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Introduction

This volume is an annotated bibliography of recent publications that have come to our attention during 1990. They are all concerned in some way with the reduction of losses stemming from hazards and disasters. The entries are arranged by general subject classification (see the table of contents) and, within individual classifications, alphabetically by author. At the end of the bibliography there are subject and author indexes.

The arrangement of the entries is as follows:

Author (corporate or personal), Title, Document Information,
Date, Number of Pages, Availability (if other than the publisher)

Annotation

Keywords

This is a working bibliography, and while it is necessarily incomplete, it does offer many materials not compiled and indexed elsewhere. It could not have been assembled without the cooperation of the many individuals and organizations who sent us copies of their publications free of charge. We are grateful to everyone who contributed. We would greatly appreciate learning about, or receiving copies of recent publications (books, papers, newsletters, bibliographies, symposium proceedings, etc.) that are relevant to the hazards field.

By the time this volume is published, a number of the listed entries may be available through the National Technical Information Service (NTIS), although they are not indicated as such in their citation.

Entries available from NTIS can be obtained by writing:

National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

EARTHQUAKES AND TSUNAMIS

1. Agbabian, M.S., S.F. Masri and R.L. Nigbor *Evaluation of Seismic Mitigation Measures for Art Objects.* Getty Conservation Institute, Scientific Program Report. Marina del Rey, Calif. 1990. 178 pp. For availability, contact the Getty Conservation Institute, 4503 Glencoe Avenue, Marina del Rey, CA 90292-6537.

The purpose of this research was to quantitatively evaluate some of the earthquake mitigation methods currently being used or being evaluated by the staff of the J. Paul Getty Museum for the support and protection of art objects. The research was accomplished in two phases. Phase 1 consisted of a general study of the earthquake response characteristics of these art objects. It included a classification of art objects, structural and material properties, and dynamic response behavior into earthquake resistance parameters. In Phase 2, specific generic art object/support systems were identified for detailed evaluation, nine generic systems were evaluated, and analytical and experimental analyses were performed to determine the response behavior of the generic systems under simulated earthquake excitations. Basically a technical manual, the document contains information on database development, base-isolation models, and design guidelines. Appendices feature an art object database that contains descriptive and structural data for 43 different art objects or groups of art objects, and a material property database (i.e., marble, limestone, gold).

KEYWORDS Earthquake, structural engineering, structural materials, cultural preservation, seismology, local planning

2 Alexander, David. "Behavior during earthquakes: A southern Italian example." *International Journal of Mass Emergencies and Disasters* 8, no. 1 (1990): 5-29.

The author combines his personal experience of the Basilicata-Campania earthquake (1980) with oral histories of the event collected from 18 of the survivors to analyze social behavior and hazard perception precipitated by the event and its aftershocks. Findings from the study included 1) flight behavior was the prevalent first reaction to the tremors, and fear of being indoors rapidly developed; 2) people were injured as a result of the early stages of emergency panic; and 3) although the results of similar studies were generally confirmed, it was found that anxiety, panic, and flight appear to have been more widespread, and preparedness less common, than in previous sociological studies. Other observations: public places constituted particular points of risk during the disaster; the cost of the earthquake to the Italian Exchequer was US$14,000 million, which absorbed 3-5 percent of the national GNP for five years; and during 1980, anxiety among the populace was heightened by 142 mafia murders in the Naples area, by periodic scares about vector-borne diseases coming from the water supply, and by many buildings posted as unsafe due to structural damage. It was noted that the Church provided considerable psychological support, particularly among the religious.

KEYWORDS Earthquake, social impact, psychological impact, risk perception, case study, sociology, emergency response.

3. Applied Technology Council, *Field Manual: Postearthquake Safety Evaluation of Buildings.* Applied Technology Council, Report no. ATC-20-1. Redwood City, Calif. 1989. Available for $15.00 from ATC, 3 Twin Dolphin Drive, Suite 275, Redwood City, CA 94065. California residents add 7% sales tax. Non-U.S. purchasers need to add $5.00 for shipping

This manual summarizes, for use in the field, the methods contained in ATC Report no. 20-1, *Procedures for Postearthquake Safety Evaluation of Buildings.* Included in both documents are procedures for rapid evaluation, as well as detailed inspection, of wood frame, masonry, tilt-up, concrete, and steel structures; geotechnical

hazards; nonstructural elements; and essential facilities Also included are examples of the procedures, and discussions of human considerations and field safety for damage inspectors following earthquakes.

KEYWORDS Earthquake. building design, structural design, damage assessment, building codes, enforcement, local response.

4. Applied Technology Council. ***Procedures for Postearthquake Safety Evaluation of Buildings.*** Applied Technology Council, Report no. ATC-20. Redwood City, Calif. 1989. Available for $30.00 from ATC, 3 Twin Dolphin Drive, Suite 275, Redwood City, CA 94065. California residents add 7% for sales tax. Non-U.S. purchasers need to add $5 00 for shipping.

ATC has conducted a series of investigations for the state of California and FEMA concerning the evaluation of seismic strength of structures. Report no. ATC-20 documents procedures and guidelines for postearthquake safety evaluation of buildings. The guidelines are written specifically for volunteer structural engineers, building inspectors and engineers from city building departments, and officials from other regulatory agencies who would be required to make on-the-spot evaluations and decisions regarding continued use and occupancy of damaged buildings

KEYWORDS Earthquake, building design, damage assessment, building codes, enforcement, structural design, local response.

5. Arnold, Christopher. ***The 1985 Chile Earthquake: Architectural and Structural Configurations as Determinants of Seismic Performance–Reinforced Concrete Buildings in Vina del Mar.*** Building Systems Development, Inc., San Mateo, Calif 1990. 73 pp. For availability, contact Building Systems Development, Inc., 3130 La Selva, Suite 308, San Mateo, CA 94403.

While building configuration–its overall size and shape–is an acknowledged factor in the capability of structures to withstand earthquake forces, the evidence for its importance remains largely empirical, and in some circumstances, contradictory. This study, for the first time, focuses not on a few selected buildings, but on an entire inventory of buildings that suffered severe damage, moderate or light damage, or no damage at all, in order to ascertain whether correlations exist between configuration characteristics and the incidence of damage. Variables taken into consideration include Chilean building codes, the architectural character of Vina del Mar structures, building orientation, and building size Findings from the study indicate 1) configuration irregularity is a significant factor in damage, but it is not a guarantor of damage; 2) the most significant irregularity was unbalanced resistance elements resulting in eccentricity between the center of mass and resistance, and consequent torsional forces; and 3) correlations definitely exist in sufficient number to justify close architectural/ engineering attention at the beginning of the design process.

KEYWORDS Earthquake, building design, damage assessment, architecture, foreign planning, structural engineering, construction.

6. Barosh, Patrick J. "The hazard from earthquakes in the Boston area." ***Civil Engineering Practice*** 4, no 1 (1989): 65-78.

Northeastern Massachusetts is one of the relatively more seismically active areas in New England, with damaging earthquakes occurring in 1755, 1727, 1638, and 1669. This article discusses tectonic causes of earthquakes in the region, identifies recent studies that have helped establish more reliable hazard zoning maps for the area, and suggests that structural engineers need to pay close attention to subsurface soil and geological conditions when siting or designing buildings in the Boston area.

KEYWORDS Earthquake, local planning, liquefaction, risk assessment, seismology, engineering geology, historical survey

7. Bay Area Regional Earthquake Preparedness Project. *An Ounce of Prevention–Reducing Economic Losses through Hazard Mitigation. Networks* 5, no. 2 (Summer 1990): 2-23. Single copies are available free of charge from BAREPP, Metrocenter, 101 8th Street, Suite 152, Oakland, CA 94607.

This issue of the newsletter focuses on two approaches to earthquake hazard mitigation: planning and controlling future land uses, and making existing structures safer. Over ten short articles discuss topics such as California's comprehensive earthquake hazard reduction program, geology and land use, shaking intensity maps for various potential earthquakes, local government planning and regulation, retrofitting of hazardous buildings, and additional hazard mitigation issues.

KEYWORDS Earthquake, masonry, retrofitting, land use management, mapping, state planning, public policy, local planning, cost-benefit analysis, mapping, legislation-regulation, risk assessment.

8. Bay Area Regional Earthquake Preparedness Project. *Earthquake Vulnerability Analysis for Local Governments.* Bay Area Regional Earthquake Preparedness Project (BAREPP). Oakland, Calif. 1989. 14 pp. Available for $3.00 plus $1.25 postage and handling from the Association of Bay Area Governments, P.O. Box 2050, Oakland CA 94604-2050. Catalog number is P89003BAR.

An earthquake vulnerability analysis is the first step in dealing with the reality of the earthquake threat, and should be part of every community's disaster plan. This document helps local planners to identify what can be done to improve public safety before an earthquake, and indicate where a community may need the most resources after an earthquake. It provides a jurisdiction-specific analysis of potential problems, many of which can be solved. Two major steps are emphasized: 1) the development of base maps with data-specific overlays (a database); and 2) analyzing vulnerability using the information compiled in the database. Lifelines, and building and population vulnerability are dealt with primarily.

KEYWORDS Earthquake, risk assessment, local planning, mapping, data sources.

9. Bay Area Regional Earthquake Preparedness Project. *Earthquake Preparedness Training for Businesses.* Bay Area Regional Earthquake Preparedness Project (BAREPP), cat. no. P90001BAR. Oakland, Calif. 1990. 88 pp. Available for $25.00 plus $5.00 postage and handling from the Association of Bay Area Governments, P.O. Box 2050, Oakland, CA 94604-2050.

This kit contains eight written packets of materials on making plans for earthquake emergencies and training personnel to respond effectively. The packets 1) discuss the need for preparedness training and provide an executive's checklist, 2) discuss the nature of seismic threat to the Bay Area; 3) suggest emergency response assignments for employees, as well as training information for the different response teams; 4) provide information and a checklist for identifying nonstructural hazards; 5) provide a series of checklists for stocking emergency provisions; 6) suggest drills to minimize employee injuries; 7) provide handouts for family and home preparedness; and 8) suggest additional resources for earthquake preparedness. It also has a set of 40 slides on seismic risk in the Bay Area and a ten-minute videotape on reducing nonstructural hazards in the workplace.

KEYWORDS Earthquake, preparedness, local planning, training, disaster exercise, nonstructural measures, risk assessment, business, emergency planning.

10. Bay Area Regional Earthquake Preparedness Project. *Earthquake Ready: Preparedness Planning for Schools.* Bay Area Regional Earthquake Preparedness Project (BAREPP), cat. no. P90002BAR. Oakland, Calif. 1990. 76 pp. Available for $5.00 plus $1.00 postage and handling from the Association of Bay Area Governments, P.O. Box 2050, Oakland, CA 94604-2050.

The six packets of this training kit have been developed to help school personnel create, supplement, and revise their earthquake emergency procedures. BAREPP assembled the packets with the assumption that each school

differs from others in levels of preparedness, levels of commitment, amounts of available resources, and the degree of planning flexibility. Packet 1 is designed for the school administrator (or designee) and presents information on legal requirements and how to begin the planning process. Packet 2 contains information on the earthquake risk in the Bay Area and how to personalize it for students and staff. Packet 3 describes earthquake response procedures and provides a summary of responsibilities by team and, in some cases, by category of position. Packet 4 aids personnel in identifying and reducing hazards caused by nonstructural elements. Packet 5 suggests the types and amounts of emergency supplies that might be kept at the school, and Packet 6 presents information on how to design and conduct drills that will help to evaluate the effectiveness of in-place preparedness measures.

KEYWORDS Earthquake, local planning, schools, preparedness, disaster exercise, nonstructural measures, awareness, emergency planning, legislation-regulation, scenario.

11. Bay Area Regional Earthquake Preparedness Project. ***Earthquake Preparedness for Child Care Providers.*** Bay Area Regional Earthquake Preparedness Project (BAREPP), Oakland, Calif. 1988. Variable paging. Copies can be purchased for $7.00 plus $1.50 for postage and handling from the Association of Bay Area Governments (ABAG), P.O. Box 2050, Oakland, CA 94604-2050.

This planning guide is intended to aid child care providers in developing an earthquake plan that meets an individual center's unique needs. The guide consists of "situation cards" that describe what might occur at a child care center during and immediately after an earthquake, "activity sheets" that contain information necessary to conduct various activities, "work sheets" to be photocopied for the activities, and a "resource list" of earthquake planning information sources. The planning activities range from identifying the need to plan, to identifying actual earthquake hazards, to developing roles and procedures, to documenting the plan. The planning process, which relies on active staff participation, is simple and effective and will benefit any institution that provides shelter and care for children residing in earthquake hazard zones.

KEYWORDS Earthquake, educational materials, children, training, preparedness, schools.

12. Bay Area Regional Earthquake Preparedness Project. *Loma Prieta in Print: A Selected, Annotated Bibliography. Networks* 5, no. 3 (Fall 1990): 2-15. Single copies available free of charge from BAREPP, Metrocenter, 101 8th Street, Suite 152, Oakland, CA 94607.

This thematic issue of the BAREPP newsletter lists publications, video tapes, and slides that cover the Loma Prieta earthquake. The entries are listed according to the following subcategories: general interest, geology and seismology, impacts on structures, lifelines, governmental response, media and communications, social impacts, video tapes and slides, and picture books. Over 80 items are listed. Each entry contains a brief summary of the item and complete ordering information.

KEYWORDS Earthquake, damage assessment, building design, structural design, emergency response, local response, seismology, geology, media, emergency communications, social impact, economic impact, psychological impact.

13 Bay Area Regional Earthquake Preparedness Project. ***Putting the Pieces Together: The Loma Prieta Earthquake One Year Later.*** Bay Area Regional Earthquake Preparedness Project (BAREPP). Oakland, Calif. 1990 253 pp. For availability, contact the Association of Bay Area Governments (ABAG), P.O. Box 55270. Oakland, CA 94604-2050. The price of $30.00 includes the proceedings and several additional materials.

Utilizing major federal funding, BAREPP convened a conference October 15-18, 1990 to determine the lessons learned from the Loma Prieta earthquake and its aftermath The conference examined preparedness and mitigation efforts prior to the quake, political and management issues of disaster response, recovery and reconstruction programs, and mitigation activities since the event. Among the numerous topics addressed in the

volume, separate chapters are given to seismological and geological considerations, geotechnical aspects, the performance of lifelines, buildings, and transportation systems and the implications for future design of these elements, effective emergency management, emotional and psychological aftereffects, economic impacts, emergency public information and the media, the restoration of lifelines, emergency medical services, business recovery, and housing reconstruction.

KEYWORDS Earthquake, federal response, emergency response, recovery, reconstruction, business, housing, emergency medical services, seismology, geology, emergency shelter, media, damage assessment, transportation, lifelines, social impact, psychological impact, economic impact, land use management, volunteers, local response.

14. Bay Area Regional Earthquake Preparedness Project. ***Strengthening Wood Frame Houses for Earthquake Safety.*** Bay Area Regional Earthquake Preparedness Project (BAREPP). Oakland, Calif. 1990. 36 pp. Available from the Association of Bay Area Governments, P.O. Box 2050, Oakland, CA 94604-2050. Catalog no. is P90003BAR. Cost is $3.25 plus $.75 postage and handling.

This booklet describes the hazards that earthquakes present to the owners of wood frame houses and explains how to reduce such hazards. Fifteen ways are presented to make houses safer to live in and the average costs for each strengthening method are set forth. The booklet also contains guidelines for planning modification projects, a list of information sources, numerous construction drawings, and a glossary.

KEYWORDS Earthquake, retrofitting, building design, local planning, economic analysis.

15 Bay Area Regional Earthquake Preparedness Project. *The Once and Future Quake: All About Loma Prieta. Networks 5*, no. 1 (Winter 1990): 2-27. Copies are available free of charge from BAREPP, Metrocenter, 101 8th Street, Suite 152, Oakland, CA 94607.

This issue of the BAREPP newsletter examines in depth the geologic, structural, institutional, and mental health consequences of the Loma Prieta earthquake. Articles discuss replacement housing concerns (as much as 50% of low-income housing was destroyed by the quake); responses of emergency services agencies; local government roles in postearthquake reconstruction, repair, retrofitting, and transportation; the roles of the media; disaster assistance; and disaster recovery. Suggestions are also offered for community planning efforts and the use of federal programs to mitigate future disasters.

KEYWORDS Earthquake, emergency response, recovery, local response, damage assessment, reconstruction, disaster assistance, media, mental health services, lifelines, transportation, emergency planning, state response, psychological impact, social impact.

16. Beatley, Timothy and Philip Berke. "Seismic safety through public incentives: The Palo Alto seismic hazard identification program." ***Earthquake Spectra*** 6, no. 1 (1990): 57-79.

Palo Alto, California has adopted a unique approach to the problem of retrofitting existing seismically vulnerable buildings. The program mandates the preparation and filing of seismic engineering reports and relies on the creation of incentives for voluntary retrofitting. In the autumn of 1988, the authors conducted a study to ascertain the program's development, to identify in detail the specifics of the program, along with its key provisions and requirements, and to determine which factors influenced adoption of the program in its final form. Preliminary results from the study suggest that a relatively high level of compliance with the reporting requirement was achieved, that the hazard disclosure requirement has created substantial incentives for seismic upgrading, and that stakeholder problem recognition, local economic conditions, and a progressive political culture were important factors in the program's success to date.

KEYWORDS Earthquake, example, local planning, incentive, public policy, legislation-regulation, retrofitting.

17. Bertero, Vitelmo V., ed. ***Lessons Learned from the 1985 Mexico Earthquake.*** Earthquake Engineering Research Institute, Publication no. 89-02. El Cerrito, Calif. 1989. 261 pp. Available for $15.00 from the EERI, 6431 Fairmount Avenue, Suite 7, El Cerrito, CA 94530-3624. California purchasers must add 7.25% sales tax. Non-U.S. orders must add 10% for surface shipping.

The Mexico earthquake of 1985 stimulated funding for 26 engineering-related studies from the U.S. National Science Foundation and 39 other studies funded by the Mexican national government. Three bi-national workshops also were convened to examine built-environment issues raised by the earthquake's impact. Over 60 papers in this volume are categorized under seven subject areas: strong ground motion (21 papers); geotechnical engineering and foundations (7 papers); response and performance of structures (13 papers); materials, repair, and retrofitting (12 papers); lifelines and response/mitigation (7 papers); architectural and urban design considerations (2 papers); and cladding and nonstructural components (3 papers). Topics explored in the papers include 1) the organizational and public response to the disaster; 2) damage to glass building components; 3) earthquake-caused injuries as a function of the physical setting in which they occurred; 4) the repair and strengthening of reinforced concrete buildings; and 5) case studies of the performance of concrete buildings.

KEYWORDS Earthquake, damage assessment, nonstructural measures, foreign response, transportation, lifelines, structural engineering, building design, seismology, geology, masonry, search and rescue, morbidity, architecture, emergency medical services, case study, retrofitting.

18. Bolin, Robert, ed. ***The Loma Prieta Earthquake: Studies of Short-Term Impacts.*** University of Colorado, Institute of Behavioral Science, Natural Hazards Research Assessment and Information Center, Monograph no. 50. Boulder, Colo. 1990. 108 pp. Available from the Publications Clerk, Natural Hazards Center, Campus Box 482, University of Colorado, Boulder, CO 80309. Cost is $10.00.

This book provides a concise description of many of the very real human problems that arose during and immediately following the earthquake and offers insights into the various effects of a major earthquake in an urban area. Each of the eleven reports contained in this volume deals with some component of social response to an earthquake, including the building damage assessment process, assessment of damage to urban infrastructure, damages and economic dislocations, earthquake epidemiology, accuracy in media coverage, the reactions of people in house, the psychological impacts of the disaster on law enforcement officers and health-care workers, perceptions and responses to aftershock warnings, gender as a variable in emergency response, the responses of volunteer organizations, and shelter and housing issues in Santa Cruz County.

KEYWORDS Earthquake, damage assessment, urban areas, economic impact, epidemiology, morbidity, media, psychological impact, social impact, disaster workers, public safety, risk perception, local response, emergency response, gender, voluntary agencies, emergency shelter, housing.

19. Brand, Stewart. "Learning from the earthquake: Volunteers crucial in disasters." ***Whole Earth Review,*** no. 68 (Fall 1990). 2-15. Back issues of the magazine are available for $7.00 from 27 Gate 5 Road, Sausalito, CA 94965.

This first-person account of voluntary assistance following the Loma Prieta earthquake is useful in that it treats the experience in a lessons-learned manner rather than as drama. Observations offered include: only a small portion of the people present offered emergency help, despite romanticized press accounts to the contrary; collect one's thoughts after the shaking ends, then collect tools!; if trapped people can still function physically, enlist their help in the extrication process; and the existing earthquake response literature focuses mostly on self-preservation rather than on providing assistance to others.

KEYWORDS Earthquake, emergency response, local response, disaster assistance, volunteers.

20. California Governor's Office of Emergency Services. ***Law Enforcement Emergency Operations Report: Loma Prieta Earthquake.*** California Governor's Office of Emergency Services, Law Enforcement Division. Sacramento, Calif. 1990. 50 pp. Single copies available free of charge from the Governor's Office of Emergency Services, 2151 East D Street, Suite 203A, Ontario, CA 91764.

In the U.S., law enforcement agencies typically perform key roles in disaster response, and this was certainly true following the Loma Prieta earthquake. A few months after the quake, a detailed survey of Bay Area law enforcement agencies was undertaken to delineate specific areas of the law enforcement and justice systems affected by the Loma Prieta earthquake. These areas included facilities and operations, planning, personnel and staffing, criminal activity, communications, mutual aid operations, and equipment. This report points out numerous lessons learned during the emergency response period and presents many ideas for the improvement of training, organization, and operations to manage such disasters. Typical lessons learned included: 1) an emergency generator was too small for the load requirements and, in another instance, only four hours of fuel was available for the emergency generator; 2) manual gasoline pumps were noted as a necessity in many postdisaster survey responses; 3) many agencies felt there was an acute need for more interagency radio coordination both in the mutual aid context and in damage assessment procedures; and 4) non-electronic police records need to be secured against their being dumped into aisles by strong ground motion.

KEYWORDS Earthquake, emergency response, local response, emergency communications, public safety, damage assessment, preparedness, social impact, training.

21. California Seismic Safety Commission. ***A California Homeowners' Earthquake Insurance Program.*** California Seismic Safety Commission, Report no. CSSC 90-02. Sacramento, Calif. 1990. 39 pp. For availability, contact the California Seismic Safety Commission, 1900 K Street, Suite 100, Sacramento, CA 95814.

This committee paper recommends to the CSSC a program that will help to deal with the potentially devastating financial problems for homeowners arising out of a major earthquake in California. Because insurance is but one element of recovery financing, the committee also makes recommendations that could affect state and federal laws regulating disaster assistance, banking, taxes, and liability. As a partial hedge against recovery costs, the committee recommends implementation of a state-sponsored homeowners' insurance program that would supplement existing homeowners' policies and be administered by the same insurer that provides the basic homeowners' coverage. Premiums would be paid to, and claims would be paid from, a state-sponsored, tax-exempt fund. Home mortgage lenders would require earthquake insurance as a condition of granting a loan. Homes would be inspected, with the cost of inspection being paid by the buyer or seller and premiums would vary according to the degree of risk inherent in the structure and its location. It is assumed that the program would 1) encourage earthquake hazard mitigation, 2) spread the risk of earthquake loss, 3) reduce requirements for disaster assistance now paid by the state after a damaging earthquake, and 4) speed economic recovery by coordinating various financial resources.

KEYWORDS Earthquake, insurance, state planning, disaster assistance, recovery.

22. Canby, Thomas Y. "Earthquake-Prelude to the big one?" ***National Geographic*** (May 1990): 76-105.

This article presents an account of the Loma Prieta earthquake (1989) as seen through the eyes of many of the people who experienced the event, together with descriptions of the seismological features of the quake as explained by scientists and geologists. Numerous photographs and diagrams aid the reader in understanding why the earthquake occurred and how it affected Bay Area inhabitants and the built environment.

KEYWORDS Earthquake, damage assessment, local response, emergency response.

23. Comfort, Louise K. ***Learning from Risk: Organizational Interaction Following the Armenian Earthquakes.*** University of California at Berkeley, Institute of Governmental Studies, Working Paper 89-23. Berkeley, Calif. 1989. 34 pp. Available from the Institute of Governmental Studies, University of California, Berkeley, CA 94720.

The magnitude 6.9 earthquake which struck Soviet Armenia on December 7, 1988, together with a magnitude 5.8 aftershock that occurred four minutes later, caused massive death and destruction. Nearly one-third of Armenia's 3.5 million people were affected to some degree, either as victims, friends or relatives of victims, or as disaster assistance workers. This essay identifies some of the major organizational problems that appeared during the emergency response period, particularly those which involved some degree of international planning and coordination. Observations offered by the author include 1) civil defense units, with legal responsibility for response in disaster situations, were available only for the two major population centers affected. Rural areas and villages had to improvise relief and rescue operations; 2) disaster assistance poured into the area from international, Soviet, and foreign sources; 3) the usual 3:1 ratio of injured to killed was reversed in Armenia; 4) problems involving communication were complicated by the fact that the language of coordination was Russian, while the language of those needing aid was Armenian; and 5) the first non-Soviet rescue team to reach the disaster area (a French team) arrived 79 hours after the earthquake.

KEYWORDS Earthquake, emergency response, local response, foreign response, international response, interorganizational, damage assessment, search and rescue, emergency medical services, disaster assistance.

24. Cook, Stuart. ***Seismic Hazards and Local Land Use Planning: A Review of California Practice.*** University of California-Berkeley, Center for Environmental Design Research, CEDR-WP01-90. Berkeley, Calif. 1987. 40 pp. Available for $4.50 from the Center for Environmental Design Research, 390 Wurster Hall, University of California, Berkeley, CA 94720.

A product of a NSF-sponsored research effort entitled "Microzonation: Methods of Linking Land Use Planning and Geologic Knowledge," this reissued paper surveys the history of legislation, practice, and research concerning hazard-related land use planning in California. It presents the author's study of seismic safety elements incorporated into local California land use planning and concludes by discussing the implications for seismic microzonation. Much of the document deals with the employment of hazard mapping and spatial seismic hazard data as mitigative tools.

KEYWORDS Earthquake, microzonation, mapping, local planning, land use management, legislation-regulation, historical survey, state planning, risk assessment.

25. Cornwall, Charles. ***Seismic Hazards and Environmental Impact Assessment: A Review of Current California Practice.*** University of California-Berkeley, Center for Environmental Design Research, CEDR-WP02-90. Berkeley, Calif. 1987. 26 pp. Available for $4.50 from the Center for Environmental Design Research, 390 Wurster Hall, University of California, Berkeley, CA 94720.

A product of a NSF-sponsored research effort entitled "Microzonation: Methods of Linking Land Use Planning and Geologic Knowledge," this paper reports on a case-study approach used to examine the use of seismic hazard information in environmental impact reports (EIRs). He concludes that, although EIRs may be the primary local forum for public discussion of seismic risks in California, they often fall short of the California Environmental Quality Act mandate to identify and avoid potential environmental impacts. Comments include 1) current (1987) EIR guidelines give almost no guidance on seismic hazard issues, 2) EIR guidelines should require compliance with a jurisdiction's Seismic Safety Elements, and 3) EIRs should clearly distinguish between seismic hazards, risks, and impacts: a standard risk assessment methodology is needed.

KEYWORDS Earthquake, zoning, local planning, state planning, risk assessment, legislation-regulation, land use management.

26. Dames & Moore. ***The October 17, 1989 Loma Prieta Earthquake.*** Dames & Moore. Los Angeles, Calif. 1989. 29 pp. For availability, contact Dames & Moore, 911 Wilshire Boulevard, Suite 700, Los Angeles, CA 90017. Attn: Craig Taylor.

An engineering firm, Dames & Moore has prepared this well-illustrated special report which outlines the structural damage caused by the earthquake. Separate sections address geologic and seismologic aspects of the tremor, liquefaction, infrastructure vulnerability, building damages, damage to data processing and manufacturing facilities, and the failure of nonstructural building elements. Among other findings, the report reveals that 1) most of the damage to data processing equipment and facilities was caused by equipment sliding or overturning; 2) damage assessments yielded very few surprises; and 3) the duration of strong ground shaking was only 8 to 10 seconds, a much shorter time period than empirical data would suggest for a magnitude 7.1 event. The report concludes with lessons learned from Loma Prieta that can be applied to future earthquake preparedness measures.

KEYWORDS Earthquake, local response, damage assessment, seismology, geology, nonstructural measures, emergency planning, lifelines, liquefaction, emergency response.

27. Degenkolb. ***Putting the Loma Prieta Earthquake into Perspective.*** Degenkolb 90.1. 1990. 12 pp. Single copies available free from H.J. Degenkolb Associates, 350 Sansome Street, Suite 900, San Francisco, CA 94104.

Following the Loma Prieta earthquake, members of the Degenkolb engineering firm studied the effects of the earthquake on buildings and other structures. This issue of the newsletter discusses what worked and what failed, San Francisco's "red-tagging" problem; microzonation; seismic standards for essential, residential, and commercial facilities, and the allocation of research funds.

KEYWORDS Earthquake, damage assessment, building design, masonry, emergency response, local response, zoning, local planning, retrofitting, structural engineering.

28. Earthquake Engineering Research Institute. ***Loma Prieta Earthquake, October 17, 1989: Preliminary Reconnaissance Report.*** Earthquake Engineering Research Institute, Report no. EERI 89-03. El Cerrito, Calif. 1989. 59 pp. Available from the EERI, 6431 Fairmount Avenue, Suite 7, El Cerrito, CA 94530-3624. The document is free to all EERI members. For others, the cost is $10.00 (California residents add 7.25% tax; residents outside the U.S. need to add $1.35. for surface shipping).

Shortly after the earthquake, the EERI, in conjunction with the National Research Council, dispatched teams of scientists and engineers to investigate the effects of the magnitude 7.1 earthquake. This report includes pictures and diagrams, summarizes information gathered by team members during the early stages of the investigation, and contains observations on seismology, strong motion records, geotechnical aspects, building and structural performance, lifeline systems, social impacts, emergency response, fires caused by the tremor, hazardous facilities, and urban planning. Items of interest include 1) San Francisco had 27 structural fires and more than 500 reported incidents of fire during the seven hours following the earthquake. Berkeley had one major fire and Santa Cruz reported about two dozen buildings destroyed by fire; 2) much of the spectacular damage caused by Loma Prieta was suffered by precode buildings, particularly of the unreinforced masonry type; and 3) significant damage was experienced by hazardous facilities, water lines, and water treatment and storage facilities.

KEYWORDS Earthquake, lifelines, damage assessment, building design, structural design, seismology, geology, social impact, structural fire, emergency response, hazardous facilities.

29. Earthquake Engineering Research Institute. ***Proceedings of the 2nd Japan-United States Workshop on Urban Earthquake Hazards Reduction.*** Earthquake Engineering Research Institute (EERI). El Cerrito, Calif. 1990. 358 pp. Available for $20.00 from the EERI, 6431 Fairmount Avenue, El Cerrito, CA 94530.

Held July 27-29, 1988 at Tokai University, Shimizu, Japan, the Workshop focused on earthquake mitigation efforts being formulated or implemented primarily in the U S. and Japan, while providing the 170 attendees with a forum for the exchange of information on urban earthquake problems. Workshop discussions centered on six areas of concern. policy problems associated with earthquake predictions and warnings; awareness strategies for the public and private individuals; estimates for earthquake vulnerability and damage reduction capabilities; fire and hazardous materials releases following an earthquake; short-term emergency response, and long-term recovery and reconstruction. The book contains four keynote speeches, and key papers, abstracts, and a summary from each of the six working group sessions. Each of the summary papers discusses the state-of-the-art of mitigation measures associated with the specific concern, identifies problems remaining to be solved, and suggests areas of possible collaborative research. Features of the proceedings volume include papers dealing with the policy implications of earthquake predictions, and a conceptual discussion about estimating losses due to earthquakes.

KEYWORDS Earthquake, prediction, loss estimation, cross cultural study, structural fire, hazardous facilities, warning responses, retrofitting, recovery, reconstruction, building design, federal planning, state planning, foreign planning, awareness.

30. Earthquake Engineering Research Institute. ***Proceedings, Fourth U.S. National Conference on Earthquake Engineering, Volume I.*** Earthquake Engineering Research Institute (EERI). El Cerrito, Calif. 1990. 1050 pp. For availability, contact the Inter-Library Loan office at a local library.

Besides containing sections on ground motion and seismicity, lifelines and transportation systems, and seismic risk analysis, this volume contains a 122-page section dealing with seismic aspects of urban design, socioeconomic impacts, and public policy. This last-named section presents 13 papers on topics such as the effects of a moderate earthquake on local preparedness, seismic risk methods for earthquake insurance, and the use of opinion surveys in planning earthquake risk reduction programs. A special section entitled "Learning from Earthquakes" presents articles on using an artificial intelligence approach to evaluate lessons learned from destructive earthquakes, and on the performance of auxiliary and portable water supply systems after the Loma Prieta earthquake. Other papers of interest deal with the neighborhood impacts of the Los Angeles seismic ordinance, and with the cost and affordability of retrofitting unsafe buildings in San Francisco.

KEYWORDS Earthquake, urban planning, seismology, damage assessment, insurance, risk assessment, education, local planning, schools, federal planning, state planning, foreign planning, retrofitting, reconstruction, foreign response, structural design, local response, lifelines, transportation, structural engineering, social impact, public policy, legislation-regulation, computer application.

31. Earthquake Spectra. ***Loma Prieta Earthquake Reconnaissance Report. Earthquake Spectra*** 6–Supplement (May 1990): 1-448. Available for $30.00 from EERI, 6431 Fairmount Avenue, Suite 7, El Cerrito, CA 94530. California residents add 7.25% sales tax; non-U.S. purchasers add $3.00 for surface mail.

Shortly after the Loma Prieta occurred, the Earthquake Engineering Research Institute, in conjunction with the National Research Council, dispatched teams of scientists and engineers to investigate its effects. The numerous findings in this reconnaissance report are organized into eleven sections: introduction and overview; geosciences; ground motion; geotechnical aspects; buildings; bridge structures; industrial facilities; lifelines; architecture, building contents, and building systems; urban planning; and socioeconomic impacts and emergency response. Many important findings are reported in the volume, most of which seem to confirm lessons learned from prior disasters. A genuine surprise which emerged from the tremor was that, contrary to expectations about how people respond to warnings, it appears that affected individuals did not seek information after the earthquake and in fact "tuned out" information about possible aftershocks and other dangers. Other findings: the principal economic impacts were experienced in the smaller communities near the quake's epicenter; the local media did a much better and more balanced job of reporting the event than did the national networks; and overall, the medical response was good

KEYWORDS Earthquake, seismology, geology, building design, damage assessment, social impact, economic impact, business, structural design, lifelines, architecture, nonstructural measures, emergency response, local response.

32. Earthquake Spectra. *Seismic Isolation*–theme issue. ***Earthquake Spectra*** 6, no. 2 (1990): 161-432. For availability, contact the EERI, 6431 Fairmount Avenue, Suite 7, El Cerrito, CA 94530.

Seismic or base isolation as a means of protecting structures from earthquake-induced ground motion appears to be a concept that has been around for nearly 100 years. This theme issue of the EERI journal consists of 15 articles which explore the problems and promises of this technology. Nine papers deal with technical aspects of base isolation, such as structural design criteria, engineer peer review responsibilities, and applications of the technique in New Zealand and Mexico City. Papers which examine social aspects of base isolation deal with 1) information needed to disseminate the technology, 2) the identification and utilization of educational channels to acquaint potential users of the merits of the technology, 3) economic considerations, 4) impediments to its effective implementation, and 5) a global perspective on the history, application, and performance of base isolation. Observations offered in the papers include 1) retrofitting with base isolation may be feasible in only one out of every eight buildings; 2) the technique's implementation has been slower in the U.S. than in New Zealand and Japan; 3) the isolation system is only as good as it is fabricated and installed; and 4) procedures need to be developed for inspection and maintenance of the isolator systems.

KEYWORDS Earthquake, structural engineering, structural design, building design, economic analysis, historical survey, education, information transfer, building codes, foreign planning.

33. EQE Engineering. ***The December 28, 1989 Newcastle Earthquake.*** EQE Engineering. San Francisco, Calif. 1990. 8 pp. Available for $3.00 from EQE Engineering, 595 Market Street, 18th Floor, San Francisco, CA 94105.

On December 28, 1989 the first earthquake to cause fatalities in Australia's history struck the city of Newcastle and the surrounding Hunter Valley region of New South Wales. While the tremor registered a comparatively mild magnitude 5.5, the proximity of the epicenter to Newcastle, combined with a lack of seismic design incorporated into the local building stock, resulted in far greater damage than is usually associated with such a moderate quake. The earthquake lasted only five seconds, but it killed 12 people, damaged over 3,000 buildings, and caused total losses estimated at over US$900 million. This report discusses the types of damage sustained by industrial facilities, residences, and commercial buildings and comments on the need for seismic building regulations in areas considered to be marginally threatened by damaging earthquakes.

KEYWORDS Earthquake, foreign planning, damage assessment, lifelines, building codes.

34. EQE Engineering. ***The July 16, 1990 Philippines Earthquake: A Quick Look Report.*** EQE Engineering. San Francisco, Calif. 1990. 47 pp. Single copies available free of charge from EQE Engineering, 595 Market Street, 18th Floor, San Francisco, CA 94105.

A severe magnitude 7.7 earthquake struck the island of Luzon on July 16, 1990, killing at least 1,700 people and leaving approximately 800 still missing two weeks later. Over 4,000 homes and commercial and public buildings were damaged beyond repair. This reconnaissance report provides information about the damage sustained by buildings, industrial facilities, structures, port facilities, and lifelines. Conclusions drawn by the investigators include 1) the distance from the fault rupture was not the most important variable in determining the extent of damage; 2) the most significant and long-lasting effect of the earthquake was the destruction of much of the nation's transportation infrastructure; and 3) damage caused by the event was generally predictable.

KEYWORDS Earthquake, damage assessment, emergency response, foreign response, structural design, building design, liquefaction, lifelines, landslide, seismology.

35. EQE Engineering. ***The October 17, 1989 Loma Prieta Earthquake.*** EQE Engineering. San Francisco. Calif. 1989. 40 pp. Single copies available free of charge from EQE Engineering, 595 Market Street, 18th Floor, San Francisco, CA 94105.

This post-disaster report presents information about the Loma Prieta earthquake's effects on commercial buildings, industrial facilities, lifelines, transportation systems, residential buildings, seismicity, and the fire caused by the quake. Findings from the investigation include 1) little of the damage incurred was unexpected to the engineering and technical communities; 2) the present disaster potential in California is at least ten times greater in 1989 than in 1906 due to population density and economic development; and 3) the earthquake should be considered a major disaster, and in general, society was not prepared for it.

KEYWORDS Earthquake, damage assessment, structural engineering, seismology, geology, structural fire, lifelines, transportation, local response, emergency response, structural design, building design.

36. French, Stephen P. and Gary G. Rudholm. "Damage to public property in the Whittier Narrows earthquake: Implications for earthquake insurance." ***Earthquake Spectra*** 6, no. 1 (1990): 105-123.

Significant damage in the Los Angeles area was caused by the Whittier Narrows earthquake of October 1, 1987. Research conducted by the authors attempts to ascertain damage to lifeline facilities and buildings owned by local governments in the Whittier area and considers the funding mechanisms used to rebuild them. Following a general discussion of federal and state disaster assistance mechanisms, the article details the types and costs of public sector damage in each of six local jurisdictions. Findings from the study indicate that 1) nearly half of the total damage caused by the earthquake occurred to public buildings; 2) earthquake damage to public buildings, in particular, comprises a much larger portion of total damages than is generally the case for other types of natural disasters. This differential in damage distribution suggests that disaster relief mechanisms designed for floods and hurricanes may be inappropriate for earthquakes; and 3) it is arguable that insuring public buildings with private companies is a better economic strategy than rebuilding public facilities with disaster assistance funds.

KEYWORDS Earthquake, insurance, damage assessment, local response, lifelines, recovery, case study, disaster assistance, federal response, state response.

37. Gori, Paula L. and Walter W. Hays, eds. ***Assessment of Regional Earthquake Hazards and Risk Along the Wasatch Front, Utah–Volume III.*** U.S. Dept. of the Interior, Geological Survey, Open-File Report no. 88-680. Reston, Va. 1988. 155 pp. Available from the USGS, Books and Open-File Reports Section, Federal Center, Box 25425, Denver, CO 80225. Paper copy: $23.75; microfiche: $4.00.

This report continues an ongoing USGS effort to provide accurate earth science information about earthquake hazards along the Wasatch Front to public officials, design professionals, land use planners, emergency managers, and the research community. It contains three papers on loss estimation that were unavailable at the time Volume II (USGS Open-File Report 87-585) was published. The papers are entitled "Earthquake Losses in Central Utah," by S.T. Algermissen, et al.; "Isoseismals of Some Historical Earthquakes Affecting the Wasatch Front Area, Utah," by Margaret Hopper; and "Seismic Risk Methods and Estimates for Utility Systems and State-Owned Buildings along the Wasatch Front," by Craig E. Taylor, et al.

KEYWORDS Earthquake, risk assessment, loss estimation, state planning, lifelines, historical survey, seismology, building design.

38. Gori, Paula L., ed. ***Assessment of Regional Earthquake Hazards and Risk Along the Wasatch Front, Utah–Volume IV.*** U.S. Dept. of the Interior, Geological Survey, Open-File Report no. 90-225. Reston, Va. 1990. 453 pp. Available from the USGS, Books and Open-File Reports Section, Box 25425, Federal Center, Denver, CO 80225. Paper copy: $68.75; microfiche: $4.00.

This report is part of a USGS effort to provide accurate earth science information to all parties interested in mitigating earthquake hazards along the Wasatch Front, Utah. It contains 13 papers that focus on issues related to the practical implementation of earthquake hazards information. Among the topics discussed are the effective utilization of interactive hazard reduction workshops, a database for urban seismic hazards studies, land use planning at the county level, and public perceptions about how earthquake mitigation policies are being implemented. Detailed county-level land use planning guides are provided for landslides, surface fault rupture, rock-fall hazards, debris flow hazards, liquefaction, and subsidence caused by tectonic movement. A lengthy essay about the exchange of information between researchers and users introduces the publication.

KEYWORDS Earthquake, seismology, state planning, local planning, subsidence, land use management, perception, urban areas, landslide, debris flow, liquefaction, information transfer, research application, geology

39. Hamilton, Robert M. and Arch C. Johnston, eds. ***Tecumseh's Prophecy: Preparing for the Next New Madrid Earthquake.*** U.S. Dept. of the Interior, Geological Survey, Circular no. 1066. Reston, Va. 1990. 30 pp. Single copies available free of charge from the USGS, Books and Open-File Reports Section, Federal Center, Box 25425, Denver, CO 80225.

This publication contains a proposed plan for a five-year program to reduce the vulnerability of the central U.S. to damage and casualties due to major earthquakes occurring in the New Madrid seismic zone. The plan was put together by a group of federal, state, academic, and private industry officials at a 1989 workshop in Memphis, Tennessee. The proposed program would include scientific research on the earthquake potential of the zone as well as investigations of ways to improve earthquake preparedness and mitigation. Specifically, the plan proposes five goals: 1) implement earthquake hazard mitigation measures; 2) improve preparedness for earthquakes of magnitude 6.0 or greater; 3) establish a modern seismic network in the New Madrid zone to monitor earthquakes and determine the nature of resulting ground motion; 4) locate faults that could cause destructive earthquakes, determine recurrence rates of New Madrid quakes, and delineate areas of potential damage; and 5) improve seismic risk assessment. Of particular interest is a discussion about the difficulties encountered in establishing recurrence rates for intraplate earthquakes.

KEYWORDS Earthquake, prediction, regional planning, preparedness, seismology, risk assessment, intergovernmental.

40. Hansen, Gladys and Emmet Condon. ***Denial of Disaster: The Untold Story and Photographs of the San Francisco Earthquake and Fire of 1906.*** San Francisco, Calif.: Cameron and Company. 1989. 160 pp. $29.95. The address of Cameron and Company is 543 Howard Street, San Francisco, CA 94105.

Illustrated with old postcards, paintings, and over 300 photographs never before published, this book is more than a detailed anecdotal account of the "Great Earthquake and Fire of 1906." It includes a chapter entitled "The Politics of Disaster" that recounts the efforts of elements of the San Francisco business community to mount a public relations campaign to offset bad publicity created by the quake (publicity that might deter investment capital and cheap labor immigration) Other topics explored include the community's recovery and reconstruction efforts and the effects of the earthquake on the city's numerous ethnic groups. A closing chapter, "The Future of San Francisco," discusses earthquake preparedness measures instituted by the city, along with dangers San Franciscans still face should another great tremor strike the area.

KEYWORDS Local response, business, emergency response, recovery, reconstruction, preparedness, local planning, politics, earthquake, public relations, ethnic groups, social impact, economic impact.

41. Hays, Walter W., ed. ***A Workshop on "USGS's New Generation of Probabilistic Ground Motion Maps and Their Applications to Building Codes."*** U.S. Dept of the Interior, Geological Survey, Open-File Report no. 89-364. Reston, Va. 1989. 118 pp. Available from the USGS, Books and Open-File Reports Section, Federal Center, Box 25425, Denver, CO 80225. Cost is $18.75 in paper; $4.00 in microfiche.

This proceedings volume contains 23 papers that examine a number of topics associated with compiling and utilizing probabilistic ground motion maps for seismic hazard reduction purposes. Comments are offered on a description of the design earthquake, the history of probabilistic ground motion maps prepared by the USGS, how a new generation of maps may affect existing building codes, and insurance industry needs. The overall goal of the workshop was to identify the technical issues that need resolution so that they would not limit the application of new maps to existing building codes.

KEYWORDS Earthquake, seismology, mapping, risk assessment, building codes, geology.

42. Holzer, Thomas L and Thomas D. O'Rourke, eds. ***Effects of the Loma Prieta Earthquake on the Marina District, San Francisco, California.*** U.S. Dept. of the Interior, Geological Survey, Open-File Report no. 90-253. Menlo Park, Calif. 1990. 138 pp. Available from the USGS, Open-File Reports Section, Federal Center, Box 25425, Denver, CO 80225. Paper copy: $19.75; microfiche: $4.00. Papers have references.

This publication is the result of on-site investigations conducted immediately following the Loma Prieta earthquake. Teams of scientists from the USGS and Cornell University were dispatched to examine damage to structures in the Marina District. Although the findings are preliminary, the report was released early to be used as a guide to reconstruction and future planning in the Marina area. Primarily technical information is included, but there are some sections that may be of interest to local decision makers, including information on the types of structural damage that occurred and the performance of pipeline systems in the Marina. There are seven papers in the report dealing with topics such as the types of structural damage, natural and artificial deposits in the Marina area, ground deformation and liquefaction, and ground motion amplification.

KEYWORDS Earthquake, liquefaction, damage assessment, lifelines, building design, seismology, geology, structural engineering, local planning.

43 International Masonry Institute. ***Mexico Earthquake–September, 1985.*** International Masonry Institute. Washington, D.C. 1986. 71 pp. For availability, contact the International Masonry Institute, 823 15th Street, N.W., Washington, DC 20005.

A reconnaissance team of structural engineers visited Mexico City shortly after the quake in order to evaluate the performance of all types of buildings, emphasizing those structures that incorporated masonry elements in their construction. This report correlates ground motion data with local soil conditions and with various types of conventional building design. Findings include 1) older, low-rise masonry construction generally performed well; 2) modern medium- and high-rise framed structures with masonry infills generally performed better than similar structures without infills; and 3) buildings which performed poorly often were designed with abrupt changes in structural stiffness or strength from one level to another, with unnecessarily heavy floors, and with inadequate separation between adjacent structures, often resulting in hammering damage.

KEYWORDS Earthquake, masonry, building design, damage assessment, building codes, structural engineering, architecture, seismology.

44 International Masonry Institute. ***The Loma Prieta, California Earthquake of October 17, 1989: Observations Regarding the Performance of Masonry Buildings.*** International Masonry Institute. Washington, D.C. 1990. 40 pp. For availability, contact the International Masonry Institute, 823 15th Street, N.W., Washington, DC 20005.

A team of seven professional engineers, experienced in masonry construction and seismic design, assessed the performance of buildings constructed of brick, concrete block, and stone under stresses caused by the Loma Prieta quake. Among the findings, it was noted that 1) properly engineered and constructed modern masonry buildings appear to have performed well, 2) unreinforced masonry buildings that had been retrofitted for seismic safety also appear to have performed well; 3) failure of some masonry veneer systems was caused by improper, inadequate, missing, or corroded anchoring; and 4) buildings with flexible structural frames, designed to deform

under seismic loads, appeared to experience damage to exterior claddings when insufficient provisions were made to accommodate the deformations. Recommendations and numerous photographs of damaged buildings supplement the text.

KEYWORDS Earthquake, damage assessment, building design, masonry, structural engineering, construction, retrofitting.

45. Jacob, Klaus and Carl Turkstra, eds. ***Earthquake Hazards and the Design of Constructed Facilities in the Eastern United States.*** New York: New York Academy of Sciences. 1989. 457 pp. $114.00.

The 31 papers in this proceedings volume review the scientific basis for assessing earthquake hazards in the eastern U.S. and develop a realistic estimate of the risk associated with such hazards. It also appraises alternative policies for the engineering design community and related regulatory agencies in response to these risks. Chapters are included on seismicity and tectonics; seismic ground motions; probabilistic seismic hazards assessment; soil liquefaction; the theoretical basis for earthquake engineering design in regions with moderate seismic hazards; seismic design of buildings, special structures, and nonstructural components; seismic rehabilitation of structures; and public policy and urban design standards. The public policy chapter contains papers on changes in design requirements in the Boston area, seismic building code efforts in the central U.S., an estimate of earthquake losses for a large eastern urban center, and a scenario for an earthquake in New York City

KEYWORDS Earthquake, building design, structural design, building codes, seismology, liquefaction, retrofitting, lifelines, state planning, local planning, scenario, masonry, risk assessment, loss estimation.

46. Japan National Land Agency. ***Outline of Countermeasures for the Tokai Earthquake.*** Japan National Land Agency, Disaster Prevention Bureau, Earthquake Disaster Countermeasures Division. Undated. 21 pp.

This booklet contains a wealth of information about Japan's efforts to prepare for a major earthquake. Beginning with a discussion of earthquake prediction programs in the Tokai area, the booklet presents an outline of the Large-Scale Countermeasures Act, recapitulates progress made in earthquake mitigation by Japan since World War II, and discusses the process under which an earthquake warning statement can be issued. Other features of the booklet include guidelines for the formulation of an earthquake mitigation plan, tax incentives used to encourage mitigation measures, and projected fiscal expenditures for implementation of the nation's seismic preparedness program. Flow charts and other graphics help organize the information into a readily understood form.

KEYWORDS Earthquake, prediction, foreign planning, legislation-regulation, incentive, foreign funding, warning systems, preparedness, emergency planning.

47. Jones, Nicholas P., et al. "Considerations in the epidemiology of earthquake injuries." ***Earthquake Spectra*** 6, no. 3 (1990): 507-528.

In July 1989, a workshop held at The Johns Hopkins University in Baltimore attracted a group of participants whose professional interests were directly or peripherally involved in the research, planning, mitigation, and response aspects of earthquake-induced morbidity or mortality. The purpose of the workshop was to lay the foundations of a research agenda for this emerging field. This paper presents a condensation and summary of the workshop's achievements, its discussions, and its important conclusions. Topics addressed included data needs and collection methods, casualty estimation modeling, problems associated with search and rescue operations, structural engineering considerations, and behavioral and morbidity/mortality issues. Major research needs identified during the workshop included 1) the development of standard data collection criteria and reporting forms; 2) the study of historical events to help assimilate a comprehensive database; and 3) the development of functional models for casualty estimation and needs assessment.

KEYWORDS Earthquake, morbidity, mortality, search and rescue, epidemiology, emergency medical services, structural engineering, loss estimation, data sources.

48. Kockelman, William J. ***Reducing Earthquake Hazards in Utah: The Crucial Connection Between Researchers and Practitioners.*** U.S. Dept. of the Interior, Geological Survey, Open-File Report 90-217. Menlo Park, Calif. 1990. 116 pp. Order from the USGS, Books and Open-File Reports Section, Federal Center, Box 25425, Denver, CO 80225 Paper copy: 18.00; microfiche: $4.00.

Emergency managers, elected officials, and other persons responsible for the implementation of hazard reduction programs often do not possess the technical training needed to assimilate scientific and engineering knowledge into their mitigation projects The author contends that a successful earthquake hazards program should include five components, each a prerequisite for its successor: 1) conducting technical studies that will identify earthquake phenomena that could prove hazardous, such as potential earthquake magnitude, likelihood of occurrence, source, and structural response; 2) translating the results of these studies into reports and maps that will adequately convey the nature and extent of the hazards to nontechnical users; 3) transferring the translated information to those who will, or are required to use it, while providing educational and advisory assistance as needed; 4) selecting and using appropriate hazard reduction techniques, such as regulation, legislation, and education; and 5) evaluating and revising the program after it has been implemented. The report presents numerous examples of the successful employment of the program components in Utah.

KEYWORDS Earthquake, local planning, state planning, information transfer, research application, example, educational materials.

49. Lew, H.S., ed. ***Performance of Structures During the Loma Prieta Earthquake of October 17, 1989.*** U.S. Dept. of Commerce, National Institute of Standards and Technology, Center for Building Technology, NIST Special Publication no. 778. Gaithersburg, Md. 1990. 201 pp. For sale from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

The day following the Loma Prieta earthquake, committees from the U.S. Congress requested the NIST to investigate earthquake damage including the collapsed section of the Nimitz Freeway and other bridge structures. The findings of the investigative team–which included civil, fire safety, geotechnical, and structural engineers–are published in this volume. Information is grouped under five headings: "Seismicity and Strong Motion Data"; "Surficial Geology and Foundation Failures" (relation of subsurface conditions to earthquake damage); "Performance of Buildings" (in San Francisco, Oakland, and the epicentral area); "Performance of Bridge and Highway Structures" (the Nimitz Freeway collapse, Highway 101, Bay Bridge); and "Performance of Fire Protection Systems." Conclusions and recommendations from the survey include 1) most building and lifeline structures in the epicentral and Bay areas performed well; 2) ground failures, including landslides and liquefaction, were frequent in both epicentral and Bay areas; 3) techniques should be developed for the reduction of pounding damages caused by one building bumping into an adjacent building; and 4) some of the older buildings retrofitted before the earthquake performed well, while others failed. Numerous photographs and illustrations supplement the text.

KEYWORDS Earthquake, damage assessment, structural design, building design, seismology, lifelines, geology, structural fire, structural engineering.

50. Massachusetts Civil Defense Agency. ***Metropolitan Boston Area Earthquake Loss Study: Loss Analysis Committee Report and Recommendations.*** Massachusetts Civil Defense Agency. Framingham, Mass. 1990. 60 pp. Single copies available free of charge from the Director, Massachusetts Civil Defense Agency and Office of Emergency Preparedness, 400 Worcester Road, P O. Box 1496, Framingham, MA 01701.

This report assesses the potential effects on the Boston area of an earthquake of the order of the 1755 Cape Ann quake (estimated magnitude 6 25), the largest known seismic event in the region in historic time. The

committee's review, based on an earlier engineering study, indicates that the recurrence of such an event would likely cause $2-10 billion damage, with the best estimate being $5-6 billion in the Boston metropolitan area alone. Most physical damage would be in the many areas of filled land in the Boston region–places where the presence of unconsolidated soils and many old, unreinforced masonry buildings amplifies the hazard. The study analyzes not only damage to virtually all kinds of buildings and infrastructure, but also interruption of services as well as injuries and deaths that would occur if the disaster happened at various times of day. The committee concludes with recommendations for enhancing earthquake awareness, emergency preparedness, and other earthquake hazard reduction measures.

KEYWORDS Earthquake, preparedness, loss estimation, risk assessment, emergency planning, local planning.

51. May, Peter, Edward Fox and Nancy Stark Hazan. ***Anticipating Earthquakes: Risk Reduction Policies and Practices in the Puget Sound and Portland Areas.*** University of Washington, Institute for Public Policy and Management. Seattle, Wash 1989. 42 pp. For availability, contact the Publications Coordinator, Institute for Public Policy and Management, Parrington Hall, DC-13, University of Washington, Seattle, WA 98195.

This report describes the findings of a project sponsored by the USGS to study earthquake risks in the Puget Sound-Portland areas. the findings provide a baseline for understanding existing earthquake risk reduction policies and practices and identify features of the political-economic landscape likely to shape future opportunities and obstacles to risk reduction. The study addresses 19 counties, 43 larger cities, and selected utilities and ports within the aforementioned areas. It begins by characterizing elected officials' risk perceptions concerning building and facility vulnerability and then outlines existing earthquake risk reduction policies and practices among the jurisdictions. The final sections assess the diverse political-economic factors in these regions and describe how they will affect future risk reduction efforts. The paper specifically looks at the potential benefits of four different strategies: disseminating hazards information, seeking mandate revisions in state-level codes or land use provisions, influencing local practice in carrying out state and local policies, and influencing practices in the engineering and design communities.

KEYWORDS Earthquake, local planning, public policy, risk perception, intergovernmental, state planning, legislation-regulation, politics.

52. Mulilis, John-Paul and Richard Lippa. "Behavioral change in earthquake preparedness due to negative threat appeals: A test of protection motivation theory." ***Journal of Applied Social Psychology*** 20, no. 8, Part 1 (1990): 619-638.

Using protection motivation theory as a conceptual framework, the authors investigated the effects of a negative, threat-inducing persuasive message on the change in earthquake preparedness over a period of five weeks. Subjects completed a survey consisting of 27 earthquake preparedness questions, 11 demographic and 6 earthquake experience questions, a 4-paragraph "information" essay designed to manipulate the subjects' beliefs along four dimensions–subjective probability of a major earthquake, expected severity of damage due to a large earthquake, perceived effectiveness of earthquake preparedness, and perceived capability of earthquake preparedness–with all the responses being screened by a set of manipulation checks. Results of the study suggest 1) that negative threat appeal messages can influence the earthquake preparedness behavior of people, and 2) the crucial variables proposed by protection motivation theory to mediate the effects of negative threat appeals proved to have complex effects on behavior not predicted by protection motivation theory in the current form.

KEYWORDS Earthquake, psychology, preparedness, individual behavior, awareness, risk assessment, psychological impact.

53. Mulilis, John-Paul, T. Shelley Duval and Richard Lippa. "The effects of a large destructive local earthquake on earthquake preparedness as assessed by an earthquake preparedness scale." ***Natural Hazards*** 3, no. 4 (1990). 357-371

This study reports on levels of earthquake preparedness and the perceived difficulty of attaining such levels both before and after a damaging seismic event. Measures of preparedness levels were taken 3 weeks prior to the magnitude 5.9 Whittier Narrows earthquake and were compared with measures of these variable taken between 1 to 10 weeks after the event. A 27-item preparedness questionnaire (reproduced in the article) utilizes standard safety practices found in many brochures and books. Findings from the study included 1) the preparedness instrument demonstrated high face validity and reasonably good reliability among four separate populations tested over a two and one-half month period, and 2) analyses of data indicated that the greatest decrease in perceived preparedness difficulty appeared to occur for safety measures pertaining to obtaining simple and inexpensive items and information which is relatively easy to obtain. Behaviors which decreased the least in perceived difficulty of accomplishment appeared to involve extended time to perform or those which may have been perceived as financially prohibitive.

KEYWORDS Earthquake, risk perception, awareness, preparedness, emergency response, psychological impact, psychology, emergency planning.

54. Munich RE. ***The Newcastle Earthquake '89: Background, Causes, Effects, Implications.*** Munchener Ruckversicherungs-Gesellschaft. Munich, Federal Republic of Germany. 1990. 40 pp. For availability, contact Munich Reinsurance Company of Australia Limited, Lufthansa House, 143 Macquarie Street, P.O. Box H35, Australia Square, Sydney N.S.W. 2000, Australia.

The magnitude 5.6 earthquake that struck Newcastle, Australia on December 28, 1989, caused damage expected to total well in excess of $1 billion, thus making the event the most costly disaster in Australian history. Approximately 35,000 damage claims for nearly $800 million have been filed with the insurance industry. This publication contains case histories of major Australian earthquakes, discusses earthquake risk for the nation, reviews the types of damage caused by the Newcastle quake, and examines the effects of the tremor on the insurance industry. Findings included in the report suggest that 1) unreinforced masonry structures sustained the greatest damage in Newcastle; 2) existing building regulations dealing with seismic resistance do not apply to individual dwellings anywhere in Australia; 3) the historical record of Australian earthquakes is too short, and it is possible that other, unsuspected parts of the continent may be at risk from intraplate earthquakes; and 4) under-insurance proved to be a significant problem in the earthquake's aftermath.

KEYWORDS Earthquake, insurance, historical survey, damage assessment, building codes, foreign response, recovery, seismology, risk assessment.

55. National Academy of Sciences. ***Earthquake Engineering for Concrete Dams: Design, Performance, and Research Needs.*** Washington, D C.: National Academy Press. 1990. 143 pp.

Concerns about the seismic safety of concrete dams have been growing, partly because the population at risk in locations downstream of major dams continues to expand and also because it is increasingly evident that the seismic design concepts in use at the time most existing dams were built were inadequate. This report evaluates the present status of knowledge about the earthquake performance of concrete dams, including procedures for investigating the seismic safety of such structures. It also informs research workers about the state of the art of earthquake analysis of concrete dams and identifies areas where additional research is needed. Separate chapters address the problems associated with earthquake excitation concepts, the analysis of linear response, nonlinear analysis and response behavior, experimental and observational evidence, and recommended criteria for evaluating seismic performance.

KEYWORDS Earthquake, seismology, dam safety, structural engineering, structural design, risk assessment, federal planning

56. National Committee on Property Insurance. ***Catastrophic Earthquakes: The Need to Insure Against Economic Disaster.*** National Committee on Property Insurance, The Earthquake Project. Boston, Mass. 1989. 307 pp. For

availability, contact Eugene L. Lecomte, National Committee on Property Insurance, Ten Winthrop Square, Boston, MA 02110.

The Earthquake Project, a coalition of insurance companies and their trade associations, prepared this draft document to explore the need for a national earthquake insurance policy. Part I discusses earthquake risk in various parts of the U.S., provides estimates of both direct and indirect damages that could be expected from a major earthquake. Indirect losses are examined in particular, with information presented about how homelessness, unemployment, loan defaults, and various ripple effects can affect economic recovery after an earthquake. Part II advocates a federal earthquake insurance program to help rectify the economic impacts of a major earthquake. Other national insurance programs (NFIP, federal crop insurance, Price-Anderson Act, etc.) are used as analogs to discuss the proposed program, and several appendices present methods of estimating earthquake losses. Another appendix contains the text and an analysis of draft legislation for the proposed "Federal Earthquake Insurance and Reinsurance Corporation Act."

KEYWORDS Earthquake, insurance, legislation-regulation, loss estimation, economic impact, federal planning, federal funding, NFIP, foreign planning, risk assessment.

57. National Science Teachers Association. ***Earthquakes: A Teacher's Package for K-6.*** U.S. Federal Emergency Management Agency, FEMA-159. Washington, D.C. 1988. 280 pp. Copies cost $15.00 and are available from the NSTA, Publications Department, 1742 Connecticut Avenue, N.W., Washington, DC 20009.

This curriculum guide includes materials about both the physical phenomena of earthquakes and safety measures a child can take before, during, and after a quake. The guide recognizes that young students learn best when they are actively, physically involved and therefore includes suggestions for many hands-on classroom activities. The package contains six units divided into three grade levels (K-2, 3-4, 5-6). All units include background material for the teacher; a scope and sequence chart; masters for producing transparencies, handouts, and worksheets; and lists of materials and resources. Other features of the package include a tectonic plate puzzle, numerous maps and drawings, ways to simulate P- and S-wave motions, a hazard hunt, an evacuation drill, and ways to construct primitive seismographs. The package imparts a quite sophisticated level of seismic knowledge in a readily assimilable fashion. Tsunamis and earthquake-generated landslides also are discussed.

KEYWORDS Earthquake, educational materials, children, preparedness, schools.

58. Noji, Eric K., et al. "The 1988 earthquake in Soviet Armenia: A case study." ***Annals of Emergency Medicine*** 19, no. 8 (1990): 892-897.

A team of investigators visited three towns seriously damaged by the Armenia earthquake to study injury patterns, to observe how rescue and emergency medical efforts were implemented, and to establish which factors contributed to increased morbidity and mortality. With allowance for the difficulties inherent in a field survey of this sort, the investigating team reported a number of findings, including 1) major medical problems resulted from collapsing buildings, severe cold and exposure, prolonged entrapment, delayed medical care, and long transport times to hospitals unaffected by the tremors; 2) deaths and injuries were 67 and 11 times higher, respectively, among trapped than nontrapped victims; 3) among people found alive, nearly 90% were rescued during the first 24 hours, mostly without the use of heavy equipment; and 4) the extrication of trapped victims was complicated by the lack of heavy equipment and trained rescue personnel.

KEYWORDS Earthquake, morbidity, mortality, case study, emergency medical services, emergency response, foreign response, search and rescue.

59. O'Rourke, T.D., et al. ***Geotechnical and Lifeline Aspects of the October 17, 1989 Loma Prieta Earthquake in San Francisco.*** State University of New York at Buffalo, National Center for Earthquake Engineering Research, Technical Report NCEER-90-0001. Buffalo, N.Y. 1990. 50 pp. Single copies available free of charge from the

Publications Department, NCEER, State University of New York at Buffalo, Red Jacket Quadrangle, Buffalo, NY 14261.

The 1906 San Francisco Earthquake and the 1989 Loma Prieta Earthquake caused extensive damage due to soil liquefaction in four major areas of San Francisco–Mission Creek, South of Market, Foot of Market, and the Marina District. Permanent ground movement, building settlement, and other surface structural damage resulted at similar sites during both earthquakes. The authors examine the geotechnical characteristics of the areas and suggest that protective measures should focus on areas where geotechnical site conditions promote strong ground shaking and liquefaction. Comparisons are made between the affects of both events on lifelines, and attention is given primarily to the impact of the Loma Prieta earthquake on water lifelines.

KEYWORDS Earthquake, damage assessment, lifelines, liquefaction, local response, engineering geology, civil engineering.

60. Olson, Robert, et al. ***To Save Lives and Protect Property: A Policy Assessment of Federal Earthquake Activities, 1964-1987.*** VSP Associates, Inc. Sacramento, Calif. 1989. 258 pp. Available for $20.00 from VSP Associates, Inc., 455 University Avenue, Suite 340, Sacramento, CA 95825. California residents should add 6.5% sales tax.

In December 1986, VSP Associates, Inc. was commissioned by FEMA to conduct an evaluation of the National Earthquake Hazards Reduction Program's first decade. As the study progressed, however, it became clear that enactment of the Earthquake Hazards Reduction Act in 1977 was simply a milestone in a more complex NEHRP story. It was discovered that the program's modern history really began shortly after the Great Alaska Earthquake of 1964, was accelerated by the San Fernando Earthquake (1971), and can be thoroughly understood only by expanding the time-frame to a period of 23 years (1964-1987). Major components of the report include a discussion of policy decisions leading to the 1977 legislation, an analysis of implementation actions taken by the executive branch of government, an examination of FEMA's role as the NEHRP's lead agency, and an analysis of the program's financial underpinnings. Numerous insights and recommendations conclude the study, and extensive appendices provide substantive background for the report's analytical sections. A discussion of the National Science Foundation's decision to fund the National Center for Earthquake Engineering Research (NCEER) at SUNY-Buffalo appears in one of these appendices.

KEYWORDS Earthquake, historical survey, public policy, federal planning, federal funding, FEMA, NEHRP, legislation-regulation, public policy.

61. Palm, Risa I., et al. ***Earthquake Insurance in California: Environmental Policy and Individual Decisionmaking.*** Boulder, Colo: Westview Press. 1990. 161 pp. $26.50 plus $2.50 postage.

This book focuses on homeowners' attitudes toward earthquake insurance and earthquake risk. The research involved a survey of California residents that was completed just a few months before the Loma Prieta earthquake occurred. The authors examine earthquake hazards and the home insurance issue, the factors affecting decisions to purchase insurance, patterns of insurance purchase, insurance providers, socioeconomic characteristics affecting insurance purchase, geophysical and perceived risks, and implications for policy and further investigation. There were four major findings: 1) the purchase of earthquake insurance coverage, as measured both by numbers of policies and percentages of households, has increased dramatically since 1973; 2) this propensity to buy insurance is not consistently related to either the demographic or economic characteristics of the homeowner; 3) the efforts of federal and state agencies to inform homeowners about geographical risks of damage have not effectively educated the public; and 4) of all the parameters studied, individual homeowner's assessment of potential damage to their homes was the factor most highly correlated to insurance purchase.

KEYWORDS Earthquake, insurance, risk perception, risk assessment, demography, state planning, legislation-regulation, preparedness.

62 Plafker, George and John P. Galloway, eds. ***Lessons Learned from the Loma Prieta, California, Earthquake of October 17, 1989.*** U.S. Dept. of the Interior, Geological Survey, Circular no. 1045. Washington, D.C. 1989. 48 pp. Single copies of the publication can be obtained free of charge upon application to the Books and Open-File Reports Section, USGS, Federal Center, Box 25425, Denver, CO 80225.

There are two recurring themes in this publication: 1) local geologic conditions strongly influence damage to the built environment, and 2) the pattern of damage in 1989 was very similar to that which occurred in 1906. USGS contributors to the publication describe the geologic and seismologic aspects of the event, the effect of aftershocks, surface deformation and expression of faulting, ground shaking, landslides, and liquefaction. On the human side, the circular also describes damage to buildings, utilities, and transportation routes and other lifelines; the potential for other damaging earthquakes in the area; and the need for continued efforts to reduce earthquake hazards. Principal but preliminary findings included: 1) displacement on the fault amounted to about 6 feet horizontally and 4 feet vertically; 2) there were no known short-term seismic or strain precursors to give warning of the impending event; 3) poorly engineered landfills can fail at much lower levels of seismic shaking than might have been expected; and 4) damage to houses and multistoried buildings with foundations on good ground was minimal outside the epicentral region.

KEYWORDS Earthquake, damage assessment, seismology, geology, local response, landslide, emergency response, liquefaction, transportation, lifelines

63. Public Service Satellite Consortium. ***A Review of the Effectiveness of Communications During and Shortly After the Loma Prieta, California Earthquake.*** Public Service Satellite Consortium. Washington, D.C. 1990. 20 pp. For availability, contact the Public Service Satellite Consortium, 600 Maryland Avenue, S.W., Suite 220, Washington, DC 20024.

Following the Loma Prieta earthquake, researchers examined seven communications systems–public and private telephone, cellular mobile phone, noncellular mobile radio, broadcast media, CB and ham radio, and government and nongovernmental satellite systems–used by public service and emergency response organizations during and shortly after the quake. The report examines the vulnerabilities of the various media and reasons for their failure. Through interviews and questionnaires, the researchers found that the problems resulting from this quake were relatively minor compared to problems arising in similar disasters elsewhere. The principal difficulties consisted of the initial inability to obtain and disseminate useful, accurate, real-time information on casualties, damage, and resource needs; the breakdown of telephone communications in the first few hours following the event; the blockage of voice phone circuits by lengthy facsimile transmissions; the failure of power supplies; and the lack of redundant or parallel networks in some key places. It also is pointed out that if the quake had occurred a few hours earlier, lasted ten seconds longer, or had occurred a few miles further north, all casualties and damage–including that to communication facilities and infrastructure–would have been dramatically higher.

KEYWORDS Earthquake, emergency response, local response, emergency communications, communication, damage assessment, lifelines.

64. Renneker, Mark. "The epistemology of disaster." ***Whole Earth Review,*** no. 68 (Fall 1990): 14-23. Back issues of the magazine can be purchased for $7.00 from 27 Gate 5 Road, Sausalito, CA 94965.

The author–the first physician on the scene following the collapse of the Cypress freeway overpass–presents his firsthand account about what happens when one's collective inexperience and denial of the reality of disasters is confronted by the real thing. Comments are offered on a variety of topics, including the inaccuracy of media reports, the efforts of volunteers, the inadequacy of disaster plans, governmental response capabilities, and emergency medical services. The disaster under discussion is the Loma Prieta earthquake of October 17, 1990

KEYWORDS Earthquake, emergency response, local response, emergency medical services, psychological impact.

65. Rogers, Everett M , et al. ***Mass Media Coverage of the 1989 Loma Prieta Earthquake: Estimating the Severity of a Disaster.*** University of Southern California, Annenberg School for Communication. Los Angeles, Calif. 1990. 54 pp. For availability, contact Everett Rogers, University of Southern California, Annenberg School for Communication, 3502 South Hoover Street, Los Angeles, CA 90089-0281.

This report relates how the members of the news media reporting on the Loma Prieta earthquake estimated the severity of the disaster. It also discusses why a considerable amount of unreliable and incorrect information about the earthquake, including casualty estimates, was obtained by members of the press from government and private sources and then conveyed to the public. Other topics discussed include the amount of news coverage, the lack of preparedness by local media, television's performance during the early coverage, amateur news coverage, and ingenious ways in which the event was covered by newspersons. Recommendations are provided for covering disasters in the future, and 26 questions are listed that were asked of reporters, editors, the "Information Czar," and experts.

KEYWORDS Media, earthquake, local response, emergency response, emergency planning, damage assessment, journalism.

66. Ross, Katharyn E.K., ed. ***Proceeding from the Conference on Disaster Preparedness–The Place of Earthquake Education in Our Schools.*** State University of New York at Buffalo, National Center for Earthquake Engineering Research, Technical Report no. NCEER-89-0017. Buffalo, N.Y. 1989. 247 pp. Single copies available from NCEER, Publications Department, State University of New York at Buffalo, 116 Red Jacket Quadrangle, Buffalo, NY 14261.

NCEER's inaugural earthquake education conference was held July 9-11, 1989, in Buffalo, New York to ascertain the status of earthquake education in the nation's schools and to explore ways of instituting earthquake preparedness and awareness programs in school systems exposed to earthquake risk. Co-sponsored by the Federal Emergency Management Agency and Emergency Preparedness Canada, the conference attracted speakers possessing a wide variety of educational, teaching, and administrative skills. Papers appearing in the proceedings volume address a wide range of problems, such as the need to enlist teacher participation in planning earthquake-related curricula, the role played by denial in school earthquake preparedness, and the utilization of scientific information to raise students' awareness of earthquake hazards. Other papers deal with implementation policies, information dissemination, and how to plan for the psychological aftermath of a school tragedy.

KEYWORDS Earthquake, education, training, schools, children, building codes, preparedness, educational materials, state planning, local planning.

67. Rymer, Michael J. and William L. Ellsworth, eds. ***The Coalinga, California, Earthquake of May 2, 1983.*** U.S. Dept. of the Interior, Geological Survey, Professional Paper no. 1487. Washington, D.C. 1990. 417 pp. Available from the USGS, Books and Open-File Reports Section, Federal Center, Box 25425, Denver, CO 80225. Paper copy: $29.00.

The magnitude 6.7 Coalinga earthquake was unique in that it was not associated with any previously known or suspected fault in California. The 23 chapters in this volume largely supersede earlier preliminary reports and generally represent the culmination of research on a variety of topics arranged under the following categories: geologic and seismologic setting, seismologic and geophysical studies, surface deformation and landslides, and engineering studies. Papers of interest describe landslides triggered by the earthquake, evaluate damages sustained by residential dwellings, overview the quake's effects on industrial facilities, and investigate damage to regional oil fields.

KEYWORDS Earthquake, seismology, geophysics, geology, loss estimation, damage assessment, hazardous facilities, landslide, business.

68. San Francisco Chronicle. ***The Quake of '89.*** San Francisco: Chronicle Books. 1989 114 pp. Available for $9.95 from Chronicle Books, 275 Fifth Street, San Francisco, CA 94103

Primarily a photo essay, this book was compiled by the Chronicle's journalists and photographers over a six-day period following the magnitude 7.1 earthquake. Over 120 black and white photographs depict the physical devastation caused by the quake, along with the faces of survivors forced to confront the numbing realities of their dislocated lives. The text provides many anecdotal accounts of how people observed the event and its effects on fellow San Franciscans.

KEYWORDS Earthquake, emergency response, recovery, disaster assistance, local response, damage assessment.

69. Schulze, William D., et al "Should we try to predict the next great U.S. earthquake?" ***Journal of Environmental Economics and Management*** 18, no. 3 (1990): 247-262.

While the science of earthquake prediction has reached the point of "real-time geology"–the scientific possibility of measuring geologic processes as they occur–little research has been done on weighing the potential economic benefits of precise short-term prediction against the costs of hazard prediction. Though much value is placed on saving lives in the U.S., the paper poses the question, does such value justify the costs of a short-term hazard prediction program? The authors employ a model to develop an empirical example of a cost-benefit analysis based upon USGS estimates for program performance. An estimate is given for the probability of the next catastrophic earthquake on the southern segment of the San Andreas Fault, and a description is provided of the assumptions made and data employed for a cost-benefit analysis for a short-term prediction affecting the Los Angeles area. Results of the study indicate that implementation of an earthquake prediction program for the southern San Andreas cannot be rejected on economic grounds and substantial net benefits might accrue to society.

KEYWORDS Earthquake, prediction, cost-benefit analysis, life value, loss estimation, seismology, economic analysis.

70. Scott, Stanley. ***Earthquake Safety for New Structures.*** University of California-Berkeley, Institute of Governmental Studies, Working Paper no 90-7. Berkeley, Calif. 1990. 12 pp. Available for $2.50 from the Institute of Governmental Studies, 102 Moses Hall, University of California, Berkeley, CA 94720.

Except for high-hazard or critical facilities, most new structures can be made seismically resistant for little additional cost, primarily through good design, proper construction methods, and careful inspection by qualified personnel. The author suggests a decision process which, if implemented judiciously, will help to ensure that structures will be built to the best seismic-resistant standards possible. These steps focus on 1) the design process, 2) plan checking, inspection, and building code enforcement; 3) quality craftsmanship during the construction phase; and 4) the operation, renovation, and maintenance of the finished product. The author contends that simple and relatively non-bureaucratic procedures can be used to monitor the entire process, and he provides a checklist of specific questions that will aid individuals or groups in ascertaining whether the process is being properly followed.

KEYWORDS Earthquake, building design, local planning, construction, architecture, building codes, enforcement.

71 Seeley, Marc W. and Donald O. West. "Approach to geologic hazard zoning for regional planning, Inyo National Forest, California and Nevada." ***Bulletin of the Association of Engineering Geologists*** 27, no. 1 (1990): 23-35.

Strong earthquake activity in eastern California during the period 1978-1981 caused an estimated $1.5 million damage in the Inyo National Forest. Additionally, at least nine injuries were caused by seismically induced rockfalls in and near the Forest. A U.S. Forest Service commission that evaluated the region for zoning and land