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NED UNIVERSITY OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF CIVIL ENGINEERING

Cowasjee Earthquake Study Centre
NED
NEWSLETTER

CESNED ACTIVITIES

"Building Pakistan's Capacity for Instruction, Research, and Practice in Earthquake Engineering and Seismic Retrofit" 2nd Year Plan

"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. S. 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 Engrg. Center, Stanford University,Pacific Earthquake Engineering Research Center Computers & Structures, Inc**. The second year project activities planned are as below**.**

Fig Prof Rafeeqi along with USAID team members

Exchange Visit

The American members of the project team plan to visit Pakistan in the first Quarter of 2008. During the visit, they will provide training in analysis procedures and background topics, meet with the case study teams to review their work, and continue the curriculum development process. A larger group of eight to ten Pakistani project participants will travel to the San Francisco area in spring or early summer 2008. These participants will include younger faculty members leading the case study teams. Participants will attend training sessions, discuss case study results to date, visit professional engineering offices, laboratory facilities and retrofit construction sites, and meet faculty members from participating local universities. Additional exchange visits will also take place in Quarters 3 and 4 of 2008.

Case Study Development

The pilot case study teams gathered information on their respective buildings and performed preliminary seismic and condition assessments. The project team selected the additional case study buildings and teams by the end of 1st year. The pilot case study teams will summarize their findings and present their results from the information gathering phase of the case study process to a peer review panel during the next visit of the U.S. project team, currently planned for Quarter 1, Year 2. The pilot case study teams will then proceed to the analysis phase after training in analysis techniques and computer software. They will present their results to a peer review panel in late Quarter 2 or early Quarter 3, most likely during their visit to California. The pilot case study teams will begin the final phase of solution development thereafter. The pilot teams will probably be approximately one quarter ahead of the remaining teams, and all case studies should be substantially complete by the end of Year 2.

Curriculum Development

After revising the draft curriculum revision plan based on feedback from NED University faculty, the curriculum development team will begin discussing the draft plan with faculty from other public universities in Pakistan. The outcome of this process will be a consensus recommendation for national minimum standards for earthquake engineering education in Pakistan, anticipated in Year 2. The recommendations will consist of the minimum basic earthquake engineering topics to be included in the civil engineering curricula, and possibly the architecture curricula. Based on the strengths of the faculty at each institution, universities will be encouraged to include topics and courses beyond the minimum requirements in their curricula. Pakistani faculty members will then submit the recommendations to The National Curriculum Revision Committee (NCRC) at Higher Education Commission (HEC) for adoption. *(continued on page 4)*

Inside this issue:

EDITORIAL

The first issue of Volume 8 of CESNED Newsletter in hand is a reflection of the consistent policy of disseminating related knowledge. CESNED has always taken a lead in developing working relationships with known centers of leading universities and professional bodies and its aspiring to serve community through its outreach activities CESNED in continuation of its endeavors organized seminars, workshops and video conferencing which were attended by leading experts.

Editor

CHAMAN FAULT SYSTEM (CFS) – A PROMINENT SEISMO-TECTONIC FEATURE IN PAKISTAN

The northward collision of Indian plate with respect to the Eurasian landmass is responsible for intense seismicity in the region and the formation of pronounced tectonic features that forms the landmarks of Indian plate boundary. These include the Himalayan Frontal Arc in the north, the Chaman fault system region in the north west and the Indo-Burma border region in the north east. (Fig.1).

Two major tectonic features attest the presence of collision boundaries in Pakistan; The Main mantle Thrust (MMT) and the Main Karakorum Thrust (MKT).

Earthquake activity in Pakistan is mainly concentrated in the north and western sections of the country, along the boundary of the Indian plate and the Iranian and Afghan micro-plates. In Pakistan Chaman Fault System (CFS) forms a prominent ~900-km-long left-lateral transform plate boundary between the Indian and Eurasian plates in Afghanistan and Pakistan.

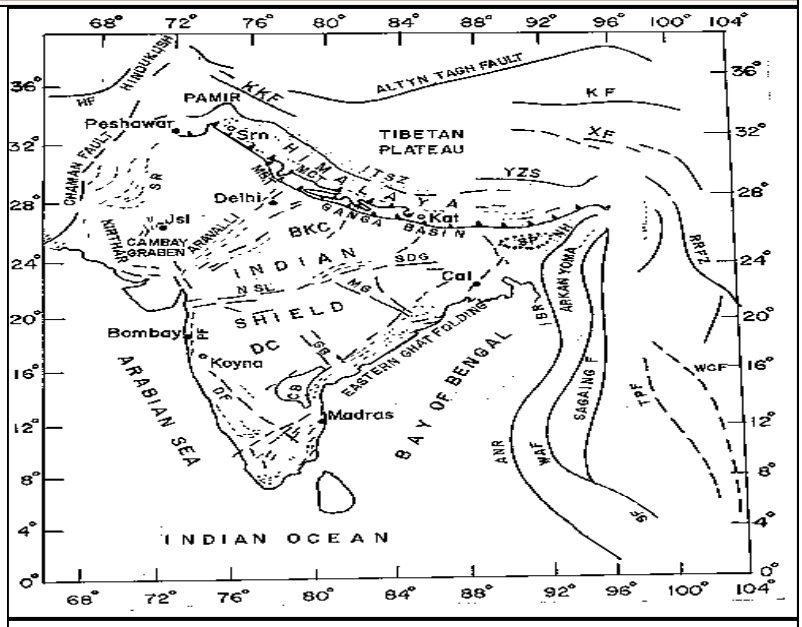

Fig 1 Regional tectonic setting and Location of Chaman fault.(After Bhatia, Kumar and Gupta)

The system connects the Makran accretionary prism to the Pamirs (Panjshir fault); from the Arabia/Asia/India triple junction on the Makran coast it passes north through Baluchistan, trending NNE into Afghanistan before merging with the Himalayan arc in the North West Frontier province of Pakistan (Fig.2).

In Pakistan CFS is constituted by numerous strike slip faults among which three main faults: The Chaman, Ghazaband and Ornach-Nal faults are more prominent.Chaman fault occurs as the most pronounced active fault in Pakistan (Fig.3).

It is a left-lateral (sinistral) transform fault runs along Pakistan's western frontier with Afghanistan from Kalat, in the northern Makran range, past Quetta and then on to Kabul, Afghanistan (Tsutsumi, 1987). and show a 200 km of left lateral displacement (Lawrence et.al,1981).

Chaman fault system is considered as mature and it is probably developed since at least 20-25My. According to the Chaman transform zone first became active in the late Oligocene or early Miocene (Lawrence et.al (1981). The total displacement and displacement rate across the

Chaman fault system varies in response to the rates of convergence. The geological studies indicate an about 25- 35*mm/yr* strike-slip displacement rate along CFS, while the global plate kinematics suggest about 40*mm/yr* rate, for the lateral motion.

Oblique convergence occurs near and north of Quetta, where it is accommodated by thrust faulting in ranges to the east of the apparently pure strike-slip Chaman fault. (Szeliga et.al 2006).

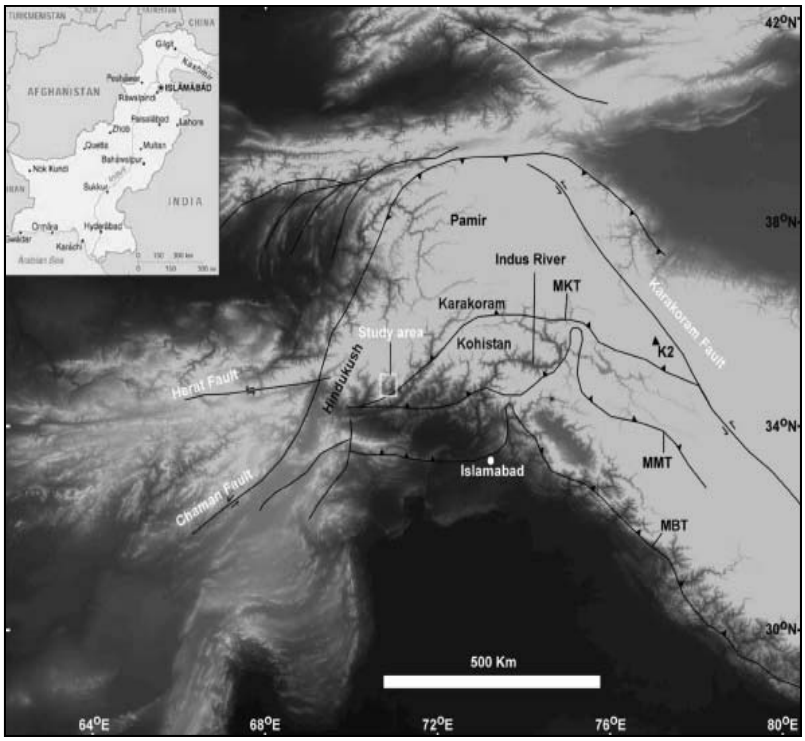

Fig.2 Chaman fault System associated with Indian Plate Boundary. (After Shuhab & Nancy, 2005)

CHAMAN FAULT SYSTEM (CFS) – A PROMINENT SEISMO-TECTONIC FEATURE IN PAKISTAN

CFS has been the site of disastrous earthquakes from moderate to high intensity. (Fig.4)

GSHAP suggest maximum peak ground acceleration (PGA) ranging between 0.24g to 0.4g. RG for the region covered by this fault system.Several earthquakes ranging in magnitude from 7 to 8.1 have resulted in colossal loss of lives and property in the past. The 1935 Quetta earthquake is one of the examples that took life of about 30,000 people and the city was badly damaged.

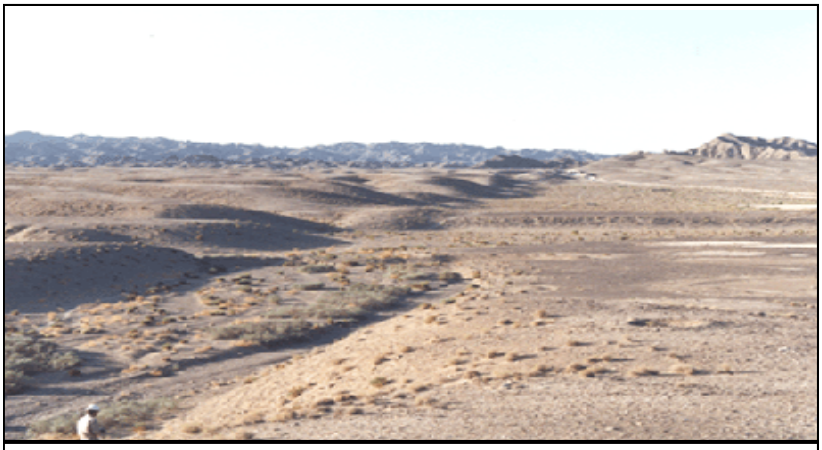

Fig.3 Photo of Fault scarp along the Chaman fault in Pakistan. (Tsutsumi, 1987)

The relative movement between the Indian and Eurasian plates is at least partially accommodated by seismic slip along the Chaman fault (Quittmeyer & Kafka, 1984).

The Recent activities in CFS show surface creep (slip) movements. ERS-1/-2 data indicate a change in range along a 110 km segment of the Chaman fault by as much as 7.8 mm/yr. The length and rate of slip of the creeping segment of the Chaman fault is similar to that of the Hayward fault in California (Szelia et.al). The Satellite Radar Interferometry (InSAR) analyses suggest a 110 km segment of the Chaman fault system north of Quetta experiencing a shallow aseismic slip (creep). It is interpolated that the plate motion along the Chaman fault is at least accommodated by slow slip episodes following moderate earthquakes in the fault.(Furuya & Satyabala, 2007).

CFS is also believed to have significant impact on regional seismicity. A study has suggested that the stresses responsible for Bhuj earthquake in the Kutch fault region were transferred from the CFS, Ornach and Murray ridge.

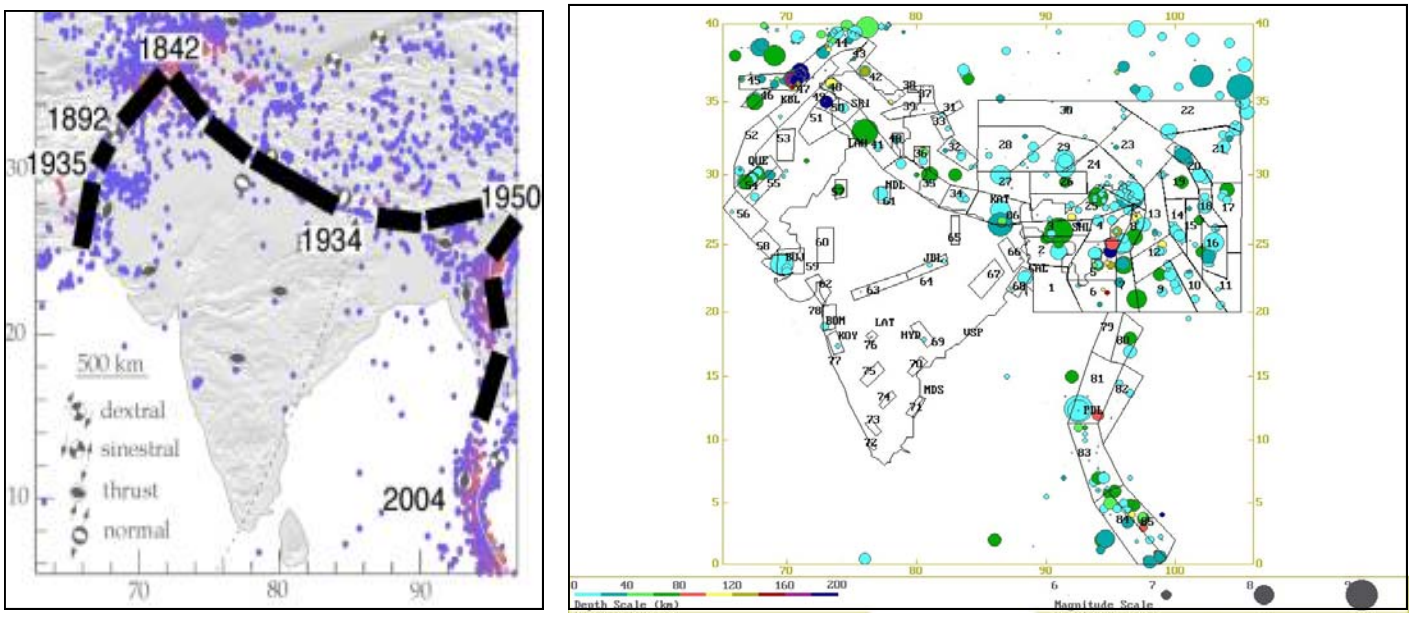

Fig.4 Major type of faulting and siesmicity along the Indian Plate boundary. Note the 1935 Quetta Earthquake location (A) and the magnitude and depths of Earthquakes (B). (After Bhatia, Kumar and Gupta)

By Dr Abid M.Khan

CESNED ACTIVITIES

Video Conference on "Assessing Seismic Vulnerability of Concrete Frame Buildings with Infill"

On Tuesday 26th February 2008, a day Training session on "Assessing Seismic Vulnerability of Concrete Frame Buildings with Infill" was held by the department of Civil Engineering through video conferencing . The training was a part of the USAID project "Building Pakistan Capacity's for Instruction, Research and Practice in Earthquake Engineering and Seismic Retrofit", which is aiming to improve Pakistan's capacity for reducing earthquake risk by building the capacity of its universities and practitioners in earthquake engineering and to transfer the knowledge needed to seismically retrofit buildings. The video conferencing was between the team members at Stanford University including Prof. Gregory G. Deierlein, Professor, Department of Civil &Environmental Engineering, Stanford University, USA, David Mar, Tipping Mar and Associates, Berkeley, USA and Ms Janise Rodger, GeoHazards International, California, USA. The participants from various professional bodies, organizations & government bodies along with the students of NED University attended the training. The main objective of 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, to understand how and why the items in the checklist make a building vulnerable and to understand the type of damages likely to result due to each vulnerability.

Fig 1 Participants attending the video conference

Fig 2 Participants attending the video conference

"Building Pakistan's Capacity for Instruction, Research and Practice in Earthquake Engineering and Seismic Retrofit " (Visit by Pakistani Participants to San Francisco October 15 to 20, 2007)

Dean of Engineering, Professor Sahibzada F.A. Rafeeqi and Chair of the Department of Civil Engineering, Professor Sarosh H. Lodi visited the San Francisco Bay Area from October 15 to 20, 2007 as part of exchange visit of 1st year plan of USAID project. The main objective was to meet with colleagues regarding structural engineering mitigation practices and curriculum for structural engineering and architecture, graduate student curricula and professional training. Professors Rafeeqi and Lodi traveled to the University of California's Richmond Field Station to visit the Earthquake Engineering Research Center (EERC). Many of the facilities are part of the National Earthquake Engineering Simulation (NEES) program funded by the National Academy of Science. Mr. Don Clyde, Lab Manager, gave a tour of research facilities including reaction floors and walls, dynamic actuators, monitoring instruments, cameras and the shaking table. Mr. Clyde discussed cooperative research through the NEES network and the possibility that universities in Pakistan to observe experiments through the Internet. They also discussed the possibility of experienced technicians and research facility operators to visit Pakistan to work with their colleagues and the possibility of Pakistani technicians visiting EERC for training. It was agreed that this type of exchange was possible.

Training *(continued from page 1)*

The case study teams will receive training in topics necessary for them to complete the case studies as planned. Training topics include nonlinear behavior, modeling and nonlinear analysis, use of software, and seismic retrofit approaches and techniques. The project research team will provide training both in-person during exchange visits and remotely via videoconference. The project team also set up the case study teams to contain junior faculty or practicing engineers in addition to students. The more senior members will provide mentoring and guidance to the younger members, enhancing the value of the training and providing additional instruction when needed.

Fig Prof Rafeeqi and Prof Lodi along with EERC member

RESOURCE PERSONS:

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

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