COSMOS Calendar

Annual Membership Meeting (following SMIP 2000):16 September 2000 at PEER: 9:00 am

Board Meeting: 16 September 2000, at PEER, 3:00 pm

Invited Workshop on Instrumental Diagnotics of Seismic Response of Bridges and Dams: October 2000 at PEER.

Editor: Claire M. Johnson

COSMOS Newsletter

No. 2, April 2000

Consortium of Organizations for Strong-Motion Observation Systems

Activities

Bruce A. Bolt, President

Since the last Newsletter (December 1999), COSMOS has been busy with a number of important initiatives. The greatest priority was the development of installation and siting policies for the Advanced National Seismic System (ANSS) (see article below). The invited representative of COSMOS, Dr. J. Carl Stepp, attended the first meeting in Albuquerque, New Mexico, on 29 February and presented recommendations developed specifically at the COSMOS Board Meeting on 24 February 2000. We are now seeking volunteers from among the strong-motion community, particularly earthquake engineers, to represent the Consortium on the various regional advisory committees now being formed. Those interested should contact Carl Stepp (cstepp@moment.net).

COSMOS has responded to a request by Dr. John Filson, U.S. Geological Survey, at the 24 February Board Meeting to contact congressional committees considering the funding of the ANSS. We have also begun to develop optimum criteria for siting of strong-motion instrumentation in urban areas. A support proposal has been submitted to the U.S. Geological Survey that will fund a COSMOS Report to be developed by Dr. Robert Nigbor, University of Southern California, with input from the COSMOS Strong Motion Program Board. This seminal document will help provide a standard for the national system.

One of the goals of the COSMOS Charter is to promote the extension and application of strong-motion systems and observations. We have, therefore, undertaken to organize in the Fall an invited workshop on the diagnostic use of strong-motion data from recording systems on large bridges and dams following earthquakes (see page 5).

COSMOS already has a long agenda of items in the year 2000 that must be considered if stability and progress of the U.S. National System is to be secured. All interested in this enterprise are invited to respond to the request for membership given later in the Newsletter.

What Is the ANSS?

Harley Benz, U.S. Geological Survey

Several important developments have recently occurred in the effort to implement an Advanced National Seismic System (ANSS), and momentum for the initiative is on the rise.

The seismological research and earthquake engineering communities have recognized for years the need for modern seismological instrumentation in order to understand better the nature of earthquakes and to improve building design. During the 1980s and 90s numerous reports and articles provided justification for modernizing different components of existing seismic monitoring systems. In 1997 Congress asked the U.S. Geological Survey (USGS) to assess regional seismic networks operating in the United States and to provide recommendations and projected costs to modernize regional seismic networks. The outcome of this directive was a consensus report outlin-

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ing the need for an Advanced National Seismic System designed to organize, modernize, and standardize operation of seismic networks in the United States to improve the nation's ability to respond effectively to damaging earthquakes, volcanoes, and tsunamis. Critical to the success of the ANSS is the need to upgrade national, regional, and urban components of the system. The ANSS report recommends the following: increasing the national seismograph network from 56 stations to 100 stations; adding or replacing 1000 modern seismographs in regional networks in areas of greatest risk; installing 6000 strong-motion recording systems in urban areas at risk to damaging earthquakes; and linking seismographs to monitoring centers with modern, robust telecommunications equipment.

The goal of the ANSS is to capitalize on current technologies to manage and organize data collection and distribution, and to provide new products and services not possible within existing seismic monitoring operations. Importantly, engineers, emergency responders, and researchers from universities, state and local governments, other federal agencies, and the private sector are actively involved in developing and implementing the ANSS. Oversight of the ANSS will be the responsibility of the USGS.

U.S. Army Corps of Engineers Seismic Strong-Motion Instrumentation Program

Robert F. Ballard, Jr., and Tina H. Grau, U.S. Army Engineer Research and Development Center

Since 1972 the U.S. Army Corps of Engineers has operated a seismic Strong-Motion Instrumentation Program (SMIP) throughout the United States to provide both a measure of project performance and insight into the safety of Corps projects, in addition to establishing a database for earthquake research. Strong-motion instruments used for SMIP consist of digital and analog accelerographs, peak acceleration recorders, and seismic alarm devices. These instruments have been placed at earth, rock, earth and rock, arch, and gravity dams owned and operated by the Corps. At present, 123 projects located in 32 states and Puerto Rico are monitored with more than 500 strong-motion instruments. The Corps network is second in size to that operated by the California Division of Mines and Geology.

The Waterways Experiment Station (WES) in Vicksburg, Mississippi, houses the U.S. Army Engineer Research and Development Center's (ERDC) Geotechnical Laboratory (GL) (one of five ERDC laboratories currently located at WES). By Corps directive, WES is responsible for maintaining records of instrument servicing and location; reviewing instrument locations and type to assure conformance with Corps policy; processing and analyzing records; furnishing copies of records to the Districts concerned; coordinating with U.S. Geological Survey (USGS) and the Districts to establish schedules for inspection visits; and providing personnel for installation and maintenance of Corps instruments not serviced by USGS. Arrangements were made with the USGS to install and maintain Corps instruments. During FY 78, WES assumed responsibility for the installation and maintenance of approximately half of the Corps instruments, which are primarily located in the eastern United States. The USGS continues to maintain those instruments on the west coast.

The Corps SMIP is designed to allow observation and analysis of seismic waves produced by earthquakes and explosions to examine the effect of these motions on Corps projects. As owners of critical structures, the Corps is obligated to ensure their safety to the public. As additional information is gained and technological advances made, both in terms of instrumentation and analytical seismic analysis techniques, more reliable assessments of Corps projects will be made.

In September 1998 WES published a comprehensive report entitled "A U.S. Army Corps of Engineers Seismic Strong-Motion Instrumentation Program," by Robert F. Ballard and Tina H. Grau, *Technical Report GL-98-25* (available in Adobe portable document format at http://geoscience.wes.army.mil/trgl-98-25.pdf). This report presents various aspects of the Corps SMIP, including criteria for design of installations, recording equipment, operation, maintenance, performance to date, upgrades, future goals, and the importance of interagency cooperation. Particular attention focuses on economics and advantages associated with ultimate conversion to remotely accessed digital instrumentation.

Reports published by the ERDC are available through the Interlibrary Loan Service. For further information, contact the Research Library at the U.S. Army Engineer Research and Development Center (Tel: 601/634-2355: Fax: 601/634-2306). To purchase a printed copy of this report, contact the National Technical Information Service (Tel: 800/553-NTIS (6847) or 703/605-6000; Fax: 703/605-6900; or Email:orders@ntis.fedworld.gov). When ordering from NTIS, include the report title, authors, and the AD-A number (***ADA353954INZ***).

Strong-Motion Data Archives at the National Geophysical Data Center

Paula Dunbar, National Geophysical Data Center

In 1932 the Coast and Geodetic Survey inaugurated a program of recording strong ground movements in

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seismically active regions of the country. The National Geophysical Data Center (NGDC) assumed responsibility for archiving and disseminating strong-motion data in 1970, and data collected during these years were provided on tape and printouts. In 1996 the NGDC placed the entire strong-motion database on a three-volume CD-ROM set, which contains more than 15,000 digitized and processed accelerograph records, dating from 1933 to 1994.

Strong-motion data are contributed to the NGDC from international organizations, academic researchers, government agencies, and industrial sources. Data in the archive include uncorrected (raw), corrected (filtered), and response spectra (includes Fourier spectra) data. The data are grouped into datasets, either by triggering events or geographic regions. Although some of the datafiles have been reformatted, most of the files are in the original format as contributed to the NGDC. A strong-motion catalog, SMCAT, contains a comprehensive database summarizing the characteristics of each accelerogram. It was included on the 1996 CD-ROM set and is updated online as new data are contributed.

Most of the strong motion archive consists of records obtained from various man-made structures, including structures of engineering importance such as dams, bridges, utilities, and large buildings. The records represent a comprehensive collection of accelerograph data suitable for the analysis of dynamic structural response and soil-structure interaction. Approximately 5000 records are available from ground response sites. The records are obtained from a wide variety of geologic environments, ranging from young alluvium to hard rock. Several near-source records included in the database are useful for source mechanism studies. Also included in the archive are records from several accelerograph instrument arrays.

The NGDC continues to gather strong-motion data from national and international sources. The data are archived onto 3480 tapes (approved archive media) and stored at on- and off-site locations. Data are distributed on CD, diskette, and via the Internet. Within the next year, the NGDC plans to compile an updated strong-motion CD-ROM collection. For further information please visit NGDC's website: http://www.ngdc.noaa.gov.

Dissemination of European Strong-Motion Data

Patrick Smit, Imperial College of Science, Technology and Medicine, London

Strong-motion instrumentation and recording in Europe and in the Middle East began much later than in United States and Japan. Recently, however, the advent of digital recorders and the need to instrument major engineered works and public buildings to comply with the requirements of hazard assessment and earthquake-resistant design stipulated in Eurocode-8 have encouraged the rapid deployment of strong-motion instruments. Although the total number of stations in Europe is difficult to estimate, presently there are around 2800 strong-motion recorders. The number of individual three-component ground motion response records of European earthquakes of all magnitudes during the last 30 years exceeds 3000 (this does not include data from the former USSR, a few European countries, or the European nuclear and oil industries). Unfortunately, most data remains under utilized, mainly because of lack of accessibility.

In a grant from the European Council, Environment and Climate Research Programme (contract ENV4-CT97-0397) more than 1000 uncorrected strong-motion acceleration records from shallow earthquakes that occurred in Europe, the Mediterranean area, and the Middle East were acquired from different networks, agencies, and data centers operated by a multitude of private, academic, or governmental establishments. This dataset contains digital strong-motion recorded at permanent, ground level recording stations. Records from temporary stations were also included if they were deemed of engineering importance. All time histories were recorded with instruments described as "free-field' or "ground response" recordings.

The records were disseminated in different formats and the associated parameters were, quite often, incomplete, inaccurate, or wrong. Therefore, it was necessary to (a) determine a number of parameters relating to the earthquakes and the recording sites using consistent procedures, and (b) present them in a uniform format.

All records, therefore, were uniformly pre-processed and corrected, and all time histories and spectra were transferred into a uniform file format, with one file for each component of the recording station. Next, a database system was developed, which was tailored to the specific requirement for the dissemination of the records and associated parameters.

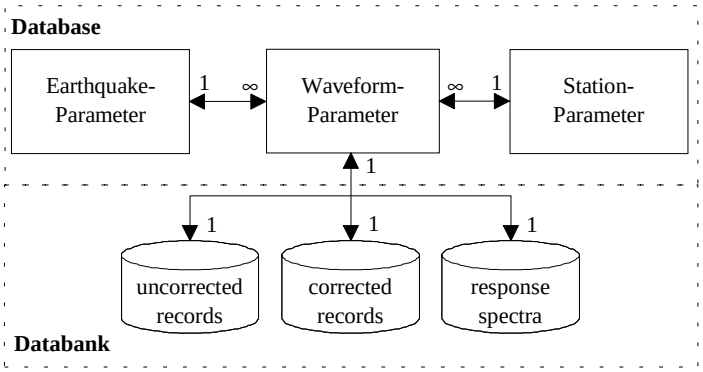

Figure 1. Schematic of databank

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The records are identified by the origin time of the earthquake and the location of the recording station; the original source of the record is duly noted. All records are archived in a databank both in uncorrected and corrected form and response spectra, which are linked to a database with associated earthquake-, station- and waveform-parameters (see Fig. 1). The associated parameters have been culled from special studies, re-assessed or adopted from bulletins, publications, or data centers.

The primary benefit of this relational structure is that it standardizes the presentation of strong-motion data and associated parameters, thereby simplifying the process of searching and extracting of design input data. The database, databank, and browser-program are designed for IBM compatible PCs, with Microsoft Windows 9x operating system and includes ~620MB of data.

Figure 2 shows the distribution of the records archived in the databank with respect to hypocentral-distance, surface-wave magnitude, M_s, and local geology. All records from earthquakes with unknown or questionable focal depth have been discarded from this figure. Note that for M > 6 distances are from the source.

This comprehensive dataset with 1069 strong-motion records from Europe and adjacent area will be published on a CD-ROM in August 2000, together with a browser for interactive selection and extraction of design input data and documentation. Copies of this CD-ROM are available upon request from Imperial College of Science Technology and Medicine, London (p.smit@ic.ac.uk), SOGIN (former ENEL) and Servizio Sismico Nazionale, Rome (berardi.raniero@enel.it), Ente per le Nuove Tecnologie, l'Energia e l'Ambiente, Rome (dario.rinaldis@infos1.casaccia.enea.it), Commissariat à l'Energie Atomique, Institut de Protéction et de Sûreté Nucléaire, Paris (fabrice.cotton@ipsn.fr), or European Council, Environment and Climate Research Programme, DG XII (Bruxelles).

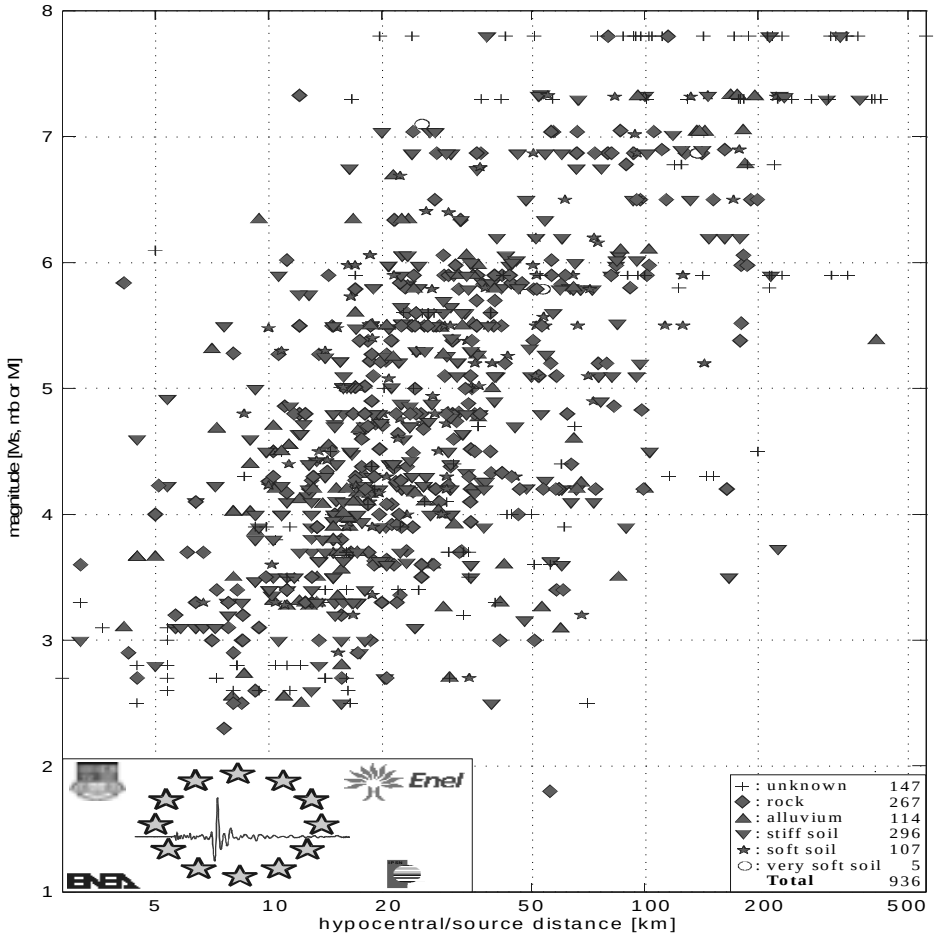

Figure 2. Distribution of the records archived in the databank with respect to hypocentral-distance, surface-wave magnitude, M_s, and local geology.

COSMOS Urban Strong-Motion Reference Station Guidelines

A. Shakal, Chairman, Strong Motion Program Board

The goal of urban strong-motion reference stations is twofold: to enhance public safety through analysis of data recorded and to improve emergency response capabilities through immediate use of the data. Urban reference stations are a departure from the traditional free-field stations in that they may be located in highly urbanized areas and do not meet the classic definition of "free field." In order to ensure recovering records of adequate quality, guidelines for the installation of urban strong motion reference stations is critical because these stations may be installed by individuals or agencies that have not previously installed strong-motion stations.

The COSMOS Strong Motion Program Board (SMPB) has developed draft Guidelines entitled "Goals, Criteria, and Specifications for Urban Strong-Motion Reference Stations." Based on their standards and practice, each COSMOS core member (USGS, CDMG, Bureau of Reclamation, and Army Corps of Engineers) provided input to the guidelines. In addition, members of the SMPB provided a wide base of input from their areas of expertise and experience. The Guidelines include sections on instrument specifications, siting specifications, and installation specifications. The SMPB also considered the perspectives of other networks, such as the Taiwan strong motion network and its performance in the Chi-Chi earthquake, and utility strong-motion instrumentation, such as that of the Pacific Gas & Electric network in California. Contributors include N. Abrahamson, J. Anderson, R. Archuleta, B. Bolt, R. Borcherdt, M. Huang, W. Joyner, C. Kircher, W. Lee, C. Poland, C. Stepp, A. Shakal and C. Wood. The draft Guidelines are available at http://www.comos-eq.org.

In a follow-on effort, C.Stepp and R. Nigbor have begun a project to restructure and expand on the guidelines to produce a user-friendly, easily understood document with explanatory text and examples. This project should be completed this summer.

COSMOS Virtual Strong-Motion Data Center

A. Shakal, California Division of Mines and Geology
R. Archuleta, University of California, Santa Barbara

Have you ever needed strong-motion records for either a project or research, but didn't know what records were available, which agency has the records, or how to get them in a common format? The COSMOS Virtual Data Center (VDC) aims to address all these issues. An ambitious project is now underway to make possible access to all records needed through a single Internet web site. The VDC will be located at http://www.cosmos-eq.org and should be operational later this year.

The University of California, Santa Barbara, working in conjunction with COSMOS, has made great strides in developing the site. The goal is to link electronically the four major strong-motion data sources (California Division of Mines and Geology, U.S. Geological Survey, U.S. Bureau of Reclamation and U.S. Army Corps of Engineers) using the World Wide Web. Although the strong-motion records will continue being stored at the source networks, the VDC will access each site to provide the requested records to the user, identifying which network recorded the data. The VDC will also have a user-friendly database search capability, so that a user can request records with criteria specific to their needs. For example, a user could ask for all available records obtained at soil sites within 20 km of the fault, for events between magnitude 6 and 7. See the next Newsletter for a report on progress, and send any comments or suggestions you may have to cosmos@peer.berkeley.edu.

Invited Workshop on Instrumental Diagnostics of Seismic Response of Bridges and Dams

There has long been a demand from owners of bridges and dams for recommendations on how best to use seismic recordings from modern strong-motion instrumentation systems on their structures. In response to this interest, COSMOS is taking the lead in organizing a small workshop of experts to discuss the present position and develop recommendations.

The workshop will be held in October at PEER, Richmond, California, and has the support of Caltrans, CUREe, the Golden Gate Bridge District, PEER, and CSMIP.

For further information on the workshop, please contact B.A. Bolt at cosmos@peer.berkeley.edu.

✸✸✸✸ REMINDER ✸✸✸✸

All members must pay their dues before the Annual Meeting in September. Membership request forms are available from our website: http://www.cosmos-eq.org.

Call for Papers

European Seismological Commission
XXVII General Assembly
Lisbon, Portugal
10-15 September 2000
"Strong Ground Motion Analysis and Prediction"

Convenors:
Ch. A. Papaioannou (chpapai@itsak.gr)
M.O. Erdik (erdik@hamlin.cc.biun.tr)
P. Smit (p.smit@ic..ac.uk)
C.S. Oliveira (scoliv@civil.ist.utl.pt)

Please check the website for details
http://www.igidl.ul.pt/esc2000

Attention COSMOS Members

There will be a meeting of Committee Members at the EERI Annual Meeting, June 1-3, St. Louis, Missouri. See web page for details. Please come and visit our booth!!!

Izmit, Turkey, 17 August 1999 Earthquake

Strong-motion records of the Izmit, Turkey, earthquake are available at the following websites:
http://angora.deprem.gov.tr/
http://www.koeri.boun.edu.tr/earthqk/earthqk/html.

List of Officers