Earthquake Damage Scenarios for Urban Areas

Atilla Ansal[1], Asli Kurtulus[2], Gökce Tönuk[3]

1. Bogazici Univ., Kandilli Observatory and Earthquake Research Institute, Turkey, ansal@boun.edu.tr
2. Bogazici Univ., Kandilli Observatory and Earthquake Research Institute, Turkey, asli.kurtulus@boun.edu.tr
3. Bogazici Univ., Kandilli Observatory and Earthquake Research Institute, Turkey, gokce.tonuk@boun.edu.tr

ABSTRACT

A software package is developed to perform earthquake damage estimation for urban areas based on detailed analyses of local site effects. The first stage of the approach involves generation of microzonation maps with respect to ground motion parameters using separately calculated regional seismic hazard input data. The effects of local geological and geotechnical site conditions are taken into account using representative soil profiles with shear wave velocities extending down to the engineering bedrock. 1D site response analyses are conducted using Shake91 to calculate an average site specific PGA and elastic acceleration response spectrum on the ground surface. In the second stage of the approach, vulnerability of the building and pipeline inventories are estimated using ground shaking parameters and empirical relationships.

Recently an extensive site investigation study was carried out on the European side of Istanbul as part of a large-scale microzonation project financed by Istanbul Metropolitan Municipality. 2912 borings (mostly down to 30m depth with approximately 250m spacing) were conducted within an area of about 182 km^2 to investigate local soil conditions. Standard Penetration Test (SPT), Cone Penetration Test (CPT), PS-Logging, Refraction Microtremor (ReMi), seismic reflection, refraction and resistivity measurements were carried out at each borehole location. Samples collected in the field were tested in the laboratory to determine index and engineering properties of local soils within the investigated area.

A detailed microzonation with respect to earthquake ground shaking parameters and liquefaction potential was carried out using these recently complied soil data. Probabilistic and deterministic seismic hazard scenarios evaluated by KOERI (Kandilli Observatory and Earthquake Research Institute) and INGV (Istituto Nazionale di Geofisica e Vulcanologia) as part of an EU FP6 Project ("LessLoss - Risk Mitigation for Earthquakes and Landslides") was used to conduct 1D site response analyses to generate microzonation maps for ground shaking and liquefaction potential. Site-specific ground motion parameters were employed to evaluate vulnerability of building stock and natural gas pipeline system in the area. A building inventory composed of 24 building classes and region-specific vulnerability relationships that were proposed by KOERI were used to estimate damage distribution of the building stock. Natural gas pipeline inventory provided by IGDAŞ (Istanbul Gas Distribution Industry and Trade Co. Inc.) and empirical correlations proposed in literature were used asses expected damage in the pipeline system due to wave propagation and liquefaction induced settlements.

The resulting damage scenarios are compared to those performed earlier where NEHRP site amplification factors were used to take into account site effects as opposed to 1D site-specific response analyses carried out in this study. The comparison provided evidence that there are significant variations in the ground motion parameters within the investigated region which cannot be detected when the site conditions and their effects are evaluated using NEHRP site classification and related amplification coefficients. Therefore it appears essential to perform site response analyses to have more accurate information on ground shaking characteristics for estimation of seismic damage in buildings and lifeline systems.

Key words: earthquake scenarios, microzonation, site effects, structural vulnerability, pipeline vulnerability

PRESENTER'S BIOGRAPHY

Prof. Dr. M. Atilla Ansal was born in 1945 in Ankara, Turkey. He received his MSCE in Civil Engineering from Istanbul Technical University in 1969, and his Ph.D. in Geotechnical Engineering from Northwestern University in 1977. He is currently in the Earthquake Engineering Department of Kandilli Observatory and Earthquake Research Institute at Bogazici University. He is Editor in Chief for the Springer Book Series on "Geotechnical, Geological and Earthquake Engineering" since 2003; Editor of International Journal "Bulletin of Earthquake Engineering" since 2003; Secretary-General of European Association for Earthquake Engineering since 1994; President of the Turkish National Committee on Earthquake Engineering since 2005; Co-chairman of ISSMGE Technical Committee TC4 on "Earthquake Geotechnical Engineering" since 2005. He published over 200 papers in journals, conference proceedings, books, and as research reports on soil mechanics, soil dynamics, microzonation, liquefaction, site amplification, earthquake hazard scenarios.

Seismic hazard prediction and earthquake risk assessment

Oktay Babazade[1], Lothar Griesser[2]

1. Centre of Seismology and Earth's Physics, Azerbaijan, oktay_babazade@yahoo.com
2. Consultant, Switzerland, lothar.griesser@bluewin.ch

ABSTRACT

This article summarizes the work done over last 10 years regarding the development of new approaches for earthquake risk mitigation. The methods of mitigation of damage from earthquakes include assessment of seismic hazard, dynamic prediction of earthquakes, analytical calculations of numerical models, microseismic zonation, etc. The approaches are demonstrated, accordingly, on examples of Azeri part of test area "Caucasus", the Caucasian-Caspian Iranian East Anatolian region, Absheron peninsula and Baku city. The schematic map of seismic zonation for Azerbaijan territory (1990), maps of seismic hazard and assessment of maximal magnitudes using the independent methods (including Probabilitic and computer calculations with package Seisrisk) as well as on the base of uniform earthquake catalogue and active faults model of seismic source zone (SSZ) were presented as results of carried done works. Peak horizontal ground acceleration is chosen as a parameter representing seismic hazard and the period of repetition in years for values of accelerations is given. The prediction values on map of maximal magnitudes of SSZ were further in good accordance with real observations of two earthquakes occurred in Baku city on November 25, 2000 with M 5.8 and 6.3.Such a long dynamic prediction for Caspian-Eastern-Turkey-Iran region based on systematic seismogeodynamic approach to investigation of focal zones of preparation main earthquake and on block modeling of seismokinematics of this region. At the same time the prediction not only the place strength of potential zones of the strongest earthquakes but also the periods of increased probability of the future main shoke. The strong-motion prediction in the Absheron penincula including Baku city were researched by using database on dynamic and velocity models of structure of surface sedimentary deposits. Besides, numerical modeling of target earthquake by near, far, and local events expressed in peak ground acceleration value compared to intensity MSK-64 scale was made for Absheron peninsula and Baku, a numerical modeling of amplification factor was plotted that gives the possibility for estimating a level of seismic motion and the visual seismic intensity picture of the researched area. The process of numerical modeling was done by visualization GIS based on application techniques applying program such as Shake, NONLI, and etc. This work also focuses on how an earthquake detection system would allow early detection by pipeline operation and how pipeline safety can the pressure – relief Before-Break principles. An early warning system of automatic telemetry have to be set up along with local and regional monitoring networks to predict short and medium term seismic hazard zonation the international earthquake monitoring and forecasting network. Economically, continuous operation of large pipelines is extremely important because of the huge energy content of the oil flow. The earthquake detection system presented here consists of accelerometers, which measure the immediate effects system presented here consists of accelerometers, which measure the immediate effects of the earthquake, and pipeline deformation sensors, which detect secondary impact to the pipeline.

Shoke; MSK-64; zonation; hazard; Absheron.

Oktay Babazade is Doctor of physical-mathematical sciences in geophysics. Graduated from Geophysical Engineering Degree – Institute of Oil and Chemistry**.** From 2002 – up to date he is President of Azerbaijan Centre of Seismology and Earth's Physics, 2002 – 2003 Director of National Data Center of CTBTO in National Academy of Sciences of Azerbaijan, 1993 – 1998 Azerbaijan State Ecology and Environment Protection Committee.
1979 – 2003 Head of Earthquake Focal Zones Research laboratory of Institute of Geology, National Academy of Sciences of Azerbaijan, 1984 – 1985 working in Earthquake Research Institute, Tokyo, Japan, 1982 working in Roma, National Geophysical Institute, Italy, 1970 – 1979 Senior Research-Worker, Junior Research Worker at laboratory of Seismology and Earth's Physics, Institute of Geology, Azerbaijan Academy of Sciences., 1967 – 1970 Postgraduate courses, 1963 – 1970 Seismic technician, engineer, geophysicist in expedition of Deep Seismic Sounding, Azerbaijan Marine Geophysical Prospecting Department (KMGR) and Azerbaijan Branch of All-Union Scientific Research Geophysical Institute (AzVniigeofizika). Specialization: Deep Seismic Sounding, seismic geodynamics, prediction of earthquake focal zones, seismological and geophysical precursory, engineering seismology.
Member of Seismological Society of America, from 2006 up to date. Member of Asian Seismological Committee of IASPEY from 1996 up to date, General Secretary of National Committee of Geophysicists of Azerbaijan, Member of International Advisory Committee (Azerbaijan). Publications: Author of more than 150 scientific, technical publications

Leveraging Academic Expertise to Improve Earthquake Monitoring

Susan Beck[1], Göran Ekström[2], Karen Fischer[3], Arthur Lerner-Lam[2],
Anne Meltzer[4], Andrew Nyblade[5], Eric Sandvol[6], **Raymond Willemann[7]**

1. University of Arizona, USA, beck@geo.arizona.edu
2. Columbia University, USA, ekstrom[lerner]@ldeo.columbia.edu
3. Brown University, USA, karen_fischer@brown.edu
4. Lehigh University, USA, ameltzer@lehigh.edu
5. Pennsylvania State University, USA, andy@geosc.psu.edu
6. University of Missouri, Columbia, USA, sandvole@missouri.edu
7. IRIS Consortium, USA, ray@iris.edu

ABSTRACT

Government investments in high-fidelity digital seismograph networks and community development of standards have created a global infrastructure for earthquake monitoring with few technical impediments to data sharing and real-time information exchange. Despite renewed commitment since the 2004 Indian Ocean tsunami, international development organizations, with notable exceptions, have been relatively passive in discussion of how the existing earthquake monitoring infrastructure could be leveraged to support risk-reduction programs and meet sustainable development goals. At the same time, the international seismological community has built research and education initiatives such as EarthScope, AfricaArray, and similar programs in China, Europe and South America, that use innovative instrumentation technologies and deployment strategies to enable new science and applications, and promote education and training in critical sectors.

Can existing models of international collaboration ensure sustainability of global earthquake monitoring? Can academic institutions work with development agencies to meet development and natural hazard risk reduction goals? The IRIS International Working Group explores the link between the activities of IRIS Members and the missions of international development agencies. Seismologists' interests are served by encouraging development of modern seismographic systems around the world to collect data for research as well as hazard mitigation and other national interests. Activities of the Working Group include communicating the benefits of geophysical infrastructure and training to disaster risk reduction programs within the United Nations and development banks, coordinating long-term loans of retired data loggers to network operators in foreign countries, and developing a white paper on the international role of IRIS.

The Working Group convened a workshop, "Out of Africa", on modernizing geophysical infrastructure in the Americas and Southeast Asia through projects that are tied to university education and research. Workshop participants found surprisingly close parallels between geophysical infrastructure in the predominantly low-income countries of AfricaArray with low risk of geophysical disasters and the mostly middle-income countries of Southeast Asia and the Americas with high risk. Except in larger countries of South America, participants reported that there are very few geophysicists in research and observatory operations, that geophysical education programs are nearly non-existent even at the undergraduate university level, and that many monitoring agencies continue to focus on limited missions even though closer relationships with researchers could facilitate new services that would make important contributions to disaster mitigation and sustainable operations.

Building sustainable earthquake monitoring systems requires well-informed cooperation among companies that manufacture components or deliver complete systems and the government or other agencies that will be responsible for operating them. Many nations or regions with significant earthquake hazard lack the technical and human resources to establish and sustain permanent observatory networks required to return the data needed for hazard mitigation. On the compressed time scale of disaster recovery, it can be difficult to find reliable, disinterested information sources. Drawing on unsurpassed educational capabilities of its Members working in close cooperation with its facility staff, IRIS is writing a guide on decisions about network design, installation and operation. The intended primary audience would be government officials seeking to understand system requirements, the acquisition and installation process, and the expertise needed operate a system. The guide would cover network design, procurement, set-up, data use and archiving. Establishing permanent networks could provide a foundation for international research and educational collaborations and critical new data for imaging Earth structure while supporting scientific capacity building and strengthening hazard monitoring around the globe.

Key words: Natural Hazards, Economic Development, Sustainability, Earthquake Monitoring, Observatory Networks.

PRESENTER'S BIOGRAPHY

Raymond Willemann, the IRIS Director of Planning and Community Activities since 2005, coordinates the activities of the IRIS International Working Group. From 1998 to 2003 he was the Director of the International Seismological Centre and from 1992 to 1997 he filled a variety of roles in GSETT-3 and at the Prototype International Data Centre for the CTBTO.

Effective Risk Reduction Requires Dialogue Among Earthquake Scientist

Mohsen Ghafory-Ashtiany

Distinguished Professor
International Institute of Earthquake Engineering and Seismology (IIEES)
Tehran, Islamic Republic of Iran
ashtiany@iiees.ac.ir

Despite the great advancement of earthquake related science and technologies, the issue of implementation of the existing know-how; development of usable and doable tool for risk reduction; and total system design still remains the biggest challenges for the scientific community. To answer the above mentioned challenges and for effective reduction of the growing earthquake risk; requires maximum participation, cooperation, collaboration and active dialogue between all earthquake related expertise: earth scientist, seismologist, earthquake engineers (geotechnical and structural), urban planners, socio-economist and managers; in order to identify the key questions and the methodologies that are required for achieving seismically safe environment. Why? Because we are still lacking the “Total View” to risk; and we are behind in providing prescriptive, simplified and easy-to-do solutions for the common structures, specially the common housing units.

While, the designers are do not know enough the expected input ground motion, or ignore the rotational component of earthquake; seismologist are working on other important issues, but not totally toward answering the real need of engineers. We are still facing the destruction of buildings, bridges and industrial facilities, either due to lack of poor assessment of the hazard level or lack of appropriate design or construction. Also, while the earthquake engineering researchers are working on very sophisticated modeling and approaches that are only useful for sophisticated structures, people are loosing their lives in the simple housing units. The result is that after each major earthquake, it has been commonly concluded that: It was a surprising earthquake...; The ground motion characteristics was different and it was not expected; Soil behavior was different than it was expected; Failures were due to poor design and construction and due to ignorance of engineering principal, Further code modification, and Finally more research and funds are needed.

For this we need to establish an active dialogue and exchange of know-how among all related specialist in the filed of earthquake risk management in order to identify and classify the key issues and try to provide answers compatible to the level of the knowledge and expertise of the respective implementer and users. Formation of “International Alliance of Seismology and Earthquake Engineering Professional Associations (IASEEPA)” with the objective of determining what specific types of activities the world’s seismology and earthquake engineering professional societies could ***jointly*** undertake to better influence public policy and advocate seismic safety, internationally, in order to reduce earthquake losses could be a good start.

Earthquake and related geo-risk assessment in Malawi: Disaster risk reduction (DRR) and preparedness matters

Chris J.H. Hartnady[1], E. Rowena Hay[2], Lostina S. Chapola[3], Eric Calais[4], D. Sarah Stamps[5], Elifuraha Saria[6].

1. Umvoto Africa (Pty) Ltd, Muizenberg, South Africa, chris@umvoto.com
2. Umvoto Africa (Pty) Ltd, Muizenberg, South Africa, rowena@umvoto.com
3. Dept of Geography, Catholic University of Malawi, Limbe, Malawi, lostinachapola@yahoo.com
4. EAS Department, Purdue University, West Lafayette, IN 47907, USA, ecalais@purdue.edu
5. EAS Department, Purdue University, West Lafayette, IN 47907, USA, dstamps@purdue.edu
6. UCLAS, Univ. of Dar Es Salaam, P. O. Box 35176, Dar Es Salaam, Tanzania, sariah@aru.ac.tz

ABSTRACT

Although the Salima event of 1989 March 10 (21:49:45.8 UTC) is the largest in historical memory within Malawi and also in the instrumental record (surface-wave magnitude [Ms] 6.1), a far worse, economically crippling, seismic disaster is possible in the event of a future, much larger earthquake. The Global Seismic Hazard Assessment Program (GSHAP) determined an "upper bound" or "maximum expected" magnitude of 7.3 for seismic Source Zone 11, which extends from the N end of Lake Malawi to S Mozambique, where the Machaze earthquake of moment-magnitude (Mw) 7.0 occurred on 2006 February 22. In SE Tanzania, the Rukwa event of revised surface-wave magnitude (Ms) 7.4 occurred on 1910 December 13. For the continental rift-boundary (CRB) type in seven kinds of plate margin, a global seismicity analysis recently (2004) estimated a "corner magnitude" $M_0x = 7.64 +0.77/-0.22$ in a modified Pareto earthquake size-frequency model. Finally, the Bilila-Mtakataka fault scarp, a short distance south of the Salima area, displays geological evidence of a prehistoric earthquake of possible magnitude 8, described as perhaps "the biggest normal faulting earthquake known on (any of) the continents". On this seismotectonic assessment, future earthquakes in the magnitude range 7.5-8.0 have a definite, albeit low, annual probability of occurrence (<0.001/yr) in Malawi.

A new kinematic model for the East African Rift System (EARS) is important for analysis of seismic hazard because it provides - with fairly high degree of confidence - rates and directions of tectonic extension along the Nubia (/Transgariep?)-Rovuma (NU/TG-RV) plate boundary, between the Rungwe (NU/TG-VI-RV) triple junction just N of Lake Malawi and the Almirante Leite (RV-LW-NU/TG) triple junction on the continental shelf of S Mozambique. The motion of RV relative to fixed NU ranges from 3.91 mm/yr towards N083°E near lat. 9.5°S (Livingstone Mountains fault scarp) to 1.07 mm/yr towards N069°E near lat. 25°S (coast near Xai-Xai). Across the conspicuous fault scarp between the Shire valley and the Thyolo highlands near Chikwawa (lat. 16°S), the model RV-NU tectonic extension rate is 2.71 mm/yr towards N085°E. A horizontal elastic strain of 5 m, equivalent to a ~Mw 7.5 earthquake if released suddenly along the main border fault of the Shire graben, takes about 2000 years to accumulate at this slow rate.

Earthquake DRR and preparedness in the region of the NU-RV plate boundary (Malawi, Tanzania, Zambia, Mozambique) requires: 1) improvement of seismographic and GPS monitoring, with ongoing seismotectonic analysis; 2) conjunctive use of space- and aircraft-based technologies (e.g., high-resolution radar altimetry and digital multispectral imagery) for hazard (fault / landslide) mapping and vulnerability assessment; and 3) a strong ground-level, community-based approach to hazard perception and risk representation. In terms of the Hyogo Framework for Action, all three elements should contribute within a broader, multinational education and public outreach (EPO) initiative, in order to make DRR effective in the wider social context amongst the potentially affected communities.

.

Key words: Malawi, earthquake risk, disaster risk reduction, preparedness, educational outreach, Hyogo Framework.

PRESENTER'S BIOGRAPHY

Chris Hartnady; b. 04 Jul 1945, Cape Town, South Africa; M.Sc., University of Cape Town (UCT), 1969; British Council scholar, Royal School of Mines, Imperial College, London, 1970-71; Junior Lecturer, Dept of Geology, UCT, 1972-1974; Research Officer, Chamber of Mines Precambrian Research Unit (PRU), UCT, 1974-1980; PhD, Dept of Geology, UCT, 1978; Senior Research Officer, PRU, UCT, 1980-86; Director, PRU, UCT, 1987-91; Associate Professor, Dept of Geological Sciences, UCT, 1987-2000; Research & Technical Director, Umvoto Africa (Pty) Ltd, Cape Town, 2000-; Member, Geol. Soc. S. Afr., 1971-; Life member, Geol. Soc. Afr.,. 2004-.

Can we minimize earthquake disasters?

Denis Hatzfeld[1], James Jackson[2] and Brian Tucker[3]

1. Laboratoire de Géophysique Interne et Tectonophysique, BP 53, 38041 Grenoble Cedex 9, France, denis.hatzfeld@ujf-grenoble.fr
2. Bullard Laboratories, Madingley Rise, Madingley Road, Cambridge, CB3 0EZ, United Kingdom
3. GeoHazards International, 200 Town & Country Village, Palo Alto, California 94301, USA

ABSTRACT

Large earthquakes are beyond human control, but we can try and prevent them from turning into major catastrophes by reducing the vulnerability of the populations affected by them. However, most urban authorities outside Japan and California show little evidence of effective coordination, action and planning with regard to earthquake vulnerability reduction. A detailed examination of global deaths in earthquakes shows that the effects are very variable between different countries. A major earthquake in Iran, Turkey or Pakistan may kill tens of thousands people, whereas a similar-sized earthquake in Japan or California typically kills only tens or hundreds of people. The economic loss is also very varied between these countries and has a major effect on development. Most of these variations in mortality and economic effects can be attributed to differences in the building standards between the countries. We expect most of the future growth in global population to occur in areas where seismic hazard is high, and to be accommodated mostly by megacities. There is therefore an urgent need to manage the seismic risk as part of urban development in such countries.

Key words: seismic hazard, building codes, developing countries, urban development

PRESENTER'S BIOGRAPHY

Denis Hatzfeld is a French senior scientist mostly involved in studying seismotectonics in several countries around the Mediterranean and Iran. He has been in charge of starting the French National Strong Motion network. Talking with several colleagues, he is convinced that more should be done to popularize and make more useful to all citizen the sophisticated results obtained by scientists of modern countries.

Vulnerability analysis of ground and structures based on microtremor measurement and scenario earthquake simulation: Applications to the Greater Beijing area

Lanbo Liu[1, 2], Qi-fu Chen[2], Kuang He[1], Weijun Wang[2],
Eric Rohrbach[1], and Cheng Qi[2]

[1]Department of Civil & Environmental Engineering, University of Connecticut, USA,
Lanbo@engr.uconn.edu
[2]Institute of Earthquake Science, China Earthquake Administration, China,
chenqf@seis.ac.cn

ABSTRACT

Existing field observations on earthquake strong ground motion indicate that the division of the squared amplification of the horizontal to vertical motion A over the predominant shaking frequency f (i.e., A^2/f, with f in the unit of Hz) is proportional to the dynamic strain caused by seismic vibrations. This ratio has been named as the K-value by Yutaka Nakamura (1997). The K-value appears to be an intrinsic index to represent the vulnerability of the ground and structures to earthquake shakings. During the 1989 Loma Prieta earthquake in California, a maximum value of 100 was found near the coast of the Marina District in San Francisco, and most structure damages occurred in the area with the K-value exceeding 20 (Nakamura 1997). In this paper we attempt to apply the vulnerability analysis to the Greater Beijing area by finding the distribution of the K-value from 1) the microtremor measurements, and 2) the simulated ground shaking resulted from a numerical simulation of the scenario earthquake based on the 1679 M8 Sanhe-pinggu earthquake 65 km east of the city center of Beijing.
Our microtremor data were acquired with a field campaign of microtremor measurements at ~1000 sites conducted in the Greater Beijing area aimed for assessing local site effect of seismic ground motion. Microtremor surveys were also conducted in selected structures. With the application of the horizontal to vertical spectral ratio (HVSR) method we can readily derive the K-values for these sites and the structures. Meanwhile, K-value analysis can also be applied to the simulated ground shaking output. Direct comparison of HVSR amplification and peak frequency has found good consistency between the microtremor results and the scenario earthquake simulations. More detailed examination of correlation of the K-values in the ground and in the structures will also be reported at the conference.

Key words: Beijing, vulnerability, microtremor, horizontal to vertical spectral ratio, scenario earthquake

PRESENTER'S BIOGRAPHY

Professor Lanbo Liu had his undergraduate and graduate education in geophysics in Peking University, Beijing, China. He worked 7 years in the State Seismological Bureau (now China Earthquake Administration) on earthquake studies before continued his advanced education in USA and received MS in Civil and Environmental Engineering and PhD in Geophysics from Stanford University.
He was the Carnegie Fellow at the Department of Terrestrial Magnetism, Carnegie Institution of Washington and joined the faculty of Geology and Geophysics at University of Connecticut in 1995.
He has more than 100 publications in peer-referred journals, conference proceedings, and technical reports. He served as the Associate Editor for *Geophysics* in 2003-2005, a guest editor for *Journal of Geophysics and Engineering* in 2006-2007, and Associate Editor for *Journal of Environmental and Engineering Geophysics* since 2007. His current research concentrates on numerical modeling and imaging with seismic, electromagnetic, and acoustic waves for exploration, geotechnical, and environmental, applications.

Software applications for rapid post-earthquake loss estimation in European urban centres

Fleur O. Strasser[1], Julian J. Bommer[2], Peter J. Stafford[3] & Mustafa Erdik[4]

1. Dept. of Civil & Environmental Engineering, Imperial College London, U.K., fleur.strasser@imperial.ac.uk
2. Dept. of Civil & Environmental Engineering, Imperial College London, U.K., j.bommer@imperial.ac.uk
3. Dept. of Civil & Environmental Engineering, Imperial College London, U.K., p.stafford@imperial.ac.uk
4. KOERI, Bogazici University, Istanbul, Turkey, erdik@boun.edu.tr

ABSTRACT

Earthquakes striking densely populated urban centres can result in substantial social and economic losses even in countries in which extensive earthquake risk mitigation programmes have been implemented. An efficient management of emergency response in the immediate aftermath of the earthquake is an essential element of earthquake risk reduction. To assist decision-makers and planners, Earthquake Loss Estimation (ELE) tools based on Geographic Information Systems (GIS) have been developed over the past few decades. This research has been pioneered by projects in the United States and Japan, with notably the development of the HAZUS multi-hazard software by the United States Federal Emergency Management Agency (FEMA).

Due to the larger political and administrative fragmentation of the Euro-Mediterranean region, there is no institution equivalent to FEMA in charge of coordinating the emergency response at a pan-European level. Instead, the post-earthquake response is coordinated at national level by the individual civil protection agencies. As a result, separate ELE tools have been developed in various European countries. In line with previous and ongoing projects to ensure coordination of research efforts in the field of ELE across the Euro-Mediterranean region, work-package JRA3 of the NERIES project funded by the European Commission addresses the issue of developing a rapid loss estimation tool to be used by European agencies such as the European Mediterranean Seismological Center (EMSC) for computing and broadcasting near-real-time earthquake loss estimates to the relevant emergency response institutions.

As a preliminary step, a review of the state-of the art of loss estimation methodology and software has been carried out. In particular, the software packages have been examined in terms of their suitability for application in a pan-European context, and for use in a rapid post-earthquake response situation. Additionally, a damage estimation exercise has been carried out using the building stock inventory and population database of the Istanbul Metropolitan Municipality and selected European earthquake loss estimation packages: KOERILOSS, SELENA, ESCENARIS, SIGE and DBELA. The input ground-motions, common to all models, correspond to a "credible worst-case scenario" involving the rupture of the four segments of the Main Marmara Fault closest to Istanbul in a M_w 7.5 earthquake. The aim of the exercise is to identify the key methodological aspects and data needs for European rapid post-earthquake loss estimation in urban centres.

The results in terms of predicted building damage and social losses are critically compared amongst each other, as well as with the results of previous scenario-based earthquake loss assessments carried out for the study area. The results show a reasonable agreement in terms of spatial distribution of the damage and overall number of buildings affected. For social losses, a direct comparison is hampered by differences in the definitions of the loss indicators. Such harmonisation issues can be addressed through the development of a modular framework. Other issues, such as regional differences in the calibration of the model, the acquisition of inventory data, and the level of spatial resolution required for the loss calculations, also require attention.

Key words: Loss Estimation, Damage Assessment, Earthquake Risk, Istanbul, Europe.

PRESENTER'S BIOGRAPHY

Fleur Strasser is a graduate from the Ecole des Mines de Nancy in France. She joined Imperial College London to complete an MSc course in Soil Mechanics and Engineering Seismology, which was followed by a PhD on the topic of the "Modelling and Interpretation of Extreme Earthquake Ground Motions" in seismic hazard assessment, supervised by Prof. Julian Bommer. After a brief period working in the London office of Arup's as a Geoseismic Engineer, she rejoined Imperial as a Post-Doctoral Research Associate, working on the European Union – funded NERIES project.

Implementation of a new seismic risk mitigation plan for Algeria (the Law 04-20 of December 2004)

A.K.Yelles-Chaouche [1], A.Kherroubi[1], H.Djellit[1]

1. C.R.A.A.G. Route de l'Observatoire B.P.63 Bouzaréah Algiers, Algeria, a.yelles@craag.dz

ABSTRACT

Northern Algeria is known to be a seismic zone: Indeed during the last twenty years, several moderate to large events occured in this region. After the earthquake of October 10 th, 1980, M:7.3 which hit the El Asnam region, the algerian authorities decided to launch an important program for reducing the seismic risk in Algeria. Unfortunately, this plan was partially applied due to the political situation of Algeria during the nineties.
The occurrence of the last Boumerdes earthquake of May 21 st, 2003 (Mw:6.8) demonstrated the obligation to have a new plan for reducing the seismic risk in Algeria
This new plan entry to force in December 2004 through the law 04-20 for the prevention against natural disasters. This law indicate the required actions in the several fields (education, research, insurances, information…)
Since December 2004, many actions were already made as:
1- fourteen decrets were published in the housing domain to constrain the citizens to use the seismic code for buildings their houses.
2- Decisions were taken to reinforce the old buildings
3- A new seismic code taking into account lessons of the Boumerdes earthquake was published
4- Studies were made to evaluate the seismic hazard in the region of Algiers and in the northern part of Algeria
5- New insurance policy against natural disasters was published.
6- A new land management promoting the High Plateaus (where the risk is less)region was decided
7- In the education field, lessons on the seismic risk were introduced for the pupils.
8- Research Centers benefited of many equipments. The CRAAG installed a new digital seismic network.

All these actions with all scientific projects will contribute in few years to reduce with efficiency the seismic risk in Algeria

Keys words: Algeria, seismic risk, prevention, decisions.

PRESENTER'S BIOGRAPHY

A.K Yelles-Chaouche
Director of the CRAAG (Centre de Recherche en Astronomie Astrophysics Géophysics
PHD in 1987 at the IPGP Paris (France)
Director of Research since 2000
Head of the Seiimology Laboratory in CRAAG.