

PROCEEDINGS
OF
INTERNATIONAL SYMPOSIUM 2008
- Discuss together on the keen and common issue -
Part3: Strategies to Mitigate Casualties by Earthquakes Focusing on
Non-engineered Construction

「地震に強い住宅に関する国際シンポジウム」報告書

〈世界共通の課題を一緒に考える〉

第三部 地震による死傷者を少なくする方策を考える -ノン・エンジニアドを中心に-



November 28-29, 2008

Building Research Institute (BRI)
National Graduate Institute for Policy Studies (GRIPS)
United Nations Centre for Regional Development (UNCRD)

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*この報告書では、地震に強い住宅に関する国際シンポジウム<世界共通の課題を一緒に考える>の「第三部：地震による死傷者を減らす方策を考える－ノン・エンジニアド－」についてまとめたものである。

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*This Proceeding is report on “Part 3: Strategies to Mitigate Casualties by Earthquake focusing on Non-engineered Construction” of the Symposium.

I . OUTLINE OF SYMPOSIUM

シンポジウム概要

「地震に強い住宅に関する国際シンポジウム」〈世界共通の課題を一緒に考える〉

1. 背景と目的

世界の地震地域では共通して、地震災害の軽減が喫緊の課題となっている。近年では、2008年の中国・四川省大地震、2007年の年ペルー・ピスコ地震、2006年の年インドネシア・ジャワ島中部地震、2005年のパキスタン北部地震が、社会に甚大な被害を及ぼした。日本でも1995年の阪神・淡路大震災で大きな被害が生じた。

地震による犠牲者の多くは、自分が住んでいる住宅が倒壊することによって亡くなる。世界の大部分の人は、伝統的な工法であるアドベ、レンガ、石や木材などによる、ノンエンジニアド住宅に住んでおり、耐震構造に関する工学的配慮に欠けているため地震に対して脆弱な構造となっている。最新の科学技術によっても地震を正確に予知することはできないことから、今後発生する地震による死者数や甚大な被害を減らすためには、これらの住宅を安全なものにすることが最も重要である。既存の住宅の耐震性を高めることができれば、地震による犠牲者を減らし、被災地の経済や社会活動の停滞を軽減することができる。いかに緊急事態の対応や救助活動が効率的に行われようとも、亡くなった人は戻らない。いかに効果のある耐震技術が開発されても、それが適用されなければノンエンジニアド住宅は安全にはならない。そこで「地震に強い住宅」に関する国際シンポジウムでは、地震に強いコミュニティづくりに向けて、ノンエンジニアド住宅の耐震安全性の向上策について、専門家の間で議論することを目的としている。

2. 日時

2008年11月28日(金)午前・午後－29日(土)午後

3. 場所

政策研究大学院大学(GRIPS)内、想海楼(そうかいろう)ホール

〒106-8677 東京都港区六本木7-22-1、代表 Tel:03-6439-6000)

4. 使用言語

英語および日本語(同時通訳使用)

5. 参加者数

62名(2008年11月28日)

52名(2008年11月29日)

主催:

- 建築研究所(BRI)
- 政策研究大学院大学(GRIPS)
- 国際連合地域開発センター(UNCRD)

後援:

- 国連防災戦略(UN/ISDR)
- ユネスコ(UNESCO)
- 内閣府
- 国土交通省
- 国際協力機構(JICA)

International Symposium 2008 on Earthquake Safe Housing

– Discuss together the keen and common issue –

1. Background and Objectives

Reduction of earthquake disasters is one of the keenest issues common in earthquake prone areas in the world. In recent years, our societies have been severely damaged by Sichuan Earthquake 2008 in China, Pisco Earthquake 2007 in Peru, Central Java Earthquake 2006 in Indonesia, and Northern Pakistan Earthquake 2005. Japan also suffered severe damages from 1995 Hanshin–Awaji Earthquake.

In most of deaths caused by earthquakes, people are killed by their own houses. Most of the world's population lives in vernacular houses that are built of adobe, brick, stone, and wood, and are non-engineered and thus vulnerable to earthquakes. Because earthquakes cannot be predicted precisely even by applying the most advanced science and technology, it is essential to make these houses safer in order to reduce the number of victims and the amount of severe damage caused by future earthquakes. The more resilient the existing houses are against earthquakes, the lower the death rate will be in the event of an earthquake, and the less drastic will be the disruptions to economic and social activities in the affected areas. No matter how effectively emergency management and relief activities are conducted, the lost lives can never be regained. No matter what effective technologies are developed, the non-engineered houses will not be safer unless these technologies are applied. This International Symposium on “Earthquake Safe Housing” therefore aims to discuss among the interested experts how we can improve the safety of houses, newly built and existing, towards safer communities against earthquakes.

2. Date

November 28–29, 2009

3. Venue

Sokairo Hall, National Graduate Institute for Policy Studies (GRIPS)

4. Language

English and Japanese (simultaneous translation is available)

5. No. of Participants

52 (November 28)

62 (November 29)

Organized by:

- Building Research Institute (BRI)
- National Graduate Institute for Policy Studies (GRIPS)
- United Nations Centre for Regional Development (UNCRD)

Supported by:

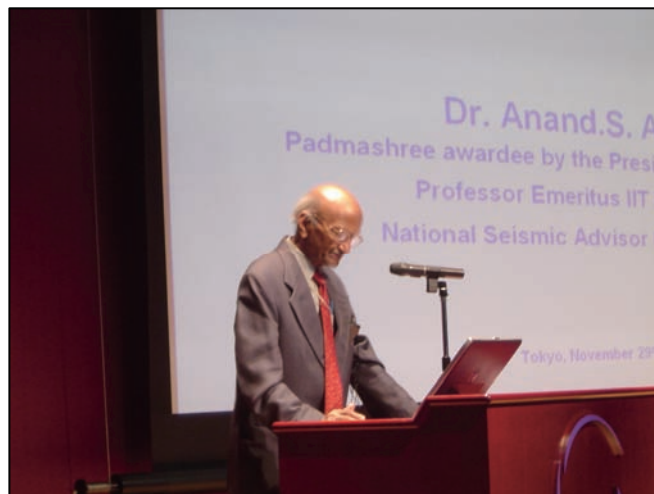
- International Strategy for Disaster Reduction (UN/ISDR)
- United Nations Educational, Scientific and Cultural Organization (UNESCO)
- Cabinet office, Government of Japan
- Ministry of Land, Infrastructure, Transport and Tourism (MLIT), Japan
- Japan International Cooperation Agency (JICA)

Photo of Symposium

会場風景1



開会挨拶 建築研究所理事長 村上周三氏
Opening Address Dr.Shuzou MURAKAMI



基調講演 インド内務省国家地震顧問 アナンド・アリア氏
Key Note Speech Dr. Anand.S. Arya



建築研究所国際協力審議役 榎府龍雄氏
General Coordinator of Research and Development Project Dr. Tatsuo Narafu

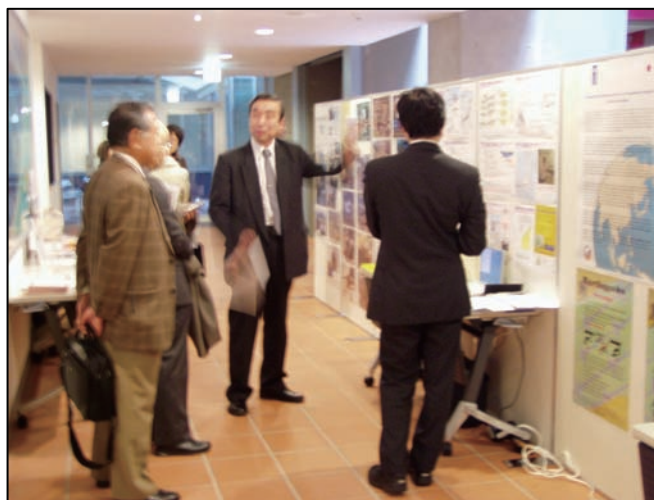
Photo of Symposium

会場風景2



ポスター展示風景

Poster Presentation



ポスターセッション風景 1

Poster Session 1



ポスターセッション風景2

Poster Session 2

II . PRESENTATION MATERIALS

発表資料

Opening Address
開会挨拶

International Symposium 2008 on Earthquake Safe Housing
- Discuss together on the keen and common issue -
「地震に強い住宅」に関する国際シンポジウム

Sokairo Hall,
National Graduate Institute for Policy Studies (GRIPS),
Tokyo, Japan
on Nov 29, 2008

Shuzo Murakami
村上周三
Chief Executive, Building Research Institute Japan (BRI)

Introduction 開発途上国の甚大な地震被害

- Earthquakes cause serious damages to human societies
- Developing countries are more vulnerable



■ Tragic Damages again in Sichuan, China in May, 2008

2008年5月12日中国四川省地震の甚大な被害

Un-reinforced brick masonry houses in Hongkou, Dujiangyan



Outline of Technical Cooperation for Developing Countries by BRI
 建築研究所の開発途上国に対する技術協力の概要

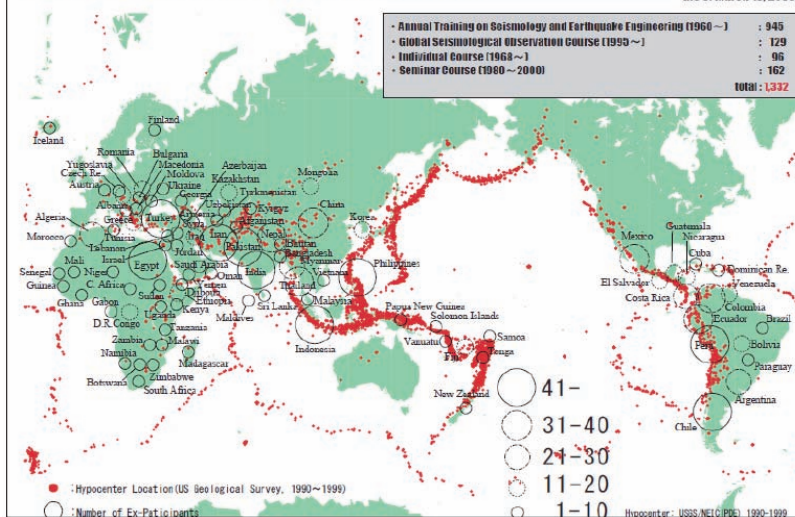
- Training courses on Japanese ODA Programs by IISEE (International Institute of Seismology and Earthquake Engineering)
- BRI/JICA projects for establishment of R&D centers for earthquake disaster mitigation in developing countries
- Activities of R&D and dissemination



Participants of Training courses from all over the world 地震工学研修の実施

Number of Ex-participants of IISEE Training Courses

(As of March 10, 2008)

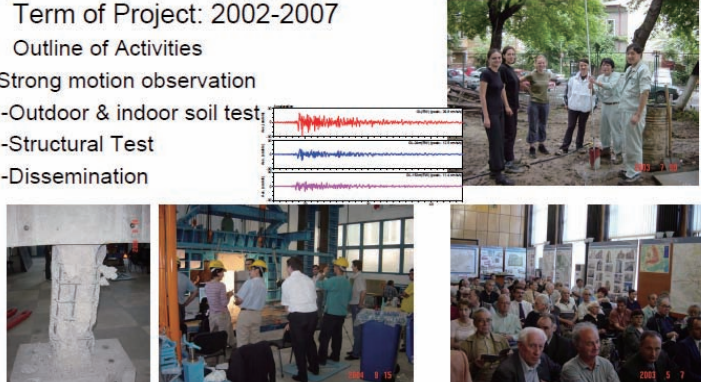


List of BRI/JICA projects for establishment of R&D centers for earthquake disaster mitigation
 BRI/JICA 地震防災センタープロジェクト

	Country	Project	Period	Counterpart
	Indonesia	The project on the development of appropriate technology for multi-story residential building and its environmental infrastructures for low income people (Structure)	1993-1998	Research Institute for Human Settlements
	Peru	The Japan-Peru Earthquake and Disaster Mitigation Research Center Project	1986-1991	Japan-Peru earthquake and Disaster Mitigation Research Center
	Chile	The joint study project on earthquake disaster mitigation in Chile	1988-1991 1995-1998	University of Catolica
	Mexico	The earthquake disaster prevention project	1990-1996	National Disaster Prevention Center(CENAPRED)
	Turkey	The project for the establishment of Earthquake Disaster Prevention Research Center on the Republic of Turkey	1993-2000	Earthquake Disaster Prevention Research Center
	Egypt	The joint study project on the evaluation of seismic activities in the plate boundaries in Egypt	1993-1996	National Research Institute of Astronomy and Geophysics (NRIAG)
	Kazakhstan	Continuation and improvement of the seismological monitoring system for earthquake preparedness and risk in the region of Almaty city in the Republic of Kazakhstan	2000-2003	Institute of Seismology, Ministry of education and Science, Republic of Kazakhstan
	Romania	The project on the reduction of seismic risk for buildings and structures in Romania	2002-2007	National Center for Seismic Risk Reduction, Ministry of Transports, Constructions and Tourism (MTCT)

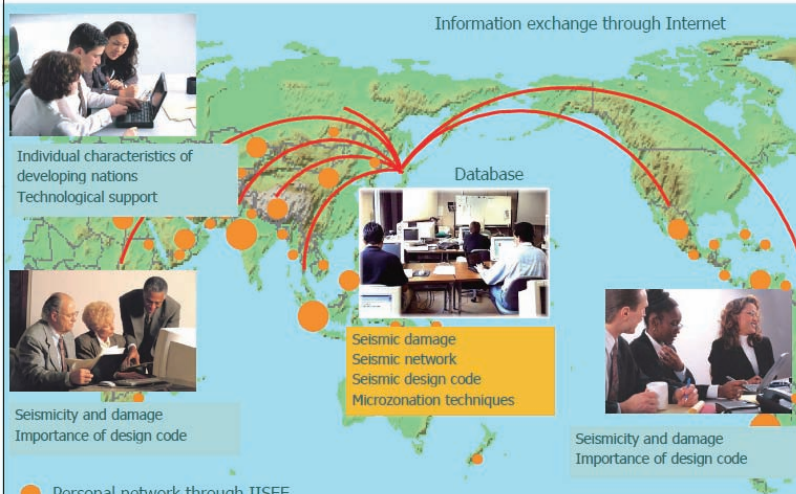
Outline of Romanian Project ルーマニアプロジェクトの概要

- Project title: JICA Project on the Reduction of Seismic Risk for Buildings and Structures in Romania
- Term of Project: 2002-2007
- Outline of Activities
 - Strong motion observation
 - Outdoor & indoor soil test
 - Structural Test
 - Dissemination



Dissemination of technical information through Internet 地震工学情報のウェブによる提供

Information exchange through Internet




Individual characteristics of developing nations
Technological support

Seismic damage
Seismic network
Seismic design code
Microzonation techniques

Seismicity and damage
Importance of design code


Seismicity and damage
Importance of design code

● Personal network through IISEE



Launch of new R&D in 2006 Collaborative R&D Project for Earthquake Disaster Mitigation

2006年度国際共同研究プロジェクトのスタート



- **Term of R&D**
three years
(2006-2008)
- **Target structures**
Non-engineered constructions in developing countries, also applicable to developed countries like Japanese conventional houses
- **Funds**
The Asia S&T Strategic Cooperation Promotion Program prepared by Ministry of Education, Culture, Sports, Science and Technology (MEXT)

Total coordination: BRI
Facilitating Institute of Topic 1
Risk Management System

Building Research Institute, Japan (BRI)

Facilitating Institutes of Topic 2
Seismic Constructions

Structures and Construction Practice
Mie University

P.I. of Experiments
National Research Institute for Earth Science and Disaster Prevention (NIED)

Facilitating Institute of Topic 3
Dissemination of Technologies
Graduate Institute for Policy Studies (GRIPS)

Mitigation of Disasters on their own initiative

Enhancement of R&D capacity Of each member country

Collaborative R&D Activities

Share of inf. and exp. (Workshops, TV conferences)
Mutual visits of researchers
Joint research
Joint experiments

Facilitating institutes of each countries

Bandung Institute of Technology (ITB)
Indonesia

Nepal Engineering College
Nepal

Preston University
Pakistan

Istanbul Technical University
Turkey

International Symposium 2008 on Earthquake Safe Housing
- Discuss together on the keen and common issue -
「地震に強い住宅」に関する国際シンポジウム

- November 28 and 29, 2008
- Organizers: Building Research Institute (BRI)
National Graduate Institute for Policy Studies (GRIPS)
United Nations Center for Regional Development (UNCRD)

- Part 1
Earthquake Risk Perception and Disaster Reduction Policies
地震リスク認知と防災政策
- Part 2
From Code to Practice: Challenge in Building Code Implementation
基準から現場へ -建築基準普及への挑戦-
- Part 3
Strategies to Mitigate Casualties by Earthquake focusing on
Non-engineered Construction
地震による死傷者を少なくする方策を考える -ノンエンジニアドを中心に-

Wenchuan earthquake and its disaster

He Yongnian

China Earthquake Administration

November 2008

Wenchuan earthquake parameters

Original time: 14:28, May 12, 2008

Location: Southwest Wenchuan, Sichuan province,
China (E. Lon 103.4° , N. Lat 31°)

Magnitude: 8.0

Focal depth: 15 km

Earthquake type: Main-shock--aftershock type

Wenchuan earthquake caused severe damage and losses of people's life and property. According to the statistics, the area of severe disastrous region is 33,174 Km²; the area of moderate disastrous is 448,291 Km².

Wenchuan earthquake resulted in the most severe damage and losses with largest affected area since foundation of PRC. Its death toll is close to 90,000 people, and about 380,000 people injured. The economic losses are estimated to be more than 8450 billion Yuan (RMB).

Tectonic background of the Wenchuan earthquake :Collision of Indian plate northward is the essential cause.

The northwestward subduction of Pacific plate and Philippine plate to the China's continent; the Indian plate pushes northward to the Euro-Asian plate, which makes China's continent being at very high stress; Especially the Indian plate collision makes Qinghai-Tibetan massif situated in critical state; when strength of the crust there isn't large enough to resist the stress resulted from plate movement, the rock layers would be fractured and the earthquake may occur.

For the Wenchuan earthquake, there is more direct cause: the stress caused by Indian plate collision toward the Tibet-Qinghai plateau has been blocked by the vast Euro-Asian continent, resulted in east-ward and west-ward transmission along the Tibet-Qinghai massif. So both the eastern and western ends of the Tibet-Qinghai massif is earthquake-prone areas.

Tectonic background of continental seismicity in China

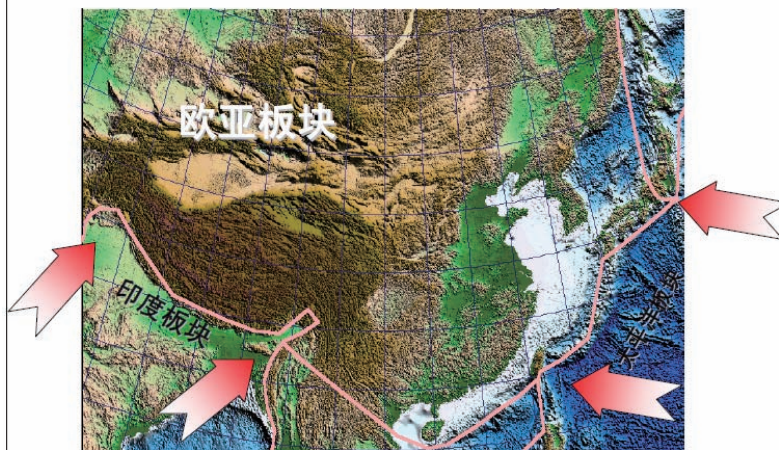
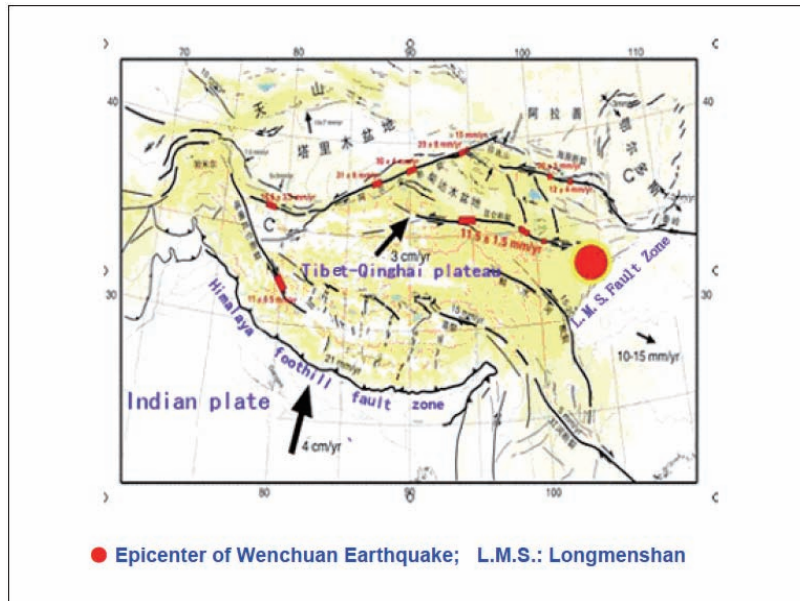
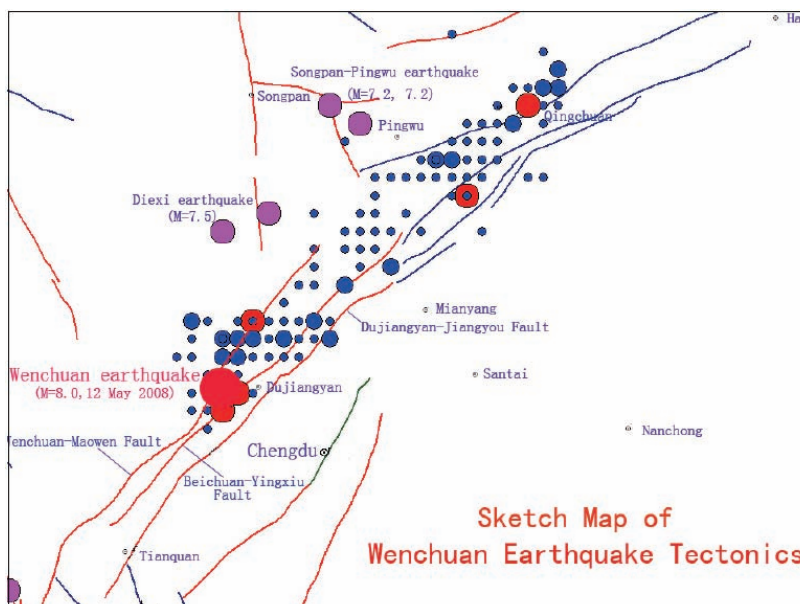
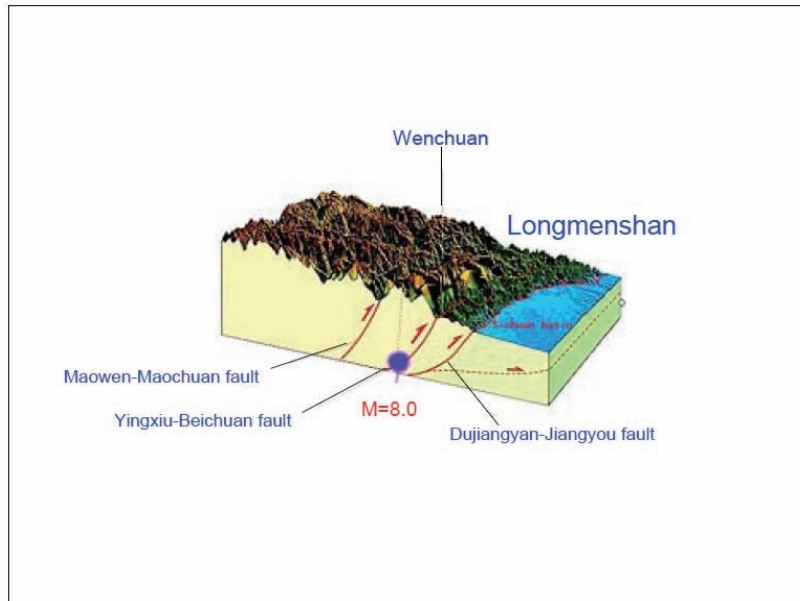


Plate movement causes strong earthquake activity



When the stress transmitted eastward and reached the eastern boundary of the Tibet-Qinghai massif—Longmenshan fault zone, triggering the sudden slip of the Yingxiu--Beichuan fault, the central fault of Longmenshan fault zone and a M=8.0 earthquake occurred. That is the Wenchuan earthquake.



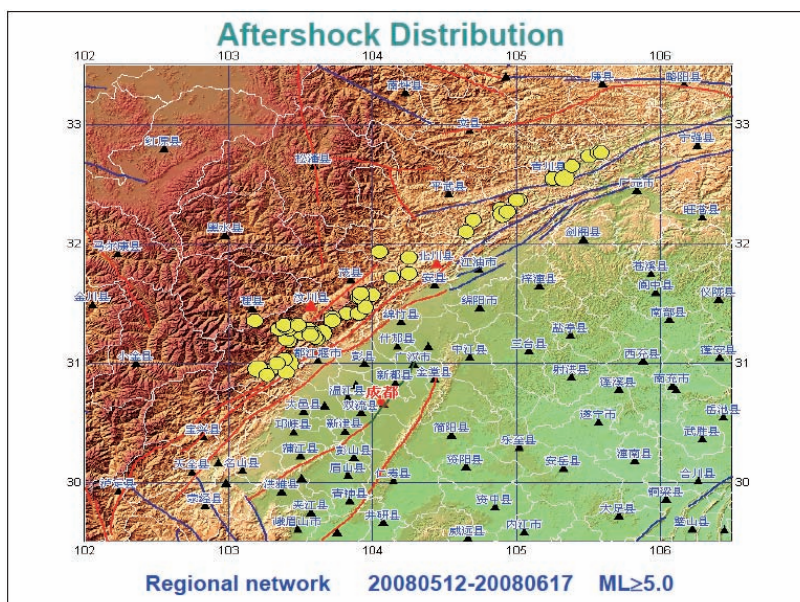


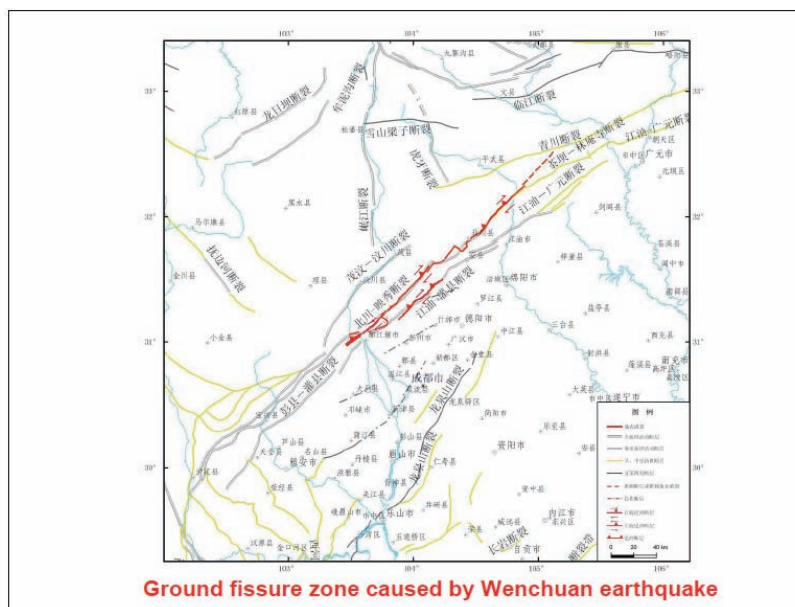
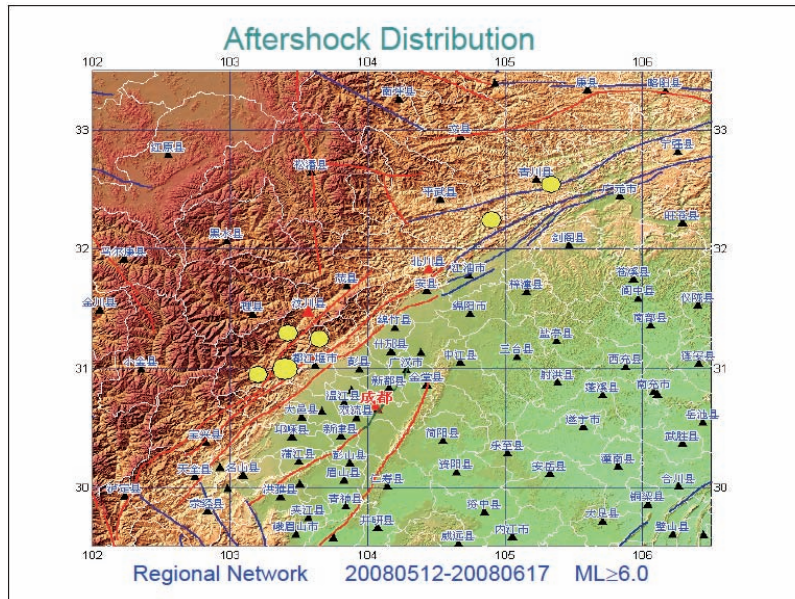
The fracture process of Wenchuan earthquake lasted about 2 minutes, and caused a long ground fracture zone with a NE strike, which extended about 300 km.

The fracture is single directional, that is, the fracture started from Yinxiu town and extended northeastward, however, there isn't the southwestward fracture found.

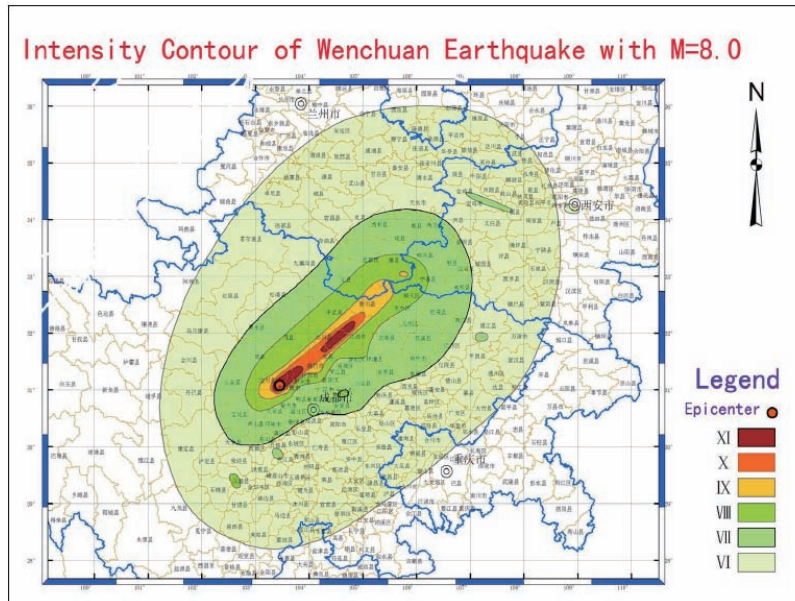
According to the observational data, there were 28529 events up to September 08, 2008; among them the events with $M=4.0-4.9$ are 222 times, the events with $M=5.0-5.9$ are 31 times and the events with $M=6.0-6.9$ are 18 times; the maximal magnitude of aftershocks is 6.4, which occurred on 25 May, 2008.

The following slides show the distribution of aftershocks, which is basically coincided with strike of Longmenshan fault zone.





Wenchuan earthquake brought about serious disaster in the earthquake-stricken region. The following slides will show you the related situation in the epicenter regions, where the seismic intensity will reach XI degrees (MMS). The region with intensity of XI covered an area of about 2420 Km². The intensity investigation The maximal intensity extent appears as an elongated region centralized with Yingxiu town, wenchuan county and Chengguan town, Beichuan county. Totally, the area with higher than VIII is larger than 500,000 Km².



A remarkable feature of earthquake disaster in Wenchuan region

Wenchuan earthquake induced severe secondary disaster, mainly, it is geological disaster, including landslide (5117 sites), mountain collaps(3575 sites) ,mud flow (358 sites) and barrier lakes (34 sites), which resulted in huge losses and casualty and difficulty for emergency relief and rescue.

Disaster



Panorama of Beichuan county (1)



All structures are almost ruined (2)

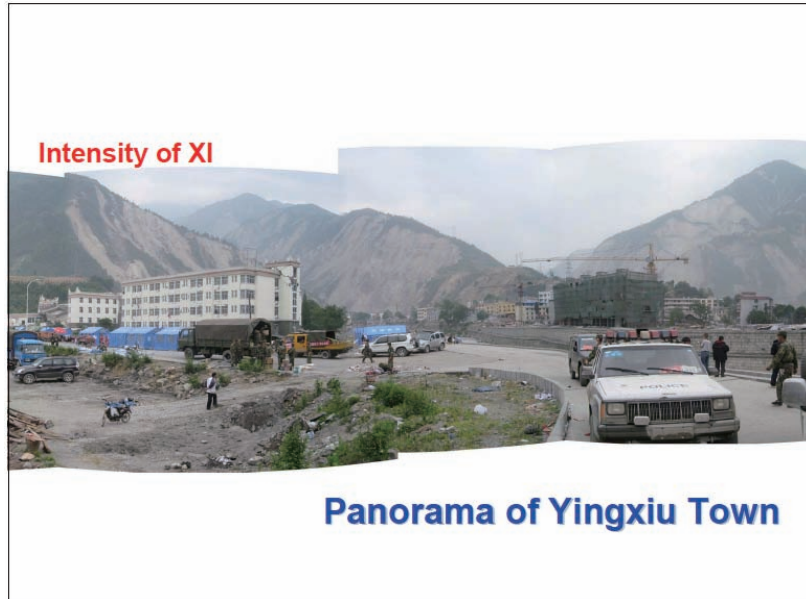


Fallen rocks damaged the houses



It was busy commercial street





The building collapsed and the cars crushed



The damaged bridge in Beichuan town



The Collapsed bridge in Beichuan town



Rail track damaged and the train derailed



Mountain collapse blocked the road in Qingchuan county



Ground fissures

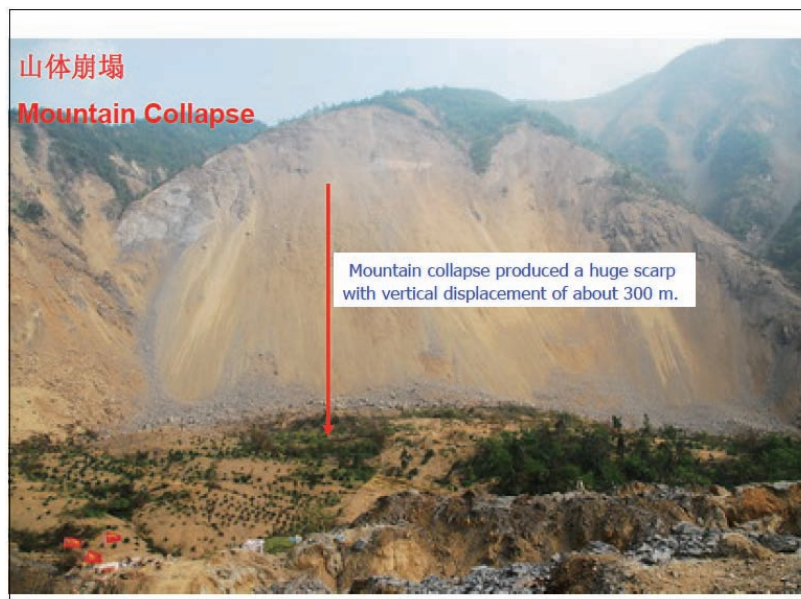
Earthquake –caused earth slide buried a village



Earth slide and collapse caused by the earthquake



Mountain collapse caused traffic interruption





Dammed lake in Wenchuan earthquake-stricken area



Tangjiashan barrier lake caused by Wenchuan

Some Remarks on Wenchuan earthquake

- ★ The southern segment of Longmenshan fault zone was considered as an active part, and the northern and middle segments were inactive; however, the Wenchuan earthquake indicated that the whole Longmenshan fault zone is active.
- ★ The seismic intensity of Longmenshan region was determined VII (MMS), it is underestimated. Now the seismic intensity of the region is re-determined as VIII.
- ★ There wasn't remarkable precursor of seismicity found before the earthquake with $M=8.0$ through careful check of the regional seismicity. Either, there were not other precursors found before the earthquake.
- ★ Wenchuan earthquake showed a large scale fracturing process, from the focal region propagated northwestward till southern Shanxi province, the ground fission zone reached more than 300 km. Accordingly, some seismologists consider that the "seismic focus" of this earthquake should be a "plane" rather than a "point".
- ★ Wenchuan earthquake induced severe secondary geological disaster, which made the disaster more serious and obstructed the emergency relief and rescue.

On damage of buildings and structures

The earthquake field investigation shows that those buildings, constructed according to the building code issued since 1989, and have good construction quality, damaged lightly; they are most of framing structure with shearing walls. On the contrary, those buildings, constructed in early times and the earthquake resistance level was lower, damaged severely, and the building types are mainly masonry structure of brick-frame construction.

On reconstruction of Wenchuan earthquake stricken region

In the light of mountainous features of the disaster stricken region, its rehabilitation and reconstruction will be divided into several sub-areas: in the mountain front area the disaster is relatively light, the focus of reconstruction will be put on reinforce of the damaged buildings to restore the life and productive order of the towns and villages as soon as possible. In Longmenshan region, where the disaster is severe, the first thing is to formulate the regional reconstruction plan based on local natural capacity, population and resources and so on. The infrastructure layout, minority custom, requirement of social and economic development and control of town and village scale and others should be considered. At same time, reconstruction must pay attention to escape the fault zones and sites, where the geological hazards may frequently occur.

Thank you very much!

Challenges for Safer Non-Engineered Constructions

Dr. Anand.S. Arya

Padmashree awardee by the President of India, 2002

Professor Emeritus IIT Roorkee

National Seismic Advisor Gol – UNDP

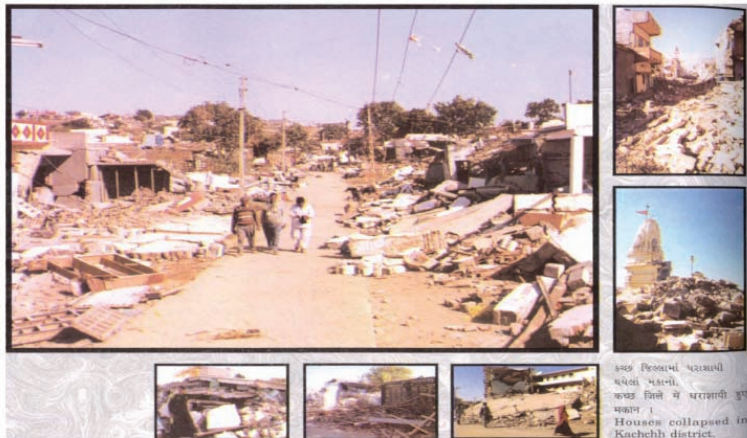
Tokyo, November 29th, 2008

KACHCHH EARTHQUAKE IN GUJARAT

Date of Occurrence	:	26 th January 2001
Time	:	8.46 a.m.
Epicenter	:	23.6 ^o North Latitude and 69.8 ^o East Longitude, 20km North East of Bhuj
Magnitude	:	6.9 Richter Scale 7.7 Moment magnitude 7..9 Surface Wave magnitude
Intensity, maximum	:	IX-X MSK Scale

A Terrible Human Tragedy

Over 1.1 million homes affected; 4 Kutch towns in ruins



A Terrible Human Tragedy

Over 5,000 Health units
damaged / destroyed



Bhuj General Hospital

Over 50,000 School rooms
damaged / destroyed



High School of Dudhai Village

A Terrible Human Tragedy



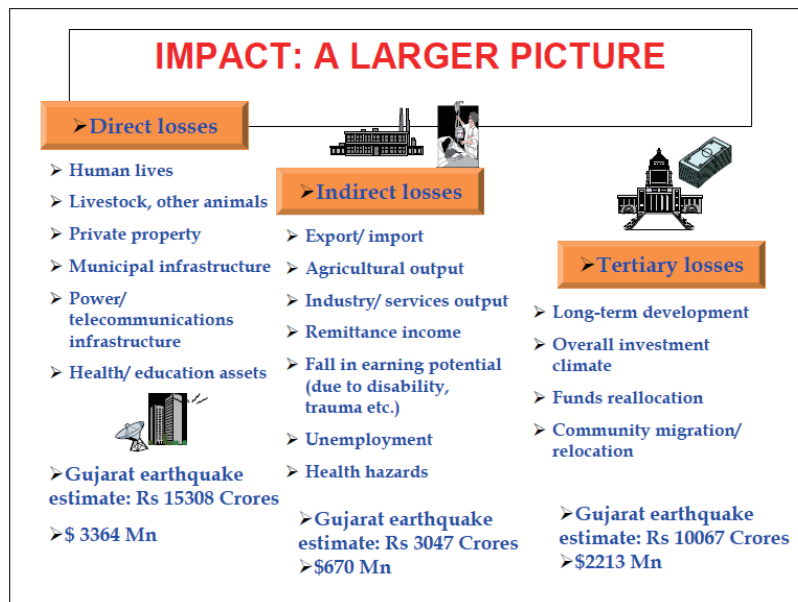
Over 50,000 artisans lost their
livelihood.

Over 10,000 small and medium
industrial units went out of
production.

A Terrible Human Tragedy

- Massive damage to telecom,
power, water supply and
transport infrastructure.





- ### The need of the hour...
- An agency to carry out...
- **Implementation of massive Relief, Rehabilitation and Reconstruction work**
 - **Co-ordination between Govt. of Gujarat and several donors, funding agencies like WB, ADB**
 - **Quick Policy Making**
 - **Effective Financial Management**
 - **Monitoring and Quality Inspection**
 - **Planning for long-term Disaster Management**
 - **Disaster Mitigation**

- ### The Answer - GSDMA
- **The Gujarat State Disaster Management Authority was constituted by the Government of Gujarat vide its GR dtd.08/02/2001 (just 12 days after the disaster)**
 - **It was found an effective response to the enormous challenges posed by natural calamities.**

Objectives of GSDMA

- To undertake relief, rehabilitation and reconstruction of social and economic activities to restore normalcy.
- To minimize the impact of natural calamities through mitigation programmes.
- To study and conduct Risk and Vulnerability Analysis of Gujarat.
- To suggest remedies to prevent or minimize the effects of natural calamities.
- To optimize the use of funds, grants, donations, assistance received from GOI, donors and other funding agencies

EMERGENCY RESPONSE

- Rescue Equipment (5449): JCBs, Cranes, Bull Dozers, Excavators, Dumpers, Trucks, Gas Cutters
- Vehicles (5022): Jeeps, Ambulances, ST buses
- Personnel (29140): Technical, Non-Technical, Labourers, Medical Teams
- International rescue teams arrived: Netherland, France, Japan, Ukraine, Switzerland, UK, Russia, Germany, Bulgaria and Israel
- Injured: 167,000 cases treated (19,000 serious nature)
- Army Hospital at Bhuj opened its door to civilians
- Hospitals set up by State Government & IMA, Israel, France, Ukraine, Denmark, Red Cross Societies of Norway, Finland & Germany

EMERGENCY RESPONSE

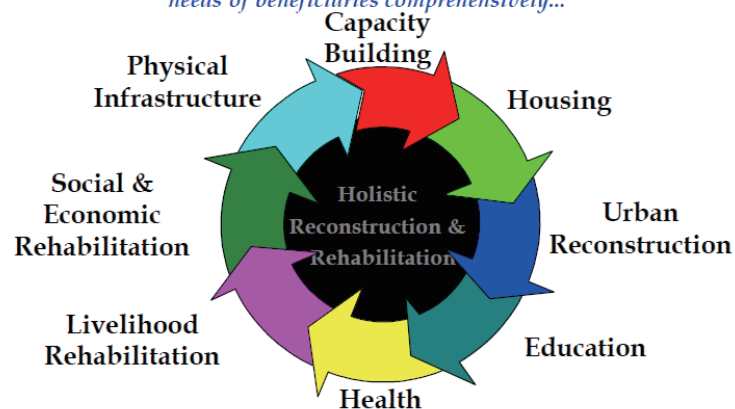
- All emergency telecommunication services restored within 24 hours
- Essential services like water,power, railway traffic, road ways restored in 36 hours in Bhuj and within 48 hours in entire Kutch
- Essential supplies of wheat, groundnut oil & sugar rushed to Kutch district for free distribution
- Free community kitchen services provided
- Cashdoles given to 9,11,096 Families, house hold kits to 3,72,027 Families
- Death Compensation paid to 13,378 Cases, Injury Assistance given to 19,648 Cases
- Emergency Shelter to 2,48,947 families

Biggest Challenge

Safer Reconstruction of Houses and other Buildings

HOLISTIC APPROACH

The reconstruction program has been designed to address the needs of beneficiaries comprehensively...



ASSESSMENT OF DAMAGE

- A very ticklish and difficult task
- Preparation of proformas for non-engineered buildings
- Preparation of proformas for reinforced concrete buildings
- Organization of teams for carrying out assessment of damage house by house (the teams consisted of an engineer, a revenue staff and a village head man.
- Establishment of grievance redressal mechanism
- Many issues and problems arose necessitating repeat damage surveys in some areas

A rational and reliable system of damage assessment needs to be developed

TYPES OF CONSTRUCTION

1. Non-engineered Building Construction.

2. Engineered Constructions including buildings and infrastructure.

Non-engineered buildings are those which are spontaneously and informally constructed in various countries in the traditional manner without any or little intervention by qualified architects and engineers in their design.

Engineered constructions include reinforced concrete buildings and structures used for various purpose which are normally designed by Architects and Engineers working in various Govt. departments or consulting organization.

BAD PERFORMANCE OF MASONRY BUILDINGS

- i Old decaying buildings predating modern construction practices
- ii New buildings not built to Indian earthquake Codes – Lack of knowledge
- iii Improper detailing of masonry building
- iv Poor materials, construction and workmanship used
- v Absence of 'header' or 'through' stones and long corner stones
- vi Buildings having poor quality foundations or foundations built on poor soils

TABLE 1 – BUILDING TYPES IN FIVE DISTRICTS OF GUJARAT

Wall Type	No. of Houses and percentage of Total in District									
	Kachchh		Jamnagar		Banaskantha (incl. Patan)		Rajkot		Surendranagar	
	No.	%	No.	%	No.	%	No.	%	No.	%
Category A	276,390	70.72	215,135	52.04	268,790	54.90	295,005	46.81	281,475	85.04
Category B	56,995	14.58	183,050	44.28	202,185	41.29	310,925	49.34	43,705	13.20
Category C	42,135	10.78	9,980	2.41	6,705	1.37	15,15	2.46	2,870	0.87
Category X	15,290	3.91	5,210	1.26	11,955	2.44	8,760	1.39	2,9	0.89
Total	390,810	100	413,375	100	489,635	100	630,205	100	330,995	100

Source: Vulnerability Atlas of India, 1997

- Category A - Building in field-stone, rural structures, unburnt brick houses, clay houses
- Category B - Ordinary brick buildings; buildings of the large block and prefabricated type, half-timbered structures, buildings in natural hewn stone
- Category C - Reinforced building, well built wooden structures
- Category X - Other types not covered in A,B,C. as of biomass, metal sheets etc. These are generally light.

Approach adopted by Gujarat Government

- Total 213685 houses to be reconstructed in 290 villages and four worst EQ affected towns
- Two broad approaches adopted for reconstruction of houses damaged/destroyed by the EQ
 - Owner Driven Reconstruction (176012 houses 82%)
 - Public Private Partnership Program (PPPP) (37673 houses 18%)

RECONSTRUCTION AND RETROFITTING OF BUILDINGS

- Ensuring Earthquake Resistance
- Available Technical know how
- Development of Appropriate guidelines
- Appropriate Awareness Creation
- Capacity building for carrying out the works
- Control and assurance of required quality of construction
- Facilitation of the constructions through materials banks

Available Technical Know how

A. Indian Standards (Codes/Guidelines)

1. IS: 1893-2002 "Criteria for Earthquake Resistant Design of Structures, Part 1 (Fifth Revision)" July 2002.
2. IS: 13920-1993 "Ductile Detailing of Reinforced Concrete Structures subjected to Seismic forces- Code of Practice" November 1993.
3. IS: 1326-1993 "Earthquake Resistant Design and Construction of Buildings- Code of Practice (Second Revision)" October 1993.
4. IS: 13828-1993 "Improving Earthquake Resistance of Low Strength Masonry Buildings-Guidelines" August 1993.
5. IS: 13827-1993 "Improving Earthquake Resistance of Earthen Buildings-Guidelines" October 1993.
6. IS: 13935-1993 "Repair and Seismic Strengthening of Buildings-Guidelines" November 1993.

B. Guidelines Published by BMTPC, Ministry of Urban Development, Government of India

7. *"Improving Earthquake Resistance of Buildings – Guidelines"* by Expert Group, pub. by Building Material and Technology Promotion Council (BMTPC), 1999.
8. *Vulnerability Atlas of India*, by Expert Group, Published by (BMTPC), 1997.
9. *Damage Assessment and Post-Earthquake Action* (after Jabalpur Earthquake of 1997, authored by Dr. A.S. Arya pub. by BMTPC, 1997)
 - Part 1: *Earthen Houses with Clay Tile Roofing*
 - Part 2: *Brick Houses with Clay Tile Roofing*
 - Part 1: *Brick Houses with RC Slab or Stone Patti Roofing, or R.C. Frames* pub. by BMTPC, 1997.
10. *Damage Assessment and Post-Earthquake Action* (after Chamoli Earthquake of 1999, authored by Dr. A.S. Arya pub. by BMTPC, 2000)
 - Part 1: *Visual Damage Identification Guide for Affected Areas*
 - Part 2: *Repair and Retrofitting of Damaged Buildings in Affected Areas*
 - Part 3: *Reconstruction and New Construction of Buildings in Affected Areas*

C. International Monographs

1. Arya A.S. et al, *Earthquake Resistant Non-Engineered Construction*, Monograph pub. by International Association for Earthquake Engineering, 1980, Revised 1986. (translated into Spanish for use in various Spanish countries).
2. Arya A.S. *Construction of Educational Buildings in Seismic Areas*, Digest No. 13, pub. by UNCSCO, Bangkok, 1987 (translated into Persian for use in Iran).

C. Guidelines Published by Gujarat State Disaster Management Authority (GSDMA) authored by Dr. A.S. Arya as Capacity Building Advisor

1. *Reconstruction and New Construction of Houses in Kachchh Earthquake Affected Areas of Gujarat*, first printing June 2001 and 2nd printing in January 2002.
2. *Control on Quality of Construction in Earthquake Affected Areas of Gujarat*, printed in June 2001.
3. *Guidelines for Construction of Compressed Stabilised Earthen Wall Buildings*, printed in December 2001.
4. *Guidelines for Cyclone Resistant Construction of Buildings in Gujarat*, printed in December 2002.
5. *Restoration and Retrofitting of Masonry Buildings in Kachchh Earthquake Affected Areas of Gujarat*, printed in March 2002.

Reconstruction through NGOs

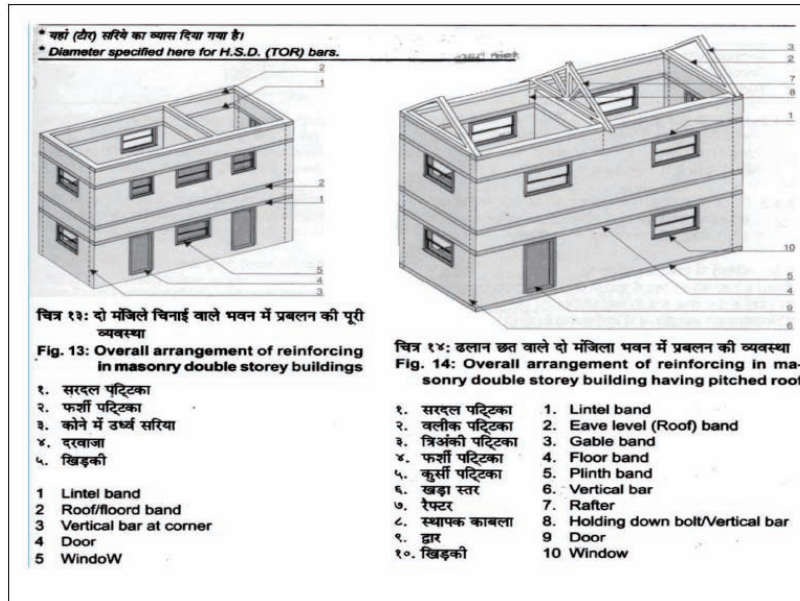
- The decision on the relocation/in-situ reconstruction of the village is passed through Gramsabha (all voting adults of the village)
- The relocation of village is done only when the majority of the community agrees on it.
- Only 5225 houses (2.5% of the total) are fully relocated
- 10299 houses (5% of the total) are partially relocated
- For rest of the houses, reconstruction is done in-situ

Owner-driven Reconstruction

- Houses constructed by the owners themselves
- It ensures that the design of the houses are determined by the owners themselves, as per their needs and preferences
- Also ensures that instead of being uniform, the houses reconstructed are of different patterns as found in case of organic evolution of the common villages
- Approach ensures 'Technology Transfer' to the community and subsequently the sustainability of program.

Owner-Driven Reconstruction

- Financial, technical & material assistance provided by the government
- The designs for seismic reconstruction of houses provided by the government
- The material assistance provided through 1082 material banks (cement bags and other materials provided at subsidised rates)
- More then 180 public consultations held for town planning.
- Design of 20 model houses provided to the public to choose from with an option to have one's own design



Restoration and Seismic Retrofitting of Existing Buildings and Infrastructure Elements

(i) Identification of Critical Buildings

- Educational Buildings
- Health Buildings
- Other Community Buildings
- Buildings used for Gathering - Cinemas, Marriage Halls
- Religious Buildings – Temples, Mosques, Churches
- Disaster Management Staff Quarters & V.I.P Residences, etc

(ii) Infrastructure Elements

- Water Supply Structures
- Electric Sub-Stations
- Telephone Exchanges
- Railway Stations
- Fire Stations
- Airport Structures, etc.

(iii) Awareness, Incentives & Disincentives to the People



Damaged
POLICE STATION BUILDING AT RAPAR



Retrofitted
POLICE STATION BUILDING AT RAPAR
FLAG HOISTING CEREMONY

AWARENESS CREATION

- **Publications**
- **Public Displays**
- **Demonstrations**
- **Audio-Visual**
- **Trainings and Workshops**
- **Exhibitions**

AWARENESS CREATION

- **4 Shake Table Demonstrations** and video shows
- Displayed messages on hazard resistant construction on **600 state transport buses** in five worst affected districts.
- Seven types of **hoardings** at strategic locations in the state
- Disaster management taken as permanent agenda in **18000 Gram Sabhas** conducted during a period from 12th Jan'03 to 24th Jan'03 and in May '03



Shock No: 11, T.M Collapse, I.M End Wall Cracked



Improved Building Ready For Shock No: 14

AWARENESS CREATION

- Exhibitions conducted on safe construction; disaster reduction; disaster preparedness; progress of GEERP
- **Information dissemination** through
 - Pamphlets, Nirdeshika, posters, seismic construction guidelines by Dr. Arya, training literature, pocket booklets, booklets, handbills, press advertisements etc.
 - CDs on progress, video and audio cassettes on multi-hazard resistant construction using folk music, street plays, dance, jokes etc.
 - A **calendar** has been printed for awareness regarding “Do’s and Don’ts in wake of disasters”.
 - Publication of Plain Truth.

AWARENESS CREATION

EXTRA COST OF EARTHQUAKE SAFETY ELEMENTS IN BUILDINGS

Buildings constructed using the Indian Standard Codes and Guidelines:

Masonry Building

Seismic Zone III	2-3%
Seismic Zone IV	3-4%
Most severe seismic Zone V	4-6%

Reinforced concrete buildings of 4 – 8 storeys

Seismic Zone III	2.6-3.2%
Seismic Zone IV	3.2-4%
Seismic Zone V	5-6%

(in each case, including about 0.7% only for ductile detailing)

*Retrofitting of buildings, not initially designed for earthquake will cost:
2 to 3 times as much as the above mentioned costs.*

CAPACITY BUILDING

- In more than 50 training programmes, 6563 engineers and 29679 masons have been trained
- Workshops conducted for training engineers
- Q&A booklet based on various queries distributed.
- Five Booklets on Reconstruction and Retrofitting guidelines.
- Advertisements in local newspapers on earthquake resistant construction.
- Videocassettes on earthquake resistant designs and techniques shown on local cable television

RECONSTRUCTION HIGHLIGHTS

- Third party quality audit, NCCBM inspected 2,10,210 houses
- Payment of installments after engineers' certification
- Joint ownership of house by husband and wife
- Grievance redressal at village and district levels
- Insurance to 14 types of hazards
- District judge as ombudsman
- Payment made directly in bank accounts
- Excise duty exemption for building materials procured in Kutch
- Minimal relocation and secondary displacement
- Choice of relocation decided by village community
- Multi-hazard resistant reconstruction
- 1082 material banks have distributed over 18 Mn cement bags

Social Buildings through Community Participations

- Village Civil Works Committee constituted for repair of schools in rural areas
- over 42000 primary school rooms repaired so far through the committee
- Ward Civil Works Committee formed to repair schools in urban areas
- 1426 school rooms restored through the committee

A SUCCESS STORY

- A comprehensive reconstruction and rehabilitation program
- Progress during the first two years, no parallel elsewhere
- Awareness, capacity building and information dissemination
- Involvement of expertise and specialized knowledge of institutions and individuals
- Effective community participation
- Medium and long-term perspective

THE CHALLENGES FOR SAFER NON-ENGINEERED CONSTRUCTION IN INDIA AS A WHOLE

BUILDING TYPES IN INDIA

Various Building Type by Wall Materials in India

Wall Type	Number of Housing Units				Damage Vulnerability in MSK Intensity		
	Census 1991		Census 2001		VII	VIII	IX
	Millions	% of Total	Millions	% of Total			
Earthen Walls (mud, unburnt brick)	74.7	38.29	73.80	29.63	M	H	VH
Stone Walls	21.7	11.10	25.48	10.23	M	H	VH
Burnt Brick Walls	68.60	35.18	111.89	44.93	L	M	H
Concrete Walls	3.96	2.03	6.54	2.62	VL	L	M
Wood & Ekra Walls	3.12	1.60	3.19	1.28	VL	L	L
GI & Other metal Sheets	1.01	0.52	1.99	0.80	VL	VL	L
Bamboo Thatch, Leaves etc.	21.63	11.09	26.18	10.51	VL	VL	L
TOTAL	195 (Approx)		249 (Approx)				

INCREASE IN BUILDING CONSTRUCTION

- Increase in housing units per year is 2.5%
- But increase in masonry units about 5 %
- So far the added units are not all earthquake resistant except those which are in the Central Govt. sector. Some State governments do provide ER elements in their buildings.

GOVERNMENT POLICIES & STRATEGIES

- Creation of Disaster Management Authority in 2005 to take care of preparedness & mitigation measures against natural & man-made disasters.
- Creating awareness amongst various sectors.
- Sensitisation amongst various stake holders.
- Demonstrative constructions including retrofitting.
- Training of architects & engineers in earthquake safe design & construction.
- Improvement of building bylaws to include hazard safety in design & construction.
- Training of masons and bar benders through various industrial training institutions and their certification.
- Establishment of Hazard Safety Cells in various States as well as undertakings.
- Inclusion of Hazard safety aspects in the technical education of architects & engineers.

ACTIONS ALREADY TAKEN IN REGARD TO SAFER CONSTRUCTION

- Building codes are being improved though Bureau of India Standards.
- Amendments to the Building Bylaws governing their construction in various levels of Urban & Rural Local Bodies *drafted* and being shared with State Govts. for implementation.
- Addition to professional curricula *drafted* and sent to various Governing Councils.
- The designs of schools & additional school rooms being constructed all over the country have been provided earthquake resistant measures and being executed in all States under the Sarva Shiksha Abhiyan (Education for All Movement).

ACTIONS ALREADY TAKEN IN REGARD TO SAFER CONSTRUCTION

- Construction Industry Development Council established by Planning Commission for training of industrial workers (Programme covers about 50 trades including masons, bar benders, carpenters etc. in which several thousands have already been trained).
- The responsibility has also been placed on the State as well as District Disaster Management Authorities established under the Act of Parliament to work towards Preparedness, Mitigation as well as Response. Safe construction activity including retrofitting of unsafe critical buildings forms an important task. Funds are being allocated under the *five year development plans*.
- A number of four page brochures in simple illustrative form have been prepared and distributed all the country for wider dissemination of safe construction practices to be adopted.

- National effort is being made to save life and reduce trauma.
- The tasks are difficult and time taking but the initial steps are taken.
- Miles to go, just move on and on.....

Chirai Vetu ! Chirai Vetu !!

**THANK YOU
FOR YOUR ATTENTION**

CHALLENGES FOR SAFETY OF NON-ENGINEERED CONSTRUCTION

By

Dr. Anand S. Arya

Padmashree awarded by the President of India, 2002

Professor Emeritus IIT Roorkee,

National Seismic Advisor, GoI-UNDP

Introduction

The following may be listed as the main challenges for achieving safer non-engineered constructions in the earthquake prone areas:-

1. Non-Engineered buildings exist on a massive scale throughout the developing world. The developed countries also have large proportion of existing non-engineered buildings coming down in traditional way through centuries.
2. There is wide spread ignorance about the earthquake risk even in earthquake prone areas. People in general do not believe that a damaging earthquake will occur in their area and destroy their building. They always ask the question: In so many generations before, there has been no earthquake occurrence, why should we be concerned about such an eventuality? Hence, there is a lack of interest in pursuing *earthquake resistant construction*, about which they have also the impression that it will make the construction much costlier.
3. In the developing countries there is a definite *lack of resources*, which include financial capability, availability of building materials, lack of trained workmen involved in the traditional constructions in which one could incorporate earthquake resisting elements, and lack of know-how in general in those who are involved in such construction activities.
4. There are a number of competing societal demands, as for example, improvement in health facilities and education, providing safer drinking water and better quality food and clothing, alleviation of poverty by livelihood generation, building sanitary facilities etc. etc.. In all election times *roti, kapda aur makaan* (Bread, clothing and housing) become the major slogans of the various political parties.
5. Consequently, there is lack on motivation of the part of the governments to include earthquake safety as the major initiative, particularly in view of the fact that although the consequences of a damaging earthquake are serious but frequency of occurrence of such events is very low and the life of the elected governments is only five years!

It has taken more than 50 years in India for the Central Govt. to become proactive in this regard and many of the state governments still need motivation to formulate policies and strategies towards earthquake safe constructions. The situation in other developing countries may be no better.

Approach towards Acceptable Solutions

Starting in 1959 with an all India seminar on earthquake engineering at the University of Roorkee, we made a multi-pronged approach including: research & development, dissemination of the *generated know-how among the scientist, engineers & other professionals*, about earthquake safety measures; covering all structures including Non-Engineered Buildings. Co-operation of structural and geo-technical engineers, geologist & seismologist was

ensured as a result of which the first Indian Standard IS:1893 was brought out in 1962 and the Indian Society of Earthquake Technology established soon after. The first Code of Practice on Design & Construction of Non-Engineered Buildings, IS:4326, was brought out in 1967. The know-how was spread amongst engineering teachers from technical colleges through 2-3 week training programmes held at the University as well as in a number of State capitals. Seismic consultancy was provided to all major engineering projects being taken up in the country under the Five Year Development Plans including major bridges, dams, Industries and atomic power plants. This necessarily included housing for the employees of these undertakings which had to be constructed with earthquake resisting features such as given in figure 1. However, all other constructions whether in private or in the Govt. sector by and large continued in the traditional manner without earthquake resisting elements.

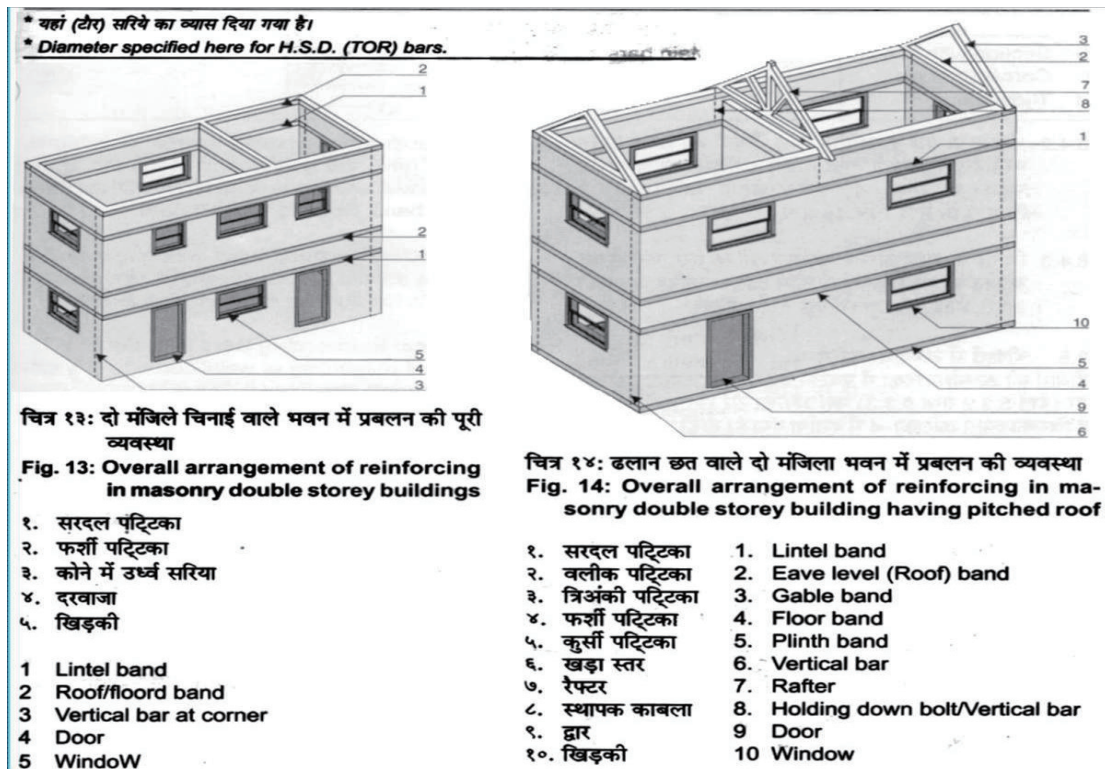


Fig. 1 Earthquake Resistant Masonry Buildings

The real impetus for *earthquake resistant* construction came after the occurrence of a series of earthquakes, namely: Uttarkashi 1991, Killary 1993, Jabalpur 1997, Chamoli 1999 and most damaging earthquake of Kutch 2001. The super cyclone in Orissa in 1998 and the earthquake in Kutch prompted the Central Govt. of India to take up the issue of earthquake safety at the National level and established the National Disaster Management Act, in 2005 which requires the establishment of following major administrative institutions:-

- National Disaster Management Authority at Central level for looking after Preparedness and Mitigation
- State Disaster Management Authority at the States to look after all pre and post disaster Management.
- District Disaster Management Authority to take disaster management action at the local level.

Techno-Legal Regime

It has been realised that the Development Control Regulations and the Municipal Building Bylaws are deficient since they do not deal with the safety of habitations including buildings from the impact of disasters. This has

been attended to in an affective manner and Model Regulations developed by the author through a National Expert Group which have been sent to all States for implementing in the Building Bylaws in such a way that all building plan approvals compulsorily require the provision of earthquake safety elements in all buildings. To strengthen this effort and to make it practically feasible, large training programme has been undertaken to train practising architects and engineers including Municipal engineers in the subject of earthquake protection engineering.

Training of Building Construction Workers

It has been considered necessary to give appropriate safe construction training to masons, carpenters, bar benders and construction supervisors, since these are the tradesmen involved in the construction of non-engineered buildings in the informal sector without any reference to architects and engineers. Experience of reconstruction after the Kutch earthquake, wherein more than 200,000 residential buildings, schools, health facilities etc. had to be constructed, shows the importance of such a training and more than 35000 masons were trained during the reconstruction process. The houses were constructed through non-government organisations, but mostly by the beneficiaries themselves maintaining strict quality controls while disseminating earthquake resistant technology to the rural and semi-urban population..

Preparation & Publication of Guidelines

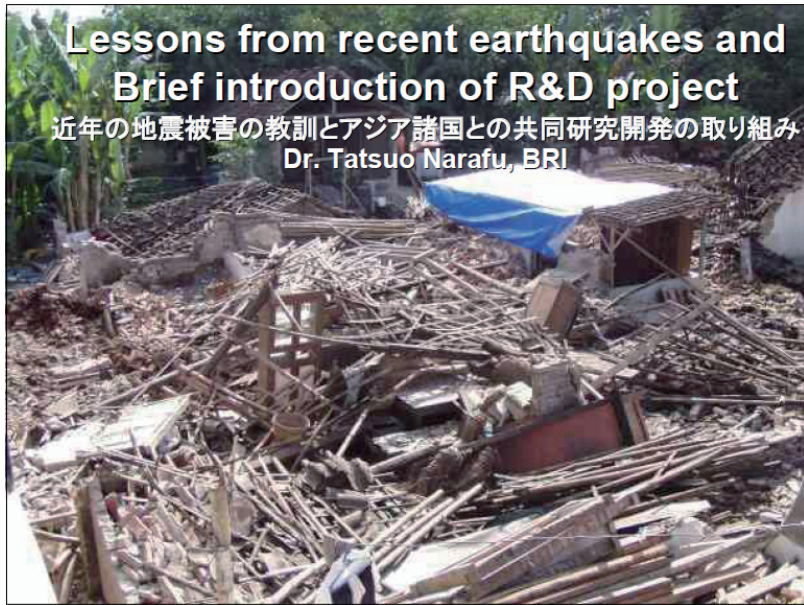
In meeting the challenges of safer non-engineered construction effectively, the availability of simple, practically feasible and inexpensive construction guidelines can not be over-emphasized. A few formal guidelines which are legally acceptable, are listed in Annexure 1.

Closing Remarks

It is indeed a most challenging task for achieving earthquake safety of Non-Engineered Buildings for a variety of reasons as highlighted in this paper. However, a proactive effort is to be made at the National as well as at the local levels for creating awareness and sensitisation among the various stake holders. Also, the available technical know-how has to be brought to the notice of the top level and also down to the building construction workers, immense improvements can be made towards minimising the impact of future earthquakes and reducing the resulting trauma to the individuals and the society as a whole. In any big task, initial steps have always to be , then we gradually move towards the final aim. In our Vedic knowledge, there is an important instruction “*Chirai Veti Chirai Veti*” which means move on and on and on....

Annexure 1



1. IS: 1893-2002 “*Criteria for Earthquake Resistant Design of Structures, Part 1 (Fifth Revision)*” July 2002.
2. IS: 4326-1993 “*Earthquake Resistant Design and Construction of Buildings- Code of Practice (Second Revision)*” October 1993.
3. IS: 13828-1993 “*Improving Earthquake Resistance of Low Strength Masonry Buildings-Guidelines*” August 1993.
4. IS: 13827-1993 “*Improving Earthquake Resistance of Earthen Buildings-Guidelines*” October 1993.
5. IS: 13935-1993 “*Repair and Seismic Strengthening of Buildings-Guidelines*” November 1993.
6. Arya A.S., et al., “*Improving Earthquake Resistance of Buildings – Guidelines*” by Expert Group, pub. by Building Material and Technology Promotion Council (BMTPC), 1999.
7. Arya A.S. et al, *Earthquake Resistant Non-Engineered Construction*, Monograph pub. by International Association for Earthquake Engineering, 1980, Revised 1986. (translated into Spanish for use in various Spanish countries).
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10. Arya A.S., *Control on Quality of Construction in Earthquake Affected Areas of Gujarat*, printed in June 2001.
11. Arya A.S., *Guidelines for Construction of Compressed Stabilised Earthen Wall Buildings*, printed in December 2001.
12. Arya A.S., *Guidelines for Cyclone Resistant Construction of Buildings in Gujarat*, printed in December 2002.
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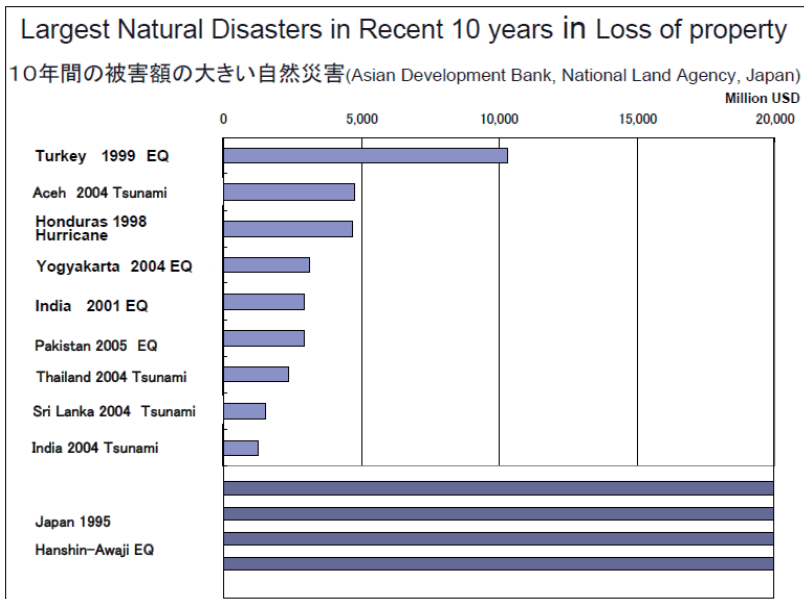


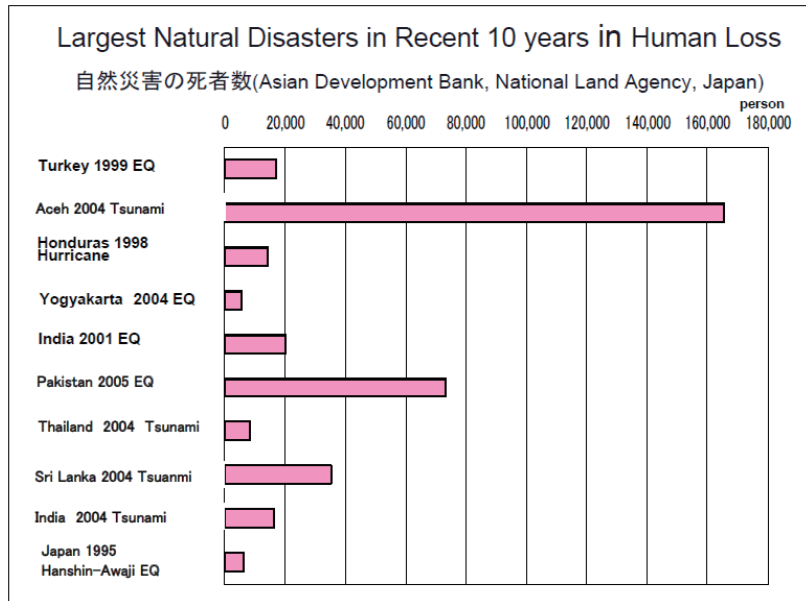
Introduction

地震による悲惨な被害、建物倒壊が死傷者発生 of 主要要因

- Earthquakes cause serious damages to human societies
- Collapse of Houses and Buildings is the main cause of human casualties





Various non-engineered houses damaged by earthquakes(3)

ノン・エンジニアド住宅の地震被害例

**Brick houses in
 Indonesia**
 レンガ造(インドネシア)



**Concrete Block
 houses in Pakistan**
 コンクリートブロック造
 (パキスタン)



Various non-engineered houses damaged by earthquakes(1)

ノン・エンジニアド住宅の地震被害例

**Houses with
 mixed materials
 in Pakistan**

混構造(自然石、
 切り石、コンクリートブ
 ロック、レンガの
 混合:パキスタン)



**Reinforced
 Concrete in
 Pakistan**
 RC造(パキスタン)



How large is the intensity of EQ motion?

地震の強さ?

- Buildings collapsed, but furniture withstand!! ??

建物は倒れても家具はそのまま!??

(Primary school in Bantul, Province of DIY, Indonesia)



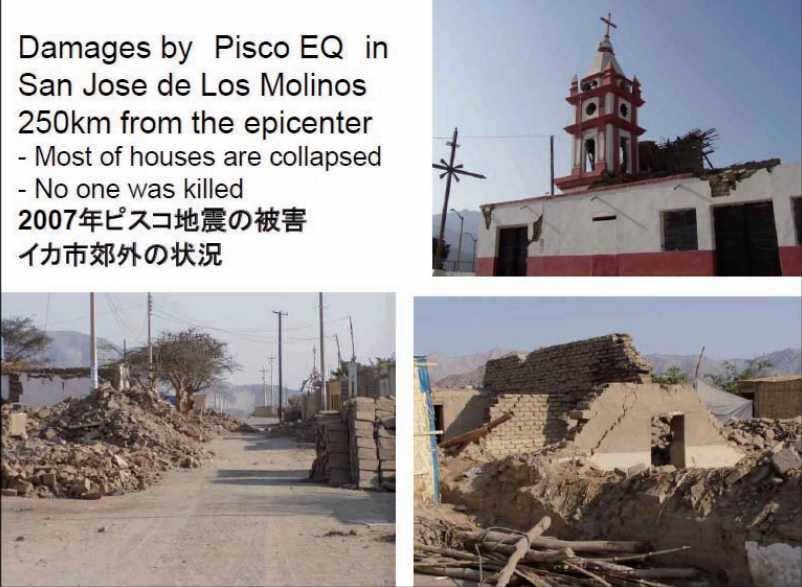
Almost no falling down of furniture
 Also TV, pictures and clocks remained
 家具、テレビ、額、時計も大丈夫

Primary school in
 Bantul, Indonesia

Houses in Bantul, Indonesia



Damages by Pisco EQ in
 San Jose de Los Molinos
 250km from the epicenter
 - Most of houses are collapsed
 - No one was killed
 2007年ピスコ地震の被害
 イカ市郊外の状況



Comparison of damages
 Pisco EQ 2007 and Central Java EQ 2006
 ピスコ地震とジャワ島中部地震の比較

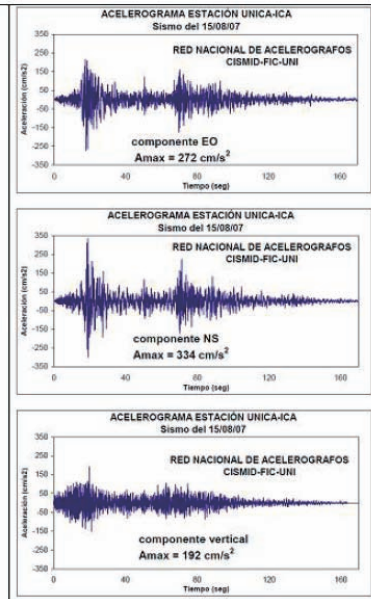
Year	Earthquake (M)	Country	Casualty		Damage to houses	
			Dead	Injured	Collapsed	Damaged
2007	Pisco (M=8.0)	Peru	519	1,844	52,887	22,939
2006	Central Java(M=6.3)	Indonesia	5,778	46,305	139,859	468,149

12

-The long duration of shaking motion with two peaks caused large damages to houses and buildings

長くピークの2つある地震動が建物被害を大きくした

- The two peaks gave people time to escape from their houses before the collapse (proved by interviews to residents)
2つのピークの間避難することが可能であった



Comparison of two types of structures non-engineered and engineered ノンエンジニアドとエンジニアドの比較

Aspects/items	conventional/non-engineered	Engineered
Materials	Available in the area No control	Usually controlled in size, quality, etc.
Construction workers	Non/semi-skilled workers	Skilled workers
Technical intervention	No/little intervention	Intervention in design, construction procedures, etc.
Users/residents	Low/middle income people	Middle/high income people

- Conventional/non-engineered constructions are completely different from engineered ones
- Each type needs its own appropriate strategy

14

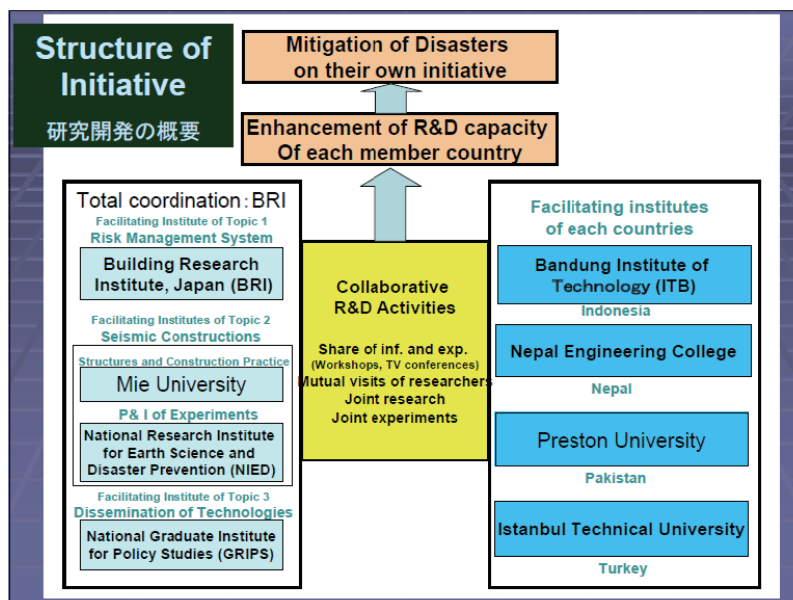
Japanese Initiative for Mitigation of Earthquake Disasters managed by BRI focusing on Non-engineered construction <Comprehensive Approach> ノンエンジニアドの地震被害軽減を目指した研究開発

- Collaborative Research and Development Projects with research institutes in four Asian countries and four Japanese institutes supported by Ministry of Education, Culture, Sports, Science and Technology (MEXT)
- Duration: three years (2006 – 2008)

15

Japanese Initiative for Mitigation of Earthquake Disasters managed by BRI <Comprehensive Approach>

- Participating organizations: National Institute for Earth Science and Disaster Prevention (NIED), National Graduate Institute for Policy Studies (GRIPS) and Mie University
- Counterpart countries: Indonesia, Nepal, Pakistan, Turkey and Peru

- **Feasible and Affordable Seismic Constructions** 実践的な耐震工法
To develop appropriate seismic structures and construction practices, which will be expected to be accepted by communities, and to verify them by a series of joint experiments
- **Strategies for Dissemination of Technologies to Communities** 技術の普及方策
To develop strategies and tools for dissemination of technologies to people and communities such as consecutive workshops in communities, demonstrations, capacity development of housing facilitators
- **Risk Management System** リスク管理システム
To develop systems for evaluation of seismic risks with assumed earthquakes, conditions of buildings etc., and to manage them through development of new strategies to mitigate disasters

Topic 2: Feasible and Affordable Seismic Constructions
Component 2-1:
**Study on Feasible and Affordable Seismic Constructions
through Full Scale Shaking Table Experiments**
実践的な耐震工法の実験研究

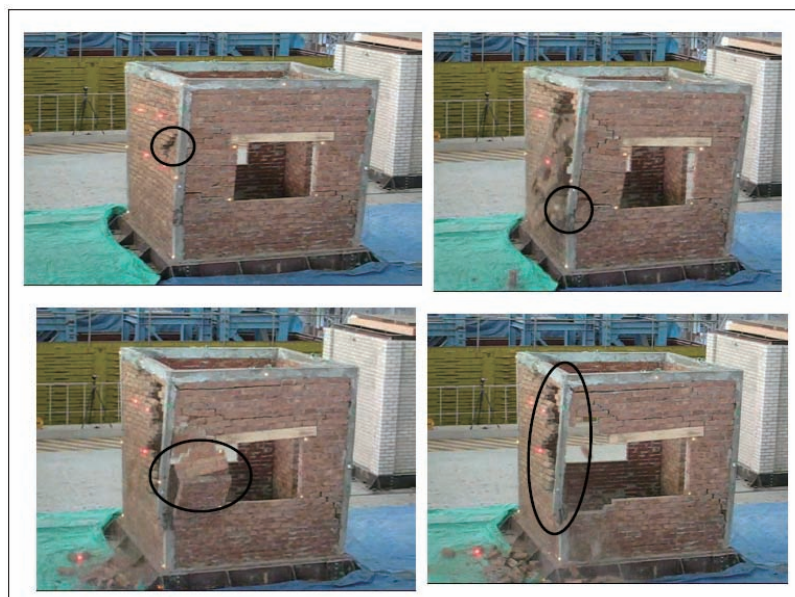
- First experiment: December 2007 on Brick masonry structure
- Second experiment: July 2008 on Confined Masonry structure
- Bricks were imported from Pakistan and mortar mixture followed the usual practice in Pakistan.



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Shaking table experiment on
confined masonry on July 4, 2008
コンファインドメゾンリーの振動台実験


- At National Institute for Earth Science and Disaster Reduction (NIED) in Tsukuba, Ibaraki, Japan



Main causes of damages

被害の主要な原因

- Separation of RC frames and walls because of insufficient bonding between walls and RC members
RC部材と壁との分離



An example of damaged house in Banda Aceh

RC部材と壁との分離の被害の実例





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Construction works to be improved in Aceh

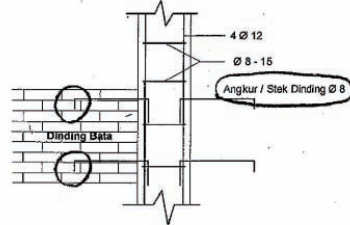
改善すべき施工方法

- Anchor of brick walls to columns is also a critical point



ANGKUR / STEK DINDING

Titik Sopi-Sopi
(16 X 6) + (3 X 3) = 96 + 9 = 105 (bh)



Same problems in West Sumatra 西スマトラの同様の問題



25

Another Main cause of damages もう一つの被害の原因

- Failure of a RC
column because of
insufficient
compaction of
concrete
コンクリートの充填不足



Same problem in West Sumatra 西スマトラの同様の問題

Compaction is very difficult work on site as the section of RC
members are quite small and only simple tools are available



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Topic 2: Risk Feasible and Affordable Seismic Constructions
 Component 2-2:
Bridge between Engineering and Construction Works
 工学と建設工事の間のブリッジ構築

- Monitoring Construction Practices on Site
- Elaborating Recommendations which could be accepted and adopted by Local Workers

Proposal of feasible and affordable seismic construction
 実践的な耐震工法の提案

Poster Presentation ポスター展示の概要

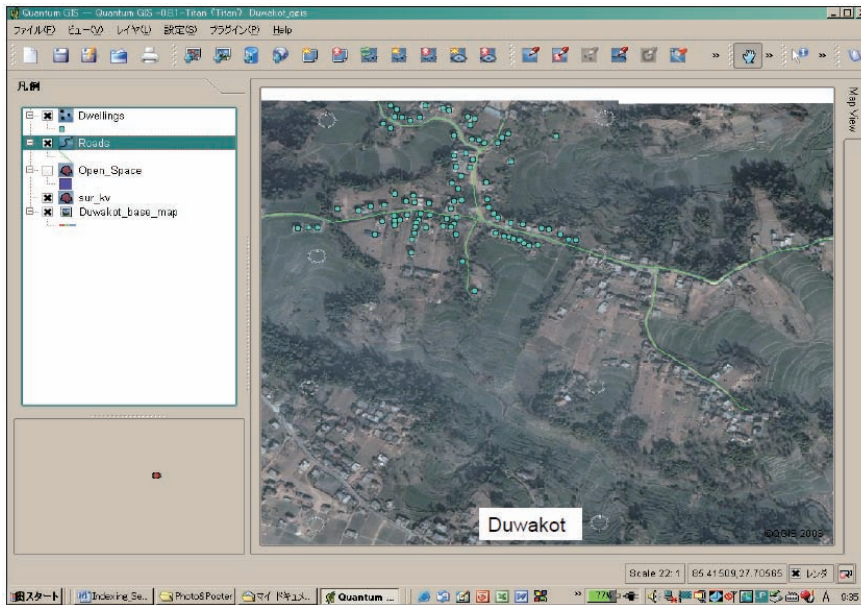
Collaborative R&D Project 研究開発の概要

- Risk Management System
- Feasible and Affordable Seismic Constructions
- Strategies for Dissemination of Technologies to Communities

Activities for Reduction of Earthquake Disasters
 連携・協力機関の地震防災の活動紹介

- United Nations Center for Regional Development (UNCRD)
- Asia Disaster Reduction Center (ADRC)
- Railway Technical Research Institute (RTRI)
- Ex-Volunteers Association for Architects (EVAA)

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**7-th General Assembly of Asian Seismological Commission: Pre-Symposium Training Course
“Microtremor Array Exploration Technique - SPAC Method -”**

International Institute of Seismology and Earthquake Engineering (IISEE), Building Research Institute (BRI), Japan and Seismological Society of Japan (SSJ) have hold a two days training course on “Microtremor Array Exploration Techniques - SPAC Method -” preceding 7-th General Assembly of Asian Seismological Commission (ASC2008) in Nov. 23th and 24th, 2008 at IISEE in Tsukuba, Japan. The course included lecture and practice on Spatial Autocorrelation Method. Computer program necessary for analysis that are made by the staff of IISEE and a free software of UNIX emulator on Windows (Cygwin) are provided to the participants.

SSJ has fully granted thirteen participants who came from Armenia, Bhutan, Egypt, Georgia, India, Indonesia, Kazakhstan, Myanmar, Nepal, Palestine, Uzbekistan and Yemen and covered almost all over Asia.

Procedures of analysis

1. Resampling/Map-projection
2. Calculation of SPAC coefficient
3. Determination of Dispersion Curve
4. Numeric Search of V_s Structure

Example

**International Institute of Seismology and Earthquake Engineering,
Building Research Institute, Japan**
<http://iisee.kenken.go.jp/>
<http://www.kenken.go.jp/english/index.html>

Collaborative R&D Project for Disaster Mitigation on Network of Research Institutes in Asia
「地震防災に関するネットワーク型共同研究」

Topic 2: Feasible and Affordable Seismic Constructions
「実践的な耐震工法の研究開発」

- **Component 2-1**
Study on Feasible and Affordable Seismic Constructions
実践的な耐震工法のための実験研究
- **Component 2-2**
Bridge between Engineering and Construction Works
工学と建設工事との間のブリッジ構築
- **Component 2-3**
Development of Simple and Affordable Seismic Isolation
簡易でローコストの免震技術開発




□ **Component 2-1:**
Study on Feasible and Affordable Seismic Constructions
「実践的な耐震工法の研究開発」 / 三重大学、防災化学技術研究所、建築研究所

➤ **Full Scale Shaking Table Experiments** 「実大振動台実験」

- **Experiment 1: December 2007 on Brick masonry structure**

- **Experiment 2: July 2008 on Confined Masonry structure**

- **Experiment 3: December 2008 on Confined masonry structure**
by Shaking Table in Peru

➤ **Several Methods are applied to analyze the results**

□ **Component 2-2 :**
Bridge between Engineering and Construction Works
「工学と建設工事との間のブリッジ構築」

- **Monitoring Construction Practices on Site**
建設の実情把握
- **Elaborating Recommendations which could be accepted adopted by Local Workers**
現場での実践可能な改善提案





□ Component 2-3 :
Development of Simple and Affordable Seismic Isolation

「簡易でローコストの免震技術開発」

➤ **Research Topics**

- Development of low cost isolation devices
- Low cost rigid base
- Simple construction procedures

➤ **Activities**

- Experiments on devices
- Workshops for dissemination
- Pilot project



Shaking Table in BRI used for the experiments



Component 3

Strategies for Dissemination of Technologies to Communities (by GRIPS)

- To develop guidelines to disseminate and broadly apply the recommended technologies for retrofitting of conventional houses at community level.
- Survey on the risk perception (2007-2008)
- Development of Guidelines for Dissemination of Technologies (2007-2008)
- Pilot Projects (2008)

Component 3: Strategies for Dissemination of Technologies to Communities



Survey on seismic risk perception

2007-2008, GRIPS

- This survey aims to better understand the earthquake risk perception of the residents, national/local government officers, and house builders/head masons, and how they want to avoid such perceived risk.
- Joint research with:
 - Institute of Technology Bandung (ITB), Indonesia
 - NSET-Nepal, Nepal,
 - Preston University, Pakistan
 - Istanbul Technical University (ITU), Turkey
 - Centre for Appropriate Technology & Development (CATD), Fiji
 - Philippine Geographical Society (PGS), Philippines
 - Indian Institute of Technology Bombay (IITB), India, and
 - University of Tsukuba, Japan

UNCRD – Indexing Poster Presentation

国際連合地域開発センター ポスター紹介



Disaster Management Planning Hyogo Office
United Nations Centre for Regional Development (UNCRD)
国際連合地域開発センター防災計画兵庫事務所

Gender in Community Based Disaster Management

CBDM

ジェンダーに配慮した
コミュニティ防災

UNCRD has so far worked on CBDM
UNCRDはこれまでCBDMに取り組んできました

▶ Why CBDM? なぜCBDMなのか？

Local community peoples are; 地元の人たちは
Potential Victims 潜在的な被害者

Potential Disaster Management workers in the
whole process (preparedness, response and
recovery) すべて
でのプロセス(災害準備、対応、復興)における潜在的な防災従事者



UNCRD Kumamoto Centre for English Development / UNCRD
ジェンダーに配慮したコミュニティ防災 (CBDM)
兵庫信託基金アクションリサーサー

ジェンダーに配慮したコミュニティ防災 (CBDM)
兵庫信託基金アクションリサーサー

アクションリサーサー
HIF IX (第一回)

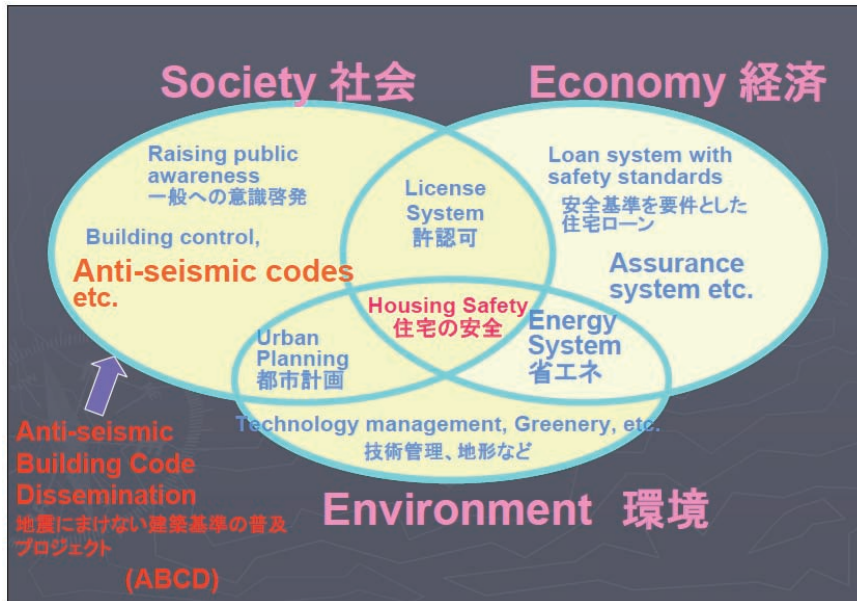
HIF ワークショップ

HIF IXへの取組み

PROJECT INFORMATION

Housing Earthquake Safety Initiatives

地震にまけない住宅計画



The poster features the UNCRD logo and the title '地震にまけない建築基準普及(ABCD)プロジェクト'. It includes several sections:

- 概要 (Overview):** A photograph of construction workers on a site.
- 目的 (Purpose):** Text explaining the goal of disseminating anti-seismic building codes.
- 活動内容 (Activities):** A list of activities including '普及啓発' (dissemination), '調査研究' (research), and '協力関係' (collaboration).
- 活動実績 (Achievements):** A bar chart showing the number of dissemination events and research activities.
- 活動地域 (Activity Areas):** A map of Japan highlighting the project's reach in various regions.

Thank You

**PROGRAMS IN EARTHQUAKE DISASTER
MANAGEMENT LIFE CYCLE
(CASE: YOGYAKARTA EARTHQUAKE)**

BY
IMAN SATYARNO

DEPARTMENT OF CIVIL AND ENVIRONMENT ENGINEERING
GADJAH MADA UNIVERSITY, INDONESIA

2008

Background

- Like other regions in Indonesia, Yogyakarta has high potential earthquake disaster
- The population is quite dense
- Community knowledge and awareness on earthquake resistant house are limited
- Potential losses and casualties are huge

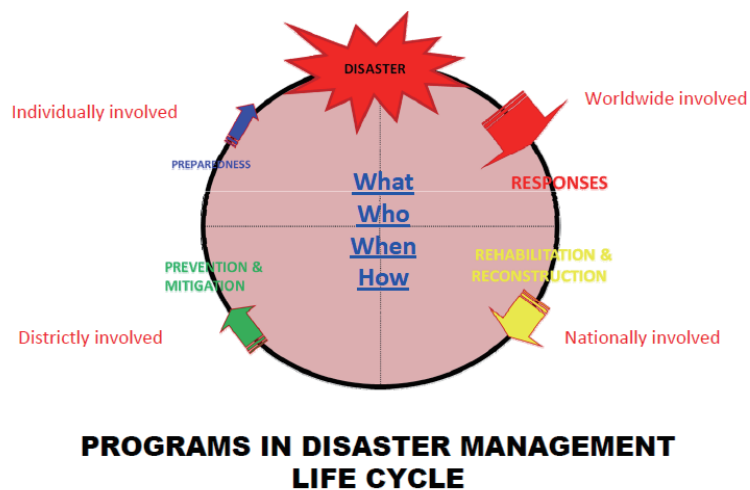
FACT:

YOGYAKARTA EARTHQUAKE, 27 MAY 2006

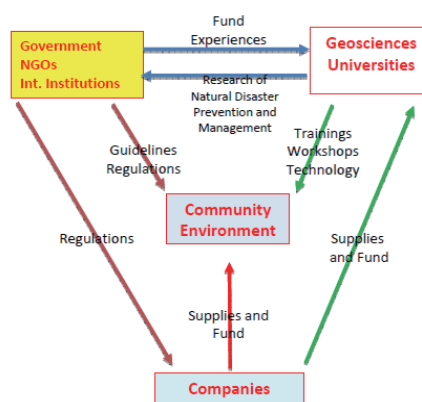
- More than 200,000 houses were collapsed or damaged
- About 50,000 were injured
- Around 6,000 people lost their lives
- More than US\$ 2.92 billion losses
- At least US\$ 0.54 billion central government budget was spent for rehabilitation and reconstruction

Programs Objectives

- Increase community knowledge and awareness on earthquake resistant house
- Suppress the number of losses and casualties
- Preserve national budget



PROJECT IMPLEMENTATION PLAN TROUGH COMMUNITY EMPOWERMENT PROGRAM



RESPONSE

What
Who
When
How

- Ground acceleration [records](#)
- Buildings damage or [collapsed](#),
- People got killed or [injured](#)
- People need accommodation and facilities [immediately](#):
 - Building Occupancy Resumption [Program](#)
 - Temporary [shelter](#)



REHABILITATION AND RECONSTRUCTION

- Damaged buildings are [rehabilitated](#)
- Collapsed buildings are [reconstructed](#)



PREVENTION AND MITIGATION

- Updated Guidelines and Codes
- Trainings of construction workers
- Rapid Visual Screening
- Detail Evaluation
- Retrofit and Strengthening
- Demolition



PREPAREDNESS

- Lesson learned
- Awareness
- Drill and Simulation



What

- Guidelines
- Materials
- Equipments



Who

- Community
- Universities
- Non Government Organisations
- Government
- International Institutions
- Companies



When

- Started
- Finished



How

- Scheme
- Coordination
- Procedure
- Evaluation
- Report
- Record
- Research

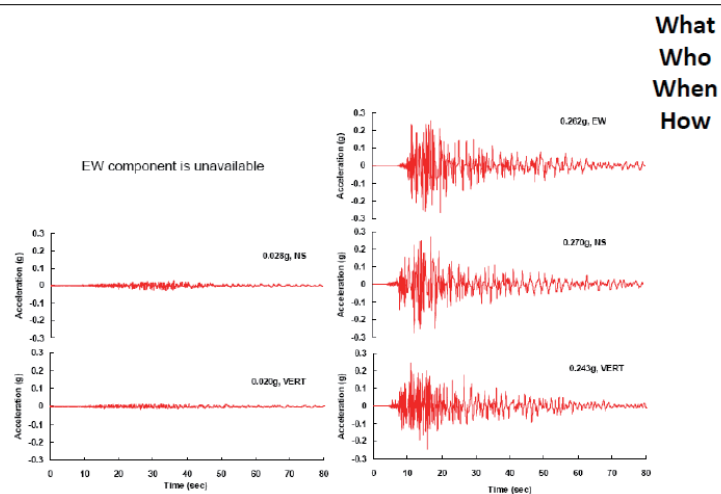


Figure 4.10 Acceleration at BJI (mean value) Figure 4.11 Acceleration at YOGI (mean value)

Elnashai et.al (2007)





Massive losses



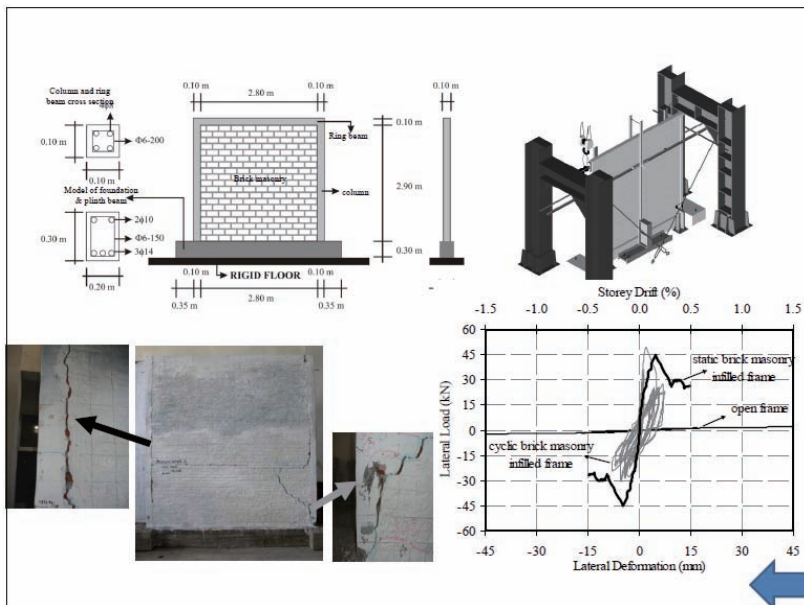
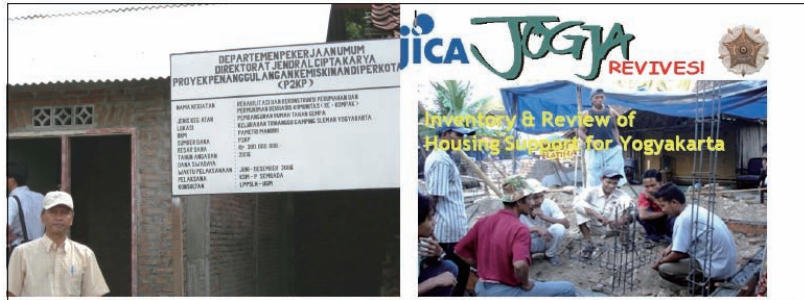
Enormous casualties



No more belongings nor families







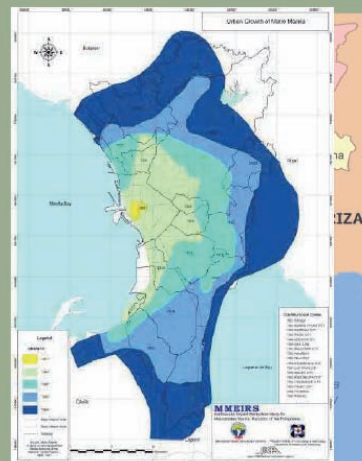
Company participation in disaster mitigation

CHALLENGES AND OPPORTUNITIES OF INFORMAL HOUSING FOR EARTHQUAKE SAFETY IN THE PHILIPPINES: NOTES FROM THE FIELD

Dr. Marqueza L. Reyes, EnP
School of Urban and Regional Planning
University of the Philippines
International Symposium on Earthquake Safe Housing,
GRIPS, Tokyo
November 29, 2008

Increasing Urban Disaster Risk of Metro Manila, Philippines

- Rapid population growth and urbanization from the 1950s
- Uncontrolled land use and development
- High rate of increase of housing and land prices
- Inadequate provision of basic social services and infrastructure, including housing
- Growth of slums and informal settlements or informal housing
- 30% of residents live in slums and informal housing (ADB)
- 76% of housing stock did not comply with the building code (1990, UNCHS)



Informal Housing in the Philippines

- Dwellings that are rent-free with or without the consent of legal owners (or informal settlements)
- Occupies land that is not owned by the residents (called informal settlers).
- Self-built housing – constructed by family members
- Built by a construction foreman (unlicensed skilled technician) and not designed or supervised by registered professional engineers/architects
- Formal housing sector – contains unknown percentage of non-engineered housing





Non-Engineered Housing in the Philippines

- Preliminary insights from the case of Bgy. Rizal, Makati City, Metro Manila, Philippines.
- Non-engineered housing is associated with informal housing.
- Have been living there for as long as 40 years.
- Some have been given titles to their land by the government.
- Informal housing, in the urban context) is characterized by slum conditions, over-congestion and blight.



Non-Engineered Housing in the Philippines



- Unreinforced/Reinforced concrete type – maybe supervised by a construction “foreman” (not registered engineers but may have long experience)
- Light weight materials – looks deceptively temporary

Non-Structural Challenges of Informal Housing to Earthquake Safety

1. Unwillingness to abide by the building code – may not be intentional and not a matter of choice for informal settlers
 - Security of land tenure – How would informal settlers be motivated to invest in properly constructed houses if there is always the possibility of being resettled in another location?
 - Issue of affordability – financial capacity to reconstruct and willingness to pay for earthquake-resistant construction
2. Level/Degree of awareness and knowledge about earthquakes – there are many misconceptions about EQ
3. Low awareness on earthquake-resistant construction of informal settlers

Non-Structural Challenges of Informal Housing to Earthquake Safety

4. Fatalistic and cavalier attitude towards earthquake disasters – act of God, taking no responsibility (nobody is to blame)
5. Motivations to act towards earthquake adaptation – typhoons and floods are more frequent, but flood adaptation techniques have not been common
6. Vulnerability of non-engineered housing in the formal sector – only ¼ of building stock in Metro Manila are code compliant
7. Vulnerability of engineered housing - may be below minimum standards of building code (cutting corners to minimize cost, no building permits) and may be poorly constructed due to poor workmanship and construction practices.

Opportunities of Informal Housing in Earthquake Safety

1. **Resettlement?** – question of earthquake safety of low-cost housing arises, aside from thorny social acceptance issues
2. **Rebuilding and redevelopment?** – engineered, high-density, multi-family dwelling, community-driven master planning
3. **Retrofitting of unreinforced/substandard RC frame structures** (add to this, the low-cost housing and socialized housing common in the country)– may require a different set of guidelines, cost effectiveness and techniques for earthquake safety.
4. **Community-based retrofitting ?** – participatory approaches since most houses are self-built/built by family members, requires training
5. **Community-based training and capacity building programs on making houses safer**, e.g. bolting of furniture and fixtures.
6. **Effective information, education and communication strategies** to increase awareness, knowledge and motivations towards **earthquake safe housing**.



International Projects for Community-Based Disaster Management

Kenji Okazaki
Professor
National Graduate Institute for Policy Studies
(GRIPS)

Why Community Based Disaster Management (CBDM)?

- Local people respond first and are the last remaining to rebuild safer communities
- Disasters reflect local conditions, of which local people are well ware
- Participatory decision making process leads to ownership of risk and actions

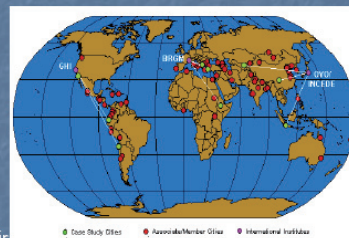
RADIUS Project (1996-1999) by UN/IDNDR Secretariat

Motivation of local people for urban seismic reduction

- Capacity building
- Local leadership and ownership
- Awareness raising

Nine (9) case study cities:

Addis Ababa (Ethiopia), Antofagasta (Chile),
Bandung (Indonesia), Guayaquil (Ecuador), Izmir
(Turkey), Skopje (TFYR Macedonia), Tashkent
(Uzbekistan), Tijuana (Mexico), Zigong (China)



The stakeholders identified seismic risk and developed action plans by themselves.



A training seminar in Japan



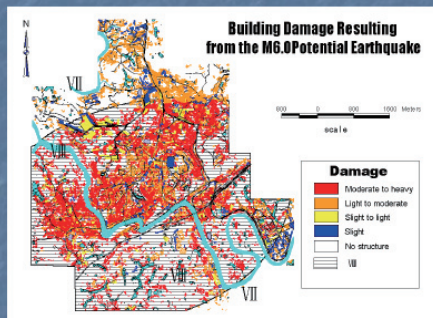
Interview with Armed Police, Zigong Brigade



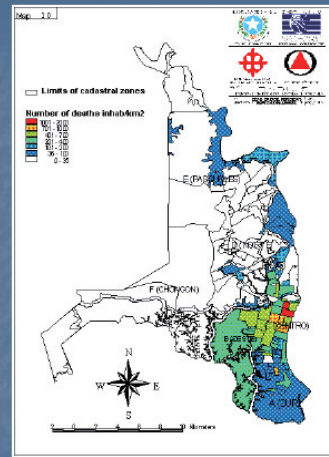
Disaster seminar for students in Bandung



Action Plan Workshop in Tashkent



Building damage estimation (Zigong, China)



Human loss (Guayaquil, Ecuador)

Development of earthquake scenario

- Damage estimation of buildings and infrastructure
- Review of the damage estimation based on the interviews with various stakeholders.
- A journalist writes a scenario, which describes the progress of situations (after an hour, day, week, month) as well as response to them, with layman's words.

Comparative analysis of vulnerability of Cities

Seeds for GESI (Global Earthquake Safety Initiative) Method



Simplified tool for damage estimation

Input: Area, population, building types, (ground conditions)

Output: Building damage, Human loss/injury

Casualties (Deaths) Distribution

City Name: Kobe	Earthquake Name: Kobe Earthquake	Color ID	Automatic Range	Max
Population Counts: 1219000	Occurrence Date:	From	To	From
Building Count: 425200	Occurrence Time: 5:46	a	0	119
Depth: 77	EQ Magnitude: 7.2	b	119	239
Depth of Mesh(km): 2	EQ Direction relative from Ref.Mesh: North West	c	239	358
Depth of Mesh: 51	EQ Distance(km) to Ref.Mesh: 1	d	358	478
Initiator Equation: Fukushima & Tanaka: 1990				358

Return Use Automatic

Population & Casualty Summary

Area Name	Day Pop	Night Pop Counts	Deaths	Injury
Wgce	118279	128199	876	10340
North	88770	71116	367	5013
Terumi	198403	220724	1709	19340
Sunna	162510	164983	1378	14753
Nagata	106903	101738	1586	14383
Hyogo	114870	117585	1293	12258
Center	152300	120199	1359	13044
Neda	125768	115029	1740	15309

population counts are 1219000 and 1% death

Map Using Automatic Range (Cell characters)

RADIUS initiative is sustainable

- Some local partnership sustains and efforts continue
 - Skopje adopted RADIUS recommendations in Master Plan.
 - Guayaquil created a new Division for Disaster Mitigation.
 - Bandung changed its building permit process.
 - Antofagasta generated US\$ 1 million to remove schools from Tsunami areas.
 - Tijuana created NGO called RADIUS.
 - Experience is transferred to neighboring cities.



School Earthquake Safety Initiative (SESI), UNCRD

- Partnership projects with NSET-Nepal (1999 -)
- Hyogo-Kerman Friendship Fund (Iran, 2005-)
- Human Security Fund (Fiji, India, Indonesia, Uzbekistan, 2005 -)



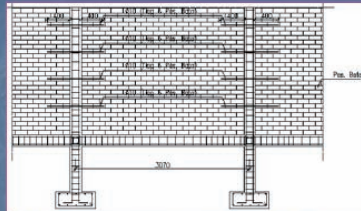
Retrofit



Retrofitting project of SD Padasuka II, Indonesia

- Strengthen school buildings (retrofitting)
- Technology transfer and training of masons/engineers
- Disaster education and mitigation culture

Bandung, Indonesia



Retrofitting design development (Krishna Pribadi)



Retrofitting work (Krishna Pribadi)



Finishing work (Krishna Pribadi)



Classroom after retrofitting work (Krishna Pribadi)



Tashkent, Uzbekistan

Retrofitting work by Tashkent City Project



Workshop and seminar



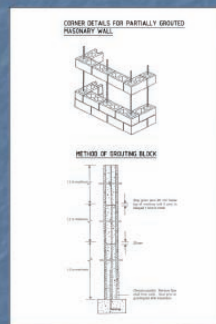
Retrofitting works

Fiji

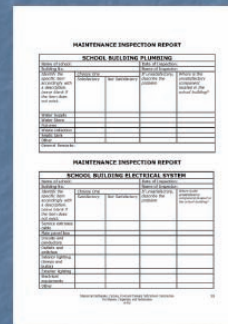
Training manual development
for masons, carpenters and technicians



Structures at risks



Retrofitting work



Maintenance and checklist

India

Community Seminar

Shimla, India
Date: 2007.04.18-2007.04.18
Organized by: Shimla District Commissioner,
DIPECO, SEEDS, UNCRD



Students at the seminar



First Aid demonstration

Pantanka New-Life Project (Gujarat, India)

Rehabilitation after Gujarat Earthquake of January 2001
Focus on non-engineered construction



UNCRD with
EDM, NCPDP,
NGOs Kobe,
NSET-Nepal,
and SEEDS

Training
Education
Awareness
Confidence

Motivation and capacity building by Shake-table Demonstration (by UNCRD + NSET Nepal)

Afghanistan Training and Livelihood Initiative, Kabul, 2003



Practical guidelines (English and Persian) was developed under the project.

After Bam Earthquake, Iran, 2004



Demonstration was conducted at the house model exhibition center.

Demonstration at World Conference on Disaster Reduction (WCDR) Kobe, 2005



Masonry (bricks)



Wooden structure

Sustainability in Community-Based Disaster Management (2002-2005) by UNCRD

Year 1 (2002):

Framework for sustainable CBDM through 6 case studies

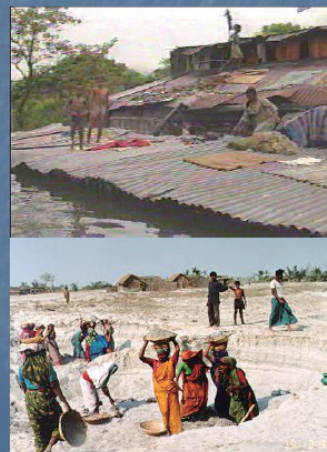
Year 2 (2003):

Development of Guidelines for Sustainable CBDM

Year 3 (2004):

10-year review of CBDM activities, Partnership building, Publication of **User's Guide**,

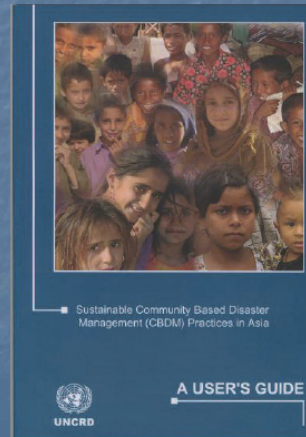
Partnership among international organizations, local NGOs, national/local governments, and experts



User's Guide for CBDM

- Generic Guidelines

This provides a complete discussion of the factors, best practices and examples that will enhance sustainability of CBDM.
- User-Specific Tools
 - Policymakers
 - National Disaster Managers
 - Local Disaster Managers
 - Trainers
 - Community Workers



Collaborative R&D Project for Disaster Mitigation on Network of Research Institutes in Asia 2006-2008

- **Strategies for Dissemination of Technologies to Communities**

To develop guidelines to disseminate and broadly apply the recommended technologies for retrofitting of conventional houses at community level.

 - Survey on the risk perception (2007-2008)
 - Development of Guidelines for Dissemination of Technologies (2007-2008)
 - Pilot Projects (2008)

Keys for Sustainable CBDM

- Participation and ownership of a program
- Risk communication and motivation
- Affordability and practicality of non-engineered technology
- Multi-disciplinary cooperation among stakeholders
 - >>> Local partnership + regional/international partnership

Disaster Management Policy Program

A Master's degree program by GRIPS, BRI, and JICA

- BRI (Building Research Institute) and JICA conducted the International Training Course on Earthquake Engineering and Seismology every year since 1962.
- In 2005, the training course has been upgraded as the master's degree program "Earthquake Disaster Mitigation" of GRIPS. It is supported by UNESCO.
- In 2006, a Tsunami course was added. In 2007, a flood management course was added. Approx. 35 students are accepted every year.



More than 1,200 graduates in 95 countries (2005)

● : Epicenters of earthquakes 1990-1999
○ : Number of Graduates from the training course

Disaster Management Program

- Target Groups:
Technical officials, engineers, or researchers in the fields of earthquakes, tsunamis, water-related disasters, and disaster risk management policy, in developing countries
- Degree:
Master of Disaster Management
- Course Duration:
One year
(October–September)
- Language of Instruction:
English



Shelter Rehabilitation and Community

Stefano Tsukamoto
Tokyo University of Foreign Studies
Peace & Conflict Studies

Natural & Human Disaster

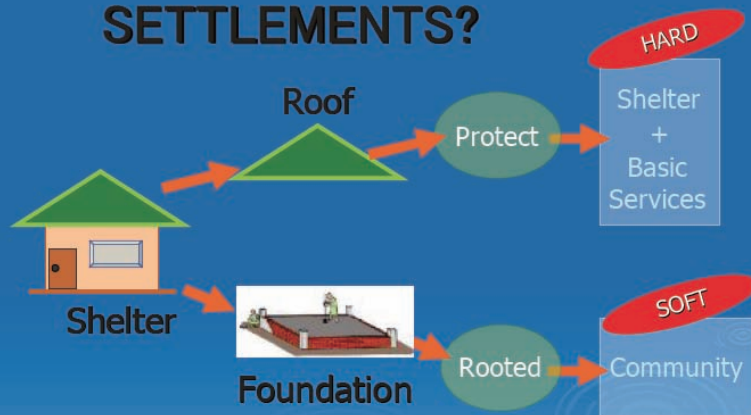
Natural Disaster (climate changes)
Earthquake • Typhoon, Floods, Cyclones, Tsunami

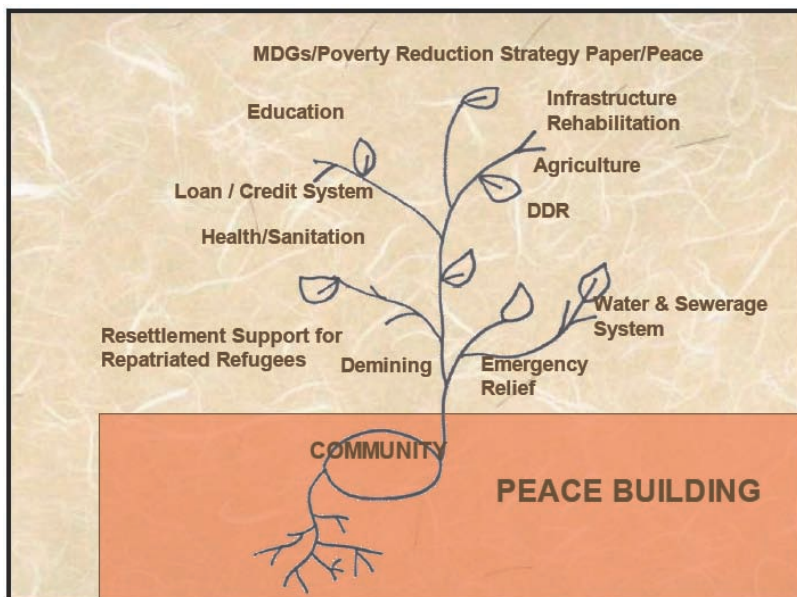
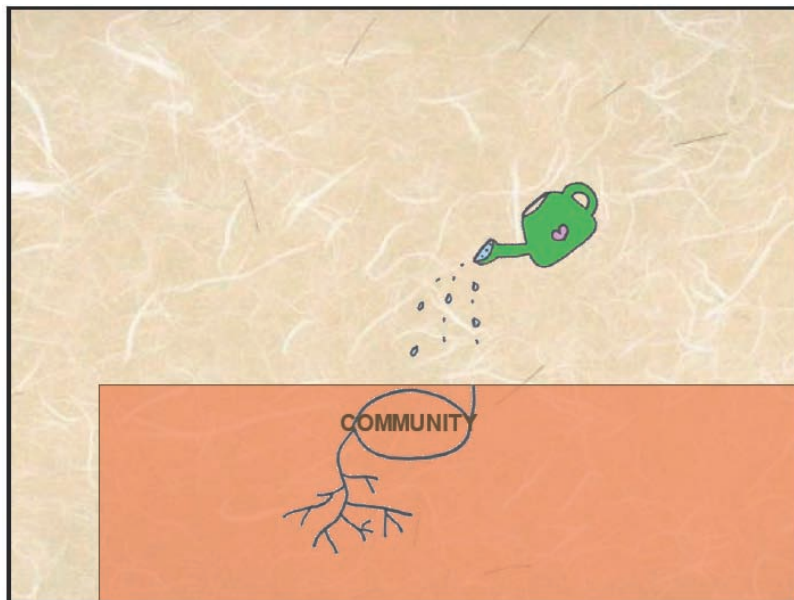


Human Disaster: Slum Evacuation • War • Conflict

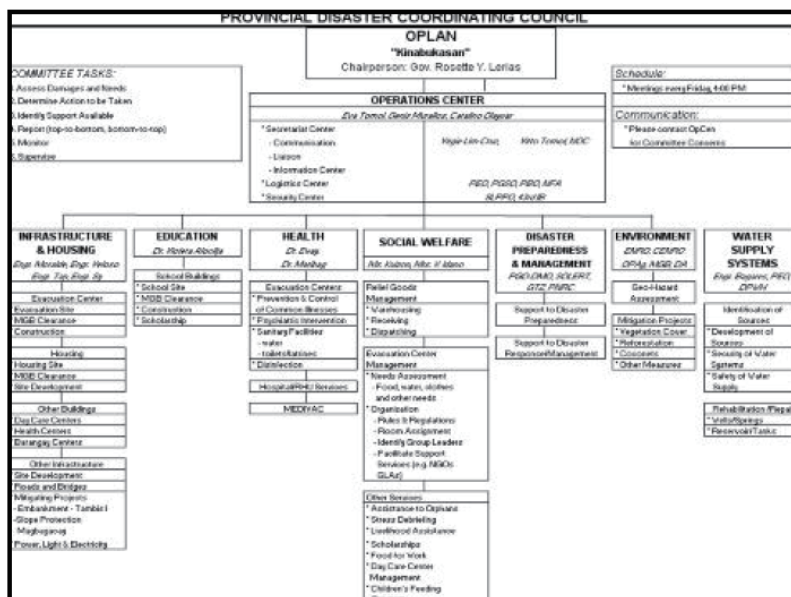


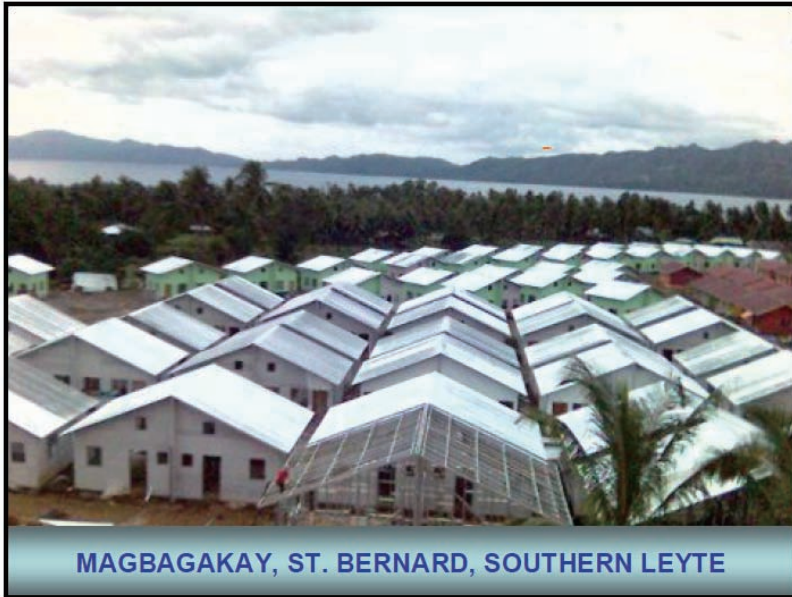
HUMAN SETTLEMENTS?





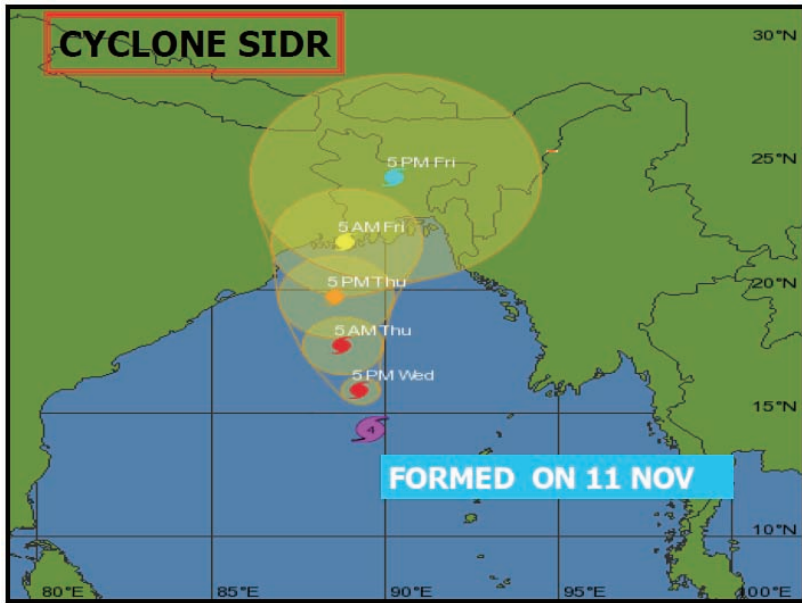






破壊された住宅の再建





CYCLONE 1991 AND 2007

Ser	Event	1991	2007
1.	Death Toll	1,38,882	3363
2.	Missing	20,000	871
3.	Crops Damaged Area	3,50,000 Acres	2472942 Acres
4.	Areas Affected	15,000 Sq km	30 Districts

DAMAGED HOUSE

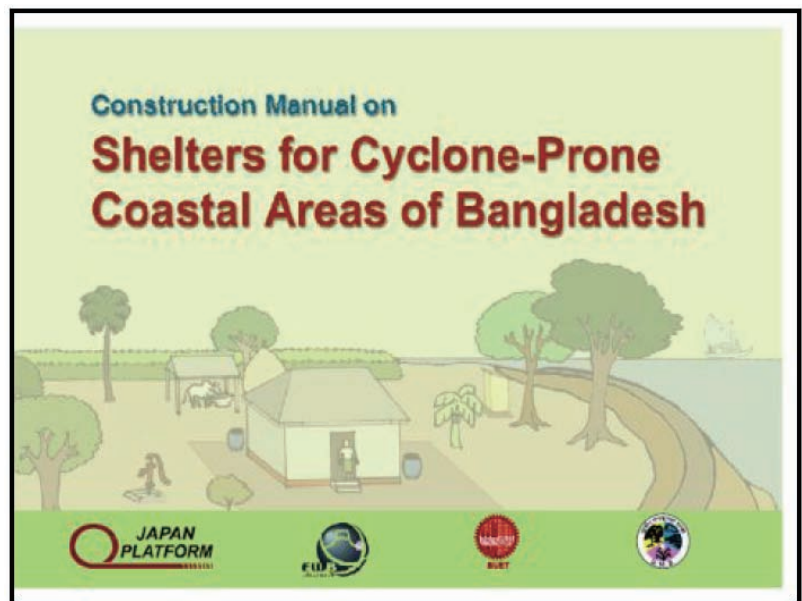
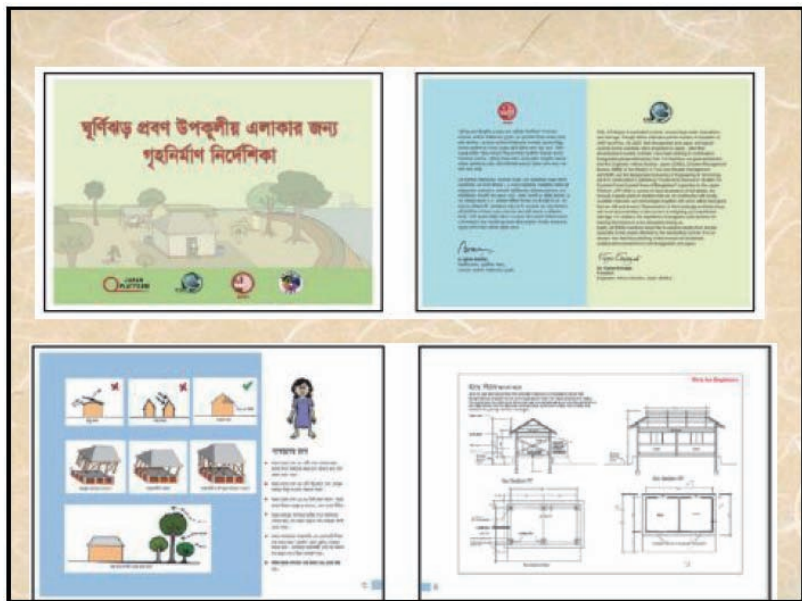


NO FOUNDATION



DAMAGED SCHOOL





Wind Load

- The slope of the roof should not be too steep, otherwise the roof will face high compressive pressure and may collapse.
- The slope of the roof should not be too low, otherwise the roof will receive high suction and may blow off.
- To balance the wind load the slope should be within 25 to 30 degrees.
- The house has to be properly anchored to the foundation, otherwise the house may overturn.
- The frame of the house has to be braced and stiffened. A properly braced house is most likely to overcome a strong storm.
- Trees can act as shields for houses when they are built at a safe distance.

3

Proposed Type 2

Only for Engineers

All wooden framed structures with GRC Slab for roof, alternative the roof can be a galvanized steel profile the one with corrugated metal sheet. The structure will be anchored to concrete foundation as per the specification with the help of RCC beams. After construction of foundation of the house proceed the jobs.

Section YY

DETAIL OF THE FOUNDATION

6

Footing for wooden posts

Follow these steps after following the concrete steps

- Concrete slabs upto the plinth level will be provided as the footing for the wooden post. It will be at least 6 inch X 6 inch in section. During concrete casting a 10 mm MS flat bar with size 12 inch dia hole will be inserted vertically. A pin-bolt may be used to maintain the verticality. At least 6 inches of the flat bar has to be embedded in the concrete.
- U shaped flat bars are stronger than angle flat bars. The wooden post should be connected to the flat bar with nuts and bolts. Pneumatic drill machine will be used for making holes in the wooden post. The flat bar should preferably be made of galvanized iron otherwise it has to be painted. It is important for protection against the stability of coastal atmosphere.
- For the posts, except for the corner ones, precast footing may be used. It will be at least 6 inches X 6 inches in section. These are available in the market.

12

Frame Structure

- All the beams and atleast the interior columns should be made of timber. The outer columns may be wooden or concrete (pre-cast mix)
- All the joints between beams and columns will preferably be connected by bolts 0.5" dia MS bolts should be used.
- The joints may also be connected by sink lashed joints are preferred because they are stronger
- The space between the columns should be strengthened by using braces. These braces should be connected by nailing
- The wooden beam and the Precast RCC joints should be connected by angles and bolts. (See the picture)

Connections for wood to posts and/or beams using bolts

Connections for wooden posts and beams using nails

Connections for pre-cast column and wooden beams using angles and bolts

House frame structure

Constructing ramp

14



Thank you!

Findings from field monitoring of house reconstruction after Central Java Earthquake

- 中部ジャワ地震住宅再建事業モニタリング報告 -

2008年11月29日
International Symposium 2008 on Earthquake Safe Housing


NPO法人都市計画・建築関連OVの会 (EVAA)
迫田 恵子

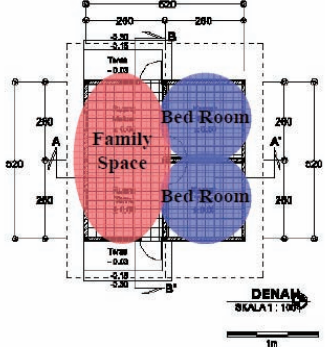
Summary: 復興による変化の概要 (Summary of Improvement through the reconstruction work)

Progress through the reconstruction
(今回の復興事業における進歩)

		Reconstruction work action		
住宅 (House)	設計(工学論理) (Engineering theory)	構造部材(柱梁) ・図面の出現 Appearance of structure parts (column, beam...) & drawings	<ul style="list-style-type: none"> ● Distribution of Working drawings ● Disseminate Confined Masonry ● Set Key requirements (Construction rule) 	
	+	建築資材 (Materials)	適正資材の規格化と使用 Standardize of material	<ul style="list-style-type: none"> ● Set Key requirement (Material standard) ● Material distribution (*By some donors)
	+	施工技術 (Workers' skill)	労働者の施工技術や知識向上 Improvement of const. Workers' skill & knowledge	<ul style="list-style-type: none"> ● Training for households & construction workers ● Knowledge sharing through poster, booklet and etc

典型的な復興住宅事例 (Common style of the reconstruction house)





▲ 典型的な復興住宅事例
(Example of reconstructed house)

Source: Field survey

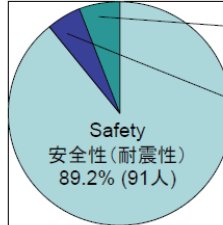
住民・労働者の意識 (Earthquake resistance awareness among inhabitants & workers)



<住民の優先事項(地震後)>

Priority for the house owners (Post-earthquake)

- The first priority for the house owners is "SAFETY".
- ⇒ Very natural



Construction speed
竣工スピード
4.9% (5人)

Available cost
5.9% (6人)

<労働者の意識>

Construction workers impression for the required skill level of the reconstruction work

- 85%* of construction workers didn't feel technical difficulty for the reconstruction work.

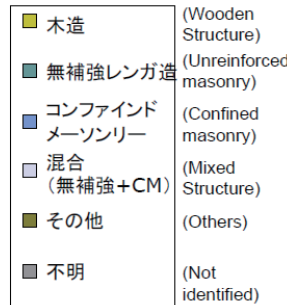
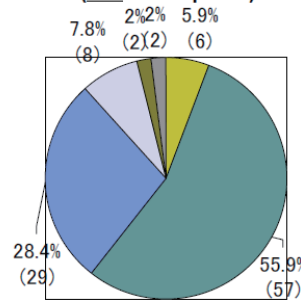
Source: Field survey

Progress①工学論理の導入 (1/2) Improve (Introduction of Engineering theory)



<構造(地震前)>

Construction (Pre-earthquake)



Source: Field survey

⇒ Though the reconstruction, almost all the houses became Confined masonry. 地震後はほぼ全てがコンファインドメーソリー(補強レンガ造)。

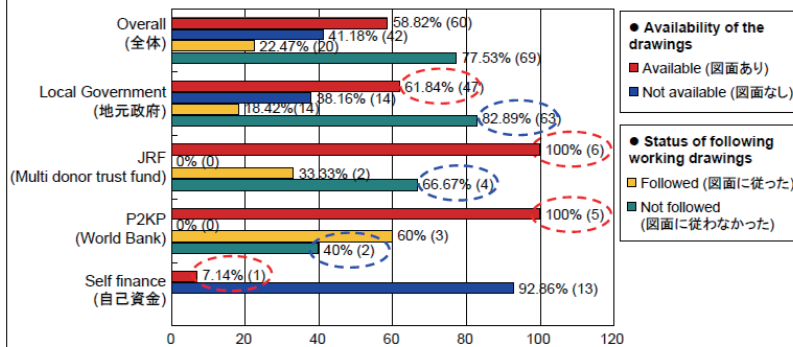
- Another improvement: Utilization of working drawings

Progress①工学論理の導入 (2/2) Improve (Introduction of Engineering theory)



<図面の有無(地震後)>

Availability of working drawings (Post-earthquake)



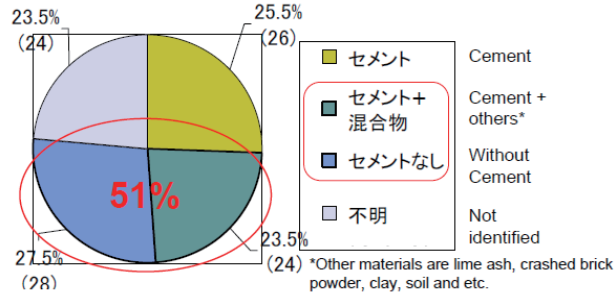
Source: Field survey

Progress②建築資材の規格化 (Standardized size/quality of materials) Improve



<目地材(地震前)>

Joint materials (Pre-earthquake)



Source: Field survey

- The dimension of iron bars were standardized as 10 or 12 mm. (使用鉄筋径は12mmと指定。)

Progress③施工技術 (Construction workers' skills) Better?



Exposed iron bars



Main structure parts with inadequate dimension



Not compacted concrete



- Installation process is one of the big problem. (ノン・エンジニアドに工学的側面を持ち込んだということで一定の成果が認められたが、施工技術の伸びは不明。)

Source: Field survey

Left Issues:労働者間の技術差 (Level gaps among construction workers)



Professionals



Amateur



Source: Field survey

- Construction workers' skill vary a lot.
- After renewing many houses, there would be only few chances of construction work. ⇒No chance utilize the trained knowledge & skill through reconstruction work. ⇒We need comprehensive solution.

Implementation of earthquake safer housing through technological and social approaches



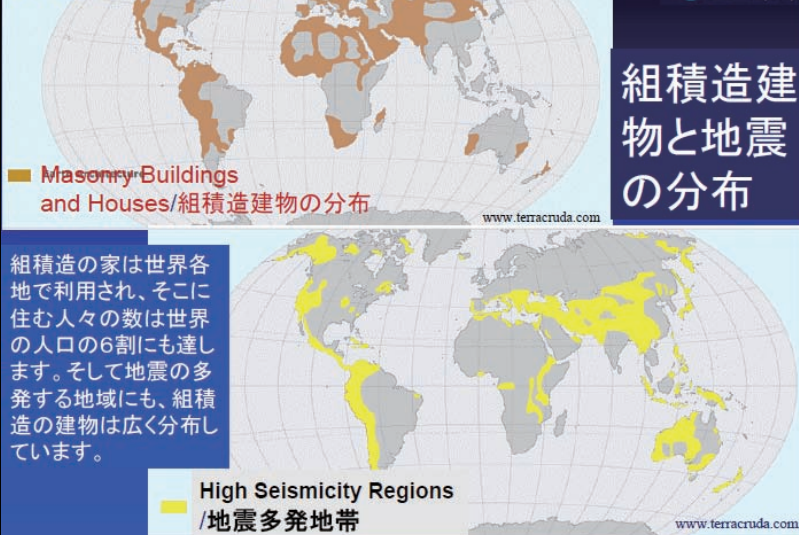
Kimio MEGURO



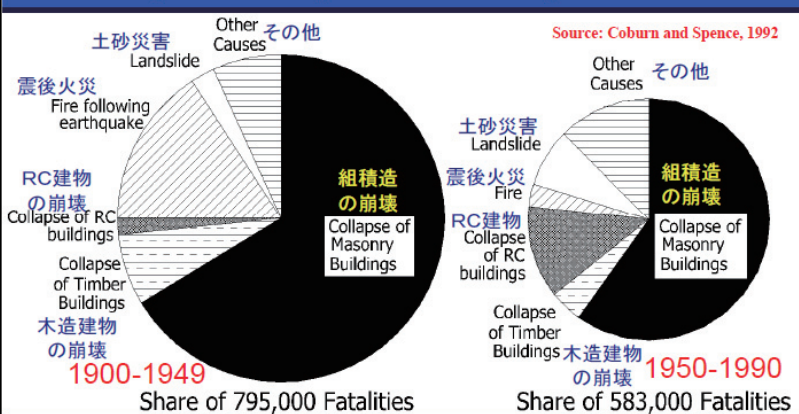
Director/Professor

**International Center for Urban Safety Engineering
Institute of Industrial Science
The University of Tokyo**

Comparison of distribution of masonry houses and high seismicity regions



Most of the casualties due to earthquakes are caused by the collapse of masonry houses.



世界の地震による犠牲者の多くは組積造建物の崩壊によって発生しているのです

Promotion of disaster mitigation countermeasures

Researchers and engineers tend to use **new and advanced technology** without considering **local condition and situation**. However, ...

Key Words

- ◆ **Local Availability /Applicability**
- ◆ **Local Acceptability**

Local Availability/Acceptability

- ◆ **Technical Aspect**
 - **method applicability**
 - **material availability**
- ◆ **Social Aspect**
 - **cultural acceptability**
 - **economical acceptability**
 - **acceptable promotion system**

Most important issues

- **Increase of disaster imagination capability**
(It's impossible to prepare for unimaginable situation.)
- **Good/proper structural codes**
(The codes that are not followed are bad codes.)
- **Implementation system of the codes**
(quality control system of design and construction, education/re-education of engineers, good workmanship, etc.)
- **Cares for existing structures, especially built before the establishment/revision of the codes**
(seismic capacity evaluation and retrofit: methods and implementation system, etc.)

by K. Meguro (University of Tokyo)

Promotion of disaster mitigation countermeasures

We should pay much attention to

- ◆ Local Availability
- ◆ Local Acceptability

also, to

- ◆ Decision/Policy Makers

We have proposed to use PP-bands to retrofit masonry...

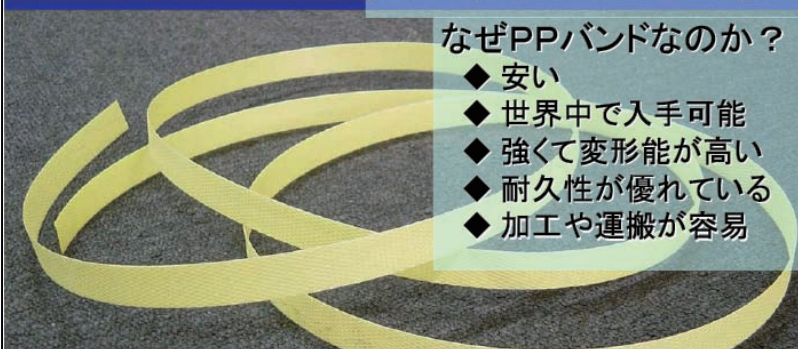
PPバンドを用いた補強法の提案

Why should PP-band be used?

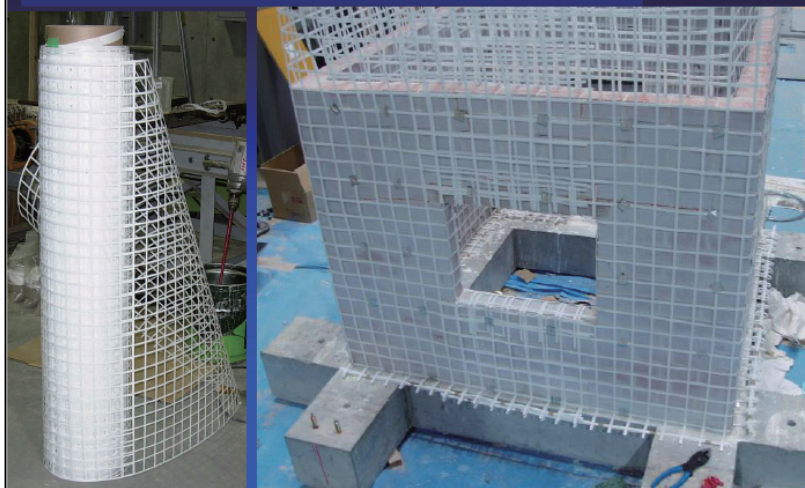
- ◆ Cheap
- ◆ Worldwide available
- ◆ Tolerates large deformations
- ◆ Durable
- ◆ Easy to handle and transport

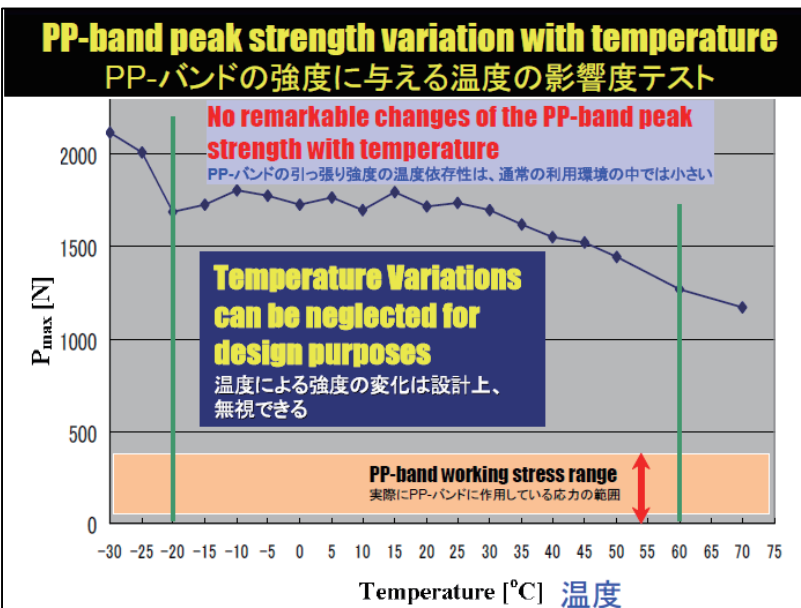
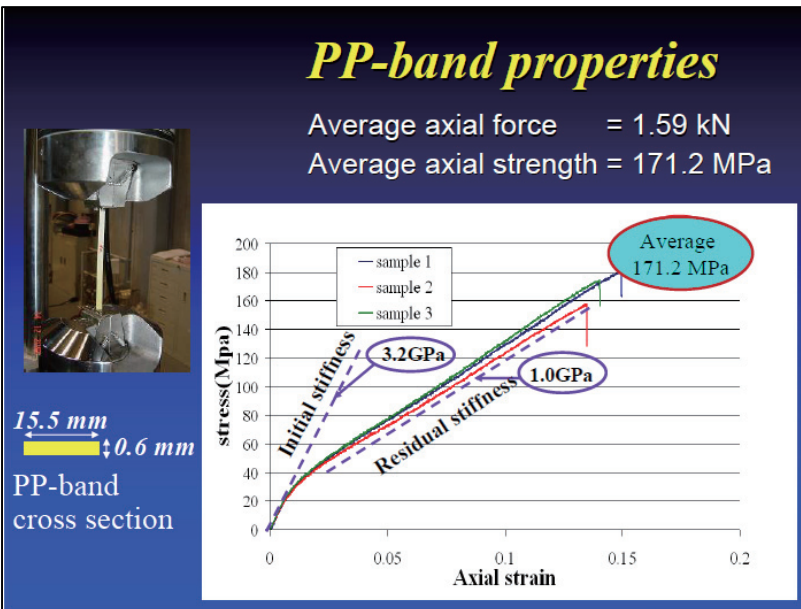
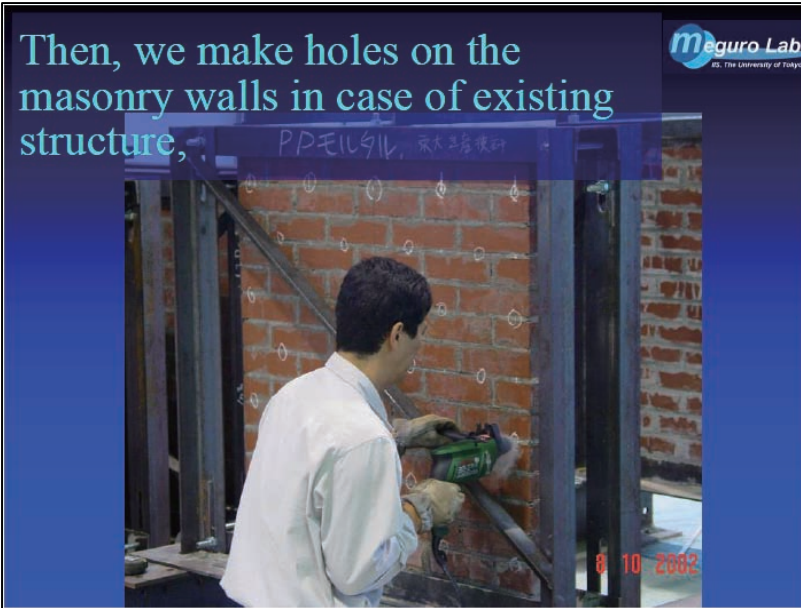
なぜPPバンドなのか？

- ◆ 安い
- ◆ 世界中で入手可能
- ◆ 強くて変形能が高い
- ◆ 耐久性が優れている
- ◆ 加工や運搬が容易



...and retrofitted them with PP-band meshes.





Panelists

Dr. Iman Satyarno / Lecturer, Gadjadara University, Indonesia

Dr. Marqueza Reyes / Assistant Professor, University of the Philippines

Dr. Kimiro MEGURO / Professor, Tokyo University

Dr. Kenji OKAZAKI / Professor, National Graduate Institute for Policy Studies

Mr. Toshiya Tsukamoto / Deputy Secretary General, NPO Engineers without Borders, Japan

Dr. Tatsuo NARAFU / General Coordinator of Collaborative Research and Development Project

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イマン・サティヤルノ

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塚本俊也

コーディネーター: 共同研究開発プロジェクト代表

榎府 龍雄

パネルディスカッション議事要旨

▶ 中部ジャワで学んだ事・ノンエンジニアに関する事の補足 (イマン)

・地震の被害軽減のために、まず、ガイドライン、2つめがソーシャライゼーション、3つめが実行＝インプリメンテーション。これらのステップを注意深くデザインする必要がある事を学んだ。

・第一に、実行出来ない様な難しいガイドラインは創らない。

・次に、収入の低い人達や教育の低い人達に、どのようにガイドラインを普及させていくかが問題である。ジョグジャカルタでは絵や図を使って理解の向上を図っている。

・次いで、実行の面では労働者自体の問題・建築資材の質の2点がある。コミュニティ・エンパワメント・プログラムにより、ファシリテーターの大学生の協力の下、約 20 万戸の住宅を自分達で造った。

・2、3千万個の新しいレンガを用意するのは時間が掛かりすぎるので、建築材料は中古或いはリサイクルしたレンガで、それらの使い方を学生が指導した。

▶バングラデシュでの経験（塚本）

- ・バングラデシュで、現地の実情を反映していない国際機関のマニュアルが政府承認を受けられなかったという経験がある。現地のレベルで、問題を自ら解決する方法が色々あるので、マニュアル作成の段階から現地の人達とのネットワークを強めていく必要があると考えている。
- ・国際機関は頭ごなしのマニュアルを提供してきたところが在るのではないかと考えている。現地の人達はかなりのキャパを持っているので、バングラディッシュ工科大学とのコラボレーションは非常に良かった。

▶地元の人達のポテンシャル（楢附）

- ・アチェ、中部ジャワ、ピスコなどの地震でも、現場でさまざまな工夫をしながら、試行錯誤を行っている。地元の人達はかなりのポテンシャルがあると今回の報告でも感じている。

▶バランガイのインフォーマルハウジング（マルケサ）

- ・マカティのジェシヤルでは、地震に強い住宅づくりのために、地震が来る前のコミュニケーション・地震に強い住宅の技法をインフォーマルハウジングに導入する活動が問題となった。
- ・一軒、一軒をレトロフィットするのではなく、コミュニティ全体を再開発する手法を探った。都市の再開発やコミュニティのマスタープランが受け入れられるような状況になって来たので、広範囲に亘って様々な人々が参加するコミュニティの再開発のプロセスを採用した。
- ・インフォーマルなコミュニティ全体を扱うことで、一軒、一軒をレトロフィットする以上の成果が得られたのではないかと考えている。

▶地元の人々のポテンシャルを生かす・引き出す戦略についての補足（岡崎）

- ・ジョグジャカルタの復興は比較的上手くいっていると思う。また、グジャラート地震の復興はかなり上手くいっていると思う。当然、地震後であり意識が高まっているという要因があると思う。一方、アチェの場合は津波被害が大き過ぎて復興については上手くコーディネート出来なかった。
- ・インドネシアのバンドンの様に、今まで一度も地震の経験が無いところで人々の耐震意識を高めていくかが今後の課題ではないかと思う。
- ・コミュニティ防災や、震動台の実験も効果があるが、手間や限られた人にしか広がらない限界があり、無数にある既存住宅の耐震性向上には社会的仕組みの変革が求められる。
- ・目黒先生の指摘は非常に良いと思われるが、地震の被害を受けた人に扱いの差を付けるのは政治的にも難しいと思われる。本当に住宅を良くした人には報いる姿勢を明らかにしないと住宅の耐震補強を拡充するのは難しい。

- ▶ノンエンジニアード、インフォーマルの対策を考えるには工学技術より社会的システムの比重が大きいと感じている。(榎府)

- ▶工学を定着させる社会的システム(目黒)
 - ・工学・社会システムの合わせ技と災害イマジネーションの教育が重要になる。地震の被害を受けてしまった時に自分の周りで何が起こるか、具体的に想像できる力が無いと対策を講ずることは出来ない。
 - ・政治家・研究者・行政・マスコミ・一般市民がそれぞれのレベルで災害イマジネーションが不足している。災害イマジネーションを高めるとともに、防災に尽力した人々の努力を明らかにし、報われる状況を早く作ることが重要。
 - ・地震が起こりやすい国の、地震が起こりやすい場所で住宅を建てて、地震に際して、きちんとした耐震住宅とそうでない物の差を明確にして普及に繋げるといったことも国に要請している。

- ▶インドのグッドプラクティス(アリア)
 - ・震災の経験を基に、耐震化の方法を村人達に訴えたうえで、住宅の再建・建築を行っている。
 - ・グジャラート地震では、防災当局が再建後もサポートを行っており、現在、州全体の学校の耐震補強を行っている。また、政府の防災管理の役人と共にこれらを行っている。
 - ・被災地で制度的な形をつくって今後の啓発活動につなげているのが重要である。
 - ・現在、他の州に対しても教育を行おうとしており、震災はあったが自分自身は地震体験は無かった地域でも減災の措置を採り始めている。これらの州省でも防災省などを設立する動きが出始めている。
 - ・防災省のトップは地域の首長なので、被災後も様々な政策や戦略を採り続けることが出来る。
 - ・インドでは津波の早期警戒システムの配備を準備している。サイクロンや高波に対してもアンテナを用意している。
 - ・日本にも学びながら、インドでは登録・軽減・教育・トレーニングの各分野に取り組んでいる。これは、どの国も見習うべきである。

会場からの質疑

佐々波

- ・途上国の低所得階層の耐震補強に向けて、NGOがどの程度参加できるかに深い興味を持っている。
- ・NGOのポイントとして大学等との連携が挙げられる。住宅問題と関連して、市政府・中央政府の協力、企業の支援などが可能性として考えられるのではないか。

斉藤

- ・日本でも耐震補強が必要な既存の建物が多く問題となっている。子供の教育を通じて耐震補強の大切さや地震の悲惨さを訴えると、親は子供のために耐震補強をしたいと思うという、教育に地震防災の意識を啓蒙する試みがあり、これらは非常に有効だと考えている。

ファイナルコメント

イマン

- ・国際機関、NGO、様々な政府や大学、コミュニティ、企業が一緒にワーク・トゥギャザーし、お互いに助け合いながら住宅の耐震化を進める必要がある。
- ・それは大学やコミュニティ、NGO、政府単独では出来ない。一つの地域、国、全世界でレッツ・ワーク・トゥギャザーが必要。

マルケサ

- ・メロマニラのインフォーマルハウジングの防災についてはジレンマがある。1. インフォーマルハウジングは地震による被害が大きい。2. メロマニラの人口の35%がインフォーマルハウジングに住んでいる。
- ・このような人々に地震に強い住宅を供給するオプションとして都市の再開発、補強、レトロフィットの3つがある。
- ・これらが参加型で、コミュニティーベースのアプローチが無ければ成功しないので、それだけでは不十分だと考えている。

岡崎

- ・地震対策の第一歩は自分の地震リスクを理解すること。しかし、地震のリスクはわかりにくい。自分の住宅の耐震性もわかりにくい。地震の発生時期もわからない。家族構成やライフスタイルによっても異なるので、地震リスクに関しては個人個人の差が非常に大きい。
- ・専門家の力を借りたリスクコミュニケーションが必要で、そういった面を助ける専門家の育成と、各人がコミュニケーションする事で自分のリスクについて理解していく事が重要。
- ・読むよりも聞く、聞くよりも見る方がわかりやすい。見るよりも体験する事の方がわかりやすいので、体験型・ビジュアル方で自らのリスクが実感できる教育方法が大切だと思われる。

塚本

- ・住宅の支援を通じてコミュニティ開発に繋げて行かなければならないので、アリア先生のホーリスティックなアプローチが非常に重要だと思われる。
- ・住宅を通して住民の人達が広がる世界がある。それはホーリスティックな、コンプレヘンシブなアプローチだと思う。
- ・住宅のテクニックの中でそういう社会的な広がりを感じていく必要があり、イマン先生のように、色々な主体が協力して取り組まなければならない分野だと思う。

目黒

- ・防災は政治的な論争のポイントにならないので上手くいかない。現在、防災士の組織代に取り組んでおり、現在、全国に25,000人の防災士が存在している。5,000人くらいから政治家の対応が変わるので政治的なパワー・プレッシャー・グループをそれぞれに持つことも重要ではないか。
- ・損得勘定に直結する情報の出し方が必要。自動車の任意保険のような、耐震補強ビジネスが必要。
- ・自然災害大国の子供たちに、きちんと防災を教えなければいけない。受験科目に防災を組み込んで、有名私立学校が受験に問題に出題するようになると変わるかもしれない。
- ・良い言葉を付けて、ブランドイメージに直結するワーディング、ブランディングが重要。上手くブランディングをして、そういう活動がみんなの為になっているということをお互いに共有するような社会システムをつくる事も重要。

榎府

- ・4年前に始めた頃は、ノンエンジニアード・低所得者層の地震防災対策は「非常に良い事だが、問題が大変なので止めた方が良い」「こういった研究をしている人は、世の中には多くない」という声が多かった。
- ・しかし、本日も世界各国から様々な方に来ていただき、共通の問題意識を持ってやっていただけの方が沢山居るということがこの4年間でわかった。
- ・非常に多岐に亘る分野で難しい問題だと思うが、今後も繋がり輪を維持しながら、少しでも安全な地域づくり、住宅づくりに貢献できればと思う。



パネルディスカッション会場風景



パネリスト



会場からの質問、コメント

III .ANNEX
参考資料

「地震に強い住宅」に関する国際シンポジウム

世界共通の課題を一緒に考える



数々の大地震を受けて、今、世界では、地震災害を減らすことが強く望まれています。地震による死因の多くは、自分の家の倒壊によるものです。しかし、世界ではまだ多くの人がノンエンジニアド(技術者が関わらない)で造られた、レンガ、石や木材など材料を使った地震に弱い住宅に住んでいます。緊急対応や救助が効率的に行われても、亡くなった人は戻りません。どんなに効果のある耐震技術が開発されても、人々がそれを使わなければ安全な住宅はできません。

そこで「地震に強い住宅」に関する国際シンポジウムでは、耐震コミュニティ作りに向けて、いかに住宅の安全性を向上させることができるかについて、関心を持つ幅広い分野の方々で議論を行います。

開催日: 2008年11月28日(金) - 29日(土)

会場: 政策研究大学院大学(GRIPS)内、想海楼ホール

〒106-8677 東京都港区六本木7-22-1

大江戸線六本木駅下車出口7より徒歩5分

日比谷線六本木駅下車出口4Aより徒歩10分

千代田線乃木坂駅下車出口5より徒歩6分

参加費: 無料 (事前登録必要)

使用言語: 英語および日本語(同時通訳あり)

主催: 建築研究所(BRI)、政策研究大学院大学(GRIPS)

国連地域開発センター(UNCRD)

後援: 国連防災戦略(UN/ISDR)、ユネスコ(UNESCO)、

内閣府、国土交通省、国際協力機構 * 予定含む



<http://www.grips.ac.jp/jp/about/access.html>



独立行政法人
建築研究所



政策研究大学院大学



UNCRD
国連地域開発センター

プログラム

2008年11月28日(金)

9:00-9:30 受付

参加申し込み・問い合わせ
建築研究所 岡倉・今井 宛
Tel: 029-864-6641
Fax: 029-864-2989
EM: sympo-2008@kenken.go.jp

第一部 地震リスク認知と防災政策

- 9:30-9:40 オープニング 開会挨拶 政策研究大学院大学学長 八田達夫
来賓挨拶 国土交通省住宅局長(政策研究大学院大学客員教授) 和泉洋人
- 9:40-12:30 パネルディスカッション
「地震リスク認知の理解と防災政策への示唆」

地震リスク認知調査の概要 政策研究大学院大学 岡崎健二

[インドネシア]	バンドン工科大学 ワヤン・センガラ	[ネパール]	ネパール地震工学協会(NSET) アモッド・ディキシット
[パキスタン]	プレストン大学 ナジブ・アーメド	[トルコ]	イスタンブール工科大学 イルマ・カラツナ
[フィジー]	鉱物資源省 ラサルサ・ヴェティバウ	[インド]	インド工科大学ボンベイ校 ラヴィ・シンハ
[フィリピン]	フィリピン大学 マルケサ・レイアス	[日本]	筑波大学 梅本通孝

第二部 基準から現場へー建築基準普及への挑戦ー

- 13:30-13:40 オープニング UNCRD所長 小野川和延
- 13:40-15:00 【セッション1】 地震にまけない住宅：これまでとこれから

基調講演: 地震と在来建築 インド内務省国家地震顧問 アナンド・アリア教授 (インド)
震災復興から学ぶ テディ・ブーン (インドネシア)

報告: 建築基準の創設ーネパールの経験 都市・建築局長 スルヤ・サンガチェ (ネパール)
工学と建設のギャップを埋める 建築研究所 榎府龍雄

- 15:00-15:20 休憩
- 15:20-16:35 【セッション2】 建築基準の実施

基調講演: もうひとつの課題:既存建築物の地震対策 東京大学名誉教授 小谷俊介

報告: 近年の震災からの経験 UNCRD兵庫事務所所長 安藤尚一
ネパールにおける建築基準の実施 NSET アモッド・ディキシット (ネパール)
建築基準実施の枠組みーHESIの経験から UNCRD兵庫事務所 ジシュヌ・スベディ

- 16:35-16:50 討論
- 16:50-17:00 まとめ・閉会のことば

2008年11月29日(土)

第三部 地震による死傷者を少なくする方策を考えるーノン・エンジニアドを中心にー

協力: 防災科学技術研究所、三重大学

* 第三部の実施運営にあたっては文部科学省(MEXT)の助成を受けています。

- 13:00-14:40 【セッション1】 ファシリテータ: 三重大学 花里利一

開会挨拶: 建築研究所理事長 村上周三

基調講演: 四川地震の被害と教訓(仮題) 中国地震局地質研究所 何永年客員教授 (中国)
ノン・エンジニアド構造の耐震性向上の取り組み(仮題) インド内務省国家地震顧問 アナンド・アリア教授 (インド)

報告: 近年の地震被害の教訓とアジア諸国との共同研究開発の取り組み 建築研究所 榎府龍雄
ポスター展示のインデキシングセッション

- 14:40-15:00 休憩・ポスターセッション
- 15:00-17:00 【セッション2】 パネルディスカッション ファシリテータ: 建築研究所 榎府龍雄

パネリスト: フィリピン大学 マルケサ・レイアス (フィリピン)、 ガジャマダ大学 イマン・サティヤルノ (インドネシア)
政策研究大学院大学 岡崎健二 (日本)
東京外国語大学客員教授/NPO国境なき技師団事務局次長 塚本俊也 (日本)

まとめ: 共同研究開発プロジェクト研究運営委員長/北海道大学名誉教授 石山祐二

- 17:00 閉会

17:15-18:15 意見交換会
基調講演者、パネリストを交えてリラックスした雰囲気での意見交換会を開催します。(別途申し込み要:参加費1000円)



International Symposium 2008 on Earthquake Safe Housing

- Discuss together on the keen and common issue -



Reduction of earthquake disasters is one of the keenest issues common in earthquake prone areas in the world. In most of deaths caused by earthquakes, people are killed by their own houses. Most of the world's population lives in vernacular houses that are built of adobe, brick, stone, and wood, and are non-engineered and thus vulnerable to earthquakes. No matter how effectively emergency management and relief activities are conducted, the lost lives can never be regained. No matter what effective technologies are developed, the non-engineered houses will not be safer unless these technologies are applied.

This International Symposium on "Earthquake Safe Housing" therefore aims to discuss among the interested experts how we can improve the safety of houses, newly built and existing, towards safer communities against earthquakes.

Date: November 28th-29th, 2008 (Friday-Saturday)

Venue: Sokairo Hall, National Graduate Institute for Policy Studies (GRIPS), Tokyo

7-22-1 Roppongi, Minato-ku, Tokyo

Admission Free (Pre-registration required)

Language: English and Japanese
(simultaneous translation is available)

Organized by

- Building Research Institute (BRI)
- National Graduate Institute for Policy Studies (GRIPS)
- UN Centre for Regional Development (UNCRD)

Supported by (tentative)

- UN International Strategy for Disaster Reduction (UN/ISDR)
- UNESCO
- Cabinet Office, Government of Japan
- Ministry of Land, Infrastructure, Transport and Tourism (MLIT), Japan
- Japan International Cooperation Agency (JICA)



<http://www.grips.ac.jp/about/access.html>



Program

Friday, November 28, 2008

9:00-9:30 Registration

Registration/ Inquiry
Attn: Okakura Ms. / Imai Mr. (BRI)
Tel: +81-29-864-6641
Fax: +81-29-864-2989
E-M: sympo-2008@kenken.go.jp

Part 1 Earthquake Risk Perception and Disaster Reduction Policies

9:30-9:40 Opening: Tatsuo Hatta, President, GRIPS,
Hiroto Izumi, Director General, Housing Bureau, MLIT (Visiting Prof. of GRIPS)

9:40-12:30 Panel Discussion
"Understanding Earthquake Risk Perception and Its Implication for Development of Disaster Reduction Policies"

Outline of the Survey on earthquake risk perception: Kenji Okazaki, GRIPS
[Indonesia] Wayan Sengara, ITB [Nepal] Amod Dixit, NSET-Nepal
[Pakistan] Najib Ahmad, Preston Univ. [Turkey] Yilma Karatuna, ITU
[FIJI] Lasarusa Vuetibau, Mineral Resources Dept. [India] Ravi Sinha, IITB
[Philippines] Marqueza Reyes, Univ. of the Philippines [Japan] Michitaka Umemoto, Univ. of Tsukuba

Part 2 From Code to Practice: Challenges in Building Code Implementation

13:30-13:40 Welcome Address: Kazunobu Onogawa, Director, UNCRD
13:40-15:00 [Session 1] Housing Earthquake Safety: Lessons and Challenges

Key note Speech:
Earthquake and Non-engineered buildings by Anad. S. Arya (India)
Lessons from re-construction after earthquakes by Teddy Boen (Indonesia)
Development of Building Code- Experience of Nepal by S.B.Sangachhe, Director General, DUDBC (Nepal)
Bridging gap between engineering and construction by Tatsuo Narafu

15:00-15:20 Break
15:20-16:35 [Session 2] Building Code Implementation

Key note Speech: Another Problem: Seismic Protection of Existing Buildings by Shunsuke Otani
Experience of damages in recent earthquakes,
by Shoichi Ando, UNCRD Disaster Management Planning Hyogo Office
Building Code Implementation in Nepal, by Amod Dixit, NSET (Nepal)
Framework for Building code Implementation: Experience of HESI, by Jishnu Subedi, Researcher UNCRD

16:35-16:50 Discussion
16:50-17:00 Closing remarks

Saturday, November 29, 2008

Part 3 Strategies to Mitigate Casualties by Earthquakes focusing on Non-engineered Construction

Supported by National Research Institute for Earth Science and Disaster Prevention (NIED), Mie Univ.

* This session is supported financially by Ministry of Education, Culture, Sports, Science and Tech. (MEXT) JAPAN

13:00-14:40 [Session 1] Facilitator: Toshikazu Hanazato, Mie Univ.

Opening Address: Shuzo Murakami, Chief Executive of BRI
Key note Speech: Damages and Lessons from Sichuan Earthquake (tentative), by Yongnian He (China)
Challenges for Safer Non-engineered Construction (tentative), by Anad.S.Arya (India)
Report: Lessons from Recent Earthquakes and Brief Introduction of Research and Development for
Safer Non-engineered Construction, by Tatsuo Narafu, BRI
Indexing Session for Poster Presentation

14:40-15:00 Break - Poster Session
15:00-17:00 [Session 2] Panel Discussion: Facilitator: Tatsuo Narafu, BRI

Panelists: Marqueza Reyes, Univ. of the Philippines (Philippines), Iman Satyarno, Gadjadara Univ. (Indonesia)
Kenji Okazaki, GRIPS (Japan)
Toshiya Tsukamoto, Visiting Professor, TUFS/ Deputy Secretary General of Engineers without Borders
Concluding Remarks: Yuji Ishiyama, Chairperson of Management Committee for R&D Project

17:00 Closing

17:15-18:15 Casual Talking
Organizers cordially invite all the participants to join "Casual Talking" in which you can enjoy talking with Key note speakers, panelists and participants in friendly atmosphere (fee: 1,000 JPY: registration needed)

「地震に強い住宅」に関する国際シンポジウム –世界共通の課題を一緒に考える–

2008年11月28日(金)、29日(土)
政策研究大学院大学、想海楼ホール、東京

主催:

- 建築研究所 (BRI)
- 政策研究大学院大学 (GRIPS)
- 国際連合地域開発センター (UNCRD)

後援:

- 国連防災戦略 (UN/ISDR)
- ユネスコ (UNESCO)
- 内閣府
- 国土交通省
- 国際協力機構 (JICA)

1. 背景と目的

世界の地震地域では共通して、地震災害の軽減が喫緊の課題となっている。近年では、2008年の中国・四川省大地震、2007年の年ペルー・ピスコ地震、2006年の年インドネシア・ジャワ島中部地震、2005年のパキスタン北部地震が、社会に甚大な被害を及ぼした。日本でも1995年の阪神・淡路大震災で大きな被害が生じた。

地震による犠牲者の多くは、自分が住んでいる住宅が倒壊することによって亡くなる。世界の大部分の人は、伝統的な工法であるアドベ、レンガ、石や木材などによる、ノンエンジニアド住宅に住んでおり、耐震構造に関する工学的配慮に欠けているため地震に対して脆弱な構造となっている。最新の科学技術によっても地震を正確に予知することはできないことから、今後発生する地震による死者数や甚大な被害を減らすためには、これらの住宅を安全なものにすることが最も重要である。既存の住宅の耐震性を高めることができれば、地震による犠牲者を減らし、被災地の経済や社会活動の停滞を軽減することができる。いかに緊急事態の対応や救助活動が効率的に行われようとも、亡くなった人は戻らない。いかに効果のある耐震技術が開発されても、それが適用されなければノンエンジニアド住宅は安全にはならない。そこで「地震に強い住宅」に関する国際シンポジウム(3部構成)では、地震に強いコミュニティづくりに向けて、ノンエンジニアド住宅の耐震安全性の向上策について、専門家間で議論することを目的としている。

2. 会場

政策研究大学院大学 (GRIPS) 内、想海楼 (そうかいろう) ホール
〒106-8677 東京都港区六本木 7-22-1、代表 Tel: 03-6439-6000
会場案内: 別紙参照

3. 使用言語

英語および日本語 (同時通訳使用)

1. 目的

ノンエンジニアド住宅は一般に耐震性が低いが、普通の人が使える適切で実用的な技術を用いて建設すれば、一定の耐震性を確保することができる。しかしながら、問題は、耐震性の低い住宅の所有者が耐震性を高めるために投資する(特に耐震改修)動機が働かないことにある。住宅の耐震改修を進めることができるのは、政府ではなく住宅所所有者である。住宅の所有者が自分の家の耐震安全性に関心を持たないために、建設業者や石工も耐震性に関心を持たない。そこで人々に対して、住宅の耐震安全性に投資することは価値のあることだと納得してもらうことが重要である。政策研究大学院大学(GRIPS)と建築研究所(BRI)は、文部科学省(MEXT)の支援による「アジアの地震地域におけるネットワーク型防災共同研究」の一環として(自主研究も含む)、耐震技術の普及を進めるための地震リスク認知に関する共同研究を実施した。

2007年から2008年にかけて、住民、政府職員、石工・住宅建設業を対象とした地震リスク認知に関する調査を、インドネシア、ネパール、パキスタン、トルコ、フィジー、インド、フィリピン、日本を対象として実施した。また耐震技術の普及のためのパイロット事業も、インドネシア、ネパール、パキスタンとトルコで2008年に実施した。第一部は、これらの最新の成果を参加者の間で共有し、それを防災政策の開発につなげるよう議論することが目的である。

2. プログラム

9:00-9:30 受付

時間：9:30-12:30 (11月28日)

部 / 時間	発表	司会/発表者	組織、役職
9:30-9:40	開会挨拶 来賓挨拶	八田達夫 和泉洋人	政策研究大学院大学学長 国土交通省住宅局長 (政策研究大学院大学客員教授)
9:40-12:30	パネルディスカッション 「地震リスク認知の理解と防災政策への示唆」		
9:40-10:00	地震リスク認知調査の概要	岡崎健二	政策研究大学院大学
10:00-10:10	インドネシア	ワヤン・センガラ	バンドン工科大学
10:10-10:20	ネパール	アモッド・ディキシッド	ネパール地震工学協会事務局長
10:20-10:30	パキスタン	ナジブ・アーメッド	プレストン大学
10:30-10:40	トルコ	イルマ・カラツナ	イスタンブール工科大学
10:40-10:50	フィジー	ラサルサ・ヴェティパウ	鉱物資源省
10:50-11:00	インド	ラヴィ・シンハ	インド工科大学ボンベイ校
11:00-11:10	フィリピン	マルケサ・レイアス	フィリピン大学
11:10-11:20	日本	梅本通考	筑波大学
11:20-11:30	休憩(参加者からの質問票回収)		
11:30-12:30	討論、質疑応答		

1. 目的

地震災害は、人間が制御できない自然現象と、災害に対する社会の弱さの相互作用によって生じる。耐震性のある建物や建築基準の普及、地盤状況を考慮した計画案や危険回避のための訓練や教育によって、社会の脆弱さとそれによる生活への地震の影響は減少できる。しかし、途上国における都市化により危機的な状況は悪化の一途を辿っている。多くの途上国では、地震から人命や財産の損失を軽減するために建築規制システムを設けている。しかし、そのシステムが効果的に機能することはあまりない。その理由は、地域の防災意識不足、実施機関の実行力不足そして効果的な実施、監視、検査の法的な仕組みの不足があげられる。

2007年にUNCRDは、住宅の構造安全性の改善を目標とした「地震にまけない住宅計画」(HESI)を開始した。その活動には、住宅の安全性を高めるための政策の助言、効果的な建築基準適用のための能力開発などがある。全世界的なネットワーク、情報交換、知識や地震リスクの軽減方法に関する共有の場を作ることは、HESIの最も重要な活動の一つである。第二部は、本事業を通じた途上国での地震災害、復興および建築基準の実施の経験を共有することを目的としている。

2. プログラム

時間：13:30-17:00 (11月28日)

部 / 時間	発表	司会/発表者	組織、役職
13:30-13:40	歓迎の言葉	小野川和延	UNCRD 所長
セッション1:	地震にまけない住宅:これまでとこれから		
13:40-14:05	基調講演 1:地震と在来建築	アナンド・アリヤ	インド内務省 国家地震顧問
14:05-14:30	基調講演 2:震災復興から学ぶ	テディ・ブーン	インドネシア
14:30-14:45	建築基準の創設:ネパールの経験	スルヤ・サンガチェ	都市・建築局長(ネパール)
14:45-15:00	工学と建設のギャップと埋める	楢府龍雄	建築研究所 国際協力審議役
15:00-15:20	休憩		
セッション2:	建築基準の実施		
15:20-15:50	基調講演 3:もうひとつの課題:既存建築物の地震対策	小谷俊介	東京大学名誉教授
15:50-16:05	近年の震災からの経験	安藤尚一	UNCRD 兵庫事務所所長
16:05-16:20	ネパールにおける建築基準の実施	アモッド・ディキシッド	ネパール地震工学協会事務局長
16:20-16:35	建築基準実施の枠組み—HESIの経験から	ジシュヌ・スベディ	UNCRD 兵庫事務所
16:35-16:50	討論		
16:50-17:00	まとめ・閉会の言葉		

第三部：地震による死傷者を減らす方策を考える –ノン・エンジニアドを中心に–

協力：防災科学研究所 (NIED)、三重大学 (* 第三部の実施について文部科学省(MEXT)の助成を受けています。)

1. 目的

第三部は、人命被害の元凶となっている、地震に対して脆弱な庶民住宅や同様の工法による小規模の建物に焦点を当て、死傷者を減らす方策について議論する。これらの建物は、耐震設計や材料の品質管理などの技術関与が不十分で、ノンエンジニアドとよばれることが多いもので、工学技術を持った人たちが建設するエンジニアド建築とは異なり、耐震技術も、それぞれの現場で調達できる材料、その地域の職人で実施できる技術でなければ実際に使われることは期待できない。また、そうした耐震技術を十分な工学知識を持っていない職人達に理解してもらうことにも工夫が必要である。

ここでは、甚大な被害をもたらした今年5月の中国・四川省大地震の被害の実態を地元の専門家から報告いただき、長年この問題に取り組んでこられた専門家からその概要の説明をいただくこととしている。それを受けて、ノンエンジニアドという安全性の向上が難しい建物について、建築構造、地震防災、国際協力などの専門家や、開発途上国での経験の豊富な実務家の方に、死傷者を減らす方策について議論していただく。

2. プログラム 時間：13:00 – 17:00 (11月29日)

部 / 時間	発表	司会/発表者	組織、役職
13:00-13:10	開会挨拶	村上周三	建築研究所 理事長
セッション1:	ファシリテーター	花里利一	三重大学 教授
13:10-13:40	基調講演 1: 四川地震の被害と教訓(仮題)	何永年	中国地震局地質研究所客員教授
13:40-14:10	基調講演 2: ノンエンジニアド構造の耐震性向上の取り組み(仮題)	アナンド・アリア	インド内務省 国家地震顧問
14:10-14:25	近年の地震被害の教訓とアジア諸国との共同研究開発の取り組み	榑府龍雄	建築研究所 国際協力審議役 (共同研究開発代表者)
14:25-14:40	ポスター展示のインデキシングセッション	ポスター展示者	
14:40-15:00	休憩、ポスターセッション		
セッション2:	ファシリテーター	榑府龍雄	建築研究所 国際協力審議役
15:00-16:50	パネリスト	マルケサ・レイアス	フィリピン大学教授
		イマン・サティヤルノ	インドネシア・ガジャマダ大学講師
		岡崎健二	政策研究大学院大学 教授
		塚本俊也	東京外国語大学客員教授 /NPO 国境なき技師段事務局次長
16:50-17:00	まとめ	石山祐二	共同研究開発研究運営委員長/ 北海道大学名誉教授
17:00	閉会		

意見交換会 (17:15-18:15)

基調講演者、パネリストを交えて、気楽な雰囲気での意見交換会を開催します。(参加費 1000 円)

会場案内

「地震に強い住宅に関する国際シンポジウム」<世界共通の課題を一緒に考える>

2008(平成20)年11月28日(金)午前・午後、29日(土)午後

開催場所: 政策研究大学院大学 講堂(想海楼ホール)

住所: 〒106-8677 東京都港区六本木 7-22-1

電話: 03-6439-6000

HP: <http://www.grips.ac.jp/about/access.html>

交通: 東京メトロ千代田線乃木坂駅、都営大江戸線六本木駅、東京メトロ日比谷線六本木駅より、いずれも徒歩10分程度です。

周辺地図:



参加登録票 Registration Form

「地震に強い住宅に関する国際シンポジウム」<世界共通の課題を一緒に考える>

International Symposium 2008 on Earthquake Safe Housing

-Discuss together on the keen and common issue

1. 称号(title) Dr. Mr. Ms. Others ()
2. 苗字(英語併記)(family name)
3. 名(英語併記)(first name)
4. 所属機関(英語併記)(organization/institute)
5. 所属部署／役職(英語併記)(position)
6. メールアドレス(email address)
7. 住所(postal address)
8. 電話、ファックス番号(tel, fax number)
9. 参加希望パート(check the part/parts you would like to attend)
()11月28日(金) 9:00-12:30 第1部 (Part1 November 28)
()11月28日(金) 13:30-17:30 第2部 (Part2 November 28)
()11月29日(金) 13:00-17:00 第3部 (Part3 November 29)
()11月29日(金) 17:15-18:15 意見交換会(Casual Taling November 29)
10. 同時通訳レシーバー 必要 不要
Do you need a receiver for simultaneous translation? Yes No
11. 意見交換会(会費 1000 円) 参加 不参加
Do you participate Casual Talking? Yes No

E-mail address: sympo-2008@kenken.go.jp ファックス: 029-864-2989

問い合わせ(電話): 029-864-6641 (建築研究所:岡倉、今井)

International Symposium 2008 on Earthquake Safe Housing

- Discuss together the keen and common issues -

28 – 29 November, 2008

Sokairo Hall, National Graduate Institute for Policy Studies, Tokyo

Organized by

- Building Research Institute (BRI)
- National Graduate Institute for Policy Studies (GRIPS)
- UN Centre for Regional Development (UNCRD)

Supported by

- UN International Strategy for Disaster Reduction (UN/ISDR)
- UNESCO
- Cabinet Office, Government of Japan
- Ministry of Land, Infrastructure, Transport and Tourism (MLT), Japan
- Japan International Cooperation Agency (JICA)

1. Background and Objectives

Reduction of earthquake disasters is one of the keenest issues common in earthquake prone areas in the world. In recent years, our societies have been severely damaged by Sichuan Earthquake 2008 in China, Pisco Earthquake 2007 in Peru, Central Java Earthquake 2006 in Indonesia, and Northern Pakistan Earthquake 2005. Japan also suffered severe damages from 1995 Hanshin-Awaji Earthquake.

In most of deaths caused by earthquakes, people are killed by their own houses. Most of the world's population lives in vernacular houses that are built of adobe, brick, stone, and wood, and are non-engineered and thus vulnerable to earthquakes. Because earthquakes cannot be predicted precisely even by applying the most advanced science and technology, it is essential to make these houses safer in order to reduce the number of victims and the amount of severe damage caused by future earthquakes. The more resilient the existing houses are against earthquakes, the lower the death rate will be in the event of an earthquake, and the less drastic will be the disruptions to economic and social activities in the affected areas. No matter how effectively emergency management and relief activities are conducted, the lost lives can never be regained. No matter what effective technologies are developed, the non-engineered houses will not be safer unless these technologies are applied. This International Symposium on "Earthquake Safe Housing" therefore aims to discuss among the interested

experts how we can improve the safety of houses, newly built and existing, towards safer communities against earthquakes.

2. Venue

Sokairo Hall, National Graduate Institute for Policy Studies (GRIPS)

3. Program

November 28

9:30 - 12:30 **Part1: Earthquake Risk Perception and Disaster Reduction Policies**

13:30 - 17:00 **Part2: From Code to Practice: Challenges in Building Code Implementation**

November 29

13:00 - 17:00 **Part3: Strategies to Mitigate Casualties by Earthquakes focusing on Non-engineered Constructions**

17:15 - 18:15 **Casual Talking**

Posters are presented at the lounge of the venue for 28-29, November

4. Language

English and Japanese (simultaneous translation is available)

5. Registration for participation

Registration for participation to Symposium should be made by sending Registration Form by e-mail or facsimile to Building Research Institute (BRI) at following address before November 21, 2008.

Confirmation will be delivered several days before the workshop.

E-mail address: sympo-2008@kenken.go.jp

Facsimile: +81-29-864-2989

Telephone: +81-29-864-6641

(Ms. Okakura or Mr. Imai)

Access to National Graduate Institute for Policy Studies (GRIPS)

Address: 7-22-1 Roppongi, Minato-ku, Tokyo, Japan



<http://www.grips.ac.jp/jp/about/access.html>

Part 1: Earthquake Risk Perception and Disaster Reduction Policies

9:30-12:30 on 28 November,2008

1. Objective

Non-engineered houses can be quite strong when they are constructed with appropriate and practical techniques that are affordable to ordinary people. A big challenge, however, is that the house owners lack the motivation to invest to secure the safety of their houses, particularly to retrofit them, even though the houses are quite vulnerable to earthquakes. The vulnerable houses can be retrofitted only by the homeowners themselves, not by the authorities. The house builders and masons lack interest in securing sufficient safety mainly because house owners are not concerned with the structural safety of the houses. It is thus crucial to convince people that the investment in safer housing will eventually prove to be worthwhile.

National Graduate Institute for Policy Studies (GRIPS) and Building Research Institute (BRI) have carried out joint researches on earthquake risk perception to promote dissemination of technologies for safer housing partially under the “Collaborative Research and Development Project for Disaster Mitigation on Network of Research Institutes in Earthquake Prone Areas in Asia” with financial support of Ministry of Education, Culture, Sports, Science and Technology (MEXT).

The survey on the earthquake risk perception of residents, government officers, and masons/house builders, was conducted in Indonesia, Nepal, Pakistan, Turkey, Fiji, India, the Philippines, and Japan in 2007- 2008. A pilot project for dissemination of technologies for safer housing is also conducted in Indonesia, Nepal, Pakistan, and Turkey in 2008. Part 1 aims to share the latest outcome of these surveys among the participants and discuss its implications to policy development for disaster reduction.

2. Agenda

Time: 9:30-12:30 (Fri, 28th November, 2008)

9:00 - 9:30 Registration

9:30 - 9:40

Opening

Tatsuo Hatta, President, GRIPS,

Hiroto Izumi, Director General, Housing Bureau, MLIT (Visiting Prof. of GRIPS)

9:40 - 12:30

Panel Discussion

“Understanding Earthquake Risk Perception and Its Implication for Development of Disaster Reduction Policies”

- 9:40 - 10:00 Outline of the Survey on earthquake risk perception / Kenji Okazaki, GRIPS

-10:00 - 10:10 [Indonesia] Wahan Sengara, ITB

-10:10 - 10:20 [Nepal] Amod Dixit, NSET-Nepal

-10:20 - 10:30	[Pakistan]	Najib Ahmad, Preston University
-10:30 - 10:40	[Turkey]	Yilma Karatuna, ITU
-10:40 - 10:50	[FIJI]	Lasarusu Vuetibau, Mineral Resources Department
-10:50 - 11:00	[India]	Ravi Sinha, IITB
-11:00 - 11:10	[Philippines]	Marqueza Reyes, Univ. of the Philippines
-11:10 - 11:20	[Japan]	Michitaka Umemoto, Univ. of Tsukuba
-11:20 - 11:30		Break (collect questions from the floor)
-11:30 - 12:30		Discussions, Q and A

Part 2: From Code to Practice: Challenges in Building Code Implementation

13:30-17:00 on 28 November, 2008

1. Objective

Earthquake disaster is interplay of natural hazard, which is beyond human control, and vulnerability, which is created by people. The vulnerability and hence impact of earthquakes on livelihood of people can be reduced by measures such as adherence to earthquake resistant building design and construction standards, proper land use planning and education and training for risk evasion. However, the risk is ever increasing as rapid urbanization in developing countries is adding extra pressure on building construction and measures to reduce earthquake risks often get low priority. Although developed countries also face risk from earthquakes, the problems in developed countries and developing countries are different in their scope and magnitude. Most of developing countries have established a building control system, aiming to prevent loss of lives and property in earthquakes. However, the system seldom functions effectively because of lack of awareness among communities, lack of capacity of implementing authorities and lack of regulatory mechanism for effective implementation, monitoring and reviewing.

In 2007, UNCRD launched the Housing Earthquake Safety Initiative (HESI) with goal to improve structural safety of houses to prevent damage and safeguard people's lives, property and livelihood from earthquakes through effective implementation of building safety regulations. The activities included perception and implementation gap analysis of target countries, awareness raising among the stakeholders, developing policy recommendations on improving safety of houses and developing capacity of national and local officials to implement building safety regulations effectively.

One of the major activities envisaged in HESI is creation of platform for networking, information exchange, sharing of knowledge and sharing of good practices in mitigating earthquake risk throughout the world. Part 2 aims to share experiences of earthquake disasters, reconstruction and building code implementation in developing countries through this project.

2. Agenda

Time: 13:30-17:00 (Fri, 28th November, 2008)

Opening Session

13:30 - 13:40 Welcome address by Kazunobu Onogawa, Director, UNCRD

Session 1: Housing Earthquake Safety: Lessons and Challenges

- 13:40 - 14:30 Key-note speech:
Earthquake and Non-engineered buildings by Prof. Anand S. Arya, India
Lessons from re-construction after earthquakes by Teddy Boen, Indonesia
- 14:30 - 14:45 Development of Building Code: Experience of Nepal
by Surya B. Sangachhe, Director General, Department of Urban, Nepal
- 14:45 - 15:00 Bridging gap between engineering and construction practice by Tatsuo Narafu
- 15:00 - 15:20 Break

Session 2: Building Code Implementation

- 15:20 - 15:50 Key-note speech:
Another Problem: Seismic Protection of Existing Buildings by Shunsuke Otani
- 15:50 - 16:05 Experience of damages in recent earthquakes
by Shoichi Ando, UNCRD Disaster Management Planning Hyogo Office
- 16:05 - 16:20 Building code Implementation in Nepal by Amod Dixit, NSET, Nepal
- 16:20 - 16:35 Framework for Building code Implementation: Experience of HESI by Jishnu Subedi,
Researcher UNCRD
- 16:35 - 16:50 Discussion
- 16:50 - 17:00 Closing remarks

Part 3: Strategies to Mitigate Casualties by Earthquakes focusing on Non-engineered Construction

13:00-17:00 on 29 November,2008

Supported by:

National Research Institute for Earth Science and Disaster Prevention (NIED)

Mie University

With financial support of Ministry of Education, Culture, Sports, Science and Technology (MEXT)

1. Objective

Part 3 is organized to discuss on strategies to mitigate casualties by earthquakes focusing on peoples' houses and community buildings, which are vulnerable and the main cause of human casualties. Those are often called non-engineered as those have no/little technical intervention such as seismic design and quality control of materials. Those need an approach different from engineered constructions as those are constructed with local materials by local non/semi skilled workers. Only feasible and affordable technologies would be accepted by people and communities.

Part 3 presents a report on tragic damages by Sichuan Earthquake May, 2008 and a summary on efforts to develop seismic technologies for non-engineered constructions. Then experts and practitioner in structural engineering, disaster management and international cooperation discuss on practical strategies for mitigation of disasters.

2. Agenda

Time: 13:00 – 17:00 (29 November)

17:15 – 18:15 Casual Talking

Session 1: Facilitator: Toshikazu Hanazato, Mie Univ

- | | |
|---------------|---|
| 13:00 - 13:10 | Opening Address by Shuzo Murakami, Chief Executive of BRI |
| 13:10 - 13:40 | Keynote Speech1: Damages and Lessons from Sichuan Earthquake (tentative)
by Yongnian He (China) |
| 13:40 - 14:10 | Keynote Speech2: Challenges for Safer Non-engineered Construction (tentative)
by Anad.S.Arya (India) |
| 14:10 - 14:25 | Lessons from Recent Earthquakes and Brief Introduction of Research and
Development for Safer Non-engineered Construction by Tatsuo Narafu, BRI |
| 14:25 - 14:40 | Indexing Session for Poster Presentation |
| 14:40 – 15:00 | Break |

Session 2: Facilitator: Tatsuo Narafu, BRI

- | | |
|---------------|-------------------------|
| 15:00 - 16:50 | Panel Discussion |
|---------------|-------------------------|

- Marqueza Reyes, Univ. of the Philippines (Philippines),
- Iman Satyarno, Gadj Mada Univ. (Indonesia)
- Kenji Okazaki, GRIPS (Japan)
- Toshiya Tsukamoto, Visiting Professor, TUFS/ Deputy Secretary General of Engineers without Borders

16:50 - 17:00 Closing remarks by Yuji Ishiyama, Chair person, Management committee for Research and Development Project

Casual Talking

17:15 – 18:15 on 29 November, 2008

Organizers cordially invite all the participants to join “Casual Talking” in which you can enjoy talking with key note speakers, panellists, presenters and participants in friendly atmosphere (fee:1,000Yen).

参加登録票 Registration Form

「地震に強い住宅に関する国際シンポジウム」<世界共通の課題を一緒に考える>

International Symposium 2008 on Earthquake Safe Housing

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Do you participate Casual Talking? Yes No

E-mail address: sympo-2008@kenken.go.jp ファックス: 029-864-2989

問い合わせ(電話): 029-864-6641 (建築研究所:岡倉、今井)