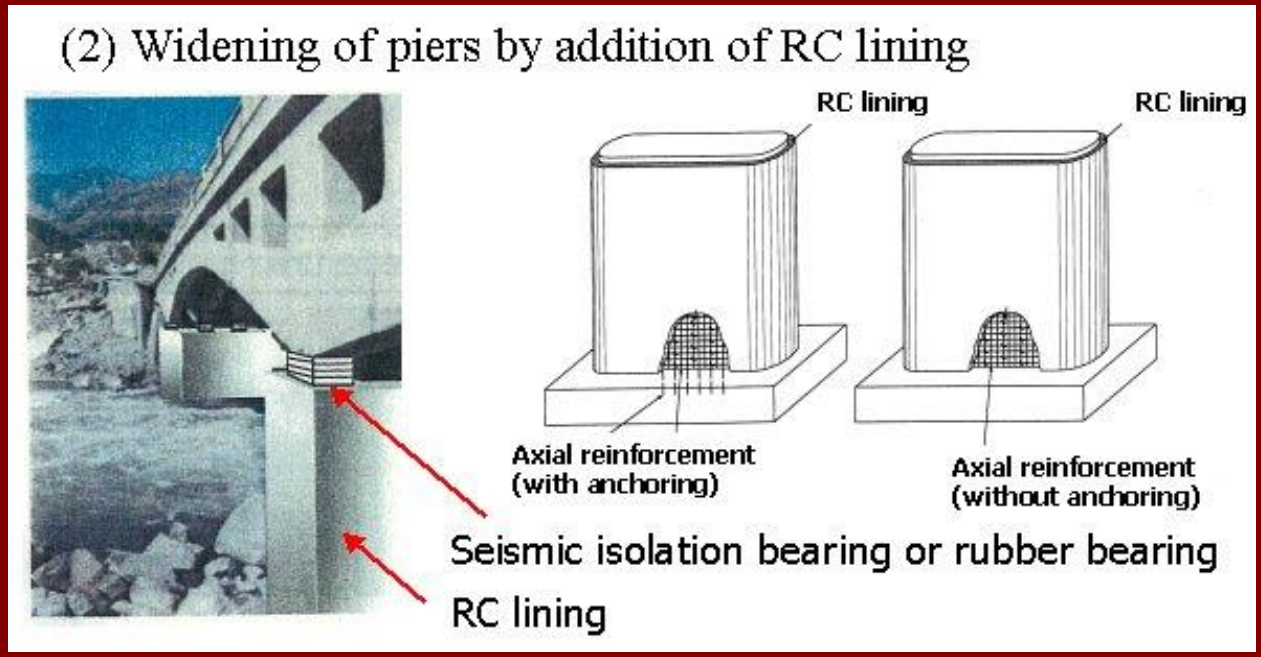
Discussions and exchanges of opinions with local engineers in Nias Island

2005 Nias Earthquake

Particularly the suggestions and recommendations as a second opinion to the authorities involved with restoration, recovery and mitigation from natural disasters are quite helpful and useful.

A view of the conference between joint JSCE-AIJ Reconnaissance team and experts of Pakistan in relation to the 2005 Azad Kashmir earthquake

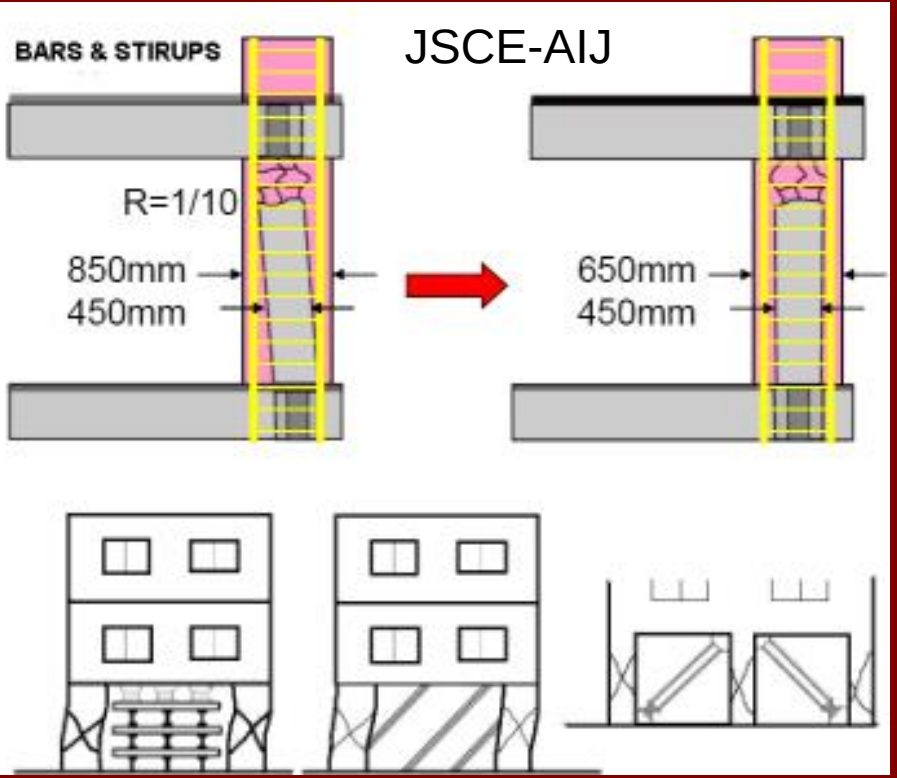


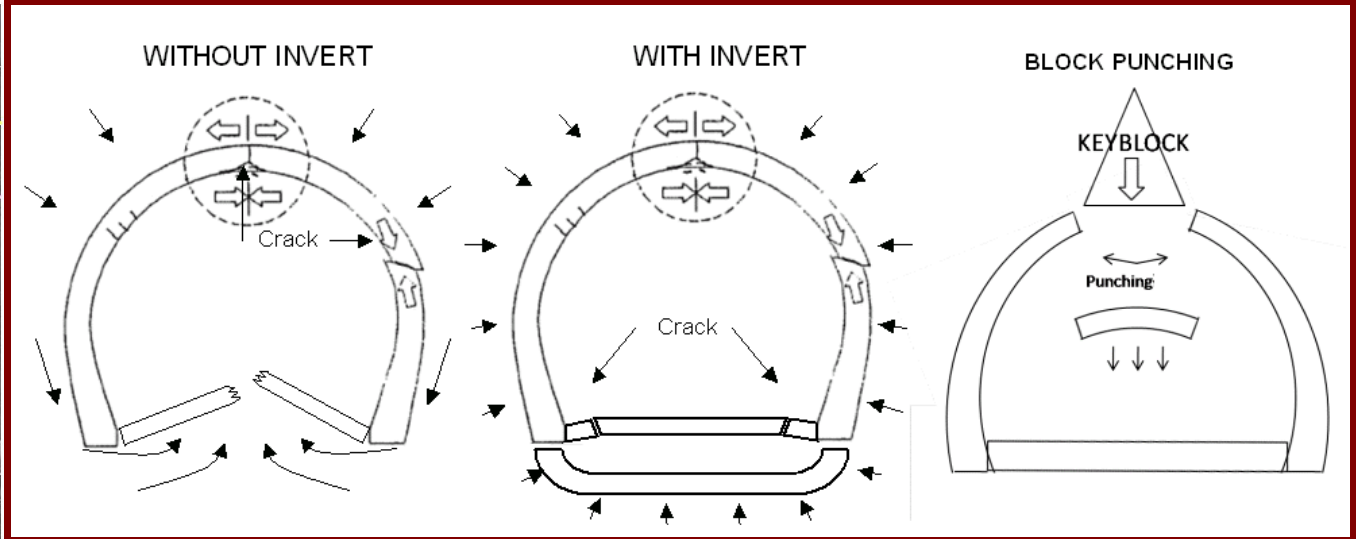


Technical support and advices for the recovery and restoration (2008 Wenchuan Earthquake-Tibet)

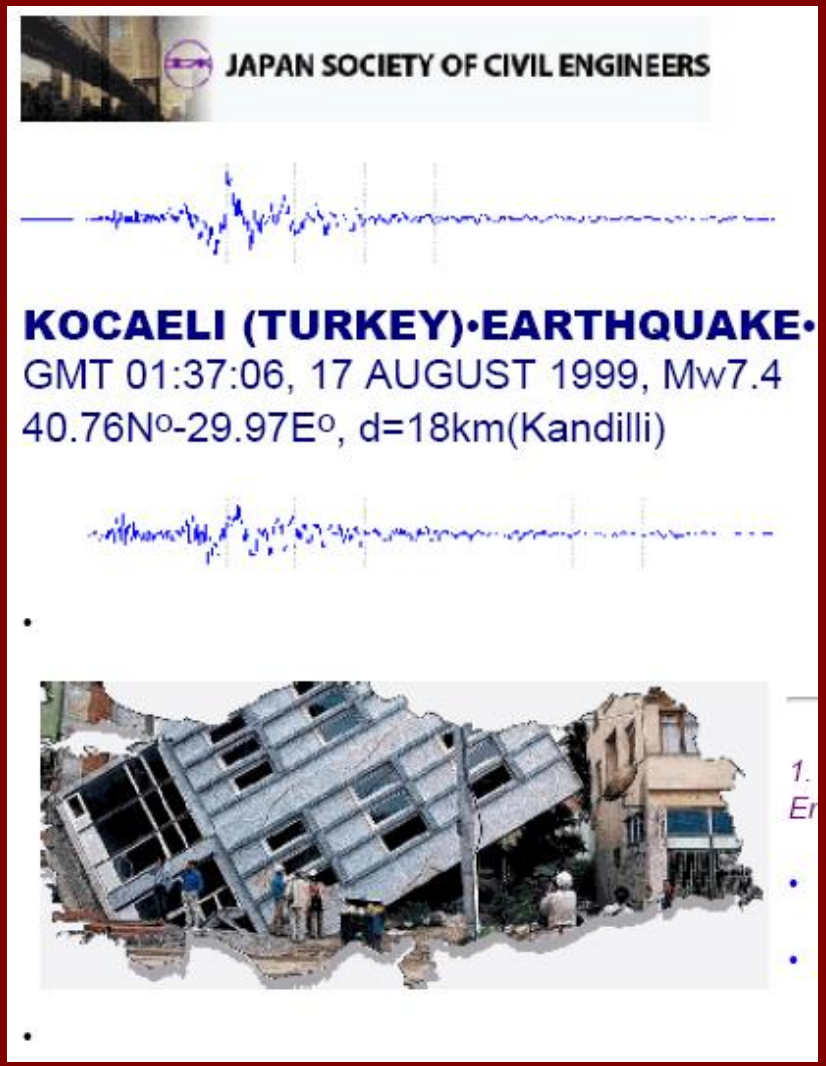
JSCE-AIJ Joint Reconnaissance Teams

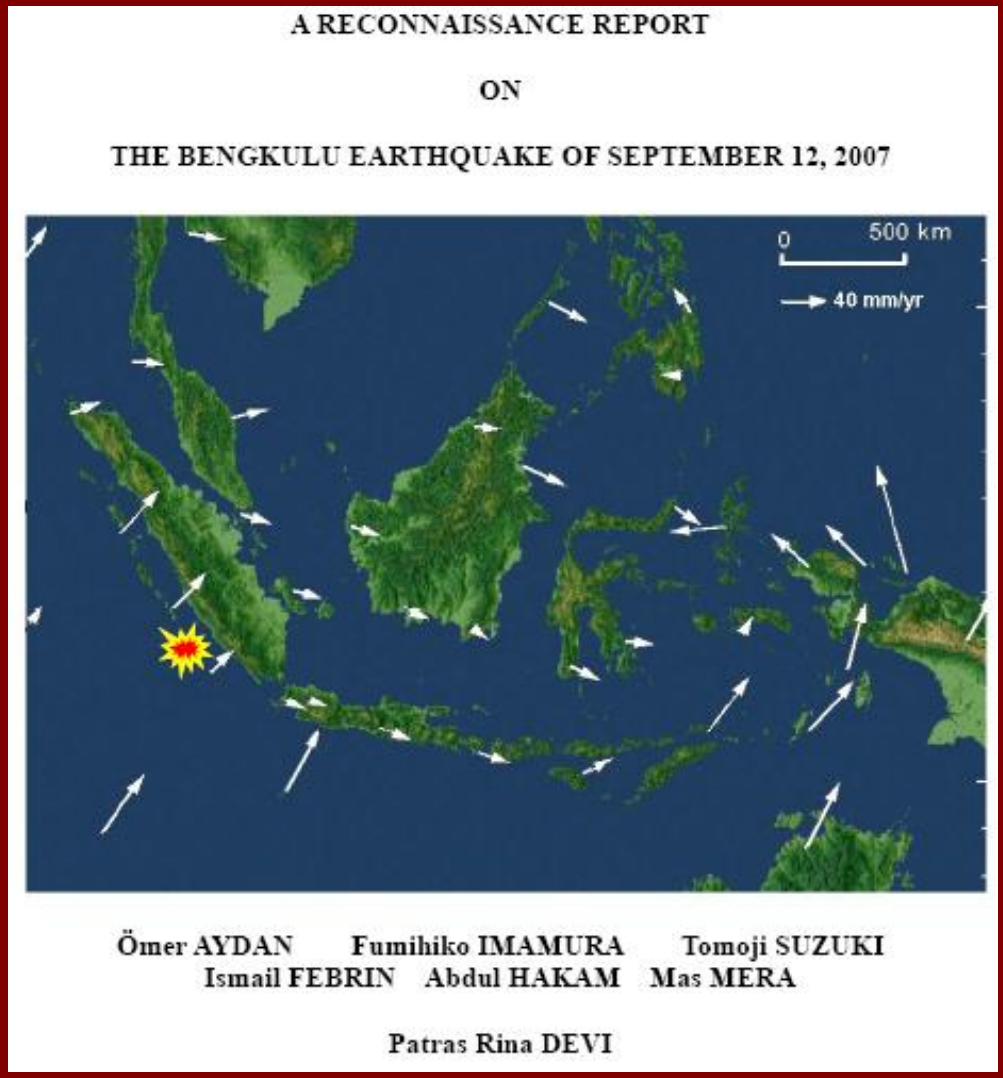
Proposals for restoration and recovery-2008 Wenchuan Earthquake





Preparation of Reconnaissance reports in English





Some examples of reports **by JSCE –EEC- EDIC**

Mini Symposium at L'Aquila with Italian authorities and Reconnaissance teams from Japan and USA during the reconnaissance of the 2009 L'Aquila earthquake

L'Aquila City

The reconnaissance of damage caused by L'Aquila earthquake was quite useful to assess the magnitude and characteristics of the earthquake on historical structures built in Roman period

L 'Aquila

Paganica

14th Century Earthquake, Denizli

Hierapolis

Laodikea

Particularly the results from reconnaissance from L'Aquila earthquake may be of great value to re-assess the past earthquakes in Turkey and other countries around Mediterranean Sea together with Geopark-like preservation of historical remains

It is also important to participate in symposiums and conferences organized by the countries suffered from the natural disasters

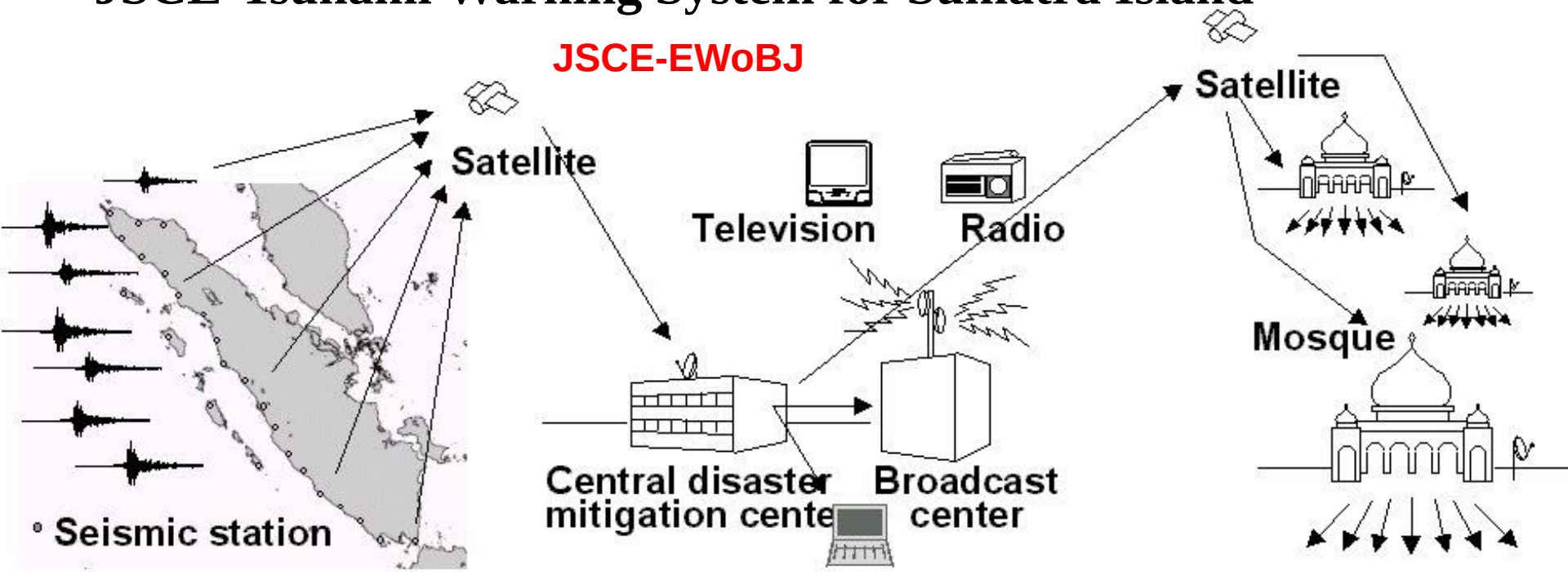
Fig 1 Japanese Speakers attending the seminar

Pakistan

Indonesia

JSCE-Tsunami Warning System for Sumatra Island

JSCE-EWoBJ



Educational Support Activities

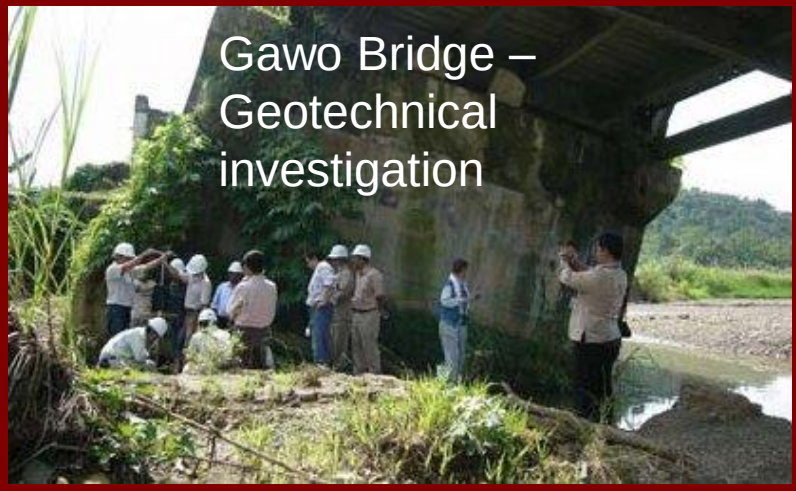
Lecture at Senior High School

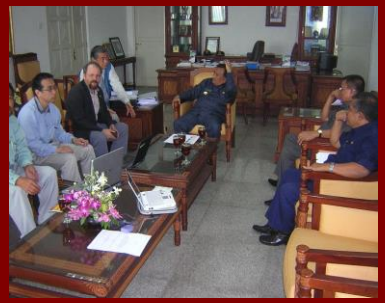
Question and Answer after The Lecture

Welcome Ceremony by Students

Lecture in Tent

Organization of joint workshops or symposium by EWoBJ and JPF to convey findings from the reconnaissance teams and support for restoration, recovery and mitigation plans.





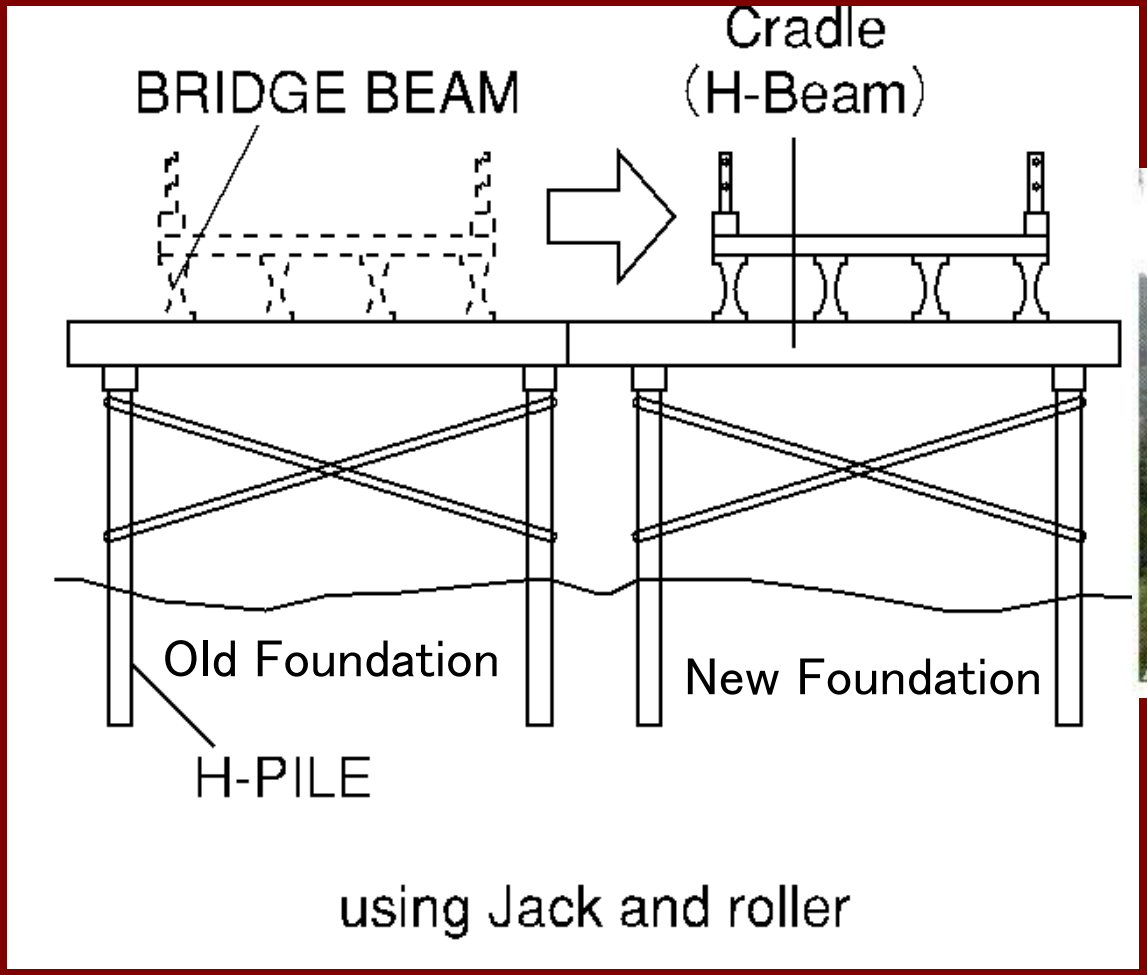
Technical Support Team of JSCE

Nias Island

ENGINEERS WITHOUT BORDERS

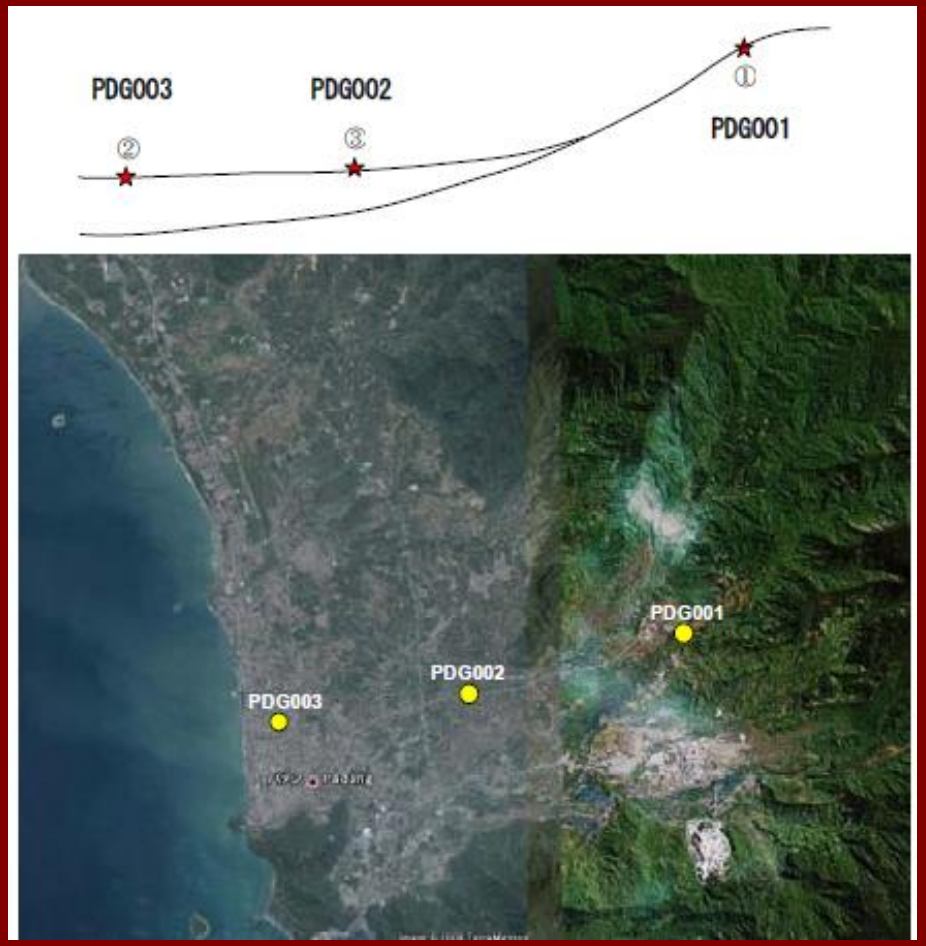
JSCE -EWoBJ

Proposal for Restoration of A Damaged Bridge

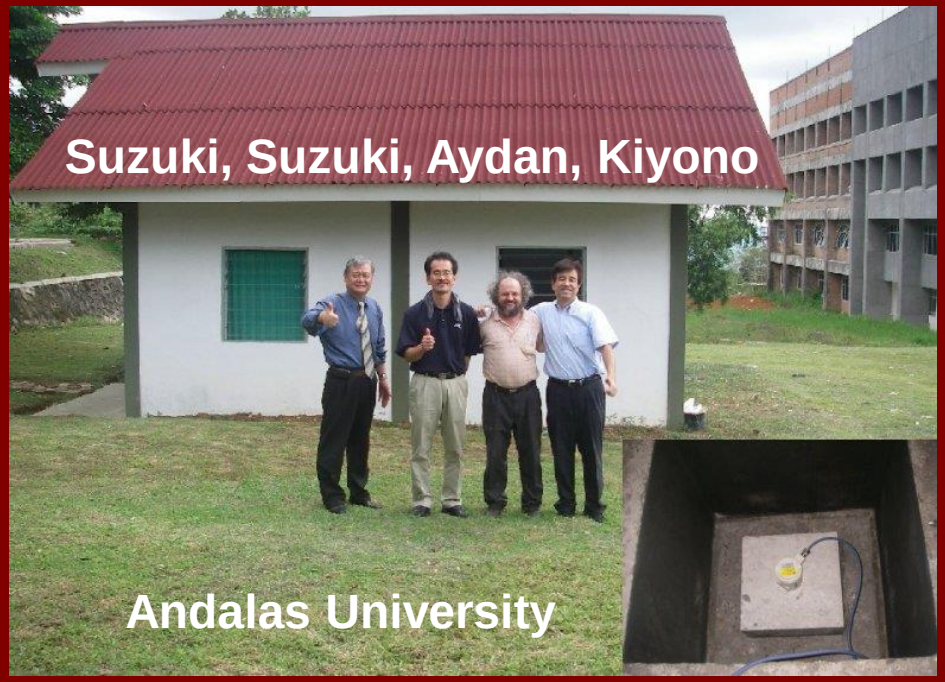


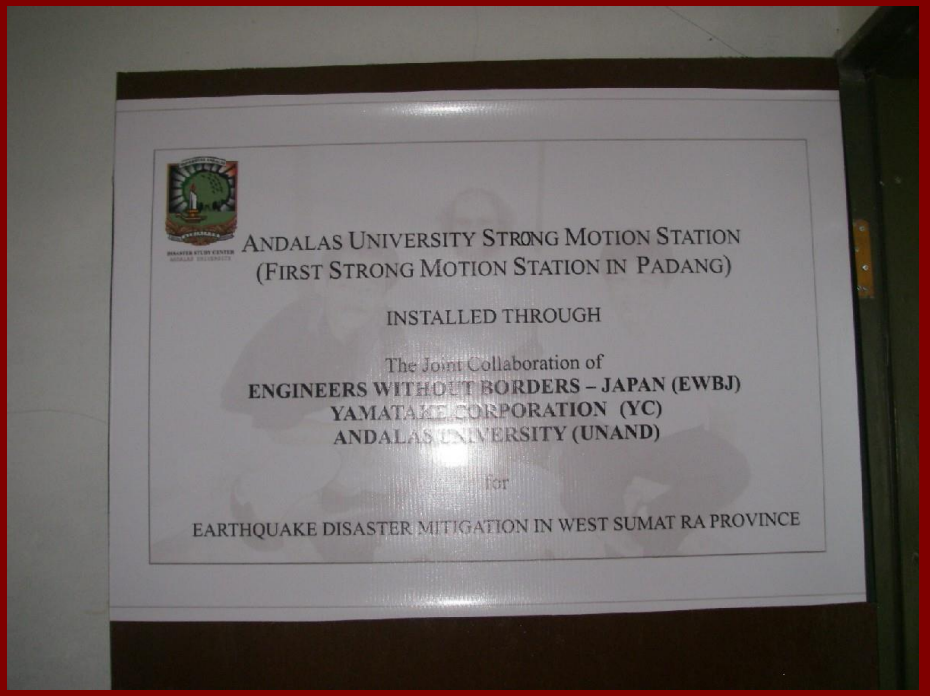
A Mega Earthquake of Magnitude 8.7 is anticipated in West Sumatra

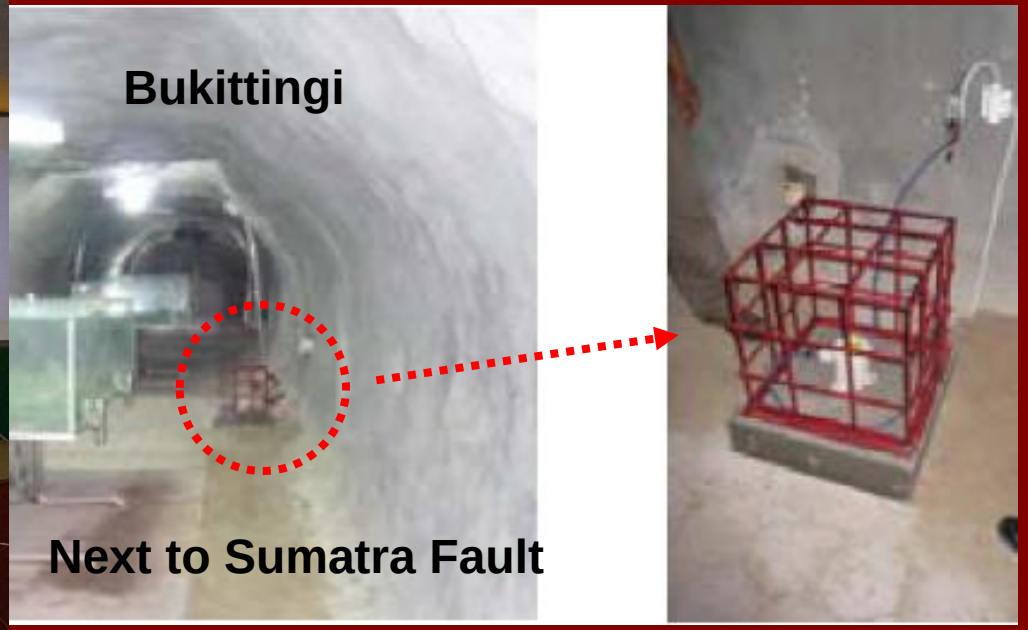
EWoBJ initiated a strong-motion instrumentation project as there were no strong motions in the province



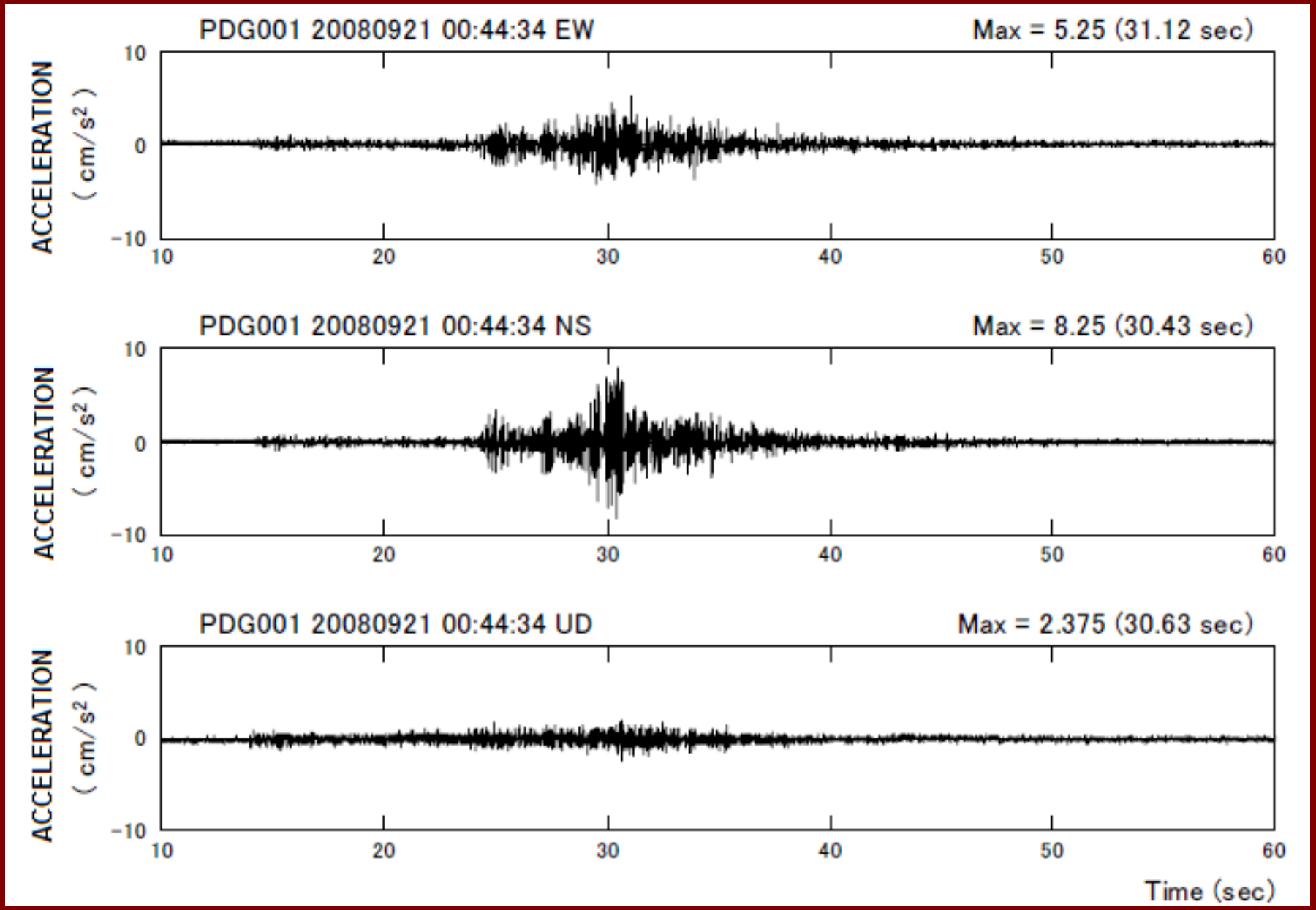
Installation of the first strong motion station at Andalas University



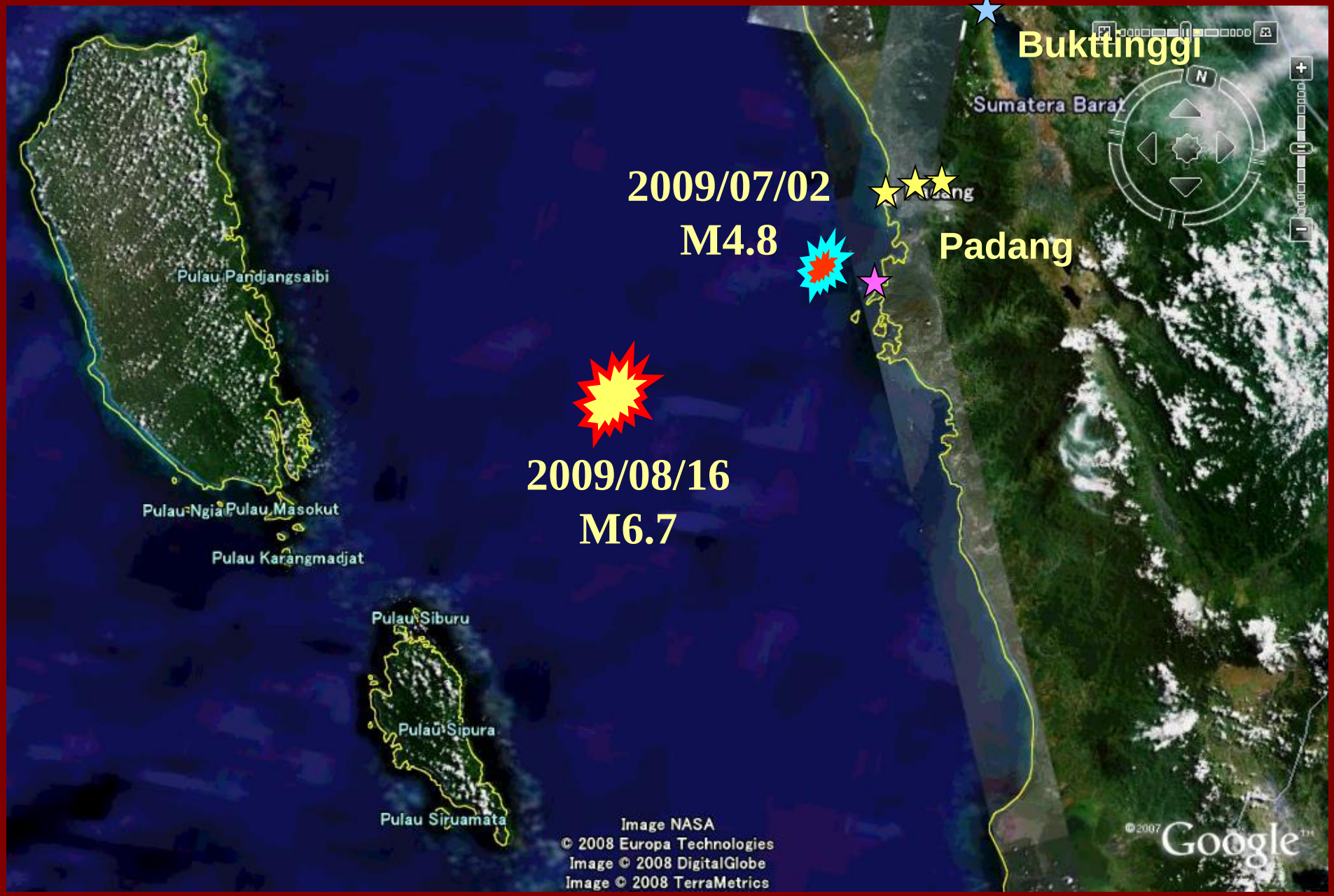




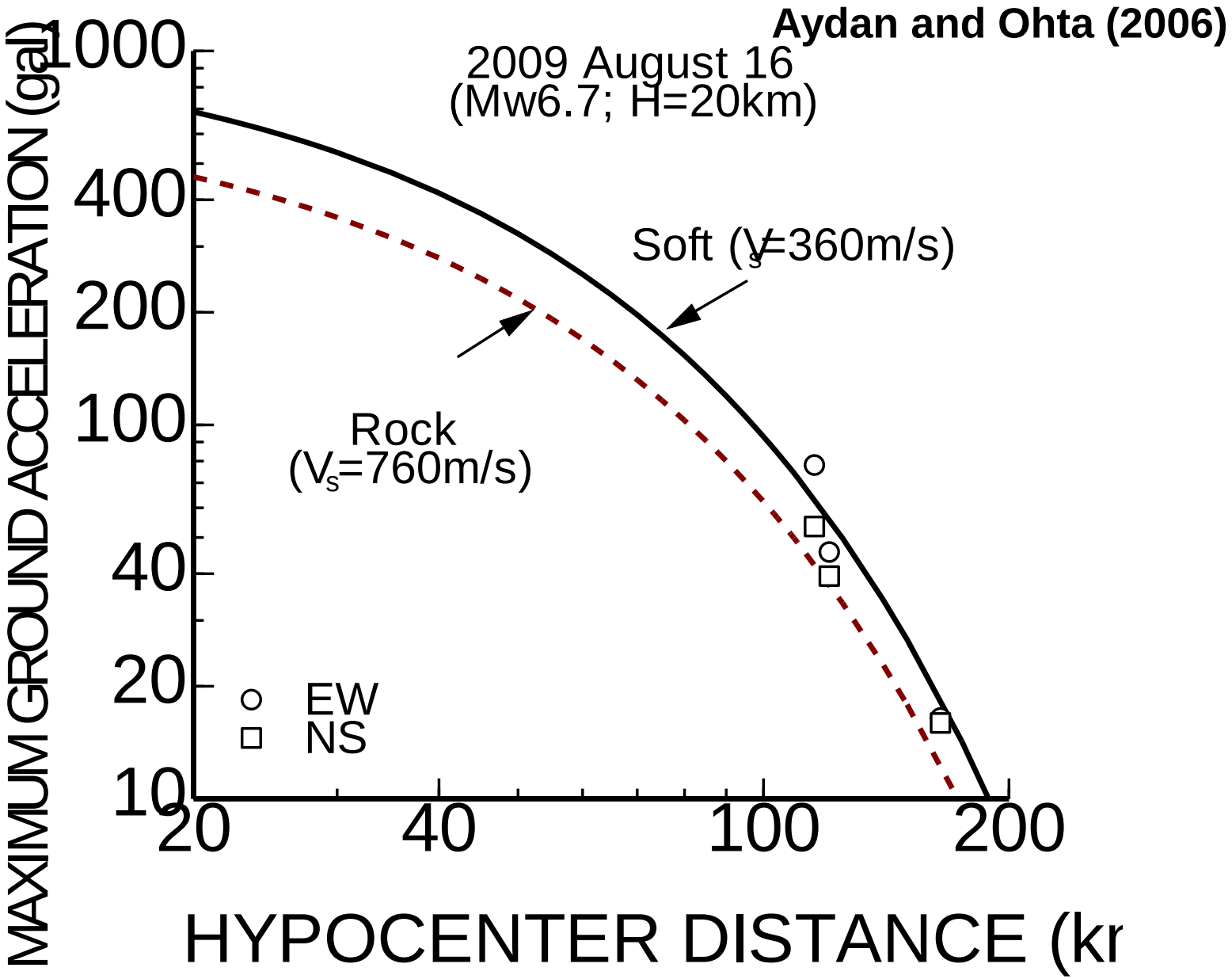
A record from 21 Sep. 2008 earthquake



West Sumatra Strong Motion Instrumentation Project
Locations of Strong Motion Stations and epicenters of some earthquakes

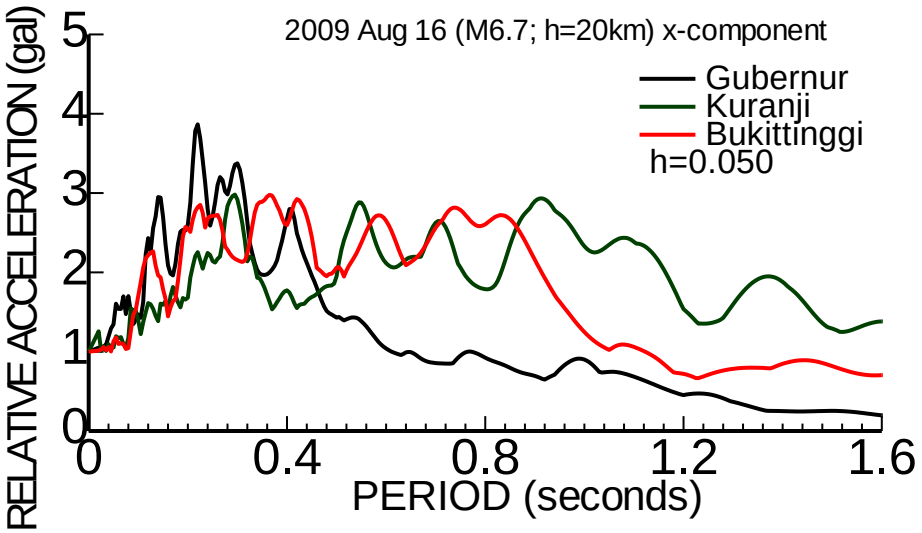


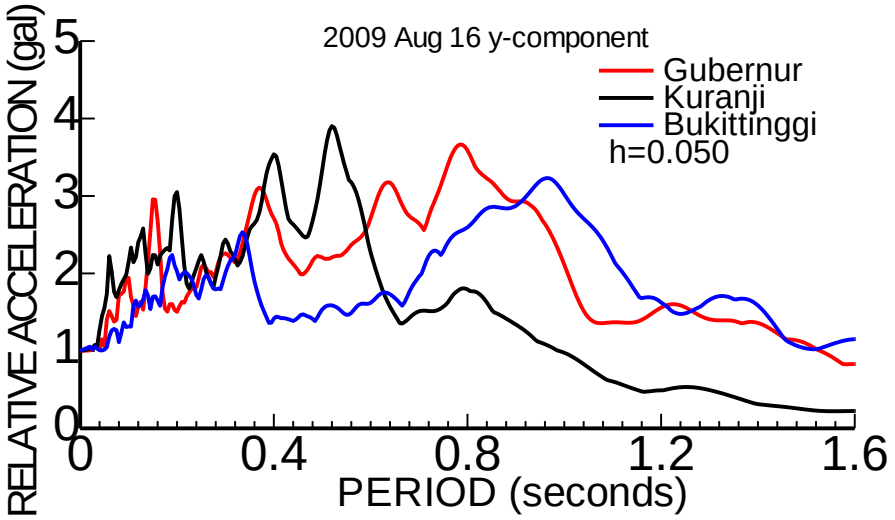
2009 August 16 M6.7 Intra-plate Earthquake

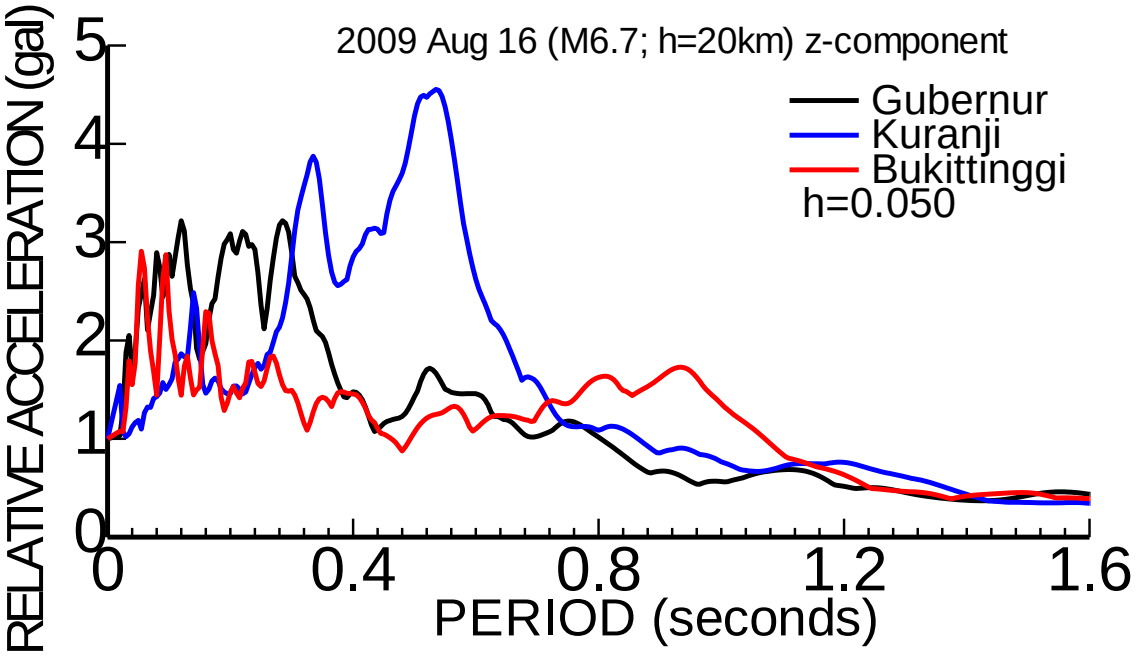


Attenuation Relation for Indonesia based on actual data

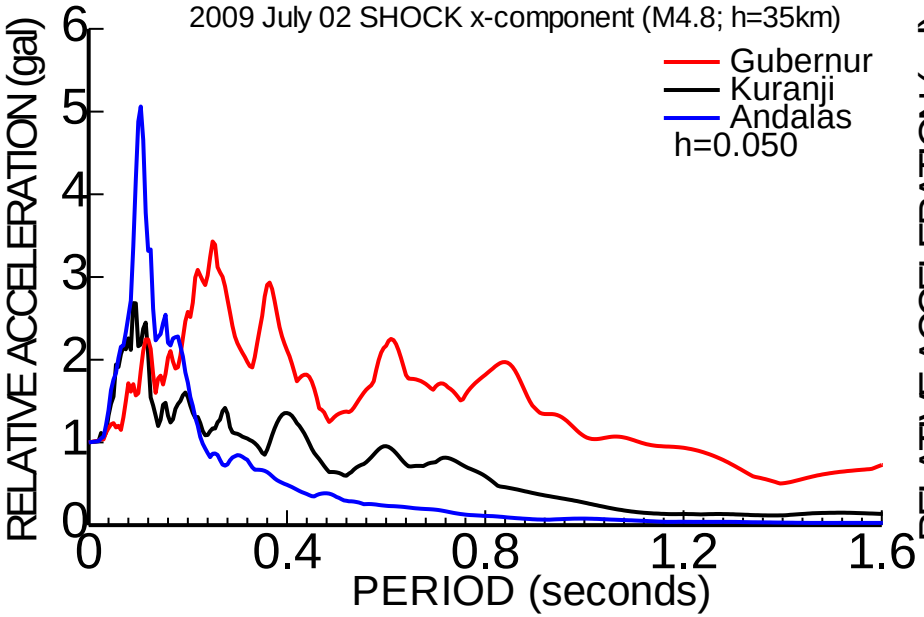
2009 Aug. 16 M6.7 – Acceleration Response Spectra

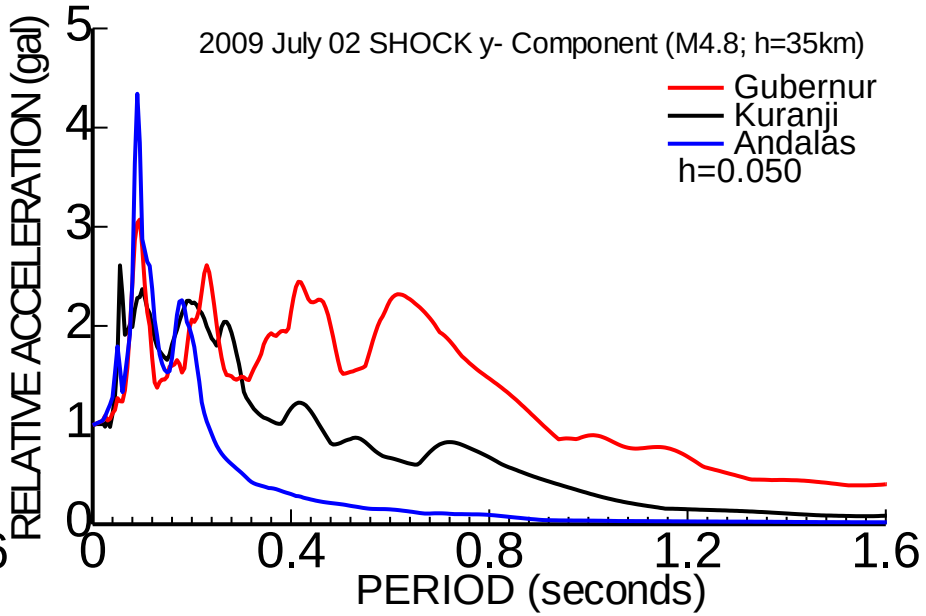


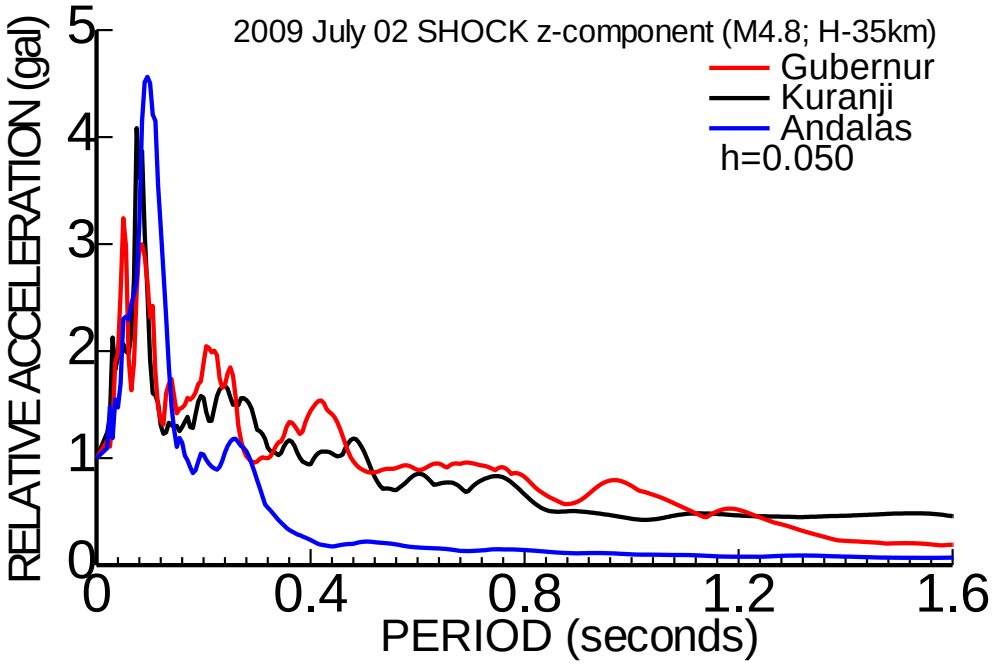




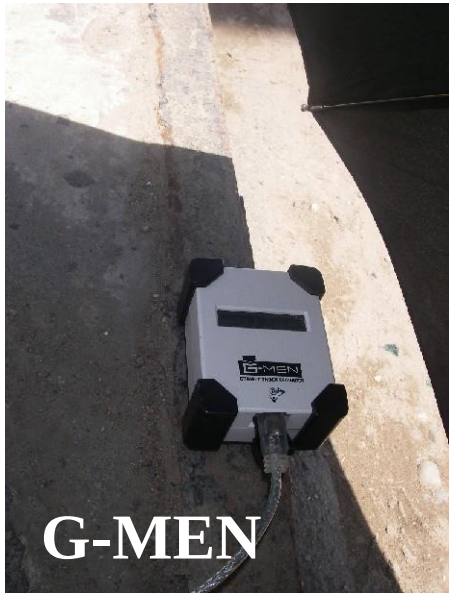
2009 July 02 M4.8 - – Acceleration Response Spectra



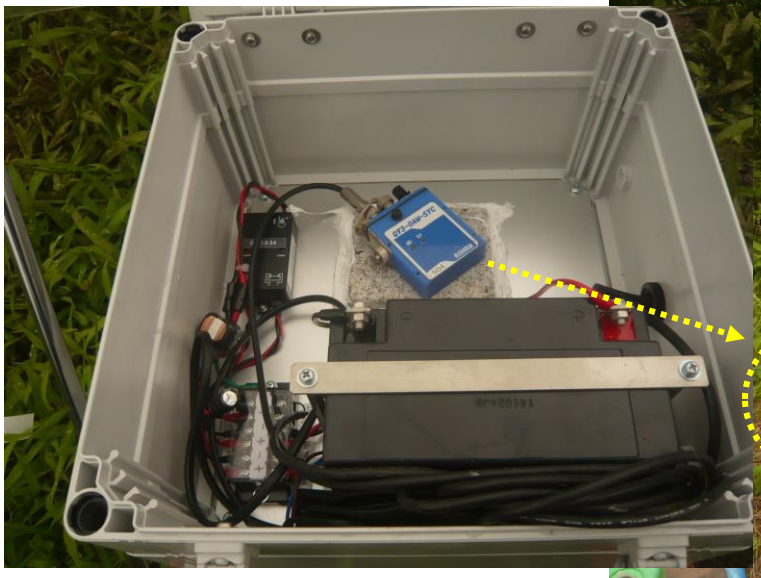




DEVELOPMENT OF LOW-COST ACCELEROMETERS



Stand-alone, Chargeable Battery, Solar Panel, Electricity with back-up battery

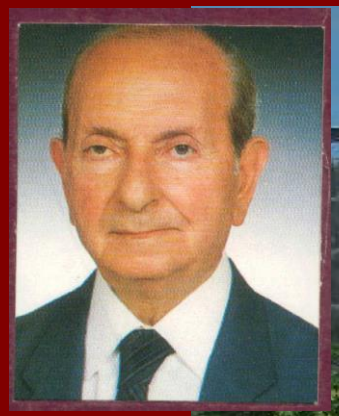


Conclusions

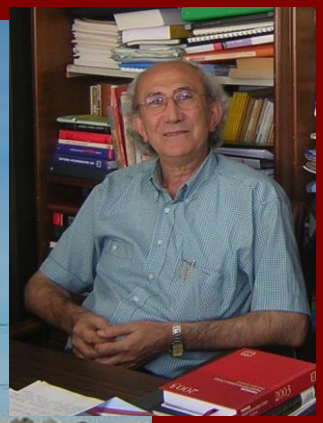
The reconnaissance activities in relation to the natural disasters are of great importance to record and convey true information to experts, authorities of present days as well as or the next generations.

After each natural disaster, mankind realizes some deficiencies and derive some lessons. There is no doubt that this leads to for better preparedness against natural disasters and to develop better mitigation plans and their implementation. Nevertheless, we have to keep reconnaissance activities for safer world and living of societies worldwide

THANKS FOR YOUR KIND ATTENTION



Prof. Rıfat Yarar



Prof. Zeki Hasgür

TEŞEKKÜR EDERİM

2007 South Sumatra Earthquake

At Andalas University