

## **II-6 Microtremor Measurement**

## II-6 Microtremor Measurements

### *What is Microtremor Measurements ?*

Any ground and civil structures are continuously subjected to small vibrations, anytime and everywhere, which are not only seismic origin but also random disturbances due to natural effects (winds, sea-waves, volcanic actions, etc.) and human activities (traffic, machinery, etc.). These motions are called *microtremor*.

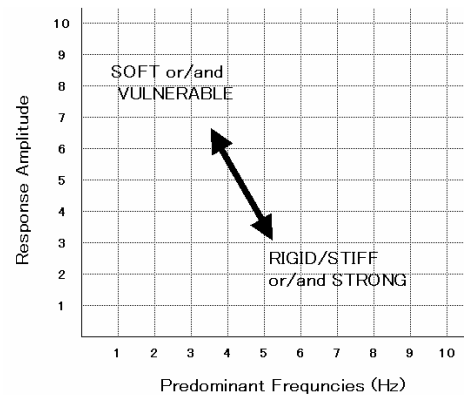
Microtremor measurement has become a useful tool for civil engineers in order to estimate ground motion characteristics, amplification of soil deposits (H/V-ratio) [1], microzonation [2] and dynamic behavior of existing structures (cross-spectrum technique and coherence) [3]. The most advantageous side of using microtremor for engineering purposes is the convenience of measurement, though their interpretation is complex.

Generally speaking, lower amplitude and higher frequencies are rigid or/and strong, and higher amplitude and lower frequencies are soft or/and vulnerable (see Figure1). But the actual strength of structures against earthquake ground motion needs more information of structural strength, intensity, frequency and duration of ground motion and soil condition.

For this purpose, the differences in source, propagation path and vibration amplitude between microtremor and earthquake ground motion necessitates further study on application to earthquake engineering. Hereby, in this work, microtremor measurement and analysis were conducted at several structures so as to examine the effectiveness of approach.

### *Equipment for site measurement*

The microtremor measurement described in this study was carried out by portable microtremor equipment, type TL-AD116 (see Figure 2 and Table 1).



**Figure1 General Tendency of Microtremor Result**



**Figure 2 Microtremor measurement**

**Table 1 Microtremor Measurement System**

Equipment	Item	Dimension
Sensor part (VSE-15)	Velocity output Acceleration output Frequency range	1V/kine, 10V/kine 5mV/gal 0.1 to 30Hz
AD converter part	Number of channels Decomposition Input range Sampling	Maximum 16 16 bits (-32768-32767) 10V(gain-1), 5V(gain-2), and 1V(gain 3) Maximum: 20kHz/ch

### Structure vibration measurements

Microtremor analysis was conducted for four typical structures. The result of analysis is shown in Figure3 and Table 2.

**Table 2 Result of measurement**

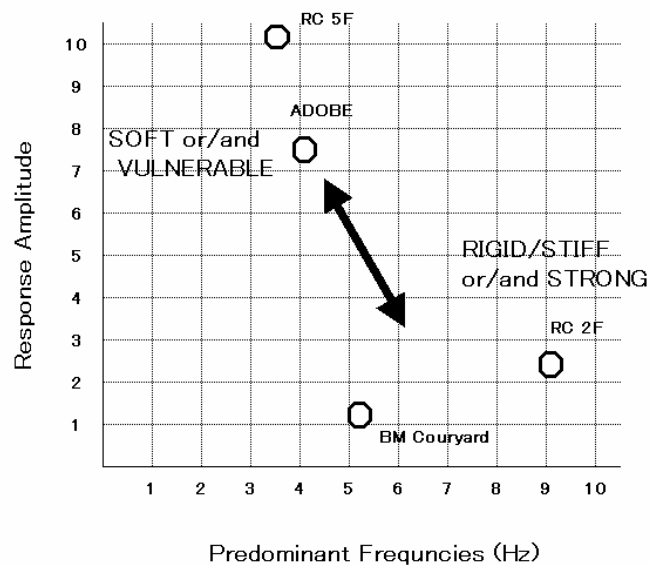
Structural Type	Response Amplitude (Top/Ground)	Predominant Frequency (Hz)
1) AD: Adobe (3 storied)	7.52	4.10
2) BM: Brick with mud mortar (courtyard) (5 storied)	1.24	5.18
3) RCL: RC frame with brick / Low storied (2 storied)	2.37	9.08
4) RCH: RC frame with brick / High storied (5 storied)	10.12	3.52

Where RC is Reinforced Concrete.

Findings are as follows:

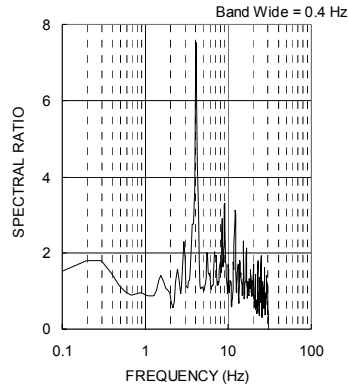
- Response amplitudes are high for Adobe and RC-High.
- Predominant frequency is 3 to 4Hz on Adobe and RC-High.
- Response amplitudes are low for BM with courtyard and RC-Low.
- Predominant frequency is 5 to 10Hz on BM and RC-Low.

These results conclude higher storied RC structures will be more vulnerable than lower storied RC one, and courtyard BM will be stronger than AD. These results lead us to conclude that higher storied RC structures and AD must be carefully considered to be weak structures as fragility relations for each building type. However, since these results are only an example of typical structures, more observations should be made to clarify the results. Because the results can be differ according to the structural condition even though the same structural type and stories.



**Figure 4 Results of building types**

Adobe



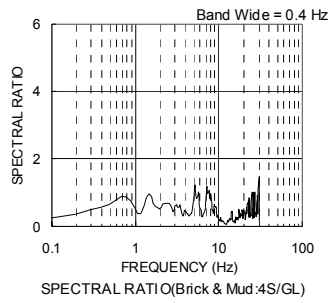
SPECTRAL RATIO  
7.52

FREQUENCY [Hz]  
4.10±0.24 sec

(Khokana: 3 storied)

SPECTRAL RATIO(Adobe:3S/GL)

Brick & Mud Mortar



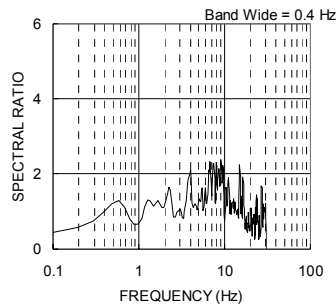
SPECTRAL RATIO  
1.24

FREQUENCY [Hz]  
5.18±0.19 sec

(Kathmandu Core: 5 storied)

SPECTRAL RATIO(Brick & Mud:4S/GL)

RC Low



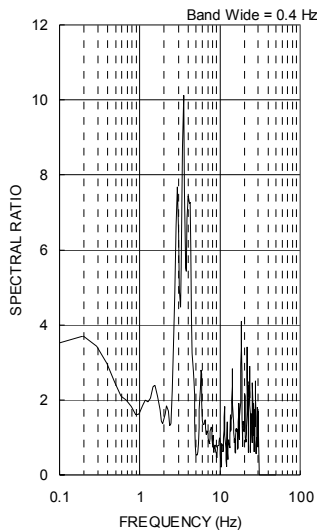
SPECTRAL RATIO  
2.37

FREQUENCY [Hz]  
9.08±0.11 sec

(Baneswor: 2 storied)

SPECTRAL RATIO(RC-Low:TOP/GL)

RC High



SPECTRAL RATIO  
10.12

FREQUENCY [Hz]  
3.52±0.28 sec

(near Airport: 5 storied)

SPECTRAL RATIO(RC-High:4S/GL)

Figure3 Microtremor measurements of structure vibration

### ***Further Issues***

This time, microtremor measurement results indicated differences in structural types. However, it was proven, as the response amplitudes are low for courtyard BM. Traditionally made BM structures are stronger than expected and will not seem to generate pancake destruction like weak RC frame structure. These results lead us to conclude that over 40% of traditional masonry remained in the 1934 earthquake, even in the strongly shaken area. For the more the courtyard building with symmetrical shape is considered strong. Thus, the results might show the usefulness of saving traditional courtyard. More measurements should show more strong conclusions.

The retrofitting will make change in predominant frequencies and response amplifications of the structure between before and after the execution. Microtremor measurement will become an effective technique for confirmation of effect, when the structure is reinforced.

Further, microtremor measurement should be worth to be applied not only for structures but also for ground characteristics, even though their interpretation may be complex.

### **References:**

- [1]. Ansary, A., M., Yamazaki F., Katayama, T., *Application of microtremor measurements to the estimation of site amplification characteristics*; Bull. ERS, Univ. of Tokyo, Vol. 29 -1996.
- [2]. Gaull, B., A., Kagami, H., Taniguchi. H., *The microzonation of Perth -Western Australia- Using microtremor spectral ratios*. Earthquake Spectra, Vol. 11-2 May 1995.
- [3]. Ganey, T., Yamazaki, F., Katayama, T., *Observation and numerical analysis of SSI of a RC tower*; EESD, Vol.24,491-503 1995.

### **III Workshop and Seminar**

### **III-1 Workshop**

## **Workshop Programme**

### **Workshop on Earthquake Disaster Mitigation in Kathmandu Valley**

Organised by Ministry of Home Affairs Department of Narcotics Control & Disaster Management and JICA Study Team

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#### **1. Purpose**

- Introduce the Project
- Build mutual understanding and trust between the concerned agencies and the JICA study team.
- Establish mutual cooperation through frank discussion

#### **2. Date and Venue**

Feb 27<sup>th</sup>, 2001 9:30-17:00  
A Conference Hall at Himalaya Hotel in Patan

#### **3. Program of the Workshop**

##### *A. Opening Session*

*09:30 ~10:15*

Ministry of Home Affairs

Japan International Cooperation Agency

JICA Study Team

Secretary

Res. Rep

Leader

Mr. Regmi

Mr. Hasegawa

Dr. Egawa

##### *B. Keynote Speech*

*10:15 ~12:30*

“Current Status and Future Task for Earthquake Disaster Mitigation”

Ministry of Home Affairs,

Dep. of Drug Control & Disaster Management Director

Dr. Chhetri

*Tea Break 10:55 ~11:10*

“Western Indian Earthquake and Disaster Mitigation”

JICA Study Team Deputy Leader

Mr. Kaneko

“(Tentative) Toward safer world through Disaster Mitigation”

Chief Advisor for JICA Study Team

Dr. Hayashi

*Lunch Break 12:30 ~13:30*



**C. Session 1 : Making Synergy**

**13:30 ~16:00 (Tea Break 14:30 ~14:50 )**

**Participatory Discussion Session for all participants with a Facilitator**

*The institutions and organizations listed down below is the JICA Team's proposal for the speakers, and subject to change. We are organizing this session not to be formal but trying to create casual atmosphere with the combination of speeches (5 to 10 mins each) and discussion.*

**Reporter : Mr. D. Bhattraï,**

**Senior Divisional Engineer of Dept. of Water Induced Disaster Prevention**

**Facilitator : Mr. Parimal Jha**

**D. Poster Session : Developing Mutual Trust**

**16:00 onwards**

Panels and Tables are set at all time during afternoon, and further discussion will be done. In each section, posters or other materials will be displayed to present what have been done so far, what will be planning in future. The JICA Team presents what are going to do in the Project.

**Big White Panel(4)**

Ministry of Home Affairs

Dep. of Mines of Geology

Dep. of Urban Development and Building Construction

NSET

**Medium Red Panel(3)**

Kathmadu Valley Town Development Committee

Nepal Telecommunication Corporation

Kathmandu Municipality, Social Welfare Dep.

**Round Table(3)**

Earthquake Disaster Mitigation Project in Teheran and India's Tragedy in the recent Earthquake

Outline of the Building Inventory Survey and Social Structure Survey in the Project

Demonstration of Micro Tremor Measurement

**E. Adjourn 17:00**

## **Session 1**

### **Introduction for asking incorporation**

Disaster Mitigation is inter relating activities.

Not only a matter of central government and local government, but also matter of citizens and locally based organizations and institutions.

In the disaster,

How do we rescue people?

Where do we get the first medical aid?

Where do we get water and food?

Where do we evacuate?

How are the things delivered?

How do you get information?

How the related ministries share the roles?

How the municipalities respond and cooperate?

In the Disaster Mitigation, it is very important to think about how to incorporate with the concerned organizations and people.

Here we are to start thinking about it.

**1. Introduce roles and activities which has been done or planned to be done related to the Earthquake Disaster Mitigation.**

**2. Ask expectations for JICA study team**

In the earthquake, lots of people were killed by buildings.

To make safer building is one of the approach that we can make.

What are involved in making a safer buildings?

Strong regulations of building construction?

Mason's training?

Public Awareness for making safer buildings?

Easy access to Housing Loans?

Just to think about a building itself we need various approaches from the different fields and levels.

To see the city structure, there are lots of narrow streets.

Some streets are even difficult to pass the ambulances in the ordinary situation.

Population growth of the Kathmandu valley is so rapid.

There is a growing demand of housing and infrastructure.

What are the policies for safer city?

Some institutions has started to compile data on GIS system.  
**In Kathmandu Mapping Project**

And in this project, we are putting basic data on GIS and making Hazard Maps  
GIS system is not for data compilation.  
How to use the data is the matter of question.  
How to utilize it for the disaster mitigation?  
Hazard mapping can be used for city planning.

### ***List of Panels***

#### **White Big Panels**

##### *Ministry of Home Affairs*

Photographs of the building damages in the 1934 earthquake  
Public Awareness

##### *Dep. of mines & Geology*

Geological Map  
Ground Condition Data

##### *Dep. of Urban Development and Building Construction*

Building Code

##### *NSET*

Public Awareness Raising Posters  
Retrofitting of the School buildings

#### **Medium Red Panels**

##### *Nepal Telecommunication Corporation*

Transmission Network in Nepal  
Emergency Telecommunication Network  
Proposed Emergency Telecommunication Network System  
Wireless Communication Network of the Police and Army

##### *Kathmandu Metropolitan City, Social Welfare Department*

Mapping Project in progress  
Public Awareness

#### **Round Table**

##### *JICA Team*

JICA's Earthquake Disaster Mitigation Project in Teheran  
Damage of the Past Earthquake, India, Turkey, and Taiwan  
Outline of the Building inventory Survey and Social Structure Survey in this project  
Demonstration of the Micro Tremor Measurement

# **Workshop on Earthquake Disaster Mitigation in Kathmandu Valley**

## **Report From**

**Damodar Bhattarai  
Senior Divisional Engineer  
Department of Water Induced Disaster Prevention**

## **Organized by:**

**Ministry of Home Affairs, Department of Narcotics Control & Disaster Management  
and**

**Japan International Cooperation Agency (JICA) Study Team**

**27<sup>th</sup> February 2001  
Kathmandu**

## **1. Background**

Nepal, occupying the central portion of the Hindu Kush Himalayas lies in a tectonically active seismic zone and is therefore vulnerable to earthquake disasters. The Kathmandu Valley is particularly in a delicate situation regarding earthquake disaster in view of its rapid population increase, clusters of already fragile and worn out buildings, unplanned development, and unconsolidated ground. Should a large-scale earthquake as that of 1934 occur, the anticipated damage to human lives and property could be enormous. Moreover, disruption of the basic amenities of civil life such as water supply, transport and communication systems, health services, etc. could be lost for prolonged periods before normalcy is restored. The adverse effects of such an event would have long-term repercussions on the socio-economic development of the whole country.

At the request of His Majesty's Government of Nepal, the Government of Japan has undertaken to conduct the Study on Earthquake Disaster Mitigation in the Kathmandu Valley through the Japan International Cooperation Agency (JICA). The JICA Study Team comprises a joint venture of Nippon Koei Co., Ltd.

and Oyo Corporation of Japan. JICA is undertaking the study in close cooperation with the concerned authorities of HMG/N, and the Department of Narcotics Drug Control and Disaster Management, Ministry of Home Affairs is the focal organizations for the implementation of the project.

The Study is planned to be carried out over a period of about 12 months, from late January 2001 divided into three phases, viz., data collection, data analysis and formulation of the plan.

The objectives of the Study are:

- To formulate a plan for earthquake disaster mitigation in Kathmandu Valley.
- To carry out technology transfer to Nepalese counterpart personnel in the course of the study.
- To form a database on earthquake and earthquake scenarios.

## **2. Workshop on Earthquake Disaster Mitigation in Kathmandu Valley**

A workshop on Earthquake Disaster Mitigation in Kathmandu Valley was held at Hotel Himalaya, Lalitpur on 27<sup>th</sup> February 2000, organized by the Ministry of Home Affairs, Department of Narcotics Drug Control and Disaster Mitigation and the JICA Study Team.

The purpose of the workshop was to:

- Introduce the Project.
- Build mutual understanding and trust among the concerned agencies and the JICA Study Team.
- Establish mutual cooperation between and among stakeholders through frank discussion.

The workshop was participated by officials from the Ministry of Home Affairs, representatives from the Department of Mines and Geology, Department of Urban Development and Building Construction, Department of Water Induced Disaster Prevention, Bir Hospital, Kathmandu Metropolitan City, Nepal Police, Royal Nepal Army Hospital, Kathmandu Valley Town Development Committee, Social Welfare Department of Kathmandu Metropolitan Municipality, Nepal Telecommunication Corporation, National Society for Earthquake Technology, UNDP, JICA Nepal Office, Embassy of Japan and the JICA Study Team in addition to officials of other Organizations. The list of participants and the Workshop Program are annexed. (*see Annex 1 and 2*)

The Workshop was facilitated by Mr. Parimal Jha of the Human Resources Development Centre HURDEC (Pvt.), Ltd.

### **2.1 Opening Session**

With a short introduction to the Workshop by Mr. Parimal Jha, the Opening Session commenced with an Inaugural Address by Mr. Shreekanth Regmi, Secretary, Ministry of Home Affairs, Mr. Regmi in his inaugural address said that working directly with the Department of Narcotics Control and Disaster Management and other agencies represented at the Workshop, the JICA Study Team would formulate a plan to reduce earthquake disaster risk in the Kathmandu Valley and provide many tools to implement it such as a GIS System and a plan for the actual retrofitting and reinforcement of critically important structures. He expressed the confidence that through this project we would arrive at a better understanding of Kathmandu Valley

earthquake risk reduction measures whereby priorities could be set for actions to protect society. Expressing the hope that the Workshop would come up with a fruitful and concrete outcome for the efficient and effective execution of the Study, Mr. Regmi declared the Workshop open and wished for its grand success.

Then, Mr. Ken Hasegawa, Resident Representative, JICA Nepal Office delivered his address. Mr. Hasegawa, in his address, recalled that following the Great Hansen Earthquake of Japan 1995, the Government of Japan had initiated cooperation on disaster mitigation with developing countries. He said that the present study was the second long-standing cooperation on disaster mitigation between Japan and Nepal. Mr. Hasegawa appreciated the initiative and enthusiasm of the Ministry of Home Affairs in taking the lead role in undertaking the Study and assured JICA assistance for the success of the study. He also requested all concerned to extend their helping hand to the study team and hoped that the Workshop would support the efforts of His Majesty's Government to mitigate earthquake disaster in Kathmandu Valley.

The JICA Study Team Leader, Dr. Yoshitake EGAWA was the final speaker during the Opening Session. He made a fairly detailed presentation on the Study on Earthquake Disaster Mitigation in Kathmandu Valley beginning with the Items of Study and Staffing and the Work Schedule. Dr. EGAWA then explained about the expected tentative output of the study that consisted of;

- Plan for Inter Agency Cooperation.
- Plan for Risk Management with how to construct the city.
- Plan for Crises Management for the saving of life and properties.
- Preparation for Restoration.
- Establishment of Websites.
- Transfer of Technology to Counterpart and Local Staff.

Dr. Egawa in his presentation stressed on the importance of consensus and Inter-Agency coordination and cooperation for effective Earthquake Disaster Mitigation.

## **2.2 Keynote Speech**

Dr. Meen Bahadur Poudyal Chhetri, Director, Department of Narcotics Drug Control and Disaster Mitigation presented the Keynote Speech of the Workshop on "Current Status and Future Task for Earthquake Disaster Mitigation".

Dr. Poudyal, in his Keynote Speech, first outlined the disaster scenario of Nepal together with the Organizational Structure of Natural Disaster Management in Nepal and the agencies involved in disaster management in the country and the measures to solve them. Dr. Poudyal Chhetri shed light on the vulnerability of the Kathmandu Valley on the basis of past records. He finally concluded with a brief background of the present study with its objectives and the expected outcomes. *Dr. Chhetri's Presentation is annexed. (see Annex 3)*

## **2.3 Western Indian Earthquake and Disaster Mitigation**

Mr. F. Kaneko, Deputy Team Leader of the JICA Study Team then made a presentation on the recent Western Indian Earthquake and Disaster Mitigation. He presented a comparison between the Kobe earthquake in Japan and the Gujarat earthquake in India. He said that the characteristics of Kathmandu Valley were similar to Gujarat with respect to masonry houses constructed without a building code and the virtual absence of awareness and preparedness. Mr. Kaneko then explained about the activities that would be done by the Earthquake Mitigation

Project in Kathmandu Valley and then called on all the officers, Government, Communities and the Private Sector to cooperate in order to realize earthquake mitigation. He concluded with a plea of cooperation from all stakeholders on data collection, current status understanding and discussion for appropriate planning regarding the JICA Study Project. *Mr. Kaneko's Presentation is annexed. (see Annex 4)*

## **2.4 Toward a Safer World through Disaster Mitigation**

The last presentation of the Morning Session was made by Dr. Hayashi, Chief Advisor of JICA Study Project. Dr. Hayashi hails from the Disaster Prevention Research Institute (DPRI) in Japan. He remarked that the USA was a high preparedness country and Japan was a high mitigation country while many developing countries were in the "Response Only" stage with respect to earthquakes. An optimal balance for the future would be somewhere between "High Mitigation" and "Preparedness". Dr. Hayashi highlighted the five steps of Risk Management as;

## **2.5 Keynote Speech**

Following the Opening Session, Dr. Meen Bahadur Poudel Chhetri;

- Establishing the Context.
- Identification, Analysis and Evaluation of Risks.
- Treating Risks.
- Monitoring and Review.
- Communication and Consultation.

Dr. Hayashi also mentioned that risk management should be regarded as a continuous and progressive process with the principal elements being the setting of measurable goals under the PDCA (Plan, Do, Check and Act) cycle for the treatment of risk. In context to the Kathmandu Valley Earthquake Mitigation Project he concluded that the following should be kept in mind:

- What are the goals in fighting earthquakes?
- Who are the stakeholders?
- For whom? Who are the target population?

Dr. Hayashi's Presentation is annexed. *(see Annex 5)*

## **3. Afternoon Session**

The afternoon session was facilitated by Mr. Parimal Jha and Mr. D. Bhattarai acted as reporter for the session.

### **3.1 Session 1: Making Synergy**

During the session, speakers from various organizations made their presentations after which queries were put to the speakers and discussions held.

#### **3.1.1 Mr. Padma Sunder Joshi, Kathmandu Valley Mapping Project**

Mr. Joshi, Co-Director of the Kathmandu Valley Mapping Program launched by Kathmandu Metropolitan City with the support of the European Union (EU) explained that the mapping program would focus on urban management issues such as solid waste, heritage conservation, building bye-laws and the metric addressing system. The maps to scales of 1:10,000 and 1:1000 scales, digitized and converged into GIS and integrated in the Urban Management Information System would be available in about a year. Mr. Joshi said that the outputs of the project would provide a good basics for Disaster Management.

The Kathmandu Valley Mapping Project would focus on the following:

- Heritage Inventory of Metropolitan City, monuments, private heritage buildings.
- Collecting household cadastral data including type of building for taxation and other purposes.

This could be useful for Disaster Management.

#### **Discussion:**

Mr. K.P. Kaphle of the Department of Mines and Geology queried on the purpose of the maps of different scales to which Mr. Joshi replied:

1:1000 scale maps for the Metropolitan City would be based on existing 1:500 cadastral maps for cadastral information, taxation purpose, urban facilities like telephone lines, water supply lines and other utilities. 1:10,000 scale maps would be produced for the whole Valley. If 1:500 maps are needed, the maps could be enlarged.

To another query, Mr. Joshi replied that a proposal has been sent to acquire satellite pictures and imagery and that the maps could be updated when necessary.

To another question regarding the issue of coordination among the various agencies involved in mapping, Mr. Joshi responded by saying that a Work Group comprising of Users and other relevant organizations such as the Nepal Telecommunication Corporation (NTC), the Postal Service, and so on would be formed and involved in the addressing system to bring about coordination.

#### **3.1.2 Dr. Madhav Raj Pandey, Department of Mines and Geology, National Seismic Centre**

Dr. Pandey in his presentation explained that the National Seismic Network of DMG had two primary functions:

1. Geological/geophysical/seismological study of the Himalayas in order to make a meaningful hazard assessment.
2. To work as watchdog for earthquakes and inform related agencies for downstream functions.

He informed that under the National Earthquake Measurement Centre, there were 17 stations of which 12 were under the Lainchar Centre and the rest were under the Surkhet Regional Seismic Centre apart from the network of 4 stations under the Karnali River Valley Network operating from Surkhet

Dr. Pandey said that the Seismic Network was equipped with an alarm system to inform the duty officer in the event of an earthquake, and that the network system was capable of recording as small as M2 magnitude earthquake. He said that it took 1-2 hours to obtain the processed result after an earthquake. Displaying the Earthquake Epicenter Map of Nepal Himalaya compiled by the Network in 1997-1998, Dr. Pandey shed light on some historical earthquakes following the Micro-seismic City Band and explained that along the Dehradun-Kathmandu stretch there has been no rupture since 1905 and 1934 and that 1.5 meter of strain was already accumulating so that there could be a rupture any time in the future.

#### **3.1.3 Mr. Sugat Kansakar, Regional Director, Nepal Telecommunication Corporation**

Mr. Kansakar described the telecommunication network within the Valley. He said that there were 5 big exchanges within the Valley comprising 50 percent of the total telephone lines in the whole country of which two were international gateway exchanges. He informed that two of the exchange buildings were constructed robustly to stand earthquakes but the enough other buildings might have to be



retrofitted. Mr. Kansakar explained that, in the event of an earthquake, the main worry was the Underground Network, where the manholes have been designed robustly but the copper cables might not have the desired flexibility. He said that the restoration of telephone lines in the event of an earthquake would take time. He explained that in case of emergency, the mobile telephone system would be the most practical for mobilizing rehabilitation and relief works. Therefore, in the construction of exchange buildings for the mobile system, safest structure design should be made irrespective of the cost. Mr. Kansakar concluded by saying that NTC had requested N-SET to train some of the 4500 NTC staff with a separate manual to deal with emergency situations.

#### **3.1.4 Mr. R.S. Moktan, SSP, Nepal Police**

Mr. Moktan, in his presentation, said that Nepal Police is the only large Government Organization with a large network of many small stations scattered all over the kingdom so that in the event of any disaster, the policeman is the first person to obtain and convey the information on site regarding lost life, damaged property and injured persons. He explained that the duty of the police in case of disasters was to save life, provide security, to maintain public order and to manage the vehicular traffic. Mr. Moktan shed some light on the chain of command, control and coordination during disaster events regarding rescue operations and relief work including information management, training and planning for the incidence of disasters. He concluded by stressing that the coordination factor among administration, hospitals, NGOs, relevant agencies and community leaders was very crucial for rescue operations.

In reply to a query by Mr. Parimal Jha on the issue of coordination between the police and army, Mr. Moktan replied that in time of need, that would be necessary as the Army had the equipment and the reserve force.

#### **3.1.5 Ms. S. D. Ranjeetkar, Kathmandu Metropolitan City (KMC)**

Ms. Ranjeetkar of the Disaster Activities and Social Welfare Department of KMC related from her 3 years of experience that even though previously people did not even want to hear about disasters, attitudes were now slowly changing. She said that the City Development Strategy Project assisted by the Asian Development Bank has given priority to Disaster Management (CDM) with focus on community level including training and street drama on DM, which have evoked a good response.

Ms. Shirely Mattingley queried to hear more on street dramas. Ms. Ranjeetkar replied that professional popular groups composed the theme and the drama was played on the street which provides entertainment as well as creation of awareness in disasters.

#### **3.1.6 Mr. Kai Weise, Advisor, Madhyapur Thimi Municipality**

Mr. Kai Weise said that the Madhyapur Municipality was working on new development guidelines and construction regulations setting up a zoning plan with reserve and open areas, and restricting the height of buildings to 3 floors (upto 5 floors in certain areas). He raised some issues on how earth quake resistant does a building need to be, quality of construction and responsibility for structural safety. He suggested that contractors/builders should register with the municipality to ensure that a building is constructed according to design and that RCC works must be controlled to maintain quality. A query was raised about the stability of the ground where construction is done. In the discussion it was put forward that any building

exceeding 150 square meters must have undergone a soil test and that the municipality should make a construction safety map. Mr. Arjun Nakarmi of N-Set remarked that people are now taking to the building code in a positive way in the aftermath of the Gujarat Earthquake. Therefore, the code must be advocated. Mr. Nakarmi suggested that there should be a geological expert in the municipalities for advice to the public on foundations. Dr. Madav Raj Pandey remarked that soil testing and settlement is different from Earthquake Engineering as local effects are unknown and change from point to point, where bed rock occurs at 50 feet at one place and 400 feet at another place, e.g. ICIMOD. He therefore suggested that a cadre of knowledgeable people must be prepared to consider local effects, which is special branch of earthquake engineering.

### **3.1.7 Mr. S.B. Pradhanang, Chairman, NSET-Nepal**

Mr. Pradhanang of the National Society for Earthquake Technology, in his presentation explained that the motivation for the establishment of N-Set came from the 1988 earthquake disaster, shock from Building Code studies, support from the then Ministry of Housing and Physical Planning (MHPP). He said that the focus of N-Set was on Earthquake Risk Management with a multi-disciplinary team and members coming from academic and other Government Organizations, and that it enjoyed tremendous national and international support.

Mr. Pradhanang highlighted the N-Set Projects as:

- Kathmandu Valley Earthquake Risk Mapping Project (KVERMP).
- Urban Environmental Mapping.
- Information and Networking.
- Earthquake Research.

He mentioned the ongoing programs as Replication of KVERMP in Pokhara, Dharan, possibly Bangladesh and Mongolia, Collaboration of WHO Kathmandu for Earthquake Safety and Health System, Bir Hospital, Training for Teachers and Students, Municipal Mapping/Environmental Mapping, Development of Methodology for Non-structural Hazard Mapping, and Improvement of Building Permit Process in Municipalities.

Mr. Pradhanang shed light on the Mission objective and Vision of N-Set for 2020, and Action Plan for 2001-2004. He said that the strategic objective of the N-Set was to become a repository of information on the system of earthquakes. Mr. Pradhanang concluded by saying that this Study has come at the right time, when people have a very positive attitude after the shock of the Gujarat Earthquake and that N-set would extend all its support and effort to the Ministry of Home, Department of Narcotic Drugs and Disaster Management and the Japanese Study Team.

### **3.1.8 Mr. Man Bahadur Thapa, UNDP**

Mr. Thapa highlighted the role played by UNDP since the late 70s and early 80s beginning with the rehabilitation of roads damaged by landslides and floods. He recalled the rehabilitation of areas damaged by the 1988 earthquake and the establishment of the National Disaster Section in the Ministry of Home Affairs. He said that the UNDP had played a significant role in coordination the international agencies during the 1993 flood disaster. It had also undertaken pilot projects at disaster rehabilitation in the districts of Kabhre and Chitwan after the 1993 floods with the use of indigenously available resources and technology. UNDP has recently contemplated launching a disaster management programme in the districts of Bardiya,

Syangja, Chitwan and Tanahu. Mr. Thapa explained that the UN Nepal Interagency Plan consisted of:

- Overview of the situation.
- Interagency Response Plan.
- Response Plan to support the Government and the Public.

He remarked that the Gujarat Earthquake had heightened our level of awareness and concluded with the recollection of the three Sectoral Working Group, viz., food and Agriculture, Logistics and Health after the 1993 flood disasters.

A discussion arose on the status of the Working Group Manuals referred to by Mr. Thapa above. Dr. Bill Berger clarified the matter by saying that the Manuals were ongoing work to be iterated over time.

### **3.1.9 Mr. Amrit Man Tuladhar, Department of Urban Development and Building Construction**

Mr. Tuladhar recalled that the 1988 earthquake had drawn the attention of HMG/N, UNDP and UNCHS (habitat) to formulate a policy on technical development in the urban sector. The National Building Code was then formulated as a sub-project where a consortium of international consultants, local consultants, Indian experts and Nepalese counterparts were involved in the three project sub components:

- Seismic Hazard Mapping and Risk Assessment of Nepal.
- Preparation of National Building Code of Nepal.
- Development of Alternative Building Materials and Technologies.

Mr. Tuladhar mentioned that the Nepal National Building Code had been finalized in 20 volumes and was available for sale, and that the Building Act 2055 had come into force; but there were difficulties in its implementation. He also mentioned that work on the Regulations of the Act is going on and that the Building Code must be regarded as a dynamic document to be revised and updated. He requested the JICA study, Team to provide concrete suggestions on improving the National Building Code.

### **3.1.10 Dr. Ram Prasad Shrestha, Director, Bir Hospital, Kathmandu**

Dr. Shrestha said the Bir Hospital, established 112 years ago, was the first modern hospital in Nepal with a multi-disciplinary health care delivery system and that the 400 beds of the hospital were not sufficient to cater to disasters with the present maximum work load. The Emergency Department with 30 beds deals with local disasters like traffic accidents, and political riots. He said that the hospital had developed a Disaster Management Plan (DMP) in 1988 following the stampede casualties of the Dasrath Stadium. Dr. Thapa stated that the hospital was not prepared for mass casualties of earthquake victims. He cited some enhancement programs at Bir Hospital:

- ❖ Emergency Treatment and Trauma Centre (to be built earthquake resistant with Indian Government support).
- ❖ Comprehensive Plan for Response in Earthquake Disaster Situation, where NSET-Nepal is also helping and Bir Hospital is trying to upgrade its preparedness and capabilities.
- ❖ Asian Disaster Preparedness Centre (ADPC) Training Program, curriculum being developed.

Dr. Shrestha stressed on the need to revitalize the Health Working Group and develop the Manual and build a First Response Group. He said that Field Hospital

Preparedness was badly needed. Dr. Shrestha stressed on the need to refuse license to private hospitals that do not have a DMP and also suggested that Mass Disaster Management curriculum should be taught in the medical colleges.

### **3.1.11 Col. Dr. K.B. Chand, Deputy Director of Medical Science, Royal Army Hospital**

Dr. Chand said that the Army Hospital had a DM Plan, which has not been tested yet in practice and also informed that the hospital had 30 beds allotted for civilians with 100 beds available in case of mass casualties. He recalled that the courses conducted by the

Hospital with the US Army on Basic Trauma Support, etc. had been effective. Dr. Chand said that as the Army Hospital was not overloaded, it could help in the event of mass casualties, but concluded that we lacked interaction and the sense of accountability.

To the query of Dr. Meen Bahadur Poudel Chhetri, if it were possible to coordinate with other hospitals, Dr. Shrestha replied that it was possible and was being done in the case of Bir Hospital.

### **3.1.12 Mr. Bill Berger, USAID, OFDA Regional Advisor**

Mr. Berger said that after 1993, USAID through the Office of US Foreign Disaster Assistance (OFDA) had assisted in 19 instances worldwide. In 1998, OFDA together with UNDP had hosted a seminar on Medical Consequences of Disasters. He also said that in 1999, OFDA had provided funding of WHO for mass casualty planning and medical consequences training and had also supported N-SET for master planning of the Urban Disaster Mitigation Program component of Kathmandu Valley Earthquake Risk Mapping Program (KVERMP). Mr. Berger recollected that having just been in Bhuj, the epicenter of the Gujarat Earthquake, this Workshop must be a very important one. He concluded with information on emergency Response, Search and Rescue Course, and Non-structural Mitigation and Mass Casualty Program courses in Nepal, Philippines, Indonesia and India, where India particularly realized the value of training and the Indian Army had asked for Training of Trainers (TOT) courses adapted to the country in the local languages

## **3.2 Poster Session: Developing Mutual Trust**

In this session, the participants observed and scrutinized the posters, maps, photographs and other material regarding earthquakes that were displayed in various panels by the organizations enlisted below:

- Ministry of Home Affairs
- Department of Mines and Geology
- Department of Urban Development and Building Construction
- N-SET
- Kathmandu Valley Town Development Committee
- Nepal Telecommunication Corporation
- Kathmandu Municipality Social Welfare Department
- Also on display were, apart from brochures on RADIUS
- Risk Assessment Tools for Diagnosis of Urban Areas Against Disaster by the IDNDR Secretariat, Geneva:
- Earthquake Disaster Mitigation Project in Teheran and India's Tragedy in the Recent Earthquake
- Outline of the "Building Inventory Survey and Social Structure Survey of the Project

### **3.3 Closing Session**

After the commencement of the Closing Session, the facilitator, Mr. Parimal Jha thanked all the participants for their enthusiast interaction in the Workshop with proceeded very well. Mr. Kaneko, the Deputy Study Team Leader, JICA expressed his high appreciation of the active participation of the participants on behalf of JICA. He said that based upon the Workshop, the Study Team would continue to keep close relations with all participants and hoped to come up onto some sustainable plan for Kathmandu Valley with the cooperation of all. He thanked everyone before the closure of the Workshop.

**List of Participants**  
**Workshop on Earthquake Disaster Mitigation in Kathmandu Valley**

on 27 Feb. 2001 at Himalaya Hotel

	Name	Affiliation	Position	Poster	Presentation
1	Mr. H. P. Joshi	Bhaktapur Municipality			o
2	Mr. Ram Gobinda Shrestha	Bhaktapur Municipality	Urban Development/Planning Section		
3	Dr. Indra Prasad Prajapati	Bhaktapur Hospital	Medical Officer		
4	Dr. Ram Prasad Shrestha	Bir Hospital	Director		o
5	Dr. K. D. Shrestha	Dept. of Health	Chief of Epidemology Division		
6	Mr. Pranab Lal Shrestha	Dept. of Mines & Geology	Deputy Director General		
7	Mr. Madhab Raj Pandey	Dept. of Mines & Geology	Senior Geologist	o	o
8	Mr. Krishna P. Kaphle	Dept. of Mines & Geology	Senior Divisional Geologist		
9	Mr. Bharat M. Jnawali	Dept. of Mines & Geology	Senior Divisional Geologist		
10	Dr. M. B. Chhetri	Dept. of NDC & Disaster	Director		o
11	Mr. R. K. Niraula	Dept. of NDC & Disaster	Section Officer	o	
12	Mr. Damodar Dhakal	Dept. of NDC & Disaster	Assistant		
13	Mr. Indra Sunuwar	Dept. of NDC & Disaster	Assistant		
14	Mr. Ananda P. Khanal	Dept. of Road	Director		
15	Mr. Ram Bahadur Shrestha	Dept. U. Planning & Building Const.	Senior Engineer		
16	Mr. Armit Man Tuladhar	Dept. U. Planning & Building Const.	Civil/Structure Senior Engineer	o	o
17	Mr. Kedar Prakash Rozal	DWIDP	Executive Director		
18	Mr. Koji Kamee	DWIDP	Chief Advisor		
19	Mr. Damodar Bhattarai	DWIDP	Senior Divisional Engineer		
20	Mr. Kedar Sharma	Free Journalist			
21	Mr. Ananta Rajlital	Himalaya Times			
22	Mr. Takamichi Okabe	Japan Embassy	Minister		
23	Mr. Yoshiyuki Toyoguchi	Japan Embassy	Second Secretary		
24	Mr. Ken Hasegawa	JICA	Res. Rep.		o
25	Mr. Katsuji Miyata	JICA			
26	Mr. Sourab Bikram Rana	JICA			
27	Dr. Haruo Hayashi	JICA Advisory Team	Leader		o
28	Dr. Hideo Fujitani	JICA Advisory Team	Advisor		
29	Dr. Yoshitake Egawa	JICA Study Team	Leader		o
30	Mr. Fumio Kaneko	JICA Study Team	Deputy Leader	o	o
31	Mr. Kenji Yano	JICA Study Team			
32	Mr. Tsuneo Osumi	JICA Study Team		o	
33	Mr. Naresh Stapit	JICA Study Team			
34	Mr. Muneo Kurono	JICA Study Team		o	
35	Mr. Nobuhiko Toyama	JICA Study Team		o	
36	Ms. Shirley Mattingly	JICA Study Team			
37	Mr. Jiro Watanabe	JICA Study Team			
38	Ms. Tomoko Shaw	JICA Study Team		o	
39	Mr. Hiroyuki Taguchi	JICA Study Team			
40	Mr. Parimal Jha	JICA Study Team	Facilitator		
41	Ms. H. D. Ranjitkar Yosha	Kathmandu Municipality	Social Welfare Dept.	o	o
42	Mr. Utpal Raymisra	Kathmandu post			
43	Mr. Padma Sunder Joshi	KVMP	National Co-Director		o
44	Mr. K. C. Shrestha	Lalitpur District	Chief District Officer		
45	Mr. Kai Weise	Madhyapur Municipality			o
46	Mr. Rudra Adhikari	Madhyapur Municipality	Urban Development/Planning Section		
47	Mr. S Regmi	MOHA	Secretary		o
48	Mr. H. D. Shrestha	Nepal Engineering Association	General Secretary		
49	Mr. Rajid	Nepal Television			
50	Mr. Neeraj Sand	Nepal Television	Reporter		
51	Mr. Laxman Upreti	NHK Correspondent			
52	Ms. Miki Upreti	NHK Correspondent			
53	Mr. Shiva B. Pradhanang	NSET Nepal	President		o
54	Mr. Mahesh Nakarmi	NSET Nepal	Project Manager		
55	Mr. Jitendra K. Bothara	NSET Nepal	Structural Engineer		
56	Dr. Bharat Kumar Yadav	Patan Hospital	Emergency Chief		
57	Mr. Tirtha Pradhan	Police Headquarter	D.I.G.		
58	Mr. Moktan	Police Headquarter	S.S.P.		o
59	Dr. K. R. Kumar	Police Hospital	Chief		
60	Mr. Uttam Silwal	R.S.S			
61	Ms. Jaya Luintel	Radio Sagarmatha			
62	Mr. Sugat R. Kansakar	Regional Telephone Office	Regional Manager	o	o
63	Dr. K. B. Chand	Royal Nepal Army HQ(Hospital)	Chief		
64	Mr. Durgendra Man Kayastha	Survey Department	Chief Survey Officer		
65	Dr. Prakash C. Adhikari	Tribhuvan University	Head		
66	Mr. Man B. Thapa	UNDP	National Programme Officer		o
67	Mr. William S. Berger	USAID	OFDA Regional Advisor for South Asia		
68	Dr. S. Neupant	WHO			

	Name	Affiliation	Position	Poster	Presentation
69	Ms. U. Nepal	Dept. NDC & Disaster	Director General		
70	Mr. L. Pokharel	Dept. NDC & Disaster	Section Officer		
71	Mr. Shreeman Shrestha	National Planning Committee	Secretary		
72	Mr. Madhav Ghimire	Ministry of Finance	Joint Secretary		
73	Mr. Nanda R. Sthapit	Department of Mines & Geology	Director General		
74	Mr. Ram Sunder Hada	Department of Mines & Geology	Under Secretary		
75	Mr. Hiranya Lal Regmi	Ministry of Physical Planning &	Secretary		
76	Mr. Shashi Bahadur Thapa	Dept. U Planning & Building Const.	Director General		
77	Mr. Purna Kadariya	Dept. U Planning & Building Const.	Deputy Director General		
78	Mr. Mani Ratna Tuladhar	Dept. U Planning & Building Const.	Civil/Structure Senior Engineer		
79	Mr. Surya Bhakta Sangache	KVTDC	Acting Member Secretary	0	
80	Mr. Adarsha Prasad Pokharel	Dept Hydrology & Meteorology	Director		
81	Mr. B. D. Chataut	Department of Health	Director General		
82	Dr. Mahendra Bahadur Bista	Chief of Epidemiology Division	Chief		
83	Mr. Rajendra B. Sing	Police Headquarter	D.I.G.		
84	Mr. Dilip Rayamajhi	Army Headquarter	Conl.		
85	Mr. Raghubar Lal Shresta	NTC	General Manager		
86	Mr. Sailendra Raj Sharma	Radio Nepal	Director		
87	Mr. Durga Nath Sharma	Nepal Television	General Manager		
88	Mr. Bishnu Bom Malla	Nepal Electricity Authority	Managing Director		
89	Mr. K. N. Bhattarai	Nepal Water Supply Corporation	Director		
90	Mr. G. B. Pradhan	R.S.S	General Manager		
91	Mr. LokDeep Thapa	Rising Nepal	Acting Editor		
92	Mr. Babu Ram Acharya	Survey Department	Director		
93	Mr. T. P. Bhattra	Kathmadu District	Chief District Officer		
94	Mr. D. Wagle	Bhaktapur District	Chief District Officer		
95	Mr. Keshab Sthapit	Kathmandu Municipality	Mayor		
96	Mr. Devendra Dangol	Kathmandu Municipality	Urban Development/Planning Section		
97	Mr. Prem Suwal	Bhaktapur Municipality	Mayor		
98	Mr. Madan Krishna Shresta	Madhyapur Municipality	Mayor		
99	Mr. Hira Kaji Maharjan	Kirtipur Municipality	Mayor		
100	Mr. Balkrishna Maharjan	Kirtipur Municipality	Urban Development/Planning Section		
101	Mr. Buddhi Raj Bajracharya	Lalitpur Municipality	Mayor		
102	Mr. Rudra Gautam	Lalitpur Municipality	Urban Development/Planning Section		
103	Mr. Ramesh Kumar Aryal	Nepal Geological Society	President		
104	Mr. Amod Mani Dixit	NSET Nepal	General Secretary		
105	Mr. Tripban MS Pradhan	DWIDP	GIS Officer		
106	Dr. Heming Karcher	UNDP	Resident Representative		
107	Mr. Rajendra Pradhanang	GTZ-UDLE	Programme Corrdinator		
108	Dr. Binayak Bhadra	ICIMOD	Director General		
109	Mr. Udaya Raj Regmi	Nepal Red Cross Society	Deputy Director General		
110	Mr. Ramesh Sharma	Nepal Red Cross Society	General Secreatry		
111	Mr. Kedar Khadka	Forum Protection of Public Interest	Director		
112	Mr. Mitsuaki Kojima	Japan Embassy	Ambassador		
113	Mr. Tetsuo Yabe	JICA	Deputy Rep.		
114	Prof. Madhav Prasad Sharma	Tribhuvan University	Professor(Geologist)		
115	Dr. P. Timilsena	Tribhuvan University	Professor(Economist)		
116	Mr. Richard W. A. Vokes	ADB(Asian Development Bank)	Resident Representative		
117	Mr. Yoshiaki Kitamura	UNESCO	Representative		
118	Dr. Klaus Wagner	WHO	Representative		
118	Ms. Sue Wardell	DFID	Chief		
119	Dr. Basant B. Panth	Bir Hospital	Chief Emergency Dept.		
120	Dr.	Teaching Hospital	Chief		
121	Mr. G. B. Ghuju	Department of Drug Administration	Pharmacist Officer		
122	Mr. Rishi K. Kafe	Health Care Foundatton	President		
123	Mr. Lajana Mananhar	LUMANTI	Director(NGO for shelter)		

## **III-2 The First Seminar**



**Programme of the 1<sup>st</sup> Seminar**  
**on**  
**Earthquake Disaster Mitigation in Kathmandu Valley**

Organised by  
Ministry of Home Affairs Department of Narcotics Control & Disaster Management  
and  
JICA Study Team

1. Purpose

- To introduce the result of the Project especially on Hazard & Risk Maps
- To discuss measures in view of Earthquake Disaster Mitigation Planning

2. Date and Venue

August 3, 2001                      10:00-15:30  
A Conference Hall at Himalaya Hotel in Patan

3. Program of the 1<sup>st</sup> Seminar

**A. Opening Session (10:00 ~10:30)**

Ministry of Home Affairs	Secretary	Mr. Regmi
Japan International Cooperation Agency	Res. Rep.	Mr. Mitoma
JICA Study Team	Leader	Dr. Egawa

**Tea Break (10:30 ~10:45)**

**B. Study Results (10:45 ~11:30)**

1) Result of Hazard and Risk Assessment	JICA Study Team	Mr. Toyama
2) Procedure of Hazard and Risk Assessment	JICA Study Team	Mr. Yano
3) Web Site and Database System	JICA Study Team	Mr. Toyama

**C. Key Note Speech (11:45 ~12:15)**

Earthquake and Earthquake Hazard in Nepal	Tribhuvan University	Prof. B.N.Upreti
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**Lunch Break (12:15 ~13:15)**

**D. Discussion for the next step to earthquake disaster mitigation in Kathmandu valley,**

***DIG (Disaster Imagination Game), based on Hazard and Risk Maps (13:15 ~15:30)***

Focal points of discussion

- 1) Inter-agency cooperation
- 2) Community based organisation
- 3) Earthquake resistant building
- 4) Information and communication
- 5) Infrastructure
- 6) Urban planning
- 7) Medical care and public health

**Tea Break (14:00 ~14:15)**

**E. Adjourn (15:30)**

Reporter : Prof. B.N.Upreti  
Facilitator : Dr. Chhetri (Sessions A to C) and Mr. Komura (Session D)

***Report on the***  
**First Seminar on Earthquake Disaster Mitigation in Kathmandu Valley**

***Organized by***  
**Ministry of Home Affairs, Department of Narcotics Control  
and Disaster Management  
and  
JICA Study Team**

The First Seminar on earthquake disaster mitigation in Kathmandu valley was jointly organized by the Department of Narcotics Control & Disaster Management, Ministry of Home Affairs and JICA Study Team. It was held on 10th August, 2001 at Hotel Himalaya, Pulchowk, Lalitpur, Nepal. The seminar was organized mainly to introduce the results of the study on Earthquake Disaster Mitigation in Kathmandu Valley Project especially to introduce the newly prepared hazard and risk maps of the valley, and to discuss on the earthquake disaster mitigation planning. The main objectives of the project are :

1. To prepare a comprehensive report on the earthquake hazard in the Kathmandu valley
2. To transfer the Japanese technology to the Nepalese counterpart.

The seminar was attended by the following dignitaries and representatives of various organizations

**Mr. Shrikant Regmi, Secretary, Ministry of Home Affairs, HMG/Nepal**  
**Mr. Eitaro Mitoma, Resident Representative, JICA**  
**Mr. Yuki Toyoguchi, Second Secretary of Embassy of Japan**  
**Dr. Y. Egawa, Team Leader, JICA Study Team**  
**Mr. Tika Dutta Niraula, Jt. Secretary, Ministry of Home Affairs,**  
**Mr. Kumar Prasad Poudel, Director General, Dept. of NC & DM, Ministry of Home**  
**Mr. Nanda Ram Sthapit, Director General, Department of Mines and Geology**  
**Dr. Meen Bahadur Poudyal Chhetri, Director, Dept. of NC & DM, Ministry of Home**  
**Mr. Achut Raj Mishra, Director, Dept. of NC & DM, Ministry of Home**  
**Mr. Bil Berger, USAID**  
**Mr. Man Bahadur Thapa, UNDP**  
**Mr. Erik Kjaergaard, WHO**

The seminar was attended by a total of 114 participants. In addition to individuals and experts of various fields, representatives from the following organizations were also invited:

Ministry of Home Affairs  
Department of Narcotics Control & Disaster Management  
Chief District Officer, Kathmandu  
Chief District Officer, Lalitpur  
Chief District Officer, Bhaktapur

## **HMG Ministries and Departments**

National Planning Commission  
Ministry of Physical Planning and Works  
Ministry of Education and Sports  
Department of Education  
Ministry of Finance  
Ministry of Information and Communication  
Ministry of Health  
Department of Mines and Geology  
Department of Survey  
Ministry of Science and Technology  
Department of Health Services  
Department of Hydrology and Meteorology  
Department of Roads  
Department of Urban Planning and Building Construction  
Department of Water Induced Disaster Prevention (DWIDP)  
Army Headquarter  
Police Headquarter

## **Corporations**

Nepal Telecommunication Corporation  
Nepal Electricity Authority  
Nepal Water Supply Corporation

## **Municipalities**

Mayors of Kathmandu Metropolitan City, Lalitpur, Bhaktapur,  
Madhyapur and Kirtipur municipalities  
Kathmandu Metropolitan City, Social Welfare Department  
Kathmandu Metropolitan City, Urban Development/planning  
Kathmandu Valley Town Development Committee  
Kathmandu Valley Mapping Project (KVMP)  
Lalitpur Municipality, Urban Development/Planning  
Bhaktapur Municipality, Urban Development / Planning  
Madhyapur Municipality, Urban Development / Planning  
Kirtipur Municipality, Urban Development Planning

## **Hospitals**

Bhaktapur Hospital  
Bir Hospital  
Patan Hospital  
Police Hospital  
Royal Nepal Army Hospital  
Teaching Hospital

## **International agencies**

British Embassy  
Chinese Embassy  
Japanese Embassy  
American Embassy  
Asian Development Bank (ADB)  
Department for International Development (DFID)  
GTZ-UDLE  
Japan International Cooperation Agency (JICA)  
United Mission to Nepal (UMN)  
UNDP, United Nations Disaster Prevention  
UNESCO  
UNICEF/ROSA  
United States Agency for International Development (USAID)  
World Food Programme (WFP)  
World Health Organization (WHO)  
Save the Children Fund (SCF) UK  
Lutheran Word Service (LWS)  
Cooperation for American Relief Everywhere (CARE)  
International Centre for Integrated Mountain Development (ICIMOD)  
Tribhuvan University, Department of Geology  
University of North Cambria, U.K.

## **Others**

Nepal Administrative Staff College  
Nepal Engineer's Association  
Nepal Geological Society  
National Society for Earthquake Technology (NSET)  
Nepal Red Cross Society  
Health Care Foundation  
Truck Association of Nepal  
Little Angles School  
Forum for Protection of Public Interest  
LUMANTI (an NGO for shelter)  
Nepal Nursing Council

## **Media**

Rastriya Samachar Samiti (RSS)  
Nepal Television  
Radio Nepal  
Radio Sagarmatha  
Kathmandu Post  
Himalaya Times  
Rising Nepal  
NHK correspondent

The seminar was inaugurated by Mr. Shreekant Regmi, Secretary, Ministry of Home Affairs, HMG/Nepal. Inaugurating the seminar, Mr. Regmi mentioned that a workshop on this subject was already held on 27th February, 2001 where the objectives and concept of the project was presented. The project is being executed by the Ministry of Home Affairs since February 2001 with the support of the Japanese Government through JICA. He mentioned that the project has come up with valuable findings at this stage of project and the findings are found quite useful to the government and the people of Nepal particularly to the inhabitants of the Kathmandu Valley. He hoped that the findings of the study will contribute a lot in preparing against the possible earthquake disaster in the valley.

In his speech Mr. Regmi also informed that the JICA study team would also formulate plan to reduce earthquake disaster risk in the Kathmandu valley working closely with the Department of Narcotics Control & Disaster Management of the Ministry of Home Affairs and other agencies in Nepal. The project will provide various ways and means to implement the plans and provide concrete guideline for retrofitting and reinforcement of critically important infrastructures. Besides, the project is also designed to transfer the Japanese technology in this field to Nepalese counterparts to help to enhance and strengthen the preparedness and response capabilities of Nepalese against the threat of earthquake hazards. Mr. Regmi emphasized that the findings of the project will be disseminated among the people by all possible means to help to raise the level of awareness among the relevant government agencies and the public. He hoped that this study will also help to regularize rapid urbanization process of the valley by adopting building code as preventive measures. Lastly, he highly commended the work and thanked for the cooperation received from the JICA study team personnel and various local and international agencies for the success of the project.

Similarly, the Resident Representative of Japan international cooperation agency (JICA) Mr. Eitaro Mitoma also spoke on the occasion. He mentioned that the nature sometimes is very cruel if not properly understood and taken care of, and such natural disasters have no boundary. With this motto in mind, he said, JICA agreed to extend cooperation to the Ministry of Home Affairs, His Majesty's Government of Nepal to study on earthquake disaster mitigation in Kathmandu Valley. Mr. Mitoma expressed happiness on the completion of the study and complimented to the Study Team and the leader Dr. Y. Egawa for their dedication and hard work. He also thanked the Ministry of Home Affairs Department of Narcotics Control and Disaster Management and other related agencies for their kind and valuable support to the Study Team. Mr. Mitoma expressed confidence that the interim report and hazard map and risk analysis will be very useful for the policy makers and planners of Nepal in designing earthquake related disaster mitigation plan for future and help create a safe Kathmandu. He was optimistic that HMG/Nepal will make every effort to materialize the findings of the study by sustainable approach towards meeting the objectives of the study. As there are numerous stakeholders in the study, without their cooperation and support the study will not be able to meet its objectives. Mr. Mitoma expressed hope that all the concerning HMG/Nepal agencies, local governments and other related local organizations will further extend their helping hand to the Study Team in their remaining work in Kathmandu. He also, reminded of the recent large earthquakes such as the Hanshin-Awaji earthquake (Kobe earthquake) of Japan, Taiwan Earthquake, Gujarat Earthquake, India and the earthquake of 1934 that affected Kathmandu Valley so heavily, and to prepare for the future earthquakes.

Finally, he expressed his sincere appreciation to the Ministry of Home Affairs, Department of Narcotics Control & Disaster Management, and the Study Team Members in organizing the

seminar. He hoped that the seminar will contribute significantly for the effort of His Majesty's Government of Nepal to mitigate and prepare for the potential earthquake disaster in the Kathmandu Valley.

Team Leader of the JICA Study Team, Dr. Y. Egawa spoke at the opening session on the objective and scope of the project and introduced the project briefly, and highlighted on the result obtained. He informed to the participants that the project was conducted successfully in cooperation with Ministry of Home Affairs and relevant organizations and the final report will be submitted in January 2002. However, the draft final report will be submitted in November 2001. He spoke about the holistic planning on earthquake preparedness and proposal for urgent projects. The major aim of any earthquake disaster management project is to protect the life and property of the people. He underlined two other important factors required to achieve the above goal i.e. (i) strengthening socioeconomic system; and (ii) protecting the stability of governance even in case of earthquake.

One of the most important concerns is the interface between the government and the people. In case of a great earthquake, a lot of rescue and relief material will come from the government and from foreign countries, but in most cases there will be no interface between the victims and relief and rescue agencies. Thus the available relief materials will not reach to the victims in time or will not reach at all. Also, sometimes the material will be dead stock or even will be missing somewhere. For proper rescue and relief works, the interface between the victims and the rescue/relief agencies is very important and needs information and prioritization in advance. In many countries, municipality plays the role for such an interface. During the presentation, Dr. Egawa laid emphasis on how to establish interface. He told that in most cases, Ward Office, Municipality and Village Development Committees (VDCs) will be the key institutions in this regard, of course, under the guidance of Ministry of Home Affairs. The project will focus on how to strengthen the function of these sectors.

He also stressed that the most important kinds of relief services that are needed at the time of emergency are water supply, sanitation, nutrition, shelter, and health services. He informed that the team would provide a holistic approach in suggesting on this sector. Another important sector is the logistics to implement rescue and relief work. Smooth functioning of airports, roads, electricity and water supply facilities is vital. The road leading to neighboring countries such as India and China and those to water intake and inter-city communication are most critical. Dr. Egawa informed that the project has already identified weak points along the roads and has found out many potential bridges, which may collapse just after a major earthquake. The project is also planning to propose urgent reinforcement projects for these bridges.

Next objective of the project is to strengthening the socio-economic system, Dr. Egawa added. These are the Active Earthquake Disaster Management Plans. Damage to water supply project is very critical. Water is essential for health, sanitary management etc.. So water supply projects need active management. Similarly, making plans for emergency communication system or preparing emergency shelter is also very important. These kind of existing or on-going active disaster oriented projects are evaluated in the present project. If a water supply project does not have a plan to store big quantity for emergency water supply, alternative plans such as plan to connect a very reliable water supply pipeline to hospitals were evaluated.

Dr. Egawa also explained that protecting the stability of governance even in case of earthquake is the most important factor in case of earthquake disaster management. After an earthquake normally governance will be lost because communication will be completely out of order and cooperation between relevant government organizations will be extremely difficult. Therefore emphasis must be given on communication system. The first information will come from the DMG regarding the epicenter and magnitude of the earthquake. But presently they do not have capability to evaluate on the earthquake intensity. DMG must develop its capability in this regard also. The information on the earthquake should be immediately transferred to His Majesty the King, the Prime Minister, Home Minister and other related ministries, radio stations, and the municipality. It is only then an initial response for relief, rescue or assistance from foreign countries can be started. Cooperation mechanism has to be improved gradually.

After the tea break, next in the series of presentation by the JICA study team, was Mr. N. Toyama. He introduced the results of the hazard and risk analysis. The focus of the presentation was, if huge earthquake occurs in the Kathmandu Valley in future, which area will be strongly shaken, which area will be heavily damaged and which area will have more casualties. Only based on these results one should think what should be done to reduce damage and make preparedness before such an earthquake. At First he introduced the analysis of the 1934 Nepal-Bihar earthquake. Due to this earthquake, the valley suffered a very severe damage. Before starting calculations, the basic data such as number of buildings and population at that time were assumed based on the population and number of houses in 1920, and also the present data was taken into account. The analyses were made for every 500 sq m area. The analysis for heavily damaged building ratio in case of 1934 earthquake was presented. He presented the coloured map showing difference in damage by various colours. In all results red colour corresponds to more severe damage and blue colour corresponds to least damage and green as intermediate. The map showed that more than 30 or 40 % buildings were heavily damaged in almost all parts of the valley and more than 50 % buildings were heavily damaged especially in the eastern parts. he also presented some old photographs of damaged buildings. In those days most buildings were made up of bricks or adobe. They were heavily damaged. Such old style buildings are no more built in Kathmandu Valley. Mr. Toyama also presented the number of heavily damaged buildings during the 1934 earthquake. As there were no so many buildings at that time the number of heavily damaged buildings were relatively small (only 38,055), as depicted in the map in colours of deep blue or yellow-green. He also compared the actual data and the calculated result, and showed that the numbers are almost the same. From this result it was found that the calculation technique used by the team had a very high accuracy.

Next, Mr. Toyama showed the calculation of damage if the Kathmandu Valley is hit by an earthquake similar to that of 1934. If a similar earthquake hits the valley again today, the number of heavily damaged building will become very large especially in central part of the valley. The comparison between actual data and calculated result showed that these numbers become very large almost 4 or 5 times than that of 1934 earthquake. As today both the number of buildings and the population in the valley has greatly increased the vulnerability to the earthquake disaster has also become large. In the recent years there were a few disastrous earthquakes in the world, such as Kobe, Taiwan, Turkey and El Salvador and India, Gujarat, and so on. Most seismologists in the world consider Himalaya as the next site for a large earthquake. Before designing the earthquake scenario, the JICA Study Team evaluated the tectonics, faults, historical earthquakes and present day seismicity in Nepal. The team also discussed with the seismologists of Department of Mines and Geology (DMG). Only after

that they finally defined the three scenario earthquakes. First one is the Mid Nepal earthquake. There is a seismic gap in this section of Nepal Himalaya and therefore there is a possibility that a major earthquake similar to that of 1934 may occur within this area and affect the Kathmandu Valley.

The second one is of middle size earthquake. By taking into account of the present seismic activity, the epicenter may occur in the north Bagmati region. And the third one is not so large, but there is possibility that it will occur just under the valley. These are the magnitudes of three scenario earthquakes. The magnitude of Mid-Nepal earthquake will be almost same as that of Gujarat earthquake. Mr. Toyama also explained briefly about the intensity and magnitude of an earthquake. Magnitude is the energy of earthquake and determined from seismic observation, and intensity is the measure of strength of seismic setting at a certain location and determined by the damage to buildings and other structures it causes in that location. So every location will have its own intensity. He also explained about the relationship between intensity and magnitude. A small earthquake will cause small intensity, and a large earthquake causes large intensity. The second point is that the intensity normally will be larger at a point nearer to the epicenter (source of earthquake) than at a farther place. Another point is that even at the same distance from the earthquake source (epicenter), the intensity will be comparatively small on hard ground whereas intensity will be much larger on soft ground such as sediment filled valleys. Mr. Toyama presented the map of Kathmandu valley showing areas of different intensities in case of an Mid Nepal earthquake. The areas are classified by different colours, red coloured areas indicating large intensity compared with the green area. The map shows that the mountainous area has relatively smaller intensity than the central area of the valley. Most of the valley will suffer with an intensity of VIII. For comparison, the intensity of Gujarat earthquake was around VIII or IX . So, Mid-Nepal earthquake will produce almost the same magnitude in the valley as that of the Gujarat earthquake.

The analysis shows that the North Bagnmati earthquake will produce an intensity of VII to VI and on southern part, the intensity will reach only V. The intensity will be smaller than the Mid-Nepal Earthquake. The earthquake produced by the active fault within the valley will produce intensity IX along the fault and far from the fault the intensity will decrease to VI. So compared to the Mid-Nepal earthquake the area of large intensity for example more than VIII, is small in this case. The intensity in Kathmandu Valley predicted for the Mid-Nepal earthquake seems almost the same as that of the 1934 earthquake.

In recent years the RC frame buildings have increased in Kathmandu Valley, and these structures are stronger than the traditional houses. It means they are less vulnerable than stone or adobe type buildings during a medium to small earthquake. But they will collapse at large intensity such as that of Gujarat earthquake.

Mr. Toyama also discussed about the result obtained regarding the liquefaction potential in the Kathmandu Valley. He also explained briefly about liquefaction. When a large earthquake occurs and shakes the ground strongly, the sand layer mixed saturated with groundwater will behave like liquid, and loose all its strength to withstand a structure such as buildings or bridges. Therefore liquefaction cause buildings to overturn and buried pipes start floating. He also showed some photographs of actual cases such as tilting of buildings in Neegata earthquake, Japan, displacement of bridge pier in Gujarat earthquake, collapse of bridge due to Kobe earthquake. Mr. Toyama presented the liquefaction potential map of Kathmandu Valley. Their results showed that the liquefaction potential of Kathmandu Valley is generally



low to moderate. Thus, the problem of liquefaction is not that much dangerous as anticipated by the previous studies. However, liquefaction may occur mostly along the river courses.

Further, based on the studies by the team, Mr. Toyama presented the maps of Kathmandu Valley with potential damage to residential buildings. Building damage is not only a loss of property but also danger to human life. And damage depends upon both seismic intensity and strength of building. Besides the strength of a building has close relation with building type. During the study, the buildings were classified into seven types. Only after that the number of buildings that may be damaged were estimated. Detailed analyses were made to establish relationship between damage potential and ground for each type of building. For example, under the same intensity, the damage to stone or adobe type of building is larger than that of RC frame building. The study showed that number of damaged building in Patan area will be much larger than in rural area. And total number of heavily damaged building in the valley is estimated at more than 50,000. When compared to the number of damaged buildings due to 1934 earthquake, this figure is much higher. More than 30 to 40% houses will be heavily damaged in some areas of the valley and damaged ratio is relatively high in rural areas than in the central area. This corresponds to the difference in building types, namely comparatively stiff RC buildings exist in urban area whereas brick, stone or adobe building exist in rural areas.

The last speaker from the JICA study team was Mr. Toyama who presented the Website and Database system prepared by the project. The address of the website is <<http://www.jica-eqdm-ktm.org.np>>. The head menu of the website includes Home, official documents, Outline, Results, topics, photos and Links. The main purpose of the website is to publish and share the information related to this study and to communicate to public interested in the present project study. he also explained the details included in each main menu. He also demonstrated how to surf the website.

The database system is known as "KERMIT" (Kathmandu Earthquake Mitigation Tool". the startup menu includes six bottoms to lead to each category of information: They are: Bibliography, Natural/Social Conditions, Seismic Hazard Analysis, Seismic Damage Analysis, New Simulation and others. At the category "New Simulation" one can simulate a ground motion and damages caused by a scenario earthquake with new parameters.

After the presentation by JICA study Team, a Key Note speech entitled " Earthquake and Earthquake Hazards in Nepal" was delivered by Professor Dr. B.N. Upreti from Department of Geology, Tribhuvan University. Professor Upreti spoke about the origin structure of the Himalaya, the nature and causes of earthquakes and the building conditions in the valley. The main part of the speech of Prof. Upreti may be summarized as below:

Earthquakes are the most sudden, dramatic and devastating natural disasters. They only last for seconds to minutes, but are the most frightening and devastating. In case of a great earthquake, the devastation is widespread and can be complete paralyzing a country or a region for days to months. Furthermore, it may take many years to recover from the damage to the infrastructure and the economy of a country. The trauma and sufferings of survivors may last for a lifetime. In general, the Asian countries such as, Iran, Afghanistan, China, Pakistan, India, Nepal, Bhutan, Bangladesh, Burma, Indonesia, Philippines and Japan all lie in zones of very high seismic risk.

Earthquakes cannot be prevented and we are far from being realistically able to predict them. Therefore we must learn to live with them and at the same time be prepared in advance towards mitigating earthquake hazards by utilizing all the tools that are available from the recent advances in science and lessons learnt from previous events.

### **Himalaya- the living mountain**

The Himalaya was formed by the most recent mountain building activity (tectonic activity) in the Earth's history and therefore it is called the youngest mountain on earth. The origin of the Himalaya began around 50 million years ago at the time when the north moving India first touched Asia. India pushed itself from near South Pole continuously for nearly 200 million years before it collided with Asia. Even after collision, India continued pushing Asia to the north and in the process India's leading edge was sliced, broken, folded and uplifted to form the youngest and the highest mountain range on our planet. Himalaya was already a dominating mountain range and causing monsoon rain in South Asia as early as 17 million years before (France-Lanord and others, 1993) .

India (the Indian plate) is constantly moving to the north even at present and converges below Tibet by 20 mm annually. This convergence builds up a very large storage of energy in the Himalayan region over a period of time. The energy is stored by building up elastic strain or deformation in the rocks of the Himalaya and adjoining areas. When the accumulated energy exceeds the ultimate strength of the rock, the rock breaks and suddenly releases the accumulated energy as slip on faults.

Since the mountain building process is still under progress the Himalayan and surrounding region is seismically one of the most active parts on earth. The earthquakes occurring in the Himalayan region are often greatly devastating and have killed large number of people in the past. Some of the largest continental earthquakes on record have been located especially along the Himalayan front.

### **What is an Earthquake?**

The earth is a dynamic body and is constantly changing, moving, and with full of energy. This dynamism comes from the internal heat energy of the earth. Earth's uppermost layer (about 100 km thick) is called lithosphere. The lithosphere is broken into many pieces called plates. These plates are constantly moving in different directions something like floating bodies of iceberg on an ocean. At the boundary of the plates, the rocks are continuously undergoing deformation (change of shape and/or volume) which is due to forces exerted by the moving plates. During the process of deformation of a plate a great amount of energy becomes gradually accumulated and stored. The stored energy is ultimately released when the strength of the rock body no longer can hold that energy. This energy is instantly released when the deforming rock ultimately breaks along a fracture and the two parts move. The smooth fracture along which two blocks of the rock move with respect to each other is called a fault.

When an accumulated energy is suddenly released, it travels through the earth and produces *waves in the rock (called seismic waves)* causing the earth's crust to shake for a period of time (few seconds to a few minutes). This is similar to the phenomenon when a stone is thrown into a pool. The dropping of a stone creates a series of waves like seismic waves on ground surface that spread through the water in all directions. The accumulated energy starts to be released from a

point within the earth, which is called focus. The point on the earth's surface vertically above the focus is called epicenter.

## **Earthquake Strength**

### **Intensity**

The strength of earthquakes is measured in two ways. One method is to find out how much and what kind of damage the quake has caused. This determines the intensity, which is a measure of an earthquake's effect on people and buildings. Intensities are expressed as Roman numerals ranging from I to XII on the modified Mercalli scale. Higher number indicates greater damage. No instruments are required to measure intensity. It is determined by visual inspection of damage after an earthquake.

### **Magnitude**

The second method of measuring the strength of a quake is to calculate the amount of energy released at the earthquake's focus. Interpretation of seismograms (the instrumental record of earthquake) has made possible to calculate the quantities of energy released by earthquakes of various magnitudes. In 1935 a leading seismologist Charles F. Richter brought forth a scale of earthquake magnitudes describing the quantity of energy released at the earthquake focus. This scale consists of numbers ranging from 0 to 8.6.

The magnitude of an earthquake is a measure of the amount of energy released. Magnitudes are based on direct measurements of the size of seismic waves (height of the waves generated on the surface of earth scientifically called amplitude of ground motion), made with recording instruments. The magnitude scale is made in such a way that the difference between two consecutive whole numbers on the scale means an increase of 10 times in the amplitude (the height of wave) of the earth's vibrations. It has been estimated that a tenfold increase in the size of the earth's vibration is caused by an increase of about 31.5 times in terms of energy. A quake of magnitude 5, for example releases 31.5 times more energy than one of magnitude 4. A magnitude 6 quake is almost 1000 times ( $31.5 \times 31.5$ ) more powerful in terms of energy released than a magnitude 4 quake.

## **Earthquakes in Nepal**

Records of earthquakes since 1253 indicate that Nepal was hit by over 16 major earthquakes. However, the records may not be complete, and the data on loss of life and property may also be not very accurate. Out of these, the 1833 (magnitude 7.9) and 1934 (magnitude 8.3) earthquakes that occurred at an interval of 100 years were better recorded and were most disastrous. Particularly the effect was severe in the Kathmandu valley. Statistically, the earthquake occurrence data of the last six years shows that in average Nepal was hit by 4 small earthquakes a day and larger earthquakes ( $6 < M < 7$ ) (DMG, 2001).

### **The future Great Central Himalayan Earthquake: An overdue event**

Many earth scientists believe that longitudinally the entire 2400 km long Himalayan arc can be segmented into different individual parts (200-300 km) which periodically break and move separately and produce mega-earthquakes (catastrophic earthquakes) in the Himalayan

region. From east to west, the great earthquakes of Assam, India (1950), Shilong, India (1897), Nepal- Bihar, India (1934), and Kangra, India (1905) are the mega-earthquakes of the last century produced by the movements in different parts of the Himalayan arc, all with magnitudes around 8.0-8.7. When a sector of the Himalaya moves and produces earthquakes, it will take some time (from decades to centuries) to repeat the same even at the same place.

Today, earth scientists are most concerned about the lack of occurrence of any great earthquake between Kathmandu in the east and Dehra Dun, India in the west during the past many centuries, and have named it the *Central Gap*. It is most likely that this segment of the Himalaya is due for a major break to trigger a mega-earthquake in the Himalaya.

### **Kathmandu, the chaotic capital city of South Asia**

After the establishment of democracy in Nepal in 1951, Kathmandu, the capital city of Nepal, started growing rapidly out of a small and quiet medieval town. The city particularly expanded very rapidly after the late seventies. Unfortunately Kathmandu may be the only capital city in the region, which was allowed to grow to the present size and population (approx. 2 million) without any proper planning and vision. No roads, sewerage, public facilities such as parks and open spaces were planned in any part of the city. The whole city grew out of chaos. Most areas out of the city core were open rice fields till as late as the eighties. It was not too late for planned development in new growth areas to avert the chaotic growth.

Today, the entire city has only a limited length of winding narrow roads and lanes. Most part of the city is inaccessible to ambulance, fire fighting equipment, heavy vehicles, excavators and dumpers. There is also a severe shortage of water supply in Kathmandu valley.

Majority of the buildings in the city are unengineered, and there is no quality control from any agency on building construction. A national building code was only very recently enacted but yet to be implemented. The buildings so far constructed were at the owner's own risk. Even the quality of most public and government buildings is highly questionable. Therefore, most private and public buildings, hospitals, hotels and schools are highly vulnerable to earthquakes.

### **Weak geologic foundation of Kathmandu valley**

In the past, Kathmandu Valley was occupied by a lake, some part of which may have existed at the central part of the valley as late as 5000 years before. The valley is therefore filled by lake sediments and river deposits. The filling sediments are made up of clay, silt, sand and gravel. The maximum thickness of these sediments is over 600 m in some places. Recent drillings in these sediments have shown that the subsurface soil of central part of Kathmandu valley is very soft up to a depth of about 40 m. Buildings and other infrastructures built on such soft and thick soils are very vulnerable to the forces of earthquakes as compared to the structures built on top of hard rocks. Due to this thick soil cover, during an earthquake the buildings in the Kathmandu Valley is shaken very strongly than the buildings in the surrounding hills with rocky base. It is estimated that during an earthquake the central part of the Kathmandu Valley may be shaken 6-8 times stronger than in the surrounding hills (Pandey, 1999, DMG, 2000). This greatly endangers higher than two storied buildings.

## **Preparedness- the urgent call**

Earthquakes as such do not kill people; the collapsed buildings kills them. Therefore, good house construction practice with strict implementation of building codes, improvement of narrow winding roads into wider roads, formulation effective disaster management plan and taking every precaution towards the earthquake disaster mitigation will certainly greatly help to minimize the loss of life and property. The action has to start today as the impending earthquakes may strike us anytime- tomorrow, next year or after 20 years.

It may be emphasized here that the presentation of the above scenario is not to panic people but to provide information, and make them realize that earthquakes are inevitable in Nepal - it is a frequently occurring natural phenomenon in the country. One should remember that in recent history, Kathmandu was almost completely destroyed in two great earthquakes (1833 and 1934 earthquakes). It is therefore not a question whether a major earthquake will strike Kathmandu (or other parts of Nepal) or not, the question is when will it strike? Scientists are not yet able to predict the time of occurrence of a future earthquake. Preparedness is the only way to minimize the impact of an earthquake disaster.

## **Disaster Imagination Game (DIG)**

The post lunch session was a very important part of the seminar. A Disaster Imagination Game (DIG) was organized for the participants. It was to initiate discussions for the earthquake disaster mitigation in the Kathmandu Valley based on Hazard and Risk maps prepared by the JICA study team. Mr. J. Watanabe was the facilitator to conduct the game and he was assisted by Ms. Tomoko Shaw, Takashi Komura, Mr. M. Kurono, Mr. Amrit Man Tuladhar, and Mr. Naresh Sthapit. All the participants were divided into six groups (A,B,C,D,E and F). Each group was seated around six large round tables with the map (1:25,000 scale) of Kathmandu Valley spread over the tables. The group consisted of participants representing various organizations and background. The programme was organized in view to familiarize the participants how to deal with the situation during an emergency caused by earthquake disaster. The main theme of the programme was on the concepts of interagency cooperation, working with community-based organizations, information and communication problems, infrastructures, urban planning and medical care and public health.

The groups were first asked to locate themselves on the map and show major locations and buildings, for example, the hospitals, airport, highways and trunk roads, strategic bridges, important government offices, installations of telecommunications, sub-stations of Nepal Electricity Authority, open spaces etc. All were equipped with the necessary maps prepared by the JICA Study Team. Each group was asked to advise on the various problems that may arise in the Kathmandu Valley due to a large earthquake. All the participants took keen interest in the programme and actively participated. At the end each group summarized their findings and made short presentation.

Dr. Meen B. Poudyal Chhetri, Director, Ministry of Home Affairs, Department of Narcotics Control & Disaster Management very ably conducted the seminar as a facilitator and was successful to organize the seminar smoothly from the beginning to the end.

**List of Participants**  
**The 1st Seminar on Earthquake Disaster Mitigation in Kathmandu Valley**

10/Aug/2001

No.	Affiliation	Postion	Name
1	ADB (Asian Development Bank)	Resident Representative	Mr. A. Moktan
2	Bhaktapur District	Chief District Officer	Mr. P. N. Sharma
3	Bhaktapur Hospital	Medical Officer	Dr. Indra Prasad Prajapati
4	Bhaktapur Municipality	Engineer/Planner	Mr. Caxman Kisiju
5	Bhaktapur Municipality		Mr. H. B. Joshi
6	Bhaktapur Municipality	Urban Development/Planning	Mr. Ram Gobinda Shrestha
7	Bir Hospital	Chief Emergency Dept.	Dr. Basant B. Pantha
8	Bir Hospital		Dr. R. P. Shrestha
9	CARE (Cooperation for American Relief Everywhere)	Director	Mr. G. Rajbhandari
10	Chief of Epidemiology Division		Dr. K. D. Shrestha
11	Department of Health	Director General	Dr. B. D. Chataut
12	Department of Mines & Geology	Seismologist	Mr. Sudhi Rajoure
13	Department of Mines & Geology	Geologist	Mr. Gyani Raja Chitrakar
14	Department of Mines & Geology	Under Secretary	Mr. Ram Sundar Hada
15	Department of Mines & Geology	Deputy Director General	Mr. Pranab Lal Shrestha
16	Department of Mines & Geology	Senior Geologist	Mr. Madhab Raj Pandey
17	Department of Mines & Geology	Senior Divisional Geologist	Mr. Krishna P. Kaphle
18	Department of Mines & Geology	Senior Divisional Geologist	Mr. Bharat M. Jnawali
19	Department of Mines & Geology		Mr. Som Nath Sapkota
20	Department of Mines & Geology		Mr. Basanta Kafle
21	Department of Mines & Geology		Mr. Bloquel Sinon
22	Department of Roads	Director General	Mr. Ananda P. Khanal
23	Department of Urban Planning & Build. Const.	Director General	Mr. Shashi Bahadur Thapa
24	Department of Urban Planning & Build. Const.	Deputy Director General	Mr. Purna Kadariya
25	Department of Urban Planning & Build. Const.	1st Class (Technical) Officer	Mr. Padam Lal Shrestha
26	Department of Urban Planning & Build. Const.	Senior Engineer	Mr. Ram Bahadur Shrestha
27	Department of Urban Planning & Build. Const.	Civil/Structure Senior Engineer	Mr. Mani Ratna Tuladhar
28	Department of Urban Planning & Build. Const.	Engineer	Mr. Amrit Man Tuladhar
29	DFID (Dept. for International Development)	Chief	Mr. P. Adhikari
30	DWIDP (Dept. of Water Induced Disas. Prevention)	Chief Advisor	Mr. Koji Kamee
31	Forum Protection of Public Interest	Director	Mr. Kedar Khadka
32	Himalaya Times		Mr. Durga Khatiwada
33	Japan Embassy	Second Secretary	Mr. Yoshiyuki Toyoguchi
34	Japan Embassy	Program Manager	Mr. Kailash M. Pradhan
35	JICA Neapl	Representative	Mr. E. Mitoma
37	JICA Nepal		Mr. Katsuji Miyata
38	JICA Nepal	Program Officer	Mr. Sourab Bickram Rana
36	JICA DOI		Mr. Y. Suzuki
39	JICA Study Team	Team Leader	Dr. Y. Egawa
40	JICA Study Team	Co-Team Leader	Mr. F. Kaneko
41	JICA Study Team		Mr. K. Yano
42	JICA Study Team		Mr. N. Sthapit
43	JICA Study Team		Mr. M. Kurono
44	JICA Study Team		Mr. N. Toyama
45	JICA Study Team		Mr. J. Watanabe
46	JICA Study Team		Ms. T. Shaw
47	JICA Study Team		Mr. T. Komura
48	JICA Study Team		Mr. H. Kagawa
49	Kantipur Publication		Mr. Rajesh Koirala
50	Kathmandu District	Chief District Officer	Mr. Tulsi Prasad Bhattarai
51	Kathmandu Post		Mr. Rajan M.
52	Kathmandu Valley Town Development Committee	Acting Member Secretary	Mr. Surya Bhakta Sangachhe
53	Kathmandu Municipality	Social Welfare Dept.	Ms. H. D. Ranjitkar Yosha
54	Lalitpur District	Chief District Officer	Mr. H. Bhandari
55	Lalitpur Municipality	Mayor	Mr. Buddhiraj Bajracharaya
56	Lalitpur Municipality	Urban Development/Planning	Mr. Rudra Gautam
57	Law Enforcement Unit	Deputy S. P.	Mr. Hemant Malla
58	Madhyapur Municipality	Advisor	Mr. Kai Weise
59	Madhyapur Municipality	Urban Development/Planning	Mr. Rudra Adhikari
60	Ministry of Educ. & Sports, Dept. of Education	Director	Mr. Laba Prasad Tripathhee
61	Ministry of Health		Dr. Kokila Devi Shrestha
62	Ministry of Information & Communication	1st Class (Technical) Officer	Mr. Pravakar Adhikari

**List of Participants**  
**The 1st Seminar on Earthquake Disaster Mitigation in Kathmandu Valley**

10/Aug/2001

No.	Affiliation	Position	Name
63	Ministry of Land Reform & Manag., Survey Dept.	Chief Survey Officer	Mr. Durgendra Man Kayastha
64	Ministry of Science and Technology	Joint Secretary	Mr. Mohan Bahadur Karki
65	MOHA	Secretary	Mr. S. Regmi
66	MOHA, D.C. & Disaster Management Sec.	Under Secretary	Mr. P. Karmacharya
67	MOHA, Dept. D.C. & Disaster Management	Director General	Mr. K. Poudyal
68	MOHA, Dept. D.C. & Disaster Management	Director	Dr. M. B. Chhetri
69	MOHA, Dept. D.C. & Disaster Management	Director	Mr. A. Mishra
70	MOHA, Dept. D.C. & Disaster Management	Section Officer	Mr. L. N. Pokharel
71	MOHA, Dept. D.C. & Disaster Management	Section Officer	Mr. R. K. Niraula
72	MOHA, Dept. D.C. & Disaster Management	Assistant	Mr. Damodar Dhakal
73	MOHA, Dept. D.C. & Disaster Management	Assistant	Mr. Indra Sunuwar
74	MOHA, Dept. D.C. & Disaster Management		Mr. N. D. Khadka
75	MOHA, Dept. D.C. & Disaster Management		Mr. H. P. Mainali
76	MOHA, Dept. D.C. & Disaster Management		Mr. Achut Prasad
77	MOHA, Law & Order Maintenance Div.	Joint Secretary	Mr. T. D. Niraula
78	National Planning Commission, Admini. Section	Under Secretary	Mr. Narendra B. Amatya
79	Nepal Electricity Authority	Manager, Transmission Line Dept.	Mr. Tirtha Man Shakya
80	Nepal Engineer's Association	General Secretary	Mr. H. R. Shrestha
81	Nepal Geological Society	President	Mr. Uttam B. Shrestha
82	Nepal Nursing Council	Registrar	Ms. Manodari Thapa
83	Nepal Red Cross Society	General Secretary	Mr. Ramesh Sharma
84	Nepal Red Cross Society		Mr. Bhshnu Hari Devkota
85	Nepal Water Supply Corporation	Deputy Manager, Mahankal Chaur	Mr. Hari Prasad Dhakal
86	NSET	President	Mr. Shiva B. Pradhanang
87	NSET	Project Manager	Mr. Mahesh Nakarmi
88	NSET	Technical Officer	Mr. R. C. Thapa
89	NSET	Technical Officer	Dr. Kailash N. Pyakuryal
90	NSET	Structural Engineer	Mr. Surya N. Shrestha
91	NSET		Ms. Sulochana Shrestha
92	NSET		Mr. Ram Chandra Kharel
93	NSET		Mr. Ramesh Adhikari
94	NSET		Mr. A. R. Silwal
95	NTC: Regional Telephone Office	Regional Manager	Mr. Surga R. Kansakar
96	Police Head quarter		Mr. Shishir Adhikari
97	Police Head quarter		Mr. Prakash K. Ranjit
98	R.S.S.		Mr. Uttam Silwal
99	Radio Nepal		Mr. Pawan Pyakurel
100	Radio Sagarmatha		Ms. Rama Luintel
101	Royal Nepal Army HQ (Hospital)	Chief	Dr. K. B. Chand
102	Singh Durbar Sec. Reconstruction		Mr. Ram Prasad
103	Staff College	Trainer	Mr. Singh Raj Uprety
104	Tathya Katha	Journalist	Mr. Chhabi Adhikari
105	Tribhuvan University	Head	Dr. Prakash C. Adhikari
106	Tribhuvan University	Professor (Geologist)	Prof. Madhav Prasad Sharma
107	Tribhuvan University	Geologist	Prof. Bishal Nath Uprety
108	Truck Association	Vice Chairman	Mr. Madhav Adhikary
109	UNDP	National Programme Manager	Mr. Man B. Thapa
110	UNESCO	Representative	Mr. Alex Shrestha
111	UNICEF/ROSA	Emergency Planning Officer	Mr. Damodar Adhikari
112	University of North Cambria U. K.		Mr. Kamal Aryal
113	USAID	OFDA Regional Advisor for South Asia	Mr. William S. Berger
114	WHO	Technical Officer	Mr. Erik Kjaergaard