



COMPREHENSIVE CD-ROM INDEX OF EARTHQUAKE ENGINEERING: NCEER-EERC-NEWCASTLE COOPERATIVE PROJECT

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ABSTRACT

It is the goal of information providers in earthquake engineering to increase access to knowledge and experience, and to improve the information transfer process for the benefit of researchers, engineers, practitioners, and the public. To this end, three earthquake research organizations have contributed databases to an international cooperative venture, Earthquakes and the Built Environment Index (EBEI) on CD-ROM, the most comprehensive index of earthquake engineering in the world. The National Center for Earthquake Engineering Research (NCEER) at the State University of New York at Buffalo, the Earthquake Engineering Research Center (EERC) at the University of California at Berkeley, and the Newcastle (Australia) Earthquake Project have combined their substantial resources to create a unique and extensive catalog of earthquake engineering knowledge.

EBEI is the culmination of years of effort on the part of the three participating organizations, evaluating the available technologies and attempting to identify affordable ways to improve and coordinate the availability of these independent databases. Once CD-ROM was selected as the format of choice, the effort was enhanced by excellent technical support from the publisher, NISC, Inc., who provided the software and technical support necessary to make the project a success.

Altogether, there are five distinct databases on EBEI, which can be searched either simultaneously or separately. Each database has a particular strength. NCEER's QUAKELINE[®] database consists of 29,000 abstracted citations, with emphasis on conference proceedings papers and technical reports. EERC's *Earthquake Engineering Abstracts* database consists of 48,000 abstracted citations, with emphasis on journal articles and retrospective coverage. The Newcastle Earthquake Database includes 3,000 abstracted citations, as well as 1000 full-text entries which highlight the Newcastle Earthquake of 1989. The other two databases on EBEI are the library catalogs of the NCEER and the EERC libraries, two library collections that contain the largest compilation of earthquake hazards mitigation knowledge in the world.

The first version of Earthquakes and the Built Environment Index on CD-ROM was published in late 1994, with an update in 1995 and a second update in early 1996. The CD can be used by English-speaking as well as Spanish-speaking users, since it offers a choice of interface languages. Also offered are various levels of search complexity, so that users can specify beginning, advanced or expert searching options.

KEYWORDS: Information transfer Knowledge transfer Libraries
CD-ROM Information technology Earthquake research

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Background

In the early 1990's, it became apparent that new information technologies could greatly facilitate the distribution of knowledge on earthquake hazards mitigation to researchers, practitioners, and the general public. At the time, various print and online resources were available, but no single comprehensive resource existed, and there was no way to connect those that did exist. QUAKELINE®, the database of the National Center for Earthquake Engineering Research (NCEER) at the State University of New York at Buffalo, was available online through the BRS Online network and through the University at Buffalo's BISON, an online library system. The *Earthquake Engineering Abstracts* of the Earthquake Engineering Research Center at the University of California at Berkeley was available as a print index, and via the University of California's Melvyl online library system. The Newcastle Earthquake Database was not yet available online.

In searching for a way to coordinate and combine these resources, particularly the Buffalo and Berkeley components, various formats and technologies were investigated and assessed. Neither of the library online systems, nor the BRS online platform, offered a satisfactory alternative for mounting a combined database, for reasons of cost, availability, and/or limited search software capabilities. CD-ROM was identified as the preferred method for this project, because it offered the most user-friendly, reasonably priced, easily distributed format for creating and distributing this resource, and because CD-ROM had the capacity for handling enormous amounts of data on a single platform, with minimal technical requirements for manipulation of the existing data. It was also felt that the international user community could be better served by a format that did not require online (telephone) connection.

A lengthy search to identify the most sophisticated yet user-friendly search and display software for manipulating the databases on CD (compact disc) was hindered by the enormous cost of such software. Fortunately, NISC, Inc., a commercial CD-ROM publisher, waived the usual initial fees and become an active player in this project, hoping to recover their initial investment with future sales.

Developing the CD

Because the databases of the three organizations were developed independently, substantial effort was required to make them electronically compatible and mutually searchable. With expert guidance from the publisher, the three earthquake organizations massaged their data and made necessary changes. Duplication between the five databases comprising the CD is approximately 11 per cent, so NISC developed a special "de-duping" software for use with this CD. When duplicate records are detected, the NISC software creates a composite record. In this way, unnecessary citations are avoided.

Features that the publisher has provided to make the CD effective and easy to use include:

- Databases are searchable independently or all together, or in any combination.
- Users can select from three levels of searching: novice, expert or advanced; these choices can be changed with a single command, at any time during searching.
- Bi-lingual searching allows for English- or Spanish-language user interface; users can toggle between these options.
- Help screens are provided for all commands and features.
- Composite records circumvent unnecessary duplicate citations.

- Telecommunications capability is not required.
- A simple mechanism for downloading to hard drive or diskette, or printing out search results, is provided; a variety of standard or user-defined display formats are available.
- All records indicate holdings information, providing the user with a direct source for obtaining cited documents.

The Result: A Comprehensive User-Friendly Resource

Earthquakes and the Built Environment Index on CD-ROM debuted in late 1994, and has been revised and updated twice since then. Included on the CD are citations for books, journals, conference papers, newspaper clippings, archival records, codes and standards, and non-print materials such as maps, slides, videos, and software. Subject coverage is multidisciplinary, including information on earthquakes, earthquake engineering, natural hazards mitigation, planning and public policy, seismology, structural dynamics, seismic retrofit, emergency response, socio-economic aspects of disasters, and other related topics.

The CD can be searched for subject terms or phrases such as "Kobe earthquake," "lateral loads," or "seismic codes," or searched using author names, institutions, geographic locations, document numbers, dates, or any other alpha-numeric strings, and immediately retrieve all pertinent records. These records contain not only bibliographic citations (e.g., author, title, date of publication, source, etc.), but also abstracts, keywords, and information on where the material can be obtained. In most cases, the material can be borrowed free of charge or photocopied for a small fee from NCEER, EERC or the Newcastle Earthquake Project.

The QUAKELINE® Database

The QUAKELINE database of the National Center for Earthquake Engineering Research (NCEER) located at the State University of New York at Buffalo, is one of the components of EBEI. QUAKELINE provides access to materials in earthquake engineering, natural hazards mitigation, and related topics from 1987 to the present, with selective retrospective (older) coverage. The database is international in scope and contains over 29,000 citations to conference proceedings, journal articles, technical reports, monographs, standards and codes, videotapes and slides, and pamphlets and brochures. Approximately 4,000 records are added each year. All of the materials in the QUAKELINE database are housed at NCEER's Information Service or in the University at Buffalo libraries.

NCEER established the QUAKELINE database in 1987 when analysis revealed gaps in the indexing and availability of earthquake engineering materials. Other resources covering this field at the time included the Abstract Journal in Earthquake Engineering, the *Engineering Index*, and the *NTIS Database*. It was determined that QUAKELINE would emphasize conference proceedings and papers, which were not covered by these other major resources. These databases are complementary, and it is notable that there is a mere 15% overlap in coverage between the QUAKELINE database and the *EEA Database*.

The QUAKELINE database reflects the strength and richness of the NCEER collection. This collection has been developed to encompass classic retrospective publications as well as a wide variety of timely materials that reflect the current needs and interests of the earthquake engineering community. In addition to historical texts by Milne and Gutenberg, the NCEER collection includes recent publications on active control of structures as well as an extensive collection of national and international seismic codes and maps, audiovisual materials, strong motion reports, a newspaper clippings file, and a great variety of grey literature, such as brochures, teaching materials, unpublished

papers, and pamphlets. Subject coverage is multidisciplinary, encompassing not only earthquake engineering and structural dynamics, but also architecture, geology, seismology, and social and economic issues.

The NCEER collection is a dynamic one which responds to the continual feedback received through daily interaction with users, and through outreach efforts at professional conferences and meetings. Members of the user community include researchers and other academicians, engineers, architects, planners and emergency preparedness practitioners, as well as the general public and students at all levels.

NCEER's responsive collection policy is reflected in the codes and seismic map portions of the NCEER collection. Because users frequently request seismic codes and maps, and interest is increasingly international in scope, NCEER Information Service staff have identified virtually all available national codes, and have sought and acquired a multitude of seismic standards for specific structures, such as bridges, nuclear power facilities and tanks. Often the process requires intensive sleuthing, involving a labyrinth of vendors and organizations. Once materials are identified and acquired, they are added to the NCEER collection and to the QUAKELINE database.

Special projects have also enriched the NCEER collection. For example, unexpected damage to steel moment frame connections was discovered following the Northridge earthquake of January 17, 1994. The SAC Joint Venture, a cooperative undertaking of the Structural Engineers Association of California (SEAOC), the Applied Technology Council (ATC), and the California Universities for Research in Earthquake Engineering (CUREe), was charged with investigating this problem and developing guidelines for inspection and repair. Under the sponsorship of the Federal Emergency Management Agency (FEMA), the SAC Joint Venture contracted with the NCEER Information Service to compile an extensive literature search on the problem. In conjunction with this undertaking, NCEER solicited all of the documentation produced by the SAC Joint Venture as well as technical papers, advisories, newspaper clippings and journal articles from around the world.

In the process of performing this literature search, subsequently named the SAC LIT database, the solicited materials were added to the NCEER collection and to the QUAKELINE database, and are consequently accessible to the public. Additionally, because of NCEER's involvement with this project on steel frame connections, the Information Service staff are continually on the watch for relevant materials to enhance this special area of the collection.

Another unique feature of the QUAKELINE database is its concentration on "grey literature," such as brochures and pamphlets, reports, and unpublished papers. These materials cover topics ranging from legislative updates to retrofit of houses and earthquake tips for the elderly. Many of these materials are solicited from local and state governments, private organizations and businesses such as insurance companies and risk consulting firms. Some materials are obtained at professional meetings or are forwarded to NCEER by their authors, often as part of established exchange agreements.

The newspaper clippings file is another distinctive feature of the NCEER collection, and consequently of EBEL. Each year over 1,500 newspaper clippings are received via a clipping service that canvasses approximately 40 significant daily newspapers in the United States and Canada. The clippings are scanned by the reference staff. Clippings of particular subject relevance or those with particularly effective graphics, such as charts or diagrams, are abstracted and added to the QUAKELINE database; the remainder are filed by general subject categories. The grey literature collection and the newspaper clippings collection have been especially valuable in the study of timely issues, such as initial damage assessments, and for the study of societal effects of damaging earthquakes.

Multimedia materials including slides, videotapes, and compact discs are an important and frequently

requested segment of the NCEER collection that are indexed and described in the QUAKELINE database. These materials and all other publications in the database are available for loan or photocopy.

Through its emphasis on both classic and current knowledge, including significant materials that originate in a diversity of organizations and are produced in a variety of formats, the QUAKELINE database provides a dynamic record of and an effective tool for gaining access to the extraordinary body of knowledge and experience that has been generated by the many organizations and individuals the world over, who are dedicated to reducing the loss of life and property from damaging earthquakes. In addition to its availability on EBEI, QUAKELINE continues to be available online, with Internet access, as part of the University at Buffalo Libraries system.

Earthquake Engineering Abstracts Database

The *Earthquake Engineering Abstracts (EEA) Database* of the Earthquake Engineering Research Center (EERC) at UC Berkeley provides access to literature in earthquake engineering, structural dynamics, and allied fields from 1971 to the present. Included are 48,000 citations and abstracts from journal articles, selected conference papers, technical reports, monographs, and other formats. In a recent project, volumes of the Abstract Journal in Earthquake Engineering from 1971 to 1983 were converted to machine readable form and added to the database. The 19,899 records in those volumes were added to the 30,000 more current abstracts, bringing the total number of records in the *EEA Database* to 50,000. Approximately new 3,700 records are added to the *EEA Database* each year.

The *EEA Database* features a heavy emphasis on journal articles. It is noteworthy that the *EEA Database* is particularly strong in its coverage of retrospective publications. In addition, through special National Science Foundation funding, the Earthquake Engineering Research Center was appointed to act as a clearinghouse for the Loma Prieta, California earthquake of 1989, and as such has assembled an extensive collection of materials on this topic. Thus the *EEA Database*, and the cooperative EBEI, include many materials about the Loma Prieta earthquake.

The EERC depends on domestic and international exchange agreements with "sister" organizations to enrich its collection. The EERC Library offers reference support to the user community and the general public, and makes the materials in its collection available for loan or photocopy.

In addition to its involvement as a part of EBEI, the Abstract Journal in Earthquake Engineering continues to be available by subscription as a print publication, and online under the title *EEA Database* through the University of California at Berkeley's library system (available on the Internet).

In the past few years, the Berkeley and Buffalo organizations have begun to identify major publications (i.e. World Conference Proceedings) for cooperative abstracting. Once appropriate publications are identified, the abstracting staff at both institutions divide the work to be done, and subsequent records are shared by both organizations, and added to both QUAKELINE and the *EEA Database*. As mentioned above, de-duplication software consolidates these duplicate citations into single, "merged" records on the EBEI CD-ROM, thus streamlining search results.

The Newcastle Earthquake Database

The Newcastle, Australia earthquake of 1989 generated a mass of documentation as well as resources for researchers, planners and decision makers, particularly in the areas of seismology, engineering and disaster management. The records resulting from the earthquake provided the experience of a real life

event, and the lessons learned from it. A database, bringing together all the information pertaining to this earthquake, was initiated.

The Newcastle Region Library began the collection of published information immediately after the event. The search for newspaper articles, journal articles and conference papers was done both manually and electronically through online searches of national and international databases. Local, state and national newspapers were scanned for reports and coverage of the event.

Publications and reports on the earthquake and its aftermath have come from a variety of sources such as the insurance industry, the Institution of Engineers, the Newcastle City Council, the University of Newcastle, federal and state government departments such as Public Works and the Department of Social Security, organizations such as the Red Cross, Rotary Club, and a host of other sources. Unpublished information was obtained in the form of office files containing information on building damage, insurance claims, repairs undertaken, emergency procedures, and minutes of meetings. Once relevant and useful information was located, its access was negotiated with each organization.

Issues of confidentiality were considered for unpublished materials that included the records from insurance companies with files on damaged residential properties; client names that would need protection; as well as decisions and responses that might be subject to later criticism or litigation. Various methods for dealing with these materials were created. These items are cited but not reproduced as full text.

Immediately, the library commissioned photographs of damage, and followed up six months later to demonstrate the extent of reconstruction. Other photographic collections were donated by private individuals and organizations. The total number of photographic records are estimated to number in the thousands, and the library plans to scan some of these into the electronic database.

A number of sound recordings have also been acquired, including broadcasts from radio stations and interviews. The library also conducted an oral history project and over 60 audio and video tapes resulted. A number of videos also form part of this collection, some prepared by organizations such as power and gas companies, TV stations and private individuals.

The Newcastle Library collection also holds valuable primary data. Various groups set up databases in the aftermath of the earthquake, many of which contain details of property damage, insurance pay outs, lists of available tradespeople, and similar information. For example, the file from NRMA, an Australian insurance company, includes data on distribution of damage, location of damage, and types of construction damaged. Other databases detail buildings and homes damaged by the earthquake. "Felt" area survey records (over 5,000) that were compiled by a seismologist to determine the Modified Mercalli Intensity of the event are also included.

The database includes 3,000 bibliographical entries with abstracts and is still growing. About 1,000 entries are available in full text. A photographic collection will be scanned in the next phase of the project. Because of the variety of formats in the database, the library is planning to develop a multimedia database that will enable information in any form to be accessed. This will enable users to read the text records, view the illustrations and listen to the audio recordings. It is hoped that a multimedia CD-ROM will be produced as a final product.

The subject disciplines covered in the database are largely on building/engineering, seismology, disaster management, and insurance, reflecting the types of materials collected. The Newcastle Earthquake database is a record of the events, the response, and the renewal. The lessons of Newcastle are available for the rest of the world to learn from, be it from a geological, engineering, disaster management, welfare or insurance perspective.

Future Directions

The dizzying evolution of electronic communication is creating ever more effective avenues for information providers and information seekers to use in the quest for efficient information transfer. CD-ROM continues to be a viable and economical technology, and one that can be easily adapted around the world.

Even as the success of Earthquakes and the Built Environment Index on CD-ROM is being evaluated, newer electronic options are being explored. Within the year, EBEI will be available on the Internet as part of a suite of databases offered by the publisher, NISC. Meanwhile, NCEER, EERC and the Newcastle Earthquake Project continue to develop and enlarge their individual databases, and continue to seek ways to coordinate and cooperate in their efforts to optimize the transfer of knowledge and experience.

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