Volume 8, Issue 2

October 2008

NED UNIVERSITY OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF CIVIL ENGINEERING

Cowasjee Earthquake Study Centre
NED
NEWSLETTER

China Wenchuan Earthquake 2008

On May 12 2008, Monday at 14:28:01 (local time in China) earthquake of magnitude 7.9 struck Eastern Sichuan of China, which is 90 km (55 miles) north-west of Chengdu and 1545 km (960 miles) and south-west of Beijing. The location of the epicenter was 30.98°N and 103.36°E and the depth of the epicenter is 19 km (11.8 miles). The quake and the aftershocks were also felt in other provinces (Yunan, Hainan, Shanghai, Henan, Hebei, and even Beijing). A total of 18,084 aftershocks had been detected since the earthquake hit, in Sichuan Province, 31 of the 34 quake lakes were no longer considered dangerous. The remaining three dangerous quake lakes are under close flooding, predicted by experts to be the worst in the past ten years is expected.

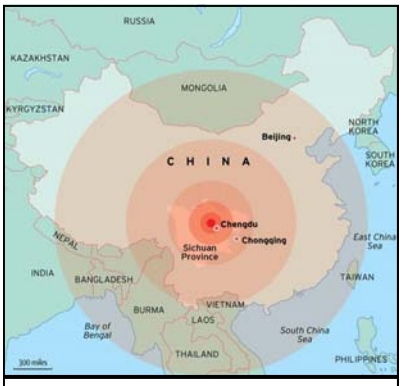

Fig1: Showing the epicenter of earthquake

Disaster in China: According to the report by WHO (World Health Organization) in the end of July, total number of casualties were 69,197, and 374,176 persons were injured and 18,238 were missing so far. 68,673 were killed and 360,341 were injured in Sichuan province, in Gansu province 365 killed and 7,560 injured, in Shaanxi province 122 were killed, in Chongqing and Henan provinces number of casualties were 18 and 2 respectively, and in Yunnan, Hubei, Guizhou, Hunan provinces there were reported 1 person killed in every province.The number of people affected by the earthquake remained at 46.24 million. The total disaster zone covering an area of 440 000 square kilometers included 417 counties, 4 656 townships and 47 789 villages.At least 15 million people were evacuated from their homes and more than 5 million were left homeless. An estimated 5.36 million buildings collapsed and more than 21 million buildings were damaged in Sichuan and in parts of Chongqing, Gansu, Hubei, Shaanxi and Yunnan. The Ministry of Health of China has taken various public health measures such as vaccination, water testing and sanitation and other logistical and technical support to health workers in the affected areas. They have deployed of 2,409 medical and health workers in 18 affected counties of China. At least 700 people were buried by a landslide at Qingchuan. Landslides also dammed several rivers, creating 34 barrier lakes which threatened about 700,000 people downstream. A train was buried by a landslide near Longnan, Gansu. At least 2,473 dams sustained some damage and more than 53,000 km of roads and 47,000 km of tap water pipelines were damaged. About 1.5 km of surface faulting was observed near Qingchuan, surface cracks and fractures occurred on three mountains and street cracks were observed in the city areas.

Technical Reasons: The Sichuan earthquake of May 12 occurred as the result of motion on a northeast striking reverse fault or thrust fault on the northwestern margin of the Sichuan Basin. The earthquake's epicenter and focal-mechanism are consistent with it having occurred as the result of movement on the Longmenshan fault or a tectonically related fault . The earthquake reflects tectonic stresses resulting from the convergence of crustal material slowly moving from the high Tibetan Plateau, to the west, against strong crust underlying the Sichuan Basin and southeastern China. The convergence of the two plates is broadly accommodated by the uplift of the Asian highlands and by the motion of crustal material to the east away from the uplifted Tibetan Plateau.

Future Significance: Researchers analyzing the Wenchuan earthquake have found that geological stress has significantly increased on three major fault systems in the region. The magnitude 7.9 quake on May 12 has brought several nearby faults closer to failure and could trigger another major earthquake in the region. Through computer models Geophysicists calculated the changes in stress along the Xianshuihe, Kunlun, and Min Jiang faults—strike-slip faults like the San Andreas—which lie about 150 to 450 kilometers (90 to 280 miles) from the Longmen Shan rupture that caused the devastating quake. The research team also examined seismic activity in the region over the past decade. They found that the May 12 event has doubled the probabilities of future earthquakes on these fault lines. The probability of another earthquake of magnitude 6 or greater in the region is 57% to 71% over the next decade. There is an 8% to 12% chance of a quake larger than magnitude 7 in the next decade and 23%-31% percent in the next 30 years. *By: Haroon Ahmed Research Assistant Civil Engg Deptt, NEDUET Source:www.usgs.gov, www.whoi.edu, www.wpro.who.int*

EDITORIAL

The 2nd issue of volume 8 of CESNED NEWSLETTER marks the completion of eight years concerted effort to uphold the main objective of this Newsletter. We have kept our promise to keep you abreast of the earthquake happenings and the response of CESNED along with informations regarding latest development in the field of earthquake engineering. This issue in remembrance of the 8th Oct 2005 massive earthquake have highlighted the efforts which NED University have taken upon itself and which in our opinion is the best way of paying tribute to all who lost their lives and still bearing the suffering of after math. Let us once again pray of the souls and for those who lost their dear ones and /or still struggling to cope up with the after effects. CESNED is and shall keep on striving hard for its cause and hope that the NEWSLETTER would receive your personal attention and patronage. Editor

Inside this issue:

GIS System (Its Applications for Earthquakes' Response and Prediction)

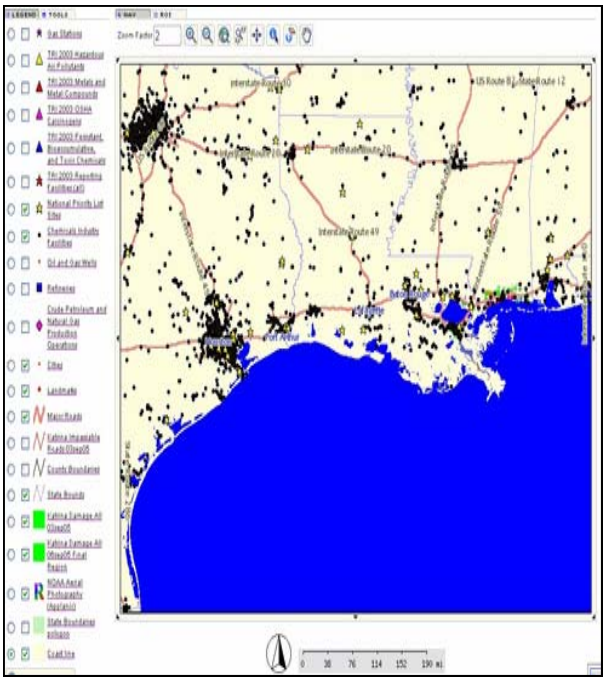

Fig 1: *An illustration of a GIS map*

GIS A GIS is a computer system capable of capturing, storing, analyzing and displaying geographically referenced information i.e. data identified according to location. This system is built on knowledge of various academic disciplines, which are: **Geography i)** Cartography ii) Location Science. **Computer Science** i) Data Modeling ii) Database design iii)Computer Graphics iv) Interface Design. **Mathematics** i)Topology ii) Graph theory iii) Geometry. **Statistics i)** Traditional Statistics ii) Spatial Statistics. **Information Science i)** Storage and Retrieval Methods ii) Metadata Documentation. A GIS system basically comprises data about the surface, subsurface and atmosphere, explanations and interpretations regarding the data and an organizational framework for access and understanding of the information.In today's environment GIS is considered to be the solution to many issues in almost all areas of concern to engineers, mainly being: i) Agriculture ii) Forestry, iii)Archeology iv)Environment v)Geology vi) Infrastructure Management vii) Social sciences. Some of the reasons for such wide use of GIS system are as follows: Save time,Increase efficiency, Provide Decision Support in a faster and cost-effective way, Better utilization of resources and Automation of tasks. Moreover, another reason for the popularity of a GIS system is its ability to interact with a wide variety of system interfaces from MSDOS to X-Windows.

GIS Application for Earthquake Prediction & Damage Evaluation

Narender Verma at al 2003 applied Remote Sensing and GIS systems to study the surface and subsurface changes for the areas of Bhuj and Kathiawar after the earthquake of 2001. In their study they studied the changes in the Geology and Geomorphic structure, surfacial and subsurfacial changes in the form of faults, cracks, lineaments, surface displacement, Lateral spreading, liquefaction in the Bhuj and Kathiawar Region through remotely sensed satellite images. They used IRS, WiFS, IRS ID and LISS III satellites in color and black and white of different dates. It was further supplemented with Indian topographical maps and pictorial images of the area for the ground truthing. The GIS system thus prepared for this study combines the surface and subsurface data with the past seismic record. At the end of the study conclusions drawn out addressed the following issues: i)The tectonic activity of the region ii) The Geology and Seismecity of the area. Therefore, in the above study GIS system was used to predict the probability of earthquake by relating it to surface and subsurface characteristics. (Narender Verma and Dr. Narpat Singh Rathore (2003): Application of Remote Sensing and GIS for the Study of Surfacial and Subsurfacial Changes in Bhuj and Kathiawar Due to Bhuj Earthquake 2001)

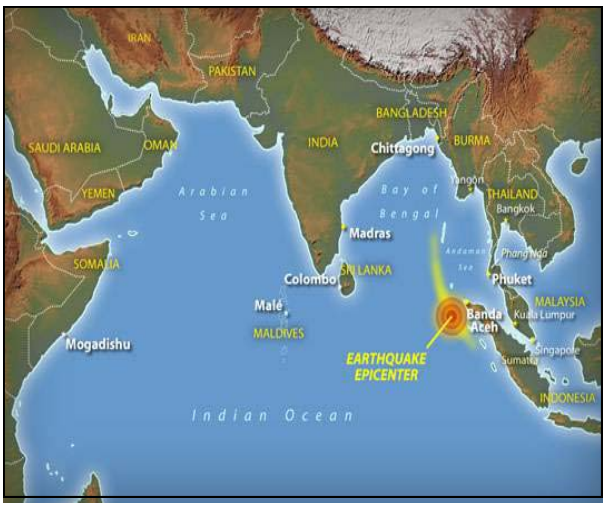

Fig. 3: A GIS map identifying epicenter location (www.ESRI.com)

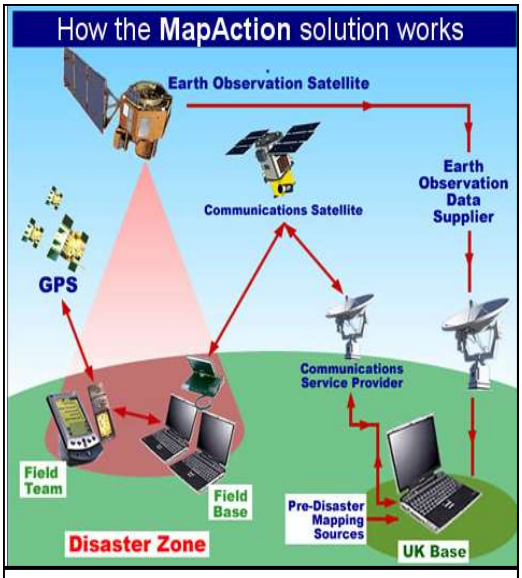

Fig 2: Schematic diagram for the process of identifying disaster zone (ww.ESRI.com)

Bazghard et al 2007 used a GIS system for the buildings of Tehran for the evaluation of damage. In their study they identified the need of a GIS system for supporting the decision making process for any disaster by giving accurate information about the destruction and its level and area and the victims. This information would help the managers in following regards: Estimation of Disaster area and number of victims,Estimation of Required resources,Facilitating Rapid and Reliable decision making

GIS System (Its Applications for Earthquakes' Response and Prediction)

and Preparing maps of destruction and its severity.The study was initiated from the scientific studies and historical records of the faults which show that Tehran can be subjected to strong earthquakes causing a lot of damage. So the preparation for these earthquakes is of utmost importance. This preparedness is related to development of a model to estimate destruction of buildings. The model combined two parameters; fragility curve and the attenuation relationships. Fragility curve depends upon the design and construction of the structures and the attenuation relationships are obtained by taking in to account the historical data of the past earthquakes with regard to their epi-center and magnitude. In this study GIS system is identified as a community preparedness tool for responding to large disasters. (A. Bazghard, B. Omidvar and A. Mansourian (2007): Developing a Seismic Damage Model for Tehran's Buildings in a GIS Environment)

GIS for Emergency Preparedness

In a white paper available at www.esri.com, utility of GIS is discussed in detail for emergency management with special focus on Tsunami disasters. This paper identifies the need of Geospatial information in disaster management. That includes rescue and recovery efforts as well as rehabilitation. GIS system, as identified in this paper can be used to locate risky areas and the monitor plate tectonics activity and to identify the type of disaster associated with the particular surface and subsurface activities. GIS can be helpful for **Disaster management in three aspects**: i)Physical ii) Engineering iii) Social

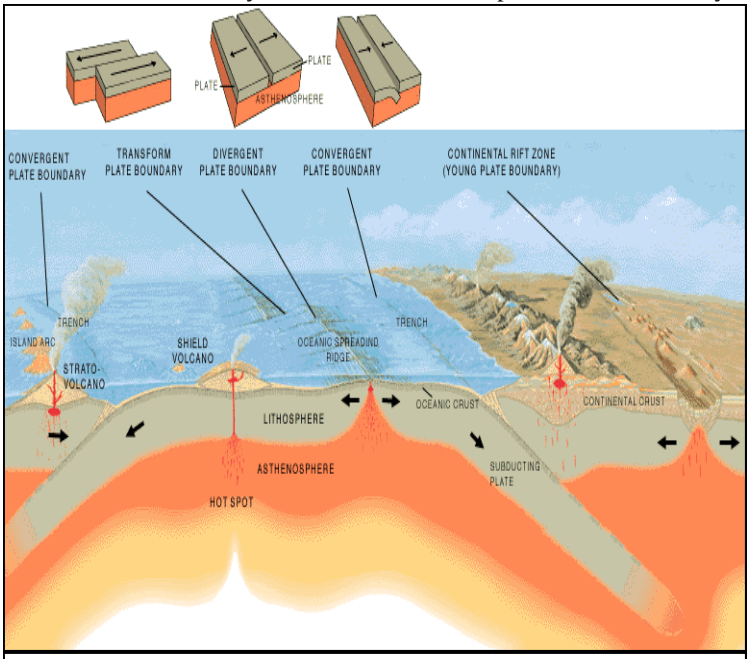

Fig. 4: An illustration of types plate boundaries (www.ESRI.com)

Physical aspects incorporates the collection and modeling of data, engineering involves analysis, design and construction of structures and social factors encompass the planning and decision making factors (land use planning, cost-benefit analysis). The paper recommends GIS usage in the following aspects for better emergency management. **Organized GIS database**, i) Critical infrastructure data ii) Up-to-date image data bank iii) Metadata iv) Data Interporability v) Predefined emergency response database mode vi) Data sharing with media. **Coordination in i)** Allocating resources ii) Preventing the duplication of data iii) Awareness of ongoing international/national GIS projects . **Upgrading to high-tech GIS system** i)Mobile mapping capabilities ii) Monitoring emergencies in real time. Inspite of the facts that a GIS system is helpful in so many aspects and to a wide variety of stakeholders but there are still some barriers to cross over before GIS becomes fully operational especially for earthquake preparation and damage management. They include: **Scientific Problems i)** Lack of data ii) Inadequate data sharing iii) Poor communication of data iv) Duplication of data. **Social Problems** i) Political problems ii) Government Structure iii) Inequity iv) Relocation of people.(GIS and Emergency Management in Indian Ocean Earthquake/Tsunami Disaster, May 2006, www.ESRI.com). However these GIS system still represents itself as the only compatible solution found thus far which can support the coordination activities for preparation and mitigation of disasters like earthquakes by handling a diversity of levels of information and having the ability to communicate the information to wide variety of user interfaces/environments. *By Uneb Gazder, Assistant Professor, Urban & Infrastructure ,Engg Deptt, NEDUET*

(CESNED Activities continued from page 4)

Tier 1 Training of participants in Islamabad and Taxila

In mid July training on "Assessing Seismic Vulnerability of Concrete Frame Buildings with Infill" was held in Islamabad and Taxila and was conducted by Chair of Civil Engineering, Professor Sarosh H. Lodi . The objective main of the training was to train the participants to use the modified ASCE 31 Tier 1 checklist form to identify the seismic vulnerabilities in a concrete frame building with masonry infill walls, and to understand how and why the items in the checklist make a building vulnerable and to understand the type of damage likely to result due to each vulnerability. The training was attended by faculty members of NUST Islamabad and UET, Taxila and Director Architecture, Capital Development Authority, Islamabad.

Continued from page 4

CESNED ACTIVITIES (After 8th Oct Earthquake 2005)

CESNED since 2001 is publishing a bi-annual newsletter and is the only newsletter in the country, which disseminates knowledge regarding earthquake, related engineering issues. After October 8th 2005 Earthquake in Pakistan CESNED started playing its role more effectively. Through its outreach efforts many important national linkages were established with industrial and governmental organisations such as KDA, Pakistan Steel, C&W , CWHR, FWO, etc.CESNED has always taken a lead in developing working relationships with known centers of leading universities and professional bodies and is aspiring to serve the Civil Engineering community of Pakistan through its outreach activities. In the wake of recent earthquake and its aftermath, various seminars, workshops, lectures and training addressed by the leading experts of the world was organized for the engineering community on the recent developments in earthquake engineering and technological advancements. "Building Pakistan's Capacity for Instruction, Research, and Practice in Earthquake Engineering and Seismic Retrofit" is Pakistan–US Joint earthquake related research project under cooperative program. **Dr. Sahibzada F.A. Rafeeqi ,Professor and Dean, Faculty Civil Engineering and Architecture,NED University of Engineering and Technology, Karachi** is the Principal Investigator from **Pakistan side** and **Dr. Brian E. Tucker,President ,GeoHazards International** is the Principal Investigator from **US side**.The other partner Institutions from **US side are Earthquake Engineering Research Center, University of California, Berkeley,John Blume Earthquake Engg. Center, Stanford University,Pacific Earthquake Engineering Research Center Computers & Structures, Inc**.Several Engineering Universities, Building Control Authorities, Professional Bodies of Architects and Engineering and Civic Agencies are partners from Pakistan side. Formation of ACI Chapter is not only helping in bringing together the various individuals and groups but also providing a platform for the development of standards for design and construction, incorporating concrete and related materials in line with international standard practice. Earthquake engineering laboratory is under construction at the Department of Civil Engineering which will be used for research purposes. Department is being invariably approached by the industry for the solution of their problems, which now would ably be resolved once the infrastructure is in place, and which now is being addressed through the promised funding by HEC and other donor agencies. On expansion, CESNED will provide its extensive research services in following areas; Disaster Mitigation and Management, Earthquake Engineering, Monitoring seismic activities, and Regional seismic hazards.

Fig

CESNED ACTIVITIES (During Last Six Months)

Training on " Seismic Shake Table"

Dr. Muhammad Masood Rafi, Associate Professor and Engr. Amir Nizam, Senior Laboratory Engineer attended three weeks training on "Seismic Shake Table " held in the month of August. The training was arranged at the headquarters of Shore Western Manufacturing Inc., in California, USA. The training covers all aspects of the system including mechanical, hydraulic, servo control, data acquisition software/hardware and seismic simulation outer loop controls/software. This single Axis Seismic test System will be very soon installed in Department of Civil Engineering at NEDUET.The system will help NED to test buildings and structures in order to assess the survivability when subjected to severe earthquakes. Data will be used to develop building codes and minimize the damage and loss of life due to potential earthquakes.

Lecture On "Seismic Threats To Karachi"

Fig Dr. Roger Bilham Delivering the Lecture.

On Saturday 14th June 2008, a lecture titled: **"Seismic threats to Karachi , Pakistan"** was held in the Department of Civil Engineering. Participants from various professional bodies, organizations, governmental agencies and NGO's from different parts of the country along with students of NED University attended the lecture. The lecture focused on the realities and facts regarding seismic hazards in Pakistan with special reference to Karachi. The lecture was delivered by Prof.Dr.Roger Bilham, Geological Sciences, University of Colorado ,USA. All the participants lauded the efforts of the Department of Civil Engineering.

Exchange Visit by Pakistani Participants to San Francisco, October 2008

Dean Faculty Civil Engineering and Architecture, Professor Sahibzada F.A. Rafeeqi and Chairman, Department of Civil Engineering, Professor Sarosh H. Lodi along with a larger group of participants, including five faculty members of Civil Engineering Department will be visiting San Francisco Bay Area in mid of October as a part of exchange visit of 2nd Year Plan of USAID project. These participants include practicing professionals in structural engineering, participants from public universities, governmental agencies and other sectors of professional practice. All the team members will be visiting San Francisco Bay Area for meetings and activities as part of joint project to improve earthquake safety in Pakistan. Meetings, site visits, and related project activities will be held during the visit.

Internship Program for the Undergraduate Students

During summer vacations (2nd June – 12th July 2008), NED University of Engineering and Technology offered a summer internship program to assist the team leaders involved in the evaluation of the case study buildings for the USAID Project. Three under graduate students worked as internees during summer vacations and developed computer model using ETABS for the case study buildings. (CESNED Activities continued on page 3).

RESOURCE PERSONS:

- Prof. Dr. S. F. A. Rafeeqi
- Prof. S. H. Lodi

Mail: Cowasjee Earthquake Study Centre NED,
Department of Civil Engineering,
NED University of Engg. and Tech.,
Karachi-75270, Pakistan

Phone: +92-21-926 1261-68
Ext. 2205 & 2223
Fax: +92-21-926 1255
Email: cesned@neduet.edu.pk
Web page: www.neduet.edu.pk

Information, news items, short notes on research findings are invited from across the globe.