

Provision of earthquake engineering information in the US

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ABSTRACT: This paper reviews the status of earthquake engineering information transfer in the United States. Since the inception of the National Center for Earthquake Engineering Research at the State University of New York at Buffalo in 1986, NCEER has given high priority to the dissemination of earthquake engineering information. An Information Service at the Center has made great strides in providing a centralized location where information on earthquake hazard mitigation can be collected, indexed and abstracted. One of the ways we accomplish this is through the QUAKELINE™ computerized online database, which identifies and describes published literature in the field so that researchers, practitioners and the general public have quick access to information which meets their specific needs. A network of information providers in the United States has also had a prominent impact on information transfer in earthquake hazard mitigation.

BACKGROUND

It is widely agreed that effective transfer of information is critical to earthquake hazards mitigation. Recently, Kockelman (Refs. 4 and 5) and Butler (Ref. 2) assert that the information gathered by researchers is valuable to society only to the extent that it initiates actions that will reduce the potentially destructive effects of future disasters. This and other issues regarding the effectiveness of technology transfer continue to be examined in the literature (Refs. 1,2,4,5,6).

Because so many agencies are involved in this activity, it can be difficult for the user to know where to go for information. This problem is especially keen for non-technical users, such as legislators, policy makers, and land-use planners. There can be confusion as to which organization provides what type of information or support, and what the content, accessibility, format and quality of data may be.

Information providers are well aware of the problems of information transfer in this multi-disciplinary field and there is growing interest in the United States in working to resolve them. While advances in information technology and cost reductions in electronic systems create promise for improved networking and cooperation, more basic solutions may lie in direct human intervention:

improved knowledge of needs, formats, and methods of information transfer. We are optimistic that enhanced cooperation among information providers will continue, and will result in a strengthened information transfer process for earthquake engineering. The NCEER Information Service and other information providers have made significant progress in bridging the gap between research and application.

We will summarize the activities of the NCEER Information Service as a model information provider, and follow with a brief review of the activities of other organizations.

THE NCEER INFORMATION SERVICE

The National Center for Earthquake Engineering Research, established in 1986, has a strong commitment to promoting technology transfer as part of its overall plan for the mitigation of earthquake hazards. The NCEER Information Service is a key component in the Center's effort; the Center's other methods for transferring technology include the publication of research reports, technical bulletins, brochures, and newsletters; organization of workshops, seminars, and educational activities; presentation of research results at national and international meetings; press releases; and the encouragement of active

participation on the part of NCEER researchers in practical application activities such as code development committees, legislative action groups, emergency planning and response organizations, and municipal, regional, and national policy-making affiliations.

The mission of the Information Service is to provide support to the affiliates of the National Center, to the constituency of professionals involved in earthquake hazard research or activities, and to the general public. Following are some of the methods used by the Information Service to accomplish our goal of comprehensive, proactive provision of knowledge to this broad constituency.

Comprehensive collection: The NCEER Information Service identifies and acquires materials in earthquake engineering, hazard mitigation, preparation and response; civil engineering; geotechnical engineering; the socio-economic aspects of disasters; seismology; risk assessment; and geology. The resulting collection contains thousands of items, perhaps the most comprehensive resource collection in the country. Housed at the State University of New York at Buffalo campus, the items are available for loan. To improve access to this collection, the Information Service enters indexed and abstracted records for the items into the QUAKELINE database, developed at the Center. Items in the collection are also listed in OCLC, an international computerized library catalogue which encourages inter-library lending by identifying library holdings.

Reference support: A fundamental activity of the Information Service is reference support. Our user population includes researchers, engineers, legislators, educators, students, government officials, and many others. Studies indicate that the users of earthquake hazard mitigation research are widely disparate (Refs. 2, 5 and 7), and the main challenge of technology transfer lies in finding the most effective ways of translating information into practical formats that can be used at various levels of application. Obviously, the information wanted by a high school student on base isolation of bridges will differ from the information wanted on the same topic by a practicing engineer. The Information Service seeks to tailor information to meet widely diverse user needs.

Our information users range from grade-school students to professionals. Their needs are virtually endless, and may be met by a simple response or may require an extensive search. Usually, reference queries are answered by providing printed information; we identify and then duplicate or loan pertinent publications. Sometimes we refer users to other sources, such as a researcher on the "cutting edge", or another information provider in the United States or abroad.

Our state of the art methods for providing information include a combination of online computer databases, CD-ROM databases, electronic mail, print, and telefacsimile. We are seeing the rapid adoption of the CD-ROM format in addition to online computer resources. The huge capacity of CD-ROMs allows for computerized desk-top indexes to many millions of documents, and provides the sophisticated searching capability of an online database, but with easier access. We are exploring the possibility of placing the QUAKELINE database onto this format.

QUAKELINE™ database: The QUAKELINE database was created in 1987 to fill a need for indexing and abstracting of publications not covered by existing indexes. The NCEER Information Service has created and entered over 15,000 records in QUAKELINE, of which the majority are proceedings papers, journal papers (many foreign), and technical reports. Each QUAKELINE record contains author, title, publisher, subject descriptors, an abstract, and other pertinent information. To ensure maximum accessibility to the database, and continuing state of the art improvements, we chose to mount the database on the BRS system, an internationally available database vendor. BRS offers sophisticated and flexible database searching capabilities in a standard and well-known library search language and provides excellent support and user documentation.

QUAKELINE on BRS is accessible via modem from virtually any location, usually requiring only a local telephone call which connects to a telecommunications node. The system's search software allows responsive searching flexibility; any term (alpha or numeric) or combination of terms can be searched, in any order, and in any field. Each search can be further refined in succeeding steps, for instance by limiting the range of publication dates or the language of publication.

Monthly Newsletter: The NCEER Information Service News reaches nearly 1,000 readers worldwide each month. Averaging almost 50 pages, much of the News is made up of current tables of contents for the many journals we receive, and listings of other new materials. The News lists local, national and international meetings; calls for papers; and announcements of new publications, educational programs, grant funding, and hazard mitigation activities. Also featured are "selected computersearches," a listing of literature searches produced on request the previous month which may be of interest to others.

Bibliographies and other publications: The Information Service produces special bibliographies to support the activities of NCEER and other organizations. Other publications include the QUAKELINE Users Manual and various brochures.

We have also published papers on earthquake information for librarians and information specialists in schools, corporations and academia, so that they can be better prepared to assist their users on this topic.

Exhibits and demonstrations: By presenting exhibits and demonstrations at professional meetings, we increase awareness of our services. We establish contact with the engineering community as well as other selected groups (e.g., the insurance industry), and promote an exchange of information between the Information Service and its potential users.

Networking activities: The NCEER Information Service participates in an informal network of information providers within the United States that are linked by informal discussion, exchange of publications, and electronic access to each others' computerized data bases. Organizations within this network are differentiated by the scope of their interests, the types of services they provide, the constituencies they serve, and the costs, if any, of their services. Each organization fills a niche in the overall pattern of information transfer among individuals, organizations, and government agencies.

In recent years we have seen great interest in the development of earthquake hazard information services overseas such as Taiwan, Australia and Europe. We hope to enhance networking activities with such organizations. As pointed out by Anderson (Ref. 1), given the systemic nature of disasters and their management, effective information exchange contributes not only to better understanding on the local level, but also to an increased understanding of the prospects for greater international cooperative action on matters of global concern.

OTHER U.S. INFORMATION PROVIDERS

Below is a brief review of other major information providers in the field of earthquake hazard mitigation in the United States. For a detailed, annotated listing of these and other natural hazard groups, consult NHRAIC's Directory (Ref. 3).

Federal Emergency Management Agency: Following the 1977 enactment of the National Earthquake Hazard Reduction Program (NEHRP), FEMA was created to provide a single point of accountability for federal emergency preparedness, mitigation, and response activities. FEMA publishes technical monographs and pamphlets and offers training programs on seismic safety. FEMA emphasizes design practices for new buildings, abatement of seismic risk posed by existing buildings, lifeline systems safety, earthquake hazard mitigation strategies, federal response planning, state and local

preparedness planning, and earthquake education and information transfer.

United States Geological Service: The USGS, also a NEHRP agency, produces and distributes books, maps, photographs, journals, and various other data formats on a wide variety of earth-science topics such as geology, cartography, geography, and remote sensing.

USGS's Office of Earthquake Studies conducts a program of basic and applied research on earthquakes, volcanoes and landslides, including research on alerts, warnings, and forecasts; hazard maps; risk assessment for loss of life and economic losses due to geologic events; and the application of such research to mitigation strategies by state and local governments.

The USGS Office of Earthquakes, Volcanoes, and Engineering maintains field data, seismograph readings, earthquake intensity information, and geological, geophysical, and engineering data from sites in the U.S. and abroad.

The National Earthquake Information Center of the USGS maintains an extensive database of earthquake locations (hypocenters) from ancient times to the present, and analog seismograms from the Worldwide Standardized Seismography Network.

National Geophysical Data Center: The NGDC of the National Oceanic and Atmospheric Administration collects North American data on earthquake seismology, tsunamis, topography, satellite imagery, and other topics. The Tsunami Digital Data Base contains data on about 2,000 tsunami events worldwide.

National Science Foundation: The NSF, an independent agency of the Federal government, promotes and advances scientific and engineering progress in the United States. In support of NEHRP, NSF has funded earthquake engineering research centers such as NCEER. NSF does not have an Information Service, but refers questions to appropriate NSF-funded organizations.

Earthquake Engineering Research Institute: Headquartered near San Francisco, EERI is a technical society for engineers, geoscientists, architects, planners, public officials and social scientists interested in advancing the study and applications of earthquake engineering. EERI acts as a spokesman for the engineering profession on seismic issues. The Institute publishes numerous reports, books, slides, a newsletter and journal, and sponsors an annual conference.

Applied Technology Council: The ATC assists design practitioners in structural engineering in keeping abreast of and applying technological developments. ATC identifies areas of need, encourages necessary research, and develops consensus opinions on structural engineering issues.

The ATC report series documents procedures and guidelines for seismic safety in structural engineering.

Building Seismic Safety Council: The BSSC provides information, data, and technical assistance on seismic safety provisions for the building community in the planning, design, construction, regulation and utilization of buildings. BSSC publications include action plans for builders, engineers, planners, and others. BSSC is a project of the National Institute of Building Sciences, which interfaces between the government and the private sector to improve the building regulatory environment.

Earthquake Engineering Research Center: The EERC at the University of California at Berkeley has been supporting research in the field of earthquake engineering for over twenty years. While their activities are directed mainly at the earthquake threat in California, EERC's research has broader applications. EERC has an information service, the National Information Service for Earthquake Engineering, which publishes an abstract journal in earthquake engineering, technical reports, and a newsletter. EERC also serves as a national clearinghouse for computer programs in earthquake engineering, and is a national clearinghouse for information on the Loma Prieta earthquake of 1989.

Natural Hazards Research Applications and Information Center: The NHRAIC at the University of Colorado at Boulder, is a national clearinghouse for research on the socio-economic aspects of natural disasters. The Center maintains a library and an annotated in-house database for responding to requests for information. Additionally, NHRAIC publishes a newsletter, monographs, papers and bibliographies related to natural hazards and hazard mitigation programs, and hosts symposia and workshops. NHRAIC's annual conference brings together experts from different disciplines, giving them an opportunity to share ideas and work collectively on the mitigation of natural hazard threats.

Disaster Research Center: The DRC at the University of Delaware engages in sociological research projects on group and organizational preparations for, responses to, and recovery from emergencies. DRC publishes field studies and maintains a collection of materials on the social and behavioral aspects of disasters.

The above organizations are perhaps the most active and well-known of the information providers in earthquake hazard mitigation in the United States. Others include the National Committee on Property Insurance, the National Coordinating Council on Emergency Management, the National Conference of States on Building Codes and Standards, the Bay Area Regional Earthquake

Preparedness Project, the California Seismic Safety Commission, the Center for Earthquake Research and Information in Memphis, Tennessee, the Southern California Earthquake Preparedness Project, and the Western States Seismic Policy Council. These groups offer different types and levels of information to many user communities. Each of them plays a significant role in the advancement of earthquake hazard mitigation.

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