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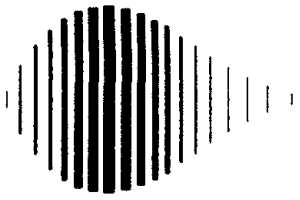

NATIONAL CENTER FOR EARTHQUAKE ENGINEERING RESEARCH

State University of New York at Buffalo

FIRST EXPERT PANEL MEETING ON DISASTER RESEARCH AND PLANNING

Edited by

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Red Jacket Quadrangle
Buffalo, NY 14261

Technical Report NCEER-88-0045

September 15, 1988

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16. Abstract (Limit: 200 words)

In August of 1987 the NCEER First Panel on Disaster Research and Planning convened at the National Center for Earthquake Engineering Research (NCEER) in Buffalo, New York. The panel was formed in order to assist NCEER with the establishment of a working plan for NCEER's Disaster Research and Planning Program, the overall goal of which is to expand NCEER's area of concern in the planning, economic, social and political aspects of earthquake impact on social systems. Three key areas were identified to be targets of discussion: research in basic issues of economic, planning, political and other effects of earthquakes on social systems, education in areas of earthquake awareness and risk communication; implementation of completed research . Some of the most significant recommendations of the panel included NCEER's establishment of state-of-the-art research assessments, NCEER's support of conferences and seminars, and finally more facilitation by NCEER in the process of linking technology transfer to the users of earthquake information. The meeting of the Expert Panel will be a regular event with membership on the panel lasting two years, with one-half of the members carrying over to the next year. Appendices within the report include a list of the twelve panel participants and their curriculum vitae.

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Edited by:

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Introduction

On August 17, 1987, the NCEER First Expert Panel on Disaster Research and Planning convened in the Conference Room of the National Center for Earthquake Engineering Research (NCEER) in the Red Jacket Quadrangle, SUNY at Buffalo. Following greetings from the hosts, Dr. Robert Ketter, NCEER Director, and Jelena Pantelic, Assistant Director, the meeting was opened by Dr. Frederick Krimgold, the Chairman of the Expert Panel. He briefly outlined the agenda[1], pointing out that the three key areas of discussion would be research, education and implementation in the area of architecture, planning, social, economic and political implications of earthquakes.

Background

The National Center for Earthquake Engineering Research was established in September of 1986. The research program for the first year was technically oriented and had been generally defined in the proposal to the National Science Foundation. In the Spring of 1987, however, it was decided that it would be appropriate and desirable to accelerate the development of the overall thrust of the Center and expand the area of its concern to planning, economic, social and political aspects of earthquake impact on social systems. In order to establish the work plan for its new Disaster Research and Planning Program, NCEER decided to convene a panel of experts in these fields and seek their advice. It was decided that the meeting of the Expert Panel would become a regular event, and that the membership in this group would last two years, with one half of the members carrying over into the next year. It was maintained that in this way, the continuity of the Panel's work would be insured, while allowing for fueling new ideas.

[1] See Appendix A for Agenda of the Meeting.

In its first meeting, the NCEER Expert Panel on Disaster Research and Planning had to discuss a variety of issues and establish a framework for action. The participants were sought from such diverse areas as disaster research, planning, architecture, earthquake education and hazard mitigation practice.

The Expert Panel consisted of 12 leading national and international experts[2] in their fields:

William Anderson
National Science Foundation

Frederick Cuny
INTERTECT

Ian Davis
Oxford Polytechnic

Russell Dynes
University of Delaware

Richard Eisner
Bay Area Regional Earthquake Preparedness Project

Barclay Jones
Cornell University

Alcira Kreimer
The World Bank

Frederick Krimgold
Virginia Polytechnic Institute

Henry Lagorio
University of California

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[2] See Appendix C for the Expert Panel Members' Curricula Vitae.

Dennis Mileti
Colorado State University

William Petak
University of Southern California

William Riebsame
Natural Hazards Research and Applications
Information Center
University of Colorado

Frederick Krimgold was invited to chair the Panel.

The Agenda for the meeting was devised jointly by the NCEER staff, the Expert Panel Chairman, and Professor Barclay Jones of Cornell University. The meeting was designed to last one and one-half days, and took place on August 17 and 18, 1987. The Panel convened at the NCEER Conference Room, Red Jacket Quadrangle, at the SUNY at Buffalo North Campus. The plenary session was held on the 17th of August and the small groups met concurrently on the following morning. The Expert Panel meeting ended with conclusions presented in the plenary session.

The Report

This report was conceived to transmit the issues and recommendations related to social aspects of earthquakes that were voiced during the Expert Panel's meeting. All the meetings were tape-recorded, and the tapes later transcribed. For comparison, the Editor also used her own, and other Panel Members' individual notes. Further thoughts that the Panel Members contributed on this theme were also used in compiling this document.

Section 1
Understanding the Context

Plenary Session
August 17, 1987

In order for the members of the Expert Panel to understand the context within which the National Center for Earthquake Engineering Research had emerged and operates, and to put its specific relationship with the NSF in the right perspective, Robert Ketter, NCEER Director, gave an introductory presentation. He addressed the key issues of the Center's origin, sources of funding, operating philosophy and its research programs. Ketter's remarks were followed by William Anderson's, NSF Program Director, Earthquake Systems Integration. His talk focused on the NSF's sponsorship of earthquake-related research in general, the situation for supporting social science earthquake research, and the NSF's rationale for supporting NCEER. The subsequent plenary discussion included some aspects of the relationship between the Center and the agencies which form the National Earthquake Hazard Reduction Program, additional sources of funding, and the future development of NCEER. Robert Ketter's and William Anderson's presentations are here summarized.

Robert Ketter:
THE NATIONAL CENTER FOR EARTHQUAKE ENGINEERING RESEARCH

Origin

The National Center for Earthquake Engineering Research was established to forward earthquake engineering research, and contribute to seismic hazard reduction in the United States and abroad. It was founded in 1986 under a grant from the National Science Foundation, with matching funds from the State of New York and other sources. The initial 25 million dollar NSF grant was for a period of five years. A requirement of that grant is that at the end of three years, a site review be carried out to ensure that the received funds were being expended properly, and that the Center is developing in an appropriate manner. A positive recommendation of the review team would

enable the Center to plan for a second five year period of operation.

Concept

While the proposal submitted to the National Science Foundation was from the State University of New York at Buffalo, a number of individuals from a group of institutions in and around New York State participated in the development of the proposal. While no formal "Consortium" agreement was entered into among and between the institutions that those individuals represented, the individuals more or less acted as if such a document existed. The academic institutions that form that core group are: Columbia University, Cornell University, Lamont-Doherty Geological Observatory of Columbia University, Lehigh University, Princeton University, Rensselaer Polytechnic Institute and the State University of New York at Buffalo. It was presumed from the outset that collaborative and cooperative efforts would be established with a number of other institutions and/or individuals, both in the public and the private sector.

NCEER is not located at a particular institutional site but rather it adopted a distributed format of facilities and research programs. Thus, management became the key ingredient of the operational format. NCEER supports research efforts throughout the country, and is involved in a number of international ventures. It is through a very well defined and direct line of management that the Center implements its mandates. The NCEER Director has been delegated the ultimate responsibility for the operation and performance of the Center. He receives advice from an Executive Committee (a body consisting of five key principle investigators), and a Scientific Advisory Committee, which currently includes seventeen internationally recognized authorities in the fields of geology, seismology, geotechnical engineering, earthquake engineering, and social sciences. The work of the Center is monitored by an Oversight Committee, a fourteen member group from academic institutions, government agencies, and

the private sector. Two NSF representatives serve as liaison members on the Oversight Committee.

In addition to supporting research endeavors, monies from NCEER are also used to upgrade experimental facilities at the core institutions.

Operational Philosophy

From the very beginning, the Center adopted a systematic, interdisciplinary and team effort approach to conducting earthquake research. It was also understood that researchers would come from academia, government, and the private sector.

By its contract with the NSF, NCEER is prohibited from accepting unsolicited proposals. Rather, the NCEER Executive Committee, through the Director, defines the major research programs, and establishes their order of priority. On the basis of these, individuals or groups of researchers are sought in the various program areas. The Center negotiates research contracts with prospective investigators, and where appropriate, recommends that supplementary funds should be found from other sources. In certain cases, NCEER acts as a facilitator of finding these extra monies.

Work Program

On the basis of the research activities defined in the proposal to the NSF, a first year work program was developed. It consisted of the following:

Seismic hazard assessment in the Eastern United States. The initial intention of this first program area was to intensify earthquake vulnerability studies for regions of the country east of the Rocky Mountains. Considerably more is known about the western states' seismicity, and their earthquake vulnerability than is known in the east. It is to be understood, however, that this does not preclude nor is it meant to minimize the overall national thrust of the Center's operation.

Ground motion, soil and soil-structure interaction. The Mexico City earthquake of 1985 clearly demonstrates that basic knowledge in this area is lacking. Local soil conditions and geography are of extreme importance, as are types and sizes of existing structures. Basic work is required in this area. The potential for liquefaction is another area of concern that requires further study.

Seismic performance, risk and reliability. The Center investigators are particularly exploring the seismic performance of existing buildings, structures, bridges, dams and lifelines. (It is to be noted that the Center is supporting a lifeline experiment at the Parkfield site.) Considerable attention is being given to secondary and protective systems.

Innovative computing and expert systems. The goals of this research program are to deal with computing technology in a two-fold manner: first is to generate knowledge and develop software to be used by design engineers and architects, in combination with expert systems; and second is to demonstrate the use of computing power for fast processing and super computing. Supercomputers exist at Cornell, Princeton, Carnegie-Mellon, and other institutions where this work is being carried out, and there is currently being examined the possibility of installing a mini-supercomputer at the State University of New York at Buffalo experimental facility.

In the second year, NCEER will more narrowly focus its program areas, and emphasize the seismic risk and vulnerability of existing buildings and structures. With an extremely large stock of such structures in the U.S., this has become an item of first priority.

Publications

The Center has a regular publishing activity, which consists of several types of publications: a quarterly newsletter called *The NCEER Bulletin*, which reports on the latest Center activities in research and educa-

tion; Center-sponsored events such as workshops, conferences and seminars; and other mangement and administrative activities. Technical reports are published at a rate of 30-40 per year. Special publications are also produced, such as proceedings from conferences, workshops and meetings. An annual report is published once per year, to inform the general public of NCEER's activities.

In its first year, the Center also undertook a translation of *Manual for Repair Methods of Civil Engineering Structures Damaged by Earthquakes* (1986), published as Vol. 45 of Technical Note of Public Works Research Institute, Tokyo, Japan.

Information Services

The information service and the knowledge dissemination function of the National Center for Earthquake Engineering Research has been at the forefront of the Center's goals. Currently, the NCEER Information Service is formally established at the Science and Engineering Library at SUNY at Buffalo, and it provides services for the Center's principal investigators, researchers and the public at large across the country and abroad. This service is in the process of developing an earthquake engineering database, which even at this stage is accessible on-line to all interested users through the BRS Information Technologies System. The Information Services' staff receives and abstracts articles from more than 250 scientific journals and magazines -- a number that is not surpassed by any other specialized earthquake research library in the country. It also publishes a monthly newsletter, featuring the latest library acquisitions, as well as abstracts of recent articles.

A study is currently underway, sponsored by the National Science Foundation with participation of members of NCEER, to establish a repository of earthquake hazard-related publications and references on optical disks.

International Cooperation

Since earthquakes know no national boundaries, the National Center for Earthquake Engineering Research has adopted the basic philosophy that it is extremely important to encourage and foster collaborative and cooperative research studies on a global basis. Whereas cooperation with the U.S. immediate neighbors, Canada and Mexico, recognizes shared earthquake risk in the North American continent, collaborative agreements with countries such as the People's Republic of China, Japan, and Taiwan are currently underway. Others are in various stages of negotiation, and include Turkey, various European countries, and several other South Asian countries.

Technology Transfer

A major thrust of NCEER activitity since its establishment has been the active transfer of knowledge and technology. In its first year, the Center organized workshops on **Seismic Computer Analysis and Design with Interactive Graphics**, and on **Structural Application of Protective Systems for Earthquake Hazard Mitigation**. It is also involved in organizing a number of other meetings. In February of 1988, in New York City, together with the New York Academy of Sciences, NCEER will host a conference on **Earthquake Hazard and the Design of Constructed Facilities in the Eastern United States**. This is planned as a major event which will bring together scientists, engineers, architects, social scientists, policy makers, public officials, to discuss earthquake hazard in the East.

In its first year of operation, NCEER also established a local Buffalo forum for discussing earthquake issues. **Seminars on Earthquakes** are a regular monthly series, which bring to Buffalo nationally and internationally recognized earthquake researchers with state-of-the-art information. Briefings on most recent earthquakes in this country and abroad are among the topics of the seminars.

Disaster Research and Planning Program

NCEER is establishing its **Disaster Research and Planning Program** to deal with a plethora of issues relating to the architectural, planning, economic, social, and political implications of earthquakes and seismic hazard mitigation. In order to connect this program with the activities of all other programs of the Center, and to establish a viable work plan, the Center convened this Expert Panel to draw on their expertise and experience.

Although considerable knowledge in this area already exists, many new fields remain undiscovered. Which of them are the most urgent to explore in order to intensify the process of earthquake hazard reduction in the United States? What are the needed activities that had so far escaped attention of policy makers? These are some of the areas where NCEER needs help.

The NCEER Director encouraged Expert Panel members to develop their recommendations with long and short-term goals in mind. Only an expertly fashioned and realistic research agenda for the social implications of earthquakes, addressing planning and architectural issues on one side, and economic, political and societal on the other, will enable NCEER to make a significant impact in this field.

William Anderson:
THE EARTHQUAKE SYSTEMS INTEGRATION PROGRAM, NATIONAL SCIENCE FOUNDATION

Investigation of the response of social systems to earthquakes is a relatively new field in social sciences. It was only after the 1964 Alaska earthquake that a variety of social phenomena occurring in the wake of earthquakes became a steady source of social science research topics in the U.S. Although this new field has had problems with funding since its beginning, the

investigators nevertheless managed to establish scientific foundations for current research endeavors, frequently with the U.S. social scientists in the lead.

In 1977 Congress passed the National Earthquake Hazard Reduction Act, which established the national framework for seismic hazard mitigation. By that time social science earthquake research had already been established, and its importance was recognized. On the basis of this Act the National Earthquake Hazard Reduction Program (NEHRP) was established and responsibilities divided among several agencies, including: United States Geological Survey (USGS), National Science Foundation (NSF), National Bureau of Standards (NBS), and Federal Emergency Management Agency (FEMA). The National Science Foundation became the main source of funding for social science earthquake research, cooperating frequently with the National Research Council of the National Academy of Sciences and the Earthquake Engineering Research Institute.

The principal agencies involved in the National Earthquake Hazard Reduction Program have distributed responsibilities in the following manner:

- USGS is charged with fundamental earth science research, earthquake prediction, and earthquake hazard analysis;
- NSF is responsible for research dealing with earth science, earthquake engineering and related disciplines, as well as social science, and architecture and planning aspects of earthquakes.
- NBS is concerned with code and standard analyses.
- FEMA is designated as the NEHRP lead agency, and it also deals with earthquake preparedness planning, response, education and implementation.

Within NSF, earthquake research activities are located within the Division of Earth Sciences (which does basic science research), and the Division of Critical

Engineering Systems, which deals with earthquake hazard mitigation. This latter division consists of four programs:

- **Siting and geotechnical systems** which deals with research on strong ground motion, lifelines, and tsunamis;
- **Structural systems** support investigations on building performance, structures, and dams;
- **Architectural and mechanical systems** focus on architectural elements of building performance, configuration, and support systems;
- **Earthquake systems integration** (ESI) attempts to integrate the research done by social scientists and practitioners.

Goals of the Earthquake Systems Integration Program

The Earthquake Systems Integration Program has several goals:

- **Provide a knowledge base for furthering mitigation and preparedness planning in the U.S.**
  Given that a few U.S. regions are involved in earthquake mitigation and preparedness planning, the ESI attempts to provide the best possible foundation for carrying out this type of community planning, on the assumption that lack of relative research results in some cases contributes to community complacency in earthquake mitigation and preparedness planning.

- **Improve responses to earthquake impacts.**
  Since the analyses of earthquake response activities in some areas of the U.S. showed that communities occasionally lacked information and knowledge on which to base their response plans, the ESI tends to answer this need by providing new knowledge.

- **Contribute to the development of an effective technology delivery system for seismic safety information.**

A great deal of research results that could effectively mitigate seismic risks in many areas are not being used. The ESI seeks ways of bridging the gap between technologies developed by engineers, architects, planners and social scientists on the one hand, and users of research results on the other.

Special Features of Earthquake Systems Integration

The ESI favors a **multidisciplinary** approach to earthquake research, because only in that way does knowledge that resides in different disciplines become integrated.

The ESI **analyzes the social, economic, organizational and institutional aspects of seismic safety,** in order to ensure that research results attained in a variety of seismic-related areas becomes applied in the right social context. If there is no knowledge about the social environment, it is very likely that research results will not be applied to the best advantage of seismic safety.

One of the most important features of the ESI is that it **attempts to establish links between producers and users of seismic safety information.** This connection is very difficult to achieve through the NSF mechanisms, which makes the existence of a national center such as NCEER very promising.

ESI Supported Research Activities

The ESI supports a number of different types of research, the most important of which include:

- **Post-disaster investigations.**
  The ESI attempts to support researchers who study earthquake impacts on social systems in participating in post-earthquake reconnaissance teams. In addition to the study of physical damage, it is imperative to study the response of human systems,

and identify prospects for recovery and reconstruction.

This activity is done either through EERI, NAS, academic institutions, or now, NCEER.

- **Surveys, case-studies and computer simulations.** Survey and case-study approaches have been successful techniques used in social science research, capable of capturing earthquake-related data, and ESI supports them decisively. The interest for computer simulations is increasingly gaining momentum nowadays, and ESI looks for constructive proposals in this area.

- **Comparative Analysis.** Comparison of experiences from different communities, involving various kinds of cultural and institutional settings, can frequently yield new knowledge and strategies for seismic mitigation.

Major Areas of ESI Activity

The ESI supports research in four major areas:

- **Mitigation planning research** deals with seismic hazard reduction activities. It focuses specifically on the processes of seismic safety policy adoption, and actual implementation of seismic safety programs. Supported research efforts attempt to identify obstacles to adoption and implementation, analyze costs and benefits of alternative measures, examine approaches to multihazard mitigation planning, and investigate alternative approaches for conducting seismic hazard assessments and vulnerability analyses.

- **Preparedness planning research** develops models and techniques for advancing preparedness planning and connection with critical systems, such as transportation, communication, health care systems, and so forth. This activity also sponsors evaluation of earthquake research preparedness programs, such

as Southern California Earthquake Preparedness Program (SCEPP) or Bay Area Regional Earthquake Preparedness Program (BAREPP). Furthermore, preparedness planning research develops procedures for furthering integrated preparedness planning, and examines the impacts of earthquake prediction on preparedness planning.

- **Impacts, recovery and reconstruction** are areas of ESI activity which deal with post-earthquake processes, emergency response, relief delivery, emergency shelter, housing and business recovery, as well as mechanisms for reconstruction of physical structures. More specifically, it assesses the impacts of earthquakes on critical urban systems, examines the multiple hazards that can be generated by earthquakes, investigates the epidemiology of earthquake casualties, analyzes emergency response systems, and examines issues and problems related to effective recovery and reconstruction.

- **Knowledge and technology delivery** investigates factors that determine the effectiveness of hazard information dissemination. Research in this area made considerable progress in defining how to deliver information to potential users. Questions such as: How to format, or "package," information? Which channels of information delivery are more effective for a given case? -- have been addressed. This area also examines the role of the mass media in information dissemination, and supports innovative managerial and technological approaches; finally, this area supports information clearinghouse activities, seminars, workshops and conferences for practitioners.

The NSF Rationale for the Support of NCEER

The National Science Foundation had several specific rationales for supporting the NCEER. One reason was to **leverage funds.** The NSF budget is limited to around $15 million a year. By allocating $5 million to

an academic institution to establish a research center, under the condition that it contributes another $5 million, the base of support for earthquake research is increased for all concerned investigators and practitioners. The second rationale was to **foster industry, government and university interaction.** This is an important goal, which attempts to break down the isolation that frequently characterizes these institutions in the U.S., in contrast to some other countries such as Japan, with very developed earthquake research. Thirdly, it was necessary to have a vehicle which develops a **systems approach.** At the NSF, this was not possible because of the unsolicited proposal mechanism of research grant awards. And finally, more direct and effective support of **technology transfer.** Although the ESI program is deeply committed to this activity, some of the NSF institutional barriers make it difficult to implement. The NCEER has a different management strategy and operational philosophy, which will facilitate the transfer of knowledge and seismic safety technology from the producers to the users.

Frederick Krimgold:
THE EXPERT PANEL'S GOALS AND TASKS

Following the presentations by Robert Ketter and William Anderson, Frederick Krimgold, the Chairman of the Expert Panel, acknowledged the differences in operation between the NSF and the NCEER, but pointed to the unity of their goals: through furthering the understanding of the seismic phenomena, ultimately to contribute to the reduction of earthquake hazard in the U.S. He emphasized that the features of the NCEER, especially its programmatic and interdisciplinary approach to earthquake research, are especially conducive to the systematic study of human systems affected by earthquakes. He asked the fellow Panel members to bear this in mind while participating in the discussions, and explained the goals and format

of the meeting, as well as the Expert Panel's tasks and expected products.

Frederick Krimgold pointed out that the major outcome of the Expert Panel's involvement will be a work plan for the NCEER Disaster Research and Planning Program which deals with planning, social and economic implications of earthquakes. He reiterated that this was a new area of the Center's research involvement, and that in order for the Program to start its activities in the same programmatic and interdisciplinary spirit as the other Programs of the Center, it was up to the Panel to draw on their experience and help establish viable working foundations. The heterogeneity of the group's areas of expertise is very suitable for such a task, because it enables the resulting program to draw from the mainstream social science research, program implementation, earthquake education and information dissemination, third world disaster planning practice and professional involvement in architecture and planning.

In order to facilitate the work of the Panel, Frederick Krimgold introduced a structure for the meeting, consisting of three key areas: implementation, education and research.

- **Implementation** is the process which applies completed research results to the effect of reducing risk exposures of the society. Whereas the mainstream assumption contends that it is through the regulatory process that implementation becomes effective, the Panel was asked to also consider other, alternative, "market" solutions to the problem.

- **Education** is an area which deals with issues of earthquake awareness and risk communication; it explores the critical audiences which should be

addressed with earthquake information, as well as the ways of reaching them.

- **Research** probes the basic issues of economic, planning, political and other effects of earthquakes on social systems.

The format for the discussion was then explained by the Chairman. The afternoon was reserved for a plenary session, in which joint discussion of all Panel members will follow three key introductory addresses: on research by Barclay Jones, on education by Richard Eisner, and on implementation by himself, Frederick Krimgold. He asked his colleagues to use the plenary session to raise the most pertinent questions and identify the fundamental issues in each of the three areas. He asked for the Expert Panel Members' effort to prepare the basis for the second part of the meeting which was to occur the following day, when the Panel was to divide into three small groups. The three committees would address Research, Education, and Implementation, respectively, and attempt to develop a viable work agenda for each of the three areas. He suggested that NCEER was not looking for a list of research topics, but rather sought an identification of problems which need solutions, and the priority order of pivotal activities. What the Expert Panel should give back to the Center, the Expert Panel Chairman said, was an outline for an NCEER work plan which deals with these primary areas (research, education and implementation).

In conclusion of the Plenary session, the Chairman suggested the membership in the three committees:

- **Research Committee:** William Anderson, Russell Dynes, Barclay Jones, Dennis Mileti.

- **Education Committee:** Ian Davis, Richard Eisner, Henry Lagorio, William Riebsame.

- **Implementation Committee:** Frederick Cuny, Alcira Kreimer, Frederick Krimgold, William Petak.

He invited observers, guests and members of the NCEER staff to join any of the three concurrent committee meetings held the next day and to participate in the discussion.

The Chairman adjourned the Plenary Session on the note that the programmatic research philosophy of the Center offers an excellent environment for investigation of economic, social and planning issues associated with earthquake hazard reduction.

Section 2
Concurrent Committee Meetings

Issues of Concern
August 18, 1987

This part of the Report presents the results of the three concurrent committee meetings held on the 18th of August. In order to preserve the unity of substance and the train of argument, relative portions of the Plenary Session discussions were included in the chapters reporting on the work of Research, Education and Implementation Committees.

Research

Participants: *William Anderson, Russell Dynes, Barclay Jones, Dennis Mileti.*

Research related to earthquake effects on urban environment and human systems is performed by investigators coming from a variety of diciplines, such as architecture, planning, and social sciences. The phenomena under observation -- human systems affected by and recovering from earthquakes -- are rapidly changing, and if not captured in time, perish forever. Investigators must act quickly to collect the earliest data regarding emergency response, but in order to ensure important insights into the long-term consequences of earthquake effects, they ought to continue their research over long periods of time.

Probing into earthquake effects on social systems has in the past received low priority on the seismic research agenda. As a consequence, there is a discrepancy between the knowledge about human response to earthquakes on the one hand, and the level of sophistication of engineering solutions developed on the basis of earthquake engineering research, on the other.

The Research Committee felt that by the establishment of the National Center for Earthquake Engineering Research, an appropriate vehicle for supporting social science earthquake research in a systematic way has been created. The NCEER's interdisciplinary and programmatic research orientation creates an ideal environment for carrying out research dealing with

economic, social, political and planning implications of earthquakes. A variety of topics, which so far have not received adequate attention, now have a much better opportunity to be investigated in a sustained way. For example, they include reconstruction problems, recovery and long-term earthquake impacts, and adoption and implementation of seismic mitigation policy.

Since earthquakes disrupt both physical structure and social systems, it is necessary to devote equal attention to investigation of earthquake effects in both of these areas. While research into the physical aspects of earthquake effects has already produced advanced earthquake hazard reduction technologies, research into social, economic, and political implications of earthquakes needs to be emphasized. The social science research community needs to enlarge, in a systematic way, the overall understanding of human behavior related to earthquakes, their effects, and earthquake mitigation measures, as well as to provide a knowledge base necessary for undertaking scientifically sound and effective earthquake education and implementation efforts.

Priorities

State-of-the-Art Research Assessments. One of the most important research priorities in the area of social impact of earthquakes is to produce a series of state-of-the-art research assessments. The benefits of this endeavor would be threefold: first, a series of such assessments will be especially appropriate for NCEER's programmatic research philosophy, providing a good orientation for future disaster research in critical areas; second, it will clarify the areas that need more concerted research efforts, or which are not investigated at all; and third, the whole earthquake research community will benefit from the results of this effort.

The following substantive areas would be especially beneficial topics for research assessments:

- *Seismic Safety Measures.* The principal goal of this research assessment is to establish the current status among the available earthquake hazard reduction measures. The key questions that ought to be asked include: What are the seismic safety measures that are available today? Which ones deal with the physical structure, and which ones with planning and preparedness?

- *Disaster Planning.* The objective of this research assessment topic would be to identify the status of disaster planning in this country and abroad, especially of emergency response, and of long-term earthquake hazard reduction planning. Some of the questions this research assessment will have to ask are: Which are the organizations that are responsible for emergency response and earthquake preparedness planning? What is the status of natural hazard-specific planning effort vs. general community emergency planning? What are the processes of adoption and implementation of earthquake-related planning documents?

- *Risk Communication.* The importance of risk communication has been recently emphasized by experts from many fields of earthquake research. This research assessment would assemble and integrate existing knowledge about how to communicate earthquake risk information, and the findings of earthquake engineering and social science research in such a fashion as to maximize their use by the vulnerable communities.

- *Reconstruction Following Earthquakes.* Reconstruction and recovery of urban environments following earthquakes have been investigated comparatively little given the importance of post-earthquake recovery policy decisions. Specific research efforts should be invested into probing such areas as housing reconstruction and economic implications of the recovery process.

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Other suggested topics include adoption and implementation of earthquake hazard reduction measures; mitigation of secondary hazards related to earthquakes; safety of building occupants in earthquakes; and business and industry earthquake mitigation, preparedness, and recovery.

Natural Disaster Impact on Urban Systems. This is a major research area which comprises a number of topics which ought to be studied, such as community and organizational response, decision-making, community change, reconstruction and recovery, economic consequences and insurance considerations. Several research questions will show the breadth of this area: How do the urban systems perform in a disaster? What factors contribute to urban vulnerability to natural disaster? What are the appropriate methodologies for search and rescue? What is the role of volunteer emergency response? Furthermore, in connection with the limitations of the regulatory process mandating implementation of measures to reduce earthquake risks, a comprehensive research effort into unregulated, independent private sector decision-making and action ought to be undertaken. An analysis of the motives leading to successful implementation of earthquake hazard mitigation measures motivated by self-interest could reveal patterns to be used for enhancement of seismic safety in this sector.

Evaluation Research. The Research Committee noted the absence of research evaluating existing activities related to earthquake hazard reductions. For example, research assessment should be undertaken into the performance of model projects in the United States which deal with promoting seismic safety mitigation. It is anticipated that such assessments would point to the areas in the policy that need to be enhanced or modified, and would provide state-of-

the-art information for establishing new programs to deal with earthquake education and planning in the seismically vulnerable areas of the country.

Post-earthquake Reconnaissance Investigations

The need has been demonstrated for social scientists, architects and planners to participate more actively in the post-earthquake reconnaissance investigation teams. The Research Committee recognized that architects,' planners,' social scientists,' and medical doctors' participation in post-earthquake reconnaissance efforts have not been sufficiently supported so far. Bearing this in mind, the Research Committee indicated that post-earthquake social phenomena are important to be captured early after the event, because they perish equally easily as do the data on the structural performance of damaged buildings. NCEER can significantly contribute to the rapid post-earthquake data collection by organizing team efforts to capture these valuable data for future analysis.

It is also important for NCEER to structure the approach for conducting future post-earthquake reconnaissance investigations, so that the results of such effort be systematic and mutually comparable. The Research Committee contends that the process of learning from earthquakes may otherwise be seriously impaired.

Education

Participants: *Ian Davis, Richard Eisner, Henry Lagorio, William Riebsame.*

General complacency about earthquakes and their destructive consequences have long been attributed to the general lack of knowledge of earthquake threat, and a widespread ignorance that effective action to abate seismic risk can be taken. Adequate earthquake education is considered to be the most potent tool in increasing earthquake awareness of principal decision-makers, members of the public and private sector, as well as the public at large, and in motivating them to undertake earthquake hazard reduction activities.

Nevertheless, the Education Committee pointed out that very little information is available on how to create adequate and effective earthquake education programs, which raise earthquake awareness and motivate targeted audiences to actually change behavior. Little is known about the education measures that are effective and those that are not, even in the regions of the U.S. where earthquake planning is most advanced. There is no credible information on whether the right audiences are being reached at all. However, undertaking comprehensive earthquake education across the section of audiences is one of the most important actions in contributing to earthquake hazard mitigation throughout the country.

On the basis of this premise, the Education Committee embarked upon the task of structuring the issue of earthquake education, and identifying all the pertinent areas that have to be dealt with in order for education to change behavior of individuals and organizations whose activities are related to earthquake hazard reduction.

The Education Committee members began by discussing the properties of some of the concepts that are frequently associated with earthquake education:

Earthquake awareness was defined as risk-oriented, and a threshold for undertaking any earthquake mitigation activity; individuals and organizations that are not aware of the risk and do not know that their action can make the difference, are not likely to undertake any effort to abate seismic risk.

Earthquake education was recognized as both risk- and action-oriented; in other words, whereas it focuses on the features and magnitude of earthquake risk in a given area and for a given audience, education is also oriented towards action: it identifies different meanings of risk, it pinpoints audiences, strategies and desired outcomes.

Earthquake preparedness planning is action-oriented; it taps into two basic sources: on the one hand, into earthquake education which produces knowledgeable actors and, on the other, into earthquake mitigation technologies supplied by earthquake hazard research (e.g., earthquake engineering, land-use planning, or behavior of people in earthquakes).

Earthquake training is also action-oriented and involves improvement of earthquake preparedness skills by instruction, drills, or exercise.

The Education Committee emphasized that creators of earthquake education programs should ensure to unify the issues of long-term mitigation and recovery effort, with earthquake awareness raising and education, while separating them from training for emergency management. They concluded that their respective experiences show that the strategic joining and separation of issues has better chances for effective implementation.

Further discussion identified five issues pertinent for understanding the notion of earthquake education, developing research programs for studying it, and producing plans for its implementation. These five

issues are: the targeter, target groups, sources of the message, the message itself, and the mechanisms of message delivery.

The Targeter

Who ought to deliver earthquake education messages to a given audience? Or, who ought to be the targeter?

The Education Committee agreed that the choice of the targeter, i.e. the individual, group, association or agency actually delivering the message, will depend on the audience that has to be reached. Previous experience in earthquake education has demonstrated that the choice of the targeter can have decisive influence on whether the message will reach its audience with a desired result -- i.e., motivate it to undertake action and change its behavior. Wrong choice of the author of the message, or those who deliver it, has been known to result in unmotivated and disinterested audiences, who were doubly difficult to tackle in subsequent efforts. The pivotal issue here is that the targeter enjoy the confidence of the targeted community.

It is for this reason that the Education Committee suggested utmost care in the choice of the targeter. It is imperative that the targeter comes either from the same professional community as the audience, or, if this is not the case, the targeter should be known to have interacted successfully with the audience in the past. Targeters need to have personal and professional integrity, to be at the same time knowledgeable about the earthquake risk, and to have competence in the professional field of their audience. They must have the authority and be respected among the members of the target group.

Target Groups

Given the multitude of various audiences that are potentially concerned with earthquakes and seismic hazard reduction, and the varied regional seismicities in the U.S., the Education Committee argued for an

audience-, or target group-specific, approach to earthquake awareness raising and eduction.

Whom the targeter wants to reach will also depend on whether the desired action should occur on the policy, or on the technical level. If the action should be on a major policy level, then earthquake education process ought to aim for the high level education decision-makers. They are the ones who could successfully take up, carry and defend the banner of public interest.

The Education Committee emphasized the need to deal with earthquake education of the professionals who are directly associated with construction of the physical structure (professional planners, architects and engineers), or who deal with building code enforcement (building inspectors). The Committee was in consensus that equal effort should be invested in reaching both practicing professionals through continuing education programs, and future professionals, on the undergraduate and graduate levels. Furthermore, earthquake education should be promoted among the special groups who use the built environment, such as high-rise office buildings' managers and occupants; schools' principals, teachers and pupils; hospital directors, doctors, nurses and patients.

Since it is vital to address the issue of existing seismically hazardous structures, it is also necessary to reach the stakeholders in this category of built environment: owners and policy-making boards of corporations and business, workers and employees, as well as homeowners and the public at large.

The role of the media for creating the right environment for earthquake education across the audiences was emphasized by the Education Committee. Whereas the media may significantly contribute to advancing the cause of earthquake safety, they have frequently been known to perpetuate the myths of

inappropriate public behavior and helplessness in the wake of disaster. Therefore, educating the media to appropriately help in educating the populations facing seismic risk is of paramount importance. This is an especially topical issue in the aftermath of earthquakes, when TV, radio and the newspapers ought to have an increased responsibility for accurately disseminating information on the event, actions taken by the relevant public agencies, and probably most importantly, on the protective actions to be undertaken by the individuals themselves. The role the media ought to play in the long-term earthquake mitigation planning and education was also discussed. It was pointed out that by and large, the media have been an underutilized source of effective earthquake education.

The Education Committee perceived the insufficiently prominent role of the private sector as an earthquake education target group. More concerted effort is necessary to elucidate particular concerns and demands of various subgroups in the private sector. Obvious examples would be small business and corporate interests.

The Education Committee produced a list of target groups, or audiences, that ought to be reached. The list includes: government officials and politicians; senior economic advisors and technical personnel; business owners and corporate board members; general population (including residential communities, school officials and students, hospital personnel and the patients, prison wardens and inmates, the disabled); current and future practicing design professionals (architects, engineers, planners); and the media.

The discussion that followed pointed out that the recipients of earthquake-related information need to be competent in their respective areas of expertise, to recognize the need for earthquake education and to

show the will to change their behavior. If these three factors are not met, it is very difficult to succeed in earthquake education efforts, however skillfully the targeter, the message and its source, and the mechanism for communicating the message were chosen. For example, the Education Committee pointed out that it is because of the lack of will to change, that the category of land developers and building contractors have been traditionally difficult to address. Only through a regulatory system of incentives and disincentives will it be possible to establish a successful dialogue with some of the key audiences.

Sources of the Message

Who prepares the message is equally important to success of the earthquake education process, as are the choice of audience and targeter. In many cases, the targeter and the source of the message will come from the same milieu: a professional association may structure an earthquake education program for the audience of its members, and deliver the message through some of them. The choice of a scientifically credible information source (academia, government, research) will depend both on availability of information and the past record of influence that an institution has had within a given audience.

The Message

Well balancing the contents of the message is considered to carry great weight in the ultimate success of earthquake awareness raising and education. The message has to communicate the earthquake risk accurately, but at the same time it should neither create a sense of desperation that nothing could constructively be done to reduce the seismic risk, nor the impression of false security. Probable physical and social magnitudes of future seismic events and regional characteristics of seismicity ought to be brought together in such a way that they realistically point to the actions to be taken by the particular audience.

The Education Committee related the contents of the message to the issues that were discussed previously,

pointing out that whereas the contents of the message is pivotal, it is also critical that it be delivered in the particular "language" of the target group. Each professional group has developed its own "language" using the terms which other groups may use in a different context and may misunderstand. In order to ensure accurate understanding of the message, the targeter must "speak the language of the audience."

Mechanisms

What are the effective mechanisms for successfully relating earthquake education message? The Education Committee acknowledged the fact that earthquake safety is generally a topic without a natural constituency, and that special efforts have to be invested into "marketing" this issue. Therefore, the techniques employed by the marketing sector, which have shown success in other substantive areas, should be tried in earthquake education. Appropriate "packaging" of seismic safety information, development of techniques that may successfully "sell" the idea to the stakeholders and populations at risk, should be explored, improved and pursued. The Education Committee particularly suggested development of innovative modes of communicating the earthquake safety message, especially to the audiences that in the past took little interest in this subject.

Recognizing that earthquakes may occur in the majority of the states in the U.S., the Education Committee suggested that "spreading" the risk across the country is a strategy that has insufficiently been used. Similarily, multiple hazard strategies ought also to be seriously explored. Multiplying constituencies may result in increased critical mass necessary for support of earthquake education.

It was also pointed out that those who are involved in earthquake education programs should be ready to take advantage of available "windows of opportunity". Damaging earthquakes should not be viewed as the sole policy windows. Rather, "windows of oppor-

tunity" may "artificially" be created by successfully orchestrated media campaigns: earthquake events in other social settings should be capitalized upon for the benefit of local earthquake education effort.

Development of earthquake scenarios was singled out as one of the extremely versatile mechanisms for communicating earthquake risk that has so far been underutilized in earthquake education. Non-alarmistic scenarios prepared in the language of a target group, and in the appropriate medium (TV spots, video, slide/tape modules) need small staff and modest sources to efficiently relate the message to large audiences.

Priorities

Databases. The Education Committee emphasized that one of the most pertinent tasks in the area of earthquake education is to assemble a series of databases. Some of them are discussed below:

- *Catalog of earthquake education programs,* in this country and abroad should be compiled including all the audiences that are being addressed, message delivery mechanisms, "packaging" and marketing strategies, published and other materials used in earthquake education process.

- *Database on regional seismicity* ought to collect regional geological and seismological variables that account for difference in seismicity in the United States.

- *Survey of earthquake education of professionals* should also be prepared. The survey will assemble information in computerized databases on education of such professional groups as architects, engineers and planners, listing professional associations involved in program planning, speakers, types of courses, course materials, feedback from course participants, and other information.

Conferences. Conferences, workshops and seminars are an excellent medium for natural hazard education of a variety of audiences. International and national education conferences, on a variety of natural hazard topics, would convene representatives from a cross-section of disciplines. These events would benefit all the members of the natural disaster community, since they would allow for examination, comparison and transfer of relevant education experiences between the hazards. Publication and distribution of conference and workshop proceedings would make the findings available to a wide audience.

Implementation

Participants: *Frederick Cuny, Alcira Kreimer, Frederick Krimgold, William Petak.*

Knowledge about and technologies for abating earthquake hazard have dramatically increased in the last twenty years: earthquake engineering design and retrofit solutions have become more sophisticated; urban planners have learned about land-use techniques; architects know more about the relation of architectural design to building performance in earthquakes; planners have improved their strategies of emergency response, preparedness and long-term recovery planning. In contrast to this, however, the level of practical application of available seismic mitigation measures is low in the U.S. and throughout the world.

Implementation of earthquake hazard reduction measures requires further investigation. Particular emphasis should be placed on understanding the relevant issues of the implementation process, and developing innovative, active and comprehensive implementation strategies.

Earthquake-related program implementation is, it was argued, an issue of no, or very small, constituencies. Furthermore, low probability/high consequence issues need powerful "windows of opportunity" in order to be followed by successful seismic safety policy implementation. The occurrence of earthquake events in the vulnerable regions create the best policy windows; however, they are the most painful and socially costly. Flurries of seismic regulatory activity which usually occur following notable earthquakes (such as the Long Beach 1933, or the San Fernando 1971 events) were quoted in support of this observation. Although local earthquakes may be the most persuasive events that open windows for earthquake mitigation policy implementation in vulnerable areas, the Committee emphasized that innovative planning for implementation may develop successful strategies

for creating policy windows in the absence of local earthquakes. For example:

- *Capitalization on non-local earthquakes.* The Mexico City 1985 earthquake and its effects were successfully used as a policy window to intensify the implementation process of the L.A. seismically hazardous buildings' ordinance, and for introducing SB 547, the California state-wide law addressing inventory of seismically hazardous unreinforced masonry buildings.

- *Creation of "artificial" policy windows.* Major seismic-related conferences or workshops may be utilized as appropriate media events for creating the climate necessary for promoting the seismic safety policy adoption and initiating program implementation. The Earthquake Month, which is organized annually in California to coincide with the anniversary of the April 18, 1906 San Francisco earthquake, was quoted as another type of occasion that might successfully be used to promote program implementation.

- *Introduction of policies that feature incentives* to motivate change in behavior of individuals and organizations is a strategy that requires local-, state- and federal-level political decision-making. An example would be property tax incentives for retrofitting the hazardous buildings.

Priorities

Implementation Case Studies. One of the urgent priorities for NCEER in this area is to support inquiry into the case studies dealing with the characteristic phases of seismic safety policy implementation process. Detailed adoption and implementation analysis of cases of successful and unsuccessful applications of earthquake hazard reduction measures would illuminate this process and point to its problem areas, and help develop an implementation methodology.

Identification of Population at Risk. In order to facilitate implementation processes throughout the United States, it is necessary to identify the population facing seismic risk, not only regionally, but also across social strata, taking into account income, age, ethnicity, and other variables.

User Councils. It is a widespread feeling that the users of earthquake research are a neglected group, and that their input is insufficiently being sought or used. However, if users had a readily available vehicle for communicating their needs and problems, the research agendas would better reflect actual problems and seismic safety policy issues.

Seismic Hazard Reduction and Low Probability/ High Consequence Earthquake Events. Because of the long recurrence period of earthquakes in many parts of the United States, seismic issues in this country do not generate constituencies. Yet, even moderate earthquake events have been known to create serious disruption in increasingly complex, sophisticated, and thus vulnerable urban systems. The development of effective strategies to motivate audiences to recognize the costs of low probability/high consequence events would motivate action and subsequently increase seismic safety in this country.

Seismic Safety Problem Definition. Perceived disparity between the desired and actual state of affairs identifies problems. Yet, different audiences have different perceptions of the same phenomenon. Furthermore, their respective evaluations of the problem on their own priority lists differ to a great degree. Coupled with the low probability/high consequence nature of earthquake risk, seismic issues seldom generate consensus on action among the concerned audiences. An inquiry into developing new, innovative ways for identifying, defining and elaborating on the seismic safety problem would help deal with this issue.

Section 3
Conclusions

August 18, 1988

The destructive forces of earthquakes cause a great deal of physical damage and human suffering. Dead, injured and homeless, as well as heavy dollar losses leave permanent marks on the earthquake-affected communities. Although many earthquake-hazard reduction technologies have been developed in the areas which include engineering and planning, awareness to earthquake threat is still considered to be low across the nation, and across the audiences at risk. Given NCEER's mandate to advance earthquake-related knowledge and contribute to greater seismic safety in the U.S., its management concept of operations, and its systematic, interdisciplinary and programmatic approach to earthquake research, the Expert Panel concluded that NCEER creates an ideal environment for carrying out research dealing with planning, economic, social and political implications of earthquakes.

The final plenary session of the meeting was held following the conclusion of concurrent sessions of Research, Education and Implementation Committees. The committee chairpersons reported to the Expert Panel members on their group's recommendations, after which joint discussion took place. This report has already presented in detail the Committees' recommendations. Here follows the summary of the most significant recommendations of the Expert Panel.

The state-of-the-art research assessments probably attracted most attention as appropriate short-term research topics. The research assessments will allow NCEER to contribute directly to the overall U.S. earthquake research effort by establishing status reports on particular substantive themes in disaster research, such as seismic safety measures, disaster planning, reconstruction or risk communication. Completed research assessments will identify lessons that have been learned in each individual field, and point to the gaps - i.e., areas important for further investigation. Research assessments also have the

potential to become benchmarks in their areas, and intensify future accumulation of knowledge.

Conferences, workshops and seminars were emphasized by the Expert Panel as the important activities NCEER should support on a variety of topics - from examining earthquake education issues, to strategic conferences suggesting earthquake hazard reduction policy.

Finally, NCEER was encouraged to contribute to the process of technology transfer, and involving more the **users of earthquake research information.** It was felt that the process of implementation of already available earthquake hazard reduction technologies can be significantly improved by more meaningful communication between the research and user communities, and that NCEER has a definite role to play in this interaction.

Beyond programmatic issues, the Expert Panel encouraged close cooperation between NCEER's Disaster Research and Planning Program and NSF's Earthquake Systems Integration Program, with an emphasis on encouraging interdisciplinary research, and meaningful information exchange among the Principal Investigators supported by the two institutions.

First Expert Panel Meeting on Disaster Research will be used in developing the work plan for the NCEER Disaster Research and Planning Program, which will be published in the *Second-Year Program in Research, Education and Technology Transfer.* This is the program statement which will guide NCEER research support policy for Disaster Research and Planning Program in the course of 1988/89 Fiscal Year. Both the present report and the *Second-Year Program* will be widely distributed, and comments will be sought from researchers throughout the country

to further develop and focus NCEER's program on Disaster Research and Planning.

The NCEER Expert Panel on Disaster Research and Planning will convene again in 1989 to assess the work results and help formulate the directions for further focusing the Program.

Appendix A
Agenda of the Meeting

The NCEER First Panel on
Disaster Research and Planning

The NCEER Conference Room
Red Jacket Quadrangle
SUNY at Buffalo

August 17 & 18, 1987

AGENDA
Monday, August 17, 1987

10:00 - 10:30 AM	Welcome **Robert Ketter** **Jelena Pantelic** Self-introduction (Each participant will introduce him/herself, drawing Panel's attention to the latest earthquake research activities he/she has been involved in.)
10:30 - 11:00 AM	National Center for Earthquake Engineering Research - Background, philosophy and research orientation **Robert L. Ketter**
11:00 - 11:30 AM	National Science Foundation - Programs, Earthquake Systems Integration and relationship with the NCEER **William Anderson**
11:30 - 12:00 noon	The NCEER First Panel on Disaster Research & Planning - Goals, tasks and products **Frederick Krimgold**
12:00 - 1:00 PM	**LUNCH**
1:00 - 2:30 PM	Plenary Session: *Implementation* **Frederick Krimgold** Discussion

2:30 - 2:45 PM	**Coffee Break**
2:45 - 4:15 PM	Plenary Session: *Education* **Richard Eisner** Discussion
4:15 - 4:30 PM	**Coffee Break**
4:30 - 6:00 PM	Plenary Session: *Research* **Barclay Jones** Discussion
7:30 - 8:00 PM	**Reception** Darwin D. Martin House 125 Jewett Parkway, Buffalo *The guests will be given a tour of this national historical landmark, a 1904 masterpiece by Frank Lloyd Wright.*
8:00 PM	**Dinner** Darwin D. Martin House

The NCEER First Panel on
Disaster Research and Planning

The NCEER Conference Room
and Breakout Rooms
Red Jacket Quadrangle
SUNY at Buffalo

August 17 & 18, 1987

AGENDA
Tuesday, August 18, 1987

9:00 - 10:30 AM	**Concurrent Sessions** Committee Meetings on *Implementation, Education, & Research*
10:30 - 11:30 AM	**Plenary Session** Brief reports from small groups' representatives and general discussion
11:30 - 12:00 noon	**Coffee Break**
12:00 - 12:30 PM	**Wrap-up** **Frederick Krimgold** **Conclusions** **Robert L. Ketter**
12:45 PM	**Lunch** At the **Port of Entry** Restaurant, Amherst

Appendix B
Roster of the Participants in the Meeting

Roster Of The NCEER Expert Panel Members

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Appendix C
Curricula Vitae of the
NCEER Expert Panel Members

WILLIAM A. ANDERSON, Ph.D.
Program Director
Earthquake Hazard Mitigation Program

William A. Anderson is Program Director for the Earthquake Hazard Mitigation Program at the National Science Foundation. He holds a B.A. in Sociology from the University of Akron (1960), an M.A. in Sociology from Kent State University (1961) and a Ph.D. in Sociology from Ohio State University (1966).

Dr. Anderson joined the National Science Foundation in 1976 as Program Manager for the Societal Response to Natural Hazards Program where his responsibilities have included the development of a program of social science and interdisciplinary research on disasters and hazards.

Prior to his service with the National Science Foundation, Dr. Anderson was a professor of sociology at Arizona State University from 1969-1976. From 1966-1969, he served as Field Director for the Disaster Research Center which was then located at Ohio State University.

Dr. Anderson has co-authored two books, and has written numerous monographs, reports and articles on the social aspects of natural hazards. Two of his recent publications include: "The Response of Social Institutions to Earthquake Prediction" (with Charles C. Thiel), in *Earthquake Prediction: Proceedings of the International Symposium on Earthquake Prediction*, Paris: UNESCO, 1984; and "Emergency Management Practice and Research in the United States," (with Shih-Chi Liu and L. Tina Yang), in *Proceedings of the CCNAA-AIT Joint Seminar on Research for Multiple Hazards Mitigation*, L. Wang and M. Sheu, editors, Tainan, Taiwan: National Cheng-Kung University.

Dr. Anderson has served on several panels and committees at the National Academy of Sciences, including the Panel on the Public Policy Implications of Earthquake Prediction. Dr. Anderson was also appointed to the Subcommittee on Chemical Emergencies, Toxic Substances Strategy Committee, Council on Environmental Quality, Executive Office of the President (1978-1979), and served as a member of the Working Group on Earthquake Hazards Reduction, Office of Science and Technology Policy, Executive Office of the President (1977-1978).

He is a member of the American Sociological Association and its section on Environment and Technology. He is associate editor for *Sociological Perspective* and is on the advisory board of *Hazard.*

Dr. Anderson has received numerous honors and awards including Outstanding Performance Awards from the National Science Foundation.

FREDERICK C. CUNY
Executive Director
INTERTECT

Frederick C. Cuny holds a B.A. in Government (Latin American Studies) from Texas A&I University, 1966; and a B.S. in Political Science (International Development) from the Inter-University African Studies Center, University of Houston and Rice University, 1967.

Mr. Cuny is a registered planner and is founder and Chairman of INTERTECT, a professional disaster management consulting firm based in Dallas, Texas. INTERTECT specializes in the provision of technical assistance, research and training to voluntary agencies, governmental and U.N. organizations involved in international disaster preparedness, relief and recovery. Since 1969, Mr. Cuny has participated in numerous major relief operations, concentrating on refugee camp planning and administration, relief management, damage and needs assessment, reconstruction, and mitigation activities.

Mr. Cuny has been involved in a number of disaster related activities, including pre-disaster planning, disaster policy development, post-disaster housing and emergency shelter programs, housing education, housing research and design (earthquake and high wind resistant construction), urban and regional planning, village and regional development, post-disaster damage assessment, refugee camp planning and needs assessment, comprehensive hazard mitigation strategies and application of aerial photography for disasters.

His most recent publications include *Disasters and Development*, published by Oxford University Press, and a number of INTERTECT studies and reports. He is also the author or editor of a number of training courses produced by the University of Wisconsin Disaster Management Center.

Mr. Cuny is a registered planner in the state of Texas; a commercial pilot in the U.S., U.K., Switzerland, Guatemala, Peru; and registered merchant marine officer in the U.S. Current memberships include advisory committee, International Decade of Hazard Reduction, National Academy of Sciences; Earthquake Engineering Research Institute; Editor, *Disasters, The International Journal of Disaster Studies and Practice*; Panel on Reduction of Vulnerability of Buildings and Settlements in Hazard-Prone Areas (UK); and Institute of Emergency Administration and Planning Advisory Committee, University of North Texas.

IAN ROBERT DAVIS, Ph.D.
Chairman
Disaster Management Center (DMC)

Dr. Ian R. Davis is the Chairman of the Disaster Management Center (DMC) at Oxford Polytechnic University, Headlington, Oxford, United Kingdom. He is currently involved in the development of a risk reduction strategy, with special emphasis on human vulnerability to seismic risk and implementation for the Government of the Federal District of Mexico City. He is also developing guidelines for the implementation of mitigation measures for UNDRO. He has investigated cultural aspects of housing in seismic areas and led the Housing and Natural Hazards Program within the International Karakoram Project Royal Geographical Society Cententary Expedition to Northern Pakistan.

Dr. Davis has conducted numerous field studies of post-impact response and mitigation planning following natural disasters, including earthquakes (most recently, San Salvador, El Salvador, 1987; Mexico City, Mexico, 1985; Popayan, Columbia, 1981; and Basilicata, Italy, 1980); floods (most recently Newcastle, Jamaica, 1983; coastal storms, UK, 1981; and Delhi, India, 1981); cyclones (including Typhoon Sisang, Sorsogon, Philippines, 1988); and volcanic eruptions (Mayon, Philippines, 1985; and Taal, Phillipines, 1981).

Dr. Davis has functioned as consultant to many agencies and governments. Included are UNESCO, UNDP, UNDRO, UNCHS, WMO, US, UK, Phillipines, Tear Fund, OXFAM and Movimente Popular and CORAF.

His most recent publications include: "Homelessness and Disaster Response," special IYSH issue of *Open House* Vol. 12, No. 3, 1987 (I. Davis, editor) and *Housing and Culture after Earthquakes. A Guide for Future Policy Making on Housing in Seismic Areas*, Yasemin Aysan and Paul Oliver (Consultant, Ian Davis), Oxford Polytechnic, 1987. Forthcoming are: *Vulnerability to Natural Disasters*, (with Wisner, Blaikie and Cannon) Chapters on Vulnerability to Earthquake, Flood and High Winds by Davis, 1989; and "Guidelines for Mitigation Implementation" (with Ernst Lohman et al), United Nations, New York, 1989.

Dr. Davis is a member of the Editorial Board of *Disasters* (1975-88). He has served as a member of or chaired numerous committees involved in disaster management, including International Advisory Board Disaster Management Center Extension Program at the University of Wisconsin; International Committee to plan the International Workshop on "Implementation of Disaster Mitigation Measures (Jamaica, 1984); International Panel on Risk Reduction in Hazard Prone Areas (London, 1981-86); and International Committee of the National Academy of Sciences on the Implications of U.S. Government Disaster Assistance Policies (Washington, DC, 1975-78).

RUSSELL R. DYNES, Ph.D.
Professor of Sociology
University of Delaware

Russell R. Dynes is the Chairman and Professor of the Department of Sociology at the University of Delaware. He holds an A.B. and an M.A. from the University of Tennessee (1948 and 1950, respectively), and a Ph.D. from Ohio State University, 1954. He is also co-director of the Disaster Research Center at the University of Delaware.

Currently, Dr. Dynes is investigating Organizational Response to the 19 September 1985 Mexico City Earthquake. His other research areas include studies on local emergency management agencies, mass media and disaster, development of baseline information of mental health disaster assistance and crisis intervention needs and resources.

Dr. Dynes has had numerous consulting positions for government agencies, research agencies, law firms and educational institutions (academic and departmental reviews). He has testified before legislative and investigative bodies including the U.S. Congress: House Public Works; Senate Subcommittee on Science, Research and Technology; Senate Committee on Governmental Operations; Atomic Safety and Licensing Board; President's Commission for the Study of Ethical Problems in Medicine and Biomedical and Behavioral Research; and the National Research Council Panel on Behavioral Sciences, Commission on Human Resources. He served as head of the Task Force on Emergency Planning and Response, the President's Commission on the Accident at Three Mile Island (1979). He has also been a member of the National Academy of Sciences/National Research Council Advisory Committee on Emergency Housing, Building Research Advisory Board (1972), Committee on International Disaster Assistance, Commission on Sociotechnical Systems (1976-1979), and the Committee on State and Federal Roles in Energy Emergency Preparedness, Energy Engineering Board, (1988).

Dr. Dynes has authored nine books, 51 chapters, monographs and reports, numerous articles and various other publications. His most recent publications include *Sociology of Disasters: Contribution of Sociology to Disaster Research*, Milano, Franco Angelli; "Planning Principles for Chemical Emergencies," in Proceedings of World Conference on Chemical Accidents, Edinburgh, CEP Consultants Ltd., (with Dennis E. Wenger), 1987; "The Organizational and Public Response to the 19 September Earthquake," in Proceedings U.S.-Mexico Workshop - on 1985 Mexico Earthquake Research, El Cerrito, CA, Earthquake Engineering Institute, April, Publication 87-B, 1987; "Strengthening Post Disaster Mitigation: A Sociological Perspective," in *Proceedings of the International Symposium on Mitigating Future Losses*, American Bar Association, (1987); "The Concept of Role in Disaster Research," *The Sociology of Disaster*, pp. 71-102, 1987; and "Introduction," *The Sociology of Disaster*, pp. 13-30, 1987; and "On Certification," *Humanity and Society*, Vol. 11, No. 3, August, pp. 385-389, 1987.

Among numerous awards and honors, Dr. Dynes received the Distinguished Professional Service Award from the North Central Sociological Association in 1982 and is an honorary member of the International Disaster Institute, London, and the Civil Defense Preparedness Agency Staff College.

Dr. Dynes is a member of the American Sociological Association, International Sociological Association, North Central Sociological Association, Religious Research Association, and the Society for the Scientific Study of Religion. Over the past 20 years, Dr. Dynes has chaired and/or served as an elected officer for these associations. He currently serves as President of the Research Committee on Disaster, International Sociological Association.

RICHARD K. EISNER

Director

Bay Area Regional Earthquake Preparedness Project (BAREPP)

Richard Eisner holds a bachelor of Architecture, with honors, 1967, and a master of City and Regional Planning, 1970, from the University of California at Berkeley. He attended the Summer Seismic Institute for Architectural Faculty at Stanford University in 1977 1978. He is registered as an architect in California and as a city and regional planner (AICP).

Mr. Eisner is the Director of the San Francisco Bay Area Regional Earthquake Preparedness Project (BAREPP), a program funded jointly by the Federal Emergency Management Agency and the Governor's Office of Emergency Services, State of California to promote and support comprehensive earthquake countermeasure planning in the ten counties of the San Francisco Bay Region. With a professional staff of seven, BAREPP provides planning and technical assistance to businesses and governments, convenes conferences and training workshops, houses a regional resource center on earthquake preparedness, and publishes NETWORKS, a quarterly newsletter with a circulation of over 8,000.

Prior to establishing BAREPP in 1984, Richard Eisner worked as a consultant to, and employee of, Building Systems Development (BSD), Inc. conducting a number of National Science Foundation research activities. He served as Program Manager for a study entitled, Urban Technology of Earthquake Hazard Reduction: Model Planning Development Based on a Comparative Study of Oakland, California and Yokohama, Japan; and as Project Director of Shelter and Housing After Earthquakes. His studies of Japanese and American preparedness activities led to the development of prototype models for comprehensive earthquake preparedness activities that are now being implemented through BAREPP in the San Francisco Bay Region. He also directed BSD's participation in the innovative study of occupant behavior that resulted in the publication of *Imperial County Services Building: Occupant Behavior and Operational Consequences as a Result of the 1979 Imperial County Earthquake.*

Mr. Eisner has specialized for a number of years in the area of urban and community planning with extensive experience in neighborhood and community development. As a member of the Faculty of the University of Kansas School of Architecture and Urban Design, he taught courses in design, building technology and seismic design, advocacy planning, and urban design in both the undergraduate and graduate curricula. While at the University of Kansas, Eisner was a founder of the MO-KAN Housing Association, a coalition of individuals and groups concerned with the provision of adequate low-cost housing in the Kansas City Metropolitan Area. He also served as a consultant to several community and housing associations and served as Director of the Architect's Community Team of Kansas City, a public service consortium of architects, planners, and VISTA volunteers. In 1977 he participated as a consultant in the Midwest Re-

search Institute study, Earthquake Risk and Damage Functions: An Integrated Preparedness and Planning Study for the Central USA.

Before moving to the midwest, Richard Eisner served as Staff Planner with the San Francisco Community Design Center (CDC), where he had primary responsibility for the development of educational programs under a grant from the Office of Economic Opportunity. Eisner's work at CDC also included serving as a consultant on community planning and development issues to numerous neighborhood groups in the San Francisco Bay Area.

Richard Eisner has made numerous presentations to business, government and professional groups on earthquake-related topics, and currently serves as a faculty member for workshops held throughout the United States on planning and preparedness issues of architectural design for the American Institute of Architects.

Mr. Eisner has also served as an urban design consultant to the Office of Chief Administrative Officer of San Diego County, and as a member of the Emergency Task Force on Earthquake Preparedness and the Mexico City Earthquake Investigating Team for the State of California. He currently is appointed to the National Urban Planning and Design Committee of the American Institute of Architects and is a Member of the National Center for Earthquake Engineering Research First Expert Panel on Disaster Research and Planning.

Mr. Eisner is a member of the American Institute of Architects (AIA), American Institute of Certified Planners (AICP), American Planning Association (APA) and the Earthquake Engineering Research Institute (EERI).

BARCLAY G. JONES, Ph.D.
Professor of City and Regional Planning
Cornell University

Dr. Barclay Jones is Professor of City and Regional Planning in the Department of City and Regional Planning at Cornell University, and Program Director of the Cornell Institute for Social and Economic Research/Program in Urban and Regional Studies. He holds a B.A. (1948) and a Bachelor of Architecture (1951) from the University of Pennsylvania, a Master of Regional Planning (1955), and a Ph.D. Economics (1961), from the University of North Carolina. He is a registered architect in the State of North Carolina, (since 1956).

Dr. Jones has been an investigator for over 25 research projects awarded by the National Science Foundation, U.S. Dept. of Agriculture, U.S. Dept. of Commerce, National Center for Earthquake Engineering Research and other entities. His most recent work includes "Developing Indirect Methods for Estimating Non-building Structures and Lifelines in Urban Areas" (1987-88) for the National Center for Earthquake Engineering Research; "Estimating Building Stocks for Earthquake Mitigation and Protection of Historic Structures" (1986-87) for the National Center for Earthquake Engineering Research; and *U.S.-Yugoslav Workshop on the Protection of Historic Structures and Town Centers in Seismic Regions: lessons from Montenegro* (1985-87) for the National Science Foundation.

Dr. Jones has been a consultant for numerous city, county and state governments, and foreign governments. He serves on the National Science Foundation's Division of Fundamental Research for Emerging and Critical Engineering Systems Advisory Committee for the Critical Engineering Systems Section. His most recent consulting projects have included acting as Training Institute Advisor for the Committee for the Preservation of Cultural Relics and Historic Sites of Beijing and Beijing Administrative Bureau for Museums and Archaeological Data (People's Republic of China, 1986); Advisor for the Committee for the Preservation of Cultural Relics and Historic Sites of Beijing (People's Republic of China, 1985); consultant for the Government of Kenya, Ministry of Finance and Planning, Rural-Urban Policy Analysis and Coordination Unit; he also reviewed the graduate program in Urban Planning at the University of Milwaukee, Wisconsin (1981).

Dr. Jones has published numerous papers, including: "Cities of the Future: Implications of the Rise and Relative Decline of Cities of the West," with William F. Shepherd, Journal of Planning Education and Research, Vol. 6, No. 3, Spring 1987, pp. 162-166; "Urban Support for Rural Development in Kenya," Economic Geography, Vol. 62, No. 3, July 1986, pp. 201-214; and Protecting Historic Architecture and Museum Collections from Natural Disasters, Editor, Boston: Butterworths, 1986.

Dr. Jones is a member of the American Association for the Advancement of Science, American Association of University Professors, American Economic Association, American Institute of Architects, American Institute of Certified Planners, American Planning Association, American Statistical Association, National Trust for Historic Preservation, Northeast Regional Science Association, Society of Architectural Historians and Urban and Regional Information Systems Association.

Dr. Jones received the Distinguished Lecturer Award for the Senior Fulbright-Hays Program in Yugoslavia in 1972. He has also been listed in the following directories: Who's Who in America, (Forty-first Edition, 1980-81); Who's Who in the East, (Seventeenth Edition, 1979-80); American Men and Women of Science, The Social and Behavioral Sciences, (Thirteenth Edition); American Architects Directory, (Third Edition, 1970); and Who's Who in American Education, Vol. 23, First Volume 1967-68, General Education.

He has also been a member of the board for the Architectural Research Centers Consortium, Inc., since 1980 and the National Preservation Institute, Inc. since 1984. He chairs the Ithaca (City) Landmarks Preservation Commission and has been a member of the board of the Historic Ithaca and Tomkins County, Inc. from 1975-81.

ALCIRA KREIMER, Ph.D.
Urban Planner
The World Bank

Alcira Kreimer holds a Ph.D. in Environmental Planning from the University of California, Berkeley, 1977, a Diploma in Urban Studies, Centre de Recherche d'Urbanisme, Paris, 1968, and an M.A. in Architecture, University of Buenos Aires, 1966. She is currently an Urban Planner in the Infrastructure and Energy Operations Division, Latin America and the Caribbean, at The World Bank. Her extensive experience as an architect/urban planner since 1966 includes work in Latin America, United States, Asia, Europe and Africa.

Since 1983, Dr. Kreimer has worked for the World Bank in policy development, operations, monitoring and evaluation of Bank activities in four main areas: (1) developing natural hazard reduction measures; (2) defining and implementing reconstruction programs after major disasters; (3) improving the efficiency of urban planning and management; and (4) developing strategies for the provision of low cost housing. She is the author of the *Guidelines for Bank Participation in Reconstruction After Disasters.* She participated in project reconnaissance, appraisal, supervision and coordination in a number of cases, among them, the following: Mexico Earthquake Reconstruction Project, El Salvador Earthquake Reconstruction Project, Columbia, Popayan Earthquake Project, Indonesia Urban Development and Thailand Shelter Project. Other activities undertaken at The World Bank were related to (1) strengthening the capacity of the construction sector, and (2) reviewing the resettlement of population in the Bank-financed projects in the water supply and urban development sectors.

Dr. Kreimer served as a consultant on urban and regional development and on environmental issues to several international agencies, among them, the Economic Development Institute (EDI), the United Nations Commission on Human Settlements (UNCHS), and the United Nations Environment Programme (UNEP). She was a professional Staff Officer at the National Academy of Sciences, in charge of the coordination and administration of a program on international disaster assistance with emphasis on housing, health, urban planning and management.

Dr. Kreimer was an Associate Professorial Lecturer, The George Washington University and an Assistant Professor, Department of Urban Studies, Massachusetts Institute of Technology (MIT). Courses taught included housing, infrastructure, environmental assessment, and urban planning. She was a Postgraduate Researcher, Institute of Urban and Regional Development (IURD), University of California, Berkeley. She worked in private practice as an Architect in Buenos Aires with emphasis on programming, urban planning and design, building cost analysis, bidding documents and specifications.

Dr. Kreimer's work has been published, among others, in *Assessing International Disaster Needs, Mass Media and Disasters, the Inter-American Planning Association Journal, Interna-*

tional Journal of Mass Emergencies and Disasters, *Ekistics*, *Habitat International*, *Mass Emergencies* and *American Institute of Planning Journal*, as well as in several Conference Proceedings. She received honors and awards from the Tinker Foundation; the Institute of International Studies, University of California, Berkeley; the Beatrix Farrand Fund; and The Ministry of Cultural Affairs of France.

She is a member of the American Planning Association (APA), the Inter-American Planning Association (SIAP), the Society for International Development (SID), the Environmental Design Research Association (EDRA), the Research Committee on Disasters and the Berkeley Alumni Association.

FREDERICK KRIMGOLD, Ph.D.
Associate Dean
College of Architecture and Urban Studies
Virginia Polytechnic Institute and State University

Frederick Krimgold is the Associate Dean for Research and Extension at the College of Architecture and Urban Studies, Virginia Polytechnic Institute and State University. He holds a B.A from Yale University (1968), and a Doctor of Technology from the Royal Institute of Technology in Stockholm, Sweden (1974).

Dr. Krimgold has been involved in issues related to architecture and planning, housing, earthquake hazard mitigation, international housing policy, program evaluation and research management, and teaching for the past 20 years. He is a member of the Building Research Board of the National Research Council, as well as a proposal reviewer for the Engineering Directorate, National Science Foundation. His most recent research projects include "Search and Rescue in Collapsed Buildings," Engineering Directorate, National Science Foundation (1986) and "National Hazard Mitigation Program Implementation," Office of Foreign Disaster Assistance, USAID.

Dr. Krimgold was a Program Director of the Engineering Directorate at the National Science Foundation for six years, from 1977-83. During this time, Dr. Krimgold developed a program of earthquake related research in the areas of architecture and planning. He has held consulting and research positions with numerous domestic agencies and foreign governments. International consulting and research projects include U.N. Environment Program in Nairobi, Kenya; the U.N. Disaster Relief Office in Geneva, Switzerland; the Relief and Rehabilitation Commission Provisional Military Government of Ethiopia; Swedish Council for Building Research, Stockholm Sweden; and the Swedish International Development Authority.

Dr. Krimgold has published numerous reports, including "Mitigation of Natural Hazards," *Maryland Emergency Medical Services News*, (1986) and *Proceedings of the International Conference on Disaster Mitigation Program Implementation*, (editor), (Ocho Rios, 1984).

He is a member of several professional societies and committee memberships and is an active member of the Academic Advisory Council, Construction Industry Institute (since 1986); Board of Trustees, Intelligent Building Institute Foundation (since 1986); Executive Committee, Building Research Board, National Research Council, National Academy of Sciences (since 1985); Editorial Board, Habitat International, Journal of Human Settlements, (since 1981) and the Earthquake Engineering Research Institute (since 1977).

HENRY J. LAGORIO
Professor of Architecture
University of California/Berkeley

Henry J. Lagorio is Professor of Architecture, Research Architect VI, at the Center for Environmental Design Research (CEDR), and Chairman of Study Area VI: Structures and Construction, in the Department of Architecture at the University of California at Berkeley. He holds a M.A. in Architecture from the University of California at Berkeley, 1945, and an A.B. in Architecture from the University of California at Berkeley, 1944.

Professor Lagorio is Secretary/Treasurer of the Earthquake Engineering Research Institute (EERI), and has held this office for seven years. He is an Honorary Member of the China Association of Architects, and is a member of the editorial board of "Earthquake Spectra," the professional journal of earthquake engineering. He has been Secretary for the Advisory Board of the state-wide Wood Building Research Center. His work involves the agriculture experiment station and cooperative extension at the Woods Product Laboratory at the University of California (since 1986).

Professor Lagorio has also been the Associate Dean of Research at the University of California at Berkeley from 1979-84, the Director of the Center for Environmental Design Research at the University of California at Berkeley from 1979-84. He is a licensed architect in the State of California (since 1947) and Hawaii, (since 1978).

His most recent publications include, "Earthquake Scenario for the Hayward Fault, San Francisco Bay Area," (with others) Division of Mines and Geology, Sacramento, California, January 1988; "Implication of Existing Hazardous Buildings in Urban Environments," Invited Technical Paper, Symposium on Urban Disaster Mitigation, China Building Technology and Development Centre, (CBTDC), Beijing, China, September, 1986; "Earthquake Planning Scenario for a Magnitude 7.5 Earthquake on the Hayward Fault, San Francisco Bay Area," (with others) California Geology, pp. 153-157, Department of Conservation, Sacramento, California, July 1986; "Issues for Seismic Strengthening of Existing Buildings: A Practical Guide for Architects," NSF Research Grant No. CEE 8411936, (with others), CEDR, University of California/Berkeley, January 1986.

Professor Lagorio's awards and honors include: Commendation of Appreciation, 1986, Board of Directors, National Council of Architectural Registration Boards, 1986 NCARB Site Design and Building Design Professional Examinations, Minneapolis, Minn.; and Bronze Medal Citation, China Building Technology Development Center, Beijing, China, 1985.

Professor Lagorio is a member of the Commonwealth Club of California, San Francisco; American Institute of Architects (AIA), Washington, DC; American Association for the Advancement of Sciences, Washington, DC; and Seismological Society of America (SSA),

Berkeley. He serves on the Executive Committee of the Earthquake Engineering Research Center (EERC), University of California/Berkeley; and is on the Board of Directors, Earthquake Engineering Research Institute (EERI).

DENNIS S. MILETI, Ph.D.
Professor
Colorado State University

Dennis S. Mileti is a Professor in the Department of Sociology at Colorado State University. He is also Director of the Hazards Assessment Laboratory and Adjunct Professor in the Department of Sociology at the University of Tenessee, Knoxville. He holds a B.A. in Sociology (1968) from the University of California, Los Angeles, an M.A. in Sociology (1971) from California State University, Los Angeles, and a Ph.D. in Sociology (1974) from the University of Colorado, Boulder. He specializes in complex organizations, and applied (hazards and policy) methods.

Dr. Mileti has conducted numerous research projects, and his most recent include: "Preparation of a Model Response Plan for the Three Mile Island Reactor," public Education and Warnings Group (subcontract from Clark University for the Three Mile Island Public Health Fund), 1987-88; "Research Applications for Emergency Preparedness," contract for Public Service Company of New Hampshire, 1987-88; "Socioeconomic Impacts of the Proposed High-Level Radioactive Waste Site at Hanford, Washington," Risk Assessment Team, subcontract from Social Impact Assessment, Inc. for the State of Washington, 1987; and "Public Perception of Seismic Risk in Santa Clara County," grant from the Bay Area Regional Earthquake Preparedness Project and the California Seismic Safety Commission, 1987.

Dr. Mileti has served on numerous committees and is an active member on the National Academy of Science, National Research Council, Commission on Engineering and Technical Systems, Committee on Natural Disasters; and the National Academy of Sciences, National Research Council, Commission on Physical Sciences, Mathematics, and Resources, Board on Earth Sciences, Subcommittee on Earthquake Research. He is also a member of the Editorial Advisory Board for *Industrial Crisis Quarterly* and Associate Editor for social science, *Earthquake Spectra*, Journal of the Earthquake Engineering Research Institute. He has also edited for the following publications, *Organizations and Occupations* (1984-85), *Environmental Sociology* (1981-85); and *Mass Emergencies*, (1976).

He has been a guest lecturer on numerous occasions, has been the organizer, and/or presider over several workshops; he has given testimony for various government agencies, the most recent being to the Nuclear Regulatory Commission in the matter of emergency planning at the Seabrook nuclear plant, Concord, 1987-88, and on emergency planning at the Shoreham nuclear reactor, Suffolk, 1987. He has also given legislative and program reviews.

Dr. Mileti has published numerous reports, including 26 books, monographs and chapters, 44 articles, 18 technical reports, 4 proceedings, 56 conference papers and has been cited in numerous book reviews and commentaries. Among his most recent publications are: "Planning and Implementing Warning Systems," (with John H. Sorensen), in *Mental Health Response to Mass*

Emergencies, pp. 204-218, 1988; "Determinants of Organizational Effectiveness in Responding to Low Probability Catastrophic Events," (with John H. Sorensen), *Columbia Journal of World Business*, XXII (1): 13-21, 1987; *Evacuation: An Assessment of Planning and Research*, (with John H. Sorenson and Barbara M. Vogt), prepared for the Federal Emergency Management Agency, 1987; and "Disaster Prevention and Mitigation During Rehabilitation and Reconstruction," paper presented to the International Research and Training Seminar on Regional Development Planning for Disaster Prevention sponsored by the United Nations Center for Regional Development, Tokyo, 1987.

Dr. Mileti is currently a member of the American Sociological Association, International Sociological Association, Pacific Sociological Association, Midwest Sociological Society, Earthquake Engineering Research Institute, National Coordinating Council on Emergency Management, and the Western Social Science Association. He has been cited for excellence in teaching, research and service by the Dean, College of Arts, Humanities and Social Sciences in 1978, and in Outstanding Young Men of America in 1981. He received the Alumni Honor Faculty Award at Colorado State University, Alumni Association for excellence in teaching, research and service in 1983.

WILLIAM J. PETAK, Ph.D.
Professor
University of Southern California

William J. Petak is Professor of Systems Management at the University of Southern California. He is also the Executive Director of the Institute of Safety and Systems Management and Director of the Risk and Emergency Management Laboratory. He holds a B.S. in Mechanical Engineering from the University of Pittsburgh (1956), an M.B.A. in Industrial Management (1963), a Master of Public Administration (January, 1969) and a Ph.D. in Public Administration (June, 1969), all from the University of Southern California in Los Angeles, California.

Dr. Petak has been principal investigator for several government agencies, including the Federal Emergency Management Agency and the National Science Foundation in the area of earthquake hazard mitigation for over 15 years. His most recent project was "Multiple Hazard Risk Assessment" (with others), for the National Science Foundation in 1986. His research studies have also included "Attitudes and Attributes of Influentials in Earthquakes and Other Natural Hazard Policy Processes," "Physical Disability and Earthquake Hazard Mitigation" and "Decision Support System for Earthquake Mitigation and Response Management."

He has been a publication/research project reviewer with both the National Science Foundation and the U.S. Geological Survey. He has held numerous consulting/advisory appointments with government agencies, and is currently adjunct faculty, National Emergency Training Center, Federal Emergency Management Agency, Emmitsburg, Maryland (since 1985). He is also a member of the Committee on Natural Disasters, National Research Council of the National Academy of Sciences, (since 1985); Committee on Ground Failures, National Research Council of the National Academy of Sciences (since 1986); and Policy Advisory Board, Southern California Earthquake Preparedness Project, Los Angeles (since 1986).

Dr. Petak currently serves on the Institute of Safety and Systems Management (ISSM) Academic Planning and Evaluation Committee, the ISSM Administrative Council, the University Graduate and Professional Studies Committee and the University Council of Deans. Among numerous academic appointments and ancillary academic appointments, he has held several non-academic positions, including most recently, Director and Vice President of the J.H. Wiggins Company, Redondo Beach, California, (1969-1981). Responsibilities included overall direction of financial and administrative matters, including accounting, personnel, purchasing and contracts administration. In addition, while with J.H. Wiggins, he was principal investigator on three major public policy studies conducted between 1975 and 1981.

Dr. Petak has also been involved in numerous public service and/or professional activities. He serves as Chairman of the American Society for Public Administration, Committee on Emergency Management, since 1984; a member of American Public Works Association, Council on

Emergency Management, since 1986; and a consultant for the Earthquake Hazard Reduction Project sponsored by the RAND Corporation, Santa Monica, California, since 1985.

Dr. Petak has published various books/monographs, committee reports, research reports, and numerous other publications. His most recent works include: *Multiple Hazard Risk Assessment Methodology*, prepared for the National Science Foundation, 1987; *Development of Earthquake Hazard Reduction Policies in Three California Cities*, prepared for the National Science Foundation, 1987; *Politics and Economics of Earthquake Hazard Mitigation*, (with D.J. Alesch), Natural Hazards Research and Information Center, Boulder, Colorado, 1986; "Natural Hazard Losses in the United States: A Public Problem," *Policy Studies Review*, Vol. 4, No. 4, 1985 (with A.A. Atkisson); 1985; and "Integrated Emergency Management: Fact or Fantasy," in 8th Annual Conference on Managing High Risk Flood Areas - 1985 and Beyond, Conference Proceedings, Natural Hazards Research and Applications Information Center.

His memberships in professional associations include the American Association of University Professors, American Public Works Association, American Society of Public Administration, Earthquake Engineering Research Institute, International Research Committee on Disasters, Society for Risk Analysis and SCAPA Praetors (Life Member) USC/SPA Alumni Support Group. His is a member of Sigma Xi, Pi Sigma Alpha (Honorary Political Science Fraternity) and is listed in *American Men and Women of Science* and *Who's Who in the West.*

WILLIAM EDWARD RIEBSAME, Ph.D.
Assistant Professor
University of Colorado

William E. Riebsame is an Assistant Professor of Geography at the University of Colorado, Boulder and is Director of the Natural Hazards Research and Applications Information Center, Institute of Behavioral Science, also at the University of Colorado at Boulder. He holds a B.S. in Geography (1975) from Florida State University, an M.S. in Geography (1978) from the University of Utah, and a Ph.D. in Geography (1981) from Clark University.

Dr. Riebsame is currently a consultant for the United Nations Environment Programme in Nairobi, Kenya where his work has led to the development of a book entitled, *Assessing the Social Implications of Climate Fluctuations: A Guide to Climate Impact Studies*, which is currently in press. He is principal investigator of an EPA project on The Policy and Economic Implications of Climate Change: A National Assessment and Regional Case Study; and a U.N. Series of Roving Seminars on Climate Impact Assessment. He has had several professional and university service appointments and is currently on the Editorial Board of *The Professional Geographer* and *The Natural Hazards Journal.*

He has published numerous articles and presented several professional papers. His most recent publications include: "Assessing Drought Impacts and Adjustments in Agriculture and Water Resource Systems," (with W.E. Easterling), in D.A. Whilhite et al. (eds.) *Planning for Drought: Toward a Reduction of Societal Vulnerability*, pp. 189-213, 1987; "Human Response to Climate Change: The Role of Decision-maker Perception," *Proceedings of the Symposium on Climate Change in the Southern United States: Future Impacts and Present Policy Issues*, 1987; and "The Social Burden of Weather and Climate Hazards," (with H. Diaz et al.), *Bulletin of the American Meteorological Society*. He presented the following papers: "Approaches to Climate Impact Assessment," International Symposium on Climate and Food Security, New Delhi, India, 1987; "Water Manager Response to Climate Impacts," Association of American Geographers, annual meeting, Portland, Oregon, 1987; and "Human Transformation of the United States Great Plains: Patterns and Causes," Symposium on the Earth Transformed by Human Action, Clark University, Worcester, Massachussetts, 1987.

Dr. Riebsame is a member of the Association of American Geographers, American Association for the Advancement of Science, American Meteorological Society, Society for Risk Analysis and the International Disaster Institute.

NATIONAL CENTER FOR EARTHQUAKE ENGINEERING RESEARCH
LIST OF PUBLISHED TECHNICAL REPORTS

The National Center for Earthquake Engineering Research (NCEER) publishes technical reports on a variety of subjects related to earthquake engineering written by authors funded through NCEER. These reports are available from both NCEER's Publications Department and the National Technical Information Service (NTIS). Requests for reports should be directed to the Publications Department, National Center for Earthquake Engineering Research, State University of New York at Buffalo, Red Jacket Quadrangle, Buffalo, New York 14261. Reports can also be requested through NTIS, 5285 Port Royal Road, Springfield, Virginia 22161. NTIS accession numbers are shown in parenthesis, if available.

NCEER-87-0001 "First-Year Program in Research, Education and Technology Transfer," 3/5/87, (PB88-134275/AS).

NCEER-87-0002 "Experimental Evaluation of Instantaneous Optimal Algorithms for Structural Control," by R.C. Lin, T.T. Soong and A.M. Reinhorn, 4/20/87, (PB88-134341/AS).

NCEER-87-0003 "Experimentation Using the Earthquake Simulation Facilities at University at Buffalo," by A.M. Reinhorn and R.L. Ketter, to be published.

NCEER-87-0004 "The System Characteristics and Performance of a Shaking Table," by J.S. Hwang, K.C. Chang and G.C. Lee, 6/1/87, (PB88-134259/AS).

NCEER-87-0005 "A Finite Element Formulation for Nonlinear Viscoplastic Material Using a Q Model," by O. Gyebi and G. Dasgupta, 11/2/87, (PB88-213764/AS).

NCEER-87-0006 "Symbolic Manipulation Program (SMP) - Algebraic Codes for Two and Three Dimensional Finite Element Formulations," by X. Lee and G. Dasgupta, 11/9/87, (PB88-219522/AS).

NCEER-87-0007 "Instantaneous Optimal Control Laws for Tall Buildings Under Seismic Excitations," by J.N. Yang, A. Akbarpour and P. Ghaemmaghami, 6/10/87, (PB88-134333/AS).

NCEER-87-0008 "IDARC: Inelastic Damage Analysis of Reinforced Concrete Frame - Shear-Wall Structures," by Y.J. Park, A.M. Reinhorn and S.K. Kunnath, 7/20/87, (PB88-134325/AS).

NCEER-87-0009 "Liquefaction Potential for New York State: A Preliminary Report on Sites in Manhattan and Buffalo," by M. Budhu, V. Vijayakumar, R.F. Giese and L. Baumgras, 8/31/87, (PB88-163704/AS). This report is available only through NTIS (see address given above).

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