



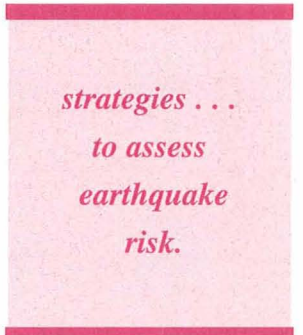
A Strategic Plan for Earthquake Safety in Utah

Part 5 of a Series

by Janine L. Jarva
Utah Geological Survey

In the past four issues of the *Fault Line Forum* we highlighted strategies to increase earthquake awareness and education (v. 10, no. 4, p. 1-3), improve emergency response and recovery (v. 11, no. 1-2, p. 1-3), improve the seismic safety of buildings and infrastructure (v. 11, no. 3-4, p. 1-7), and improve essential geoscience information (v. 12, no. 1, p. 1-6). In this issue, we focus on the strategies contained in the fifth and final key objective, to assess earthquake risk.

Anyone interested in obtaining a copy of *A Strategic Plan for Earthquake Safety in Utah* can contact Janine Jarva, Utah Geological Survey, P.O. Box 146100, Salt Lake City, UT 84114-6100, (801) 537-3300, fax (801) 537-3400, e-mail address: nrugs.jjarva@email.state.ut.us, or Bob Carey, Utah Division of Comprehensive Emergency Management, 1110 State Office Building, Salt Lake City, UT 84114, (801) 538-3784, fax (801) 538-3770.



STRATEGY: Update estimates of direct losses expectable from earthquakes.

OUTPUT: Comprehensive studies to estimate the potential losses of life, number of injuries, and damages to structures and lifelines from earthquakes of various magnitudes and locations.

OUTCOME: Earthquakes are placed in a proper policy perspective based on credible projections of losses and societal impacts; emergency planning is improved; and long-term hazard-reduction activities are prioritized.

Background

Utah's last comprehensive forecast of earthquake losses was published in 1976 and is out of date. Subsequent studies have restrictively analyzed losses, say, to buildings only, or apply to restricted areas, such as Salt Lake County. In 1991, the Federal Emergency Management

Agency (FEMA) funded the non-profit, California-based Applied Technology Council (ATC) to develop methods to estimate losses, including casualties, and apply these methods to estimate losses associated with a magnitude 7.5 earthquake in Salt Lake County. This and a study by the University of Utah Geography Department considered only losses in Salt Lake County. FEMA and the National Institute of Building Sciences (NIBS) have also developed a draft methodology (planned for release in 1996) to estimate earthquake losses at various levels of detail, depending on available data bases and technical experience of those performing the analysis.

Implementation

In order to establish credible forecasts of earthquake losses in Utah, various methodologies,



together with available information, must be carefully evaluated. This will require close coordination among technically diverse experts and the use of both scenario-based and probabilistic risk methods for damage and casualty estimates. Available methodologies include those developed by the ATC, FEMA/NIBS, and the University of Utah Department of Geography. The Utah Seismic Safety Commission can provide a suitable forum for coordinating the interdisciplinary teams and studies required to produce well-founded estimates of direct losses expectable from earthquakes in Utah. These estimates must account for significant differences due to time of day and season. Also, loss estimates are needed for specific classes of buildings, such as schools, and for different levels of ground shaking accompanying moderate to large earthquakes, so that the cost-effectiveness of retrofit options and other loss-reduction measures can be realistically evaluated.

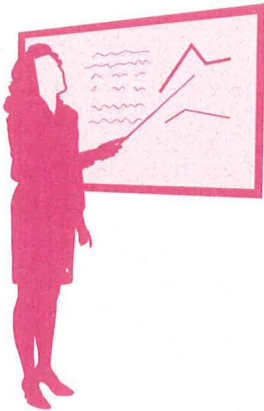
Responsible Agencies

Utah Seismic Safety Commission
 Utah Division of Comprehensive Emergency Management/Utah Geological Survey/other data providers
 Utah Division of Risk Management/other users of loss estimates
 Structural Engineers Association of Utah

Resources Needed

Cost to review methods and determine needs: \$30,000.
 Cost to apply University of Utah methods: not available at this time.
 Cost to apply ATC-36 methods: not available at this time.
 Cost to apply FEMA/NIBS methods to first earthquake scenario: \$250,000.

STRATEGY: Evaluate the indirect losses associated with earthquakes.



OUTPUT: A study assessing the indirect economic losses from earthquakes including: wage and job loss, rebuilding cost, impacts on insurance and financial institutions, and costs of business interruption and failure.

OUTCOME: Identification of indirect economic impacts, resulting in increased preparedness, more rapid recovery, and wise resource allocation.

Background

An earthquake may only last for thirty seconds, but the indirect effects and recovery can last for months or years. The rate of small business failures following an earthquake is high. Also, financial and insurance institutions will incur costs, including disruption of electronic communications and loan/premium payments. Once the costs are known, institutions and businesses can act accordingly in pre-disaster recovery planning.

Implementation

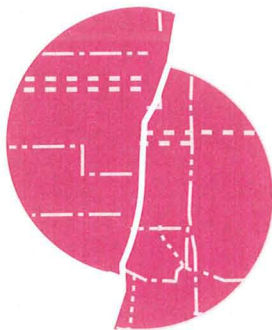
This strategy would be best implemented using the results of a study to estimate the direct losses from an earthquake, as outlined above. Economists will then be able to estimate indirect losses from direct losses from various scenario earthquakes in various areas. A team of economists will need to be assembled and funding sought to perform the study.

Responsible Agencies

Utah Seismic Safety Council
 Utah Division of Comprehensive Emergency Management
 Utah Department of Commerce
 Utah Division of Risk Management

Resources Needed

Cost for study unknown at this time.



STRATEGY: Conduct lifeline collocation vulnerability studies.

OUTPUT: All lifeline collocation sites in UBC seismic zone 3 are identified; a plan is developed for each one.

OUTCOME: During an earthquake emergency, damaged lifelines in one area will not cripple each other.

Background

In many locations, various lifelines, including pipeline, rail, highway, electric, and communications are located within close proximity of each other, either in defined corridors or at crossings. Seismic damage to one lifeline may easily impact

adjacent lifelines. The Federal Emergency Management Agency (FEMA) has funded the study of earthquake-induced failure of the concentrated lifelines at the Beck Street overpass area in Salt Lake City; numerous other similar locations exist along the Wasatch Front.

Implementation

Undertake studies to identify all critical collocation sites within UBC seismic zone 3. Establish a task force of public and private sector lifeline operators to evaluate the potential impacts of their facilities from damage to adjacent lifelines.

Responsible Agencies

Utah Division of Comprehensive Emergency Management
Utah Department of Transportation
Municipal and private utilities, railroads, and pipeline operators

Resources Needed

Cost to identify UBC seismic zone 3 collocation sites and perform screening studies to identify potential risks, using existing methods and data: \$100,000.

Cost to perform detailed studies depends on number and complexity of sites and quality of existing data.



This issue marks a changing of the guard at the *Fault Line Forum (FLF)*. Janine L. Jarva has been at the helm for the past nine years, taking over from Wendy Hassibe (U.S. Geological Survey) with volume III, no. 3 in spring 1987. Janine steered the publication from its original mission as a chiefly technical publication to disseminate early results of scientific studies, to its present mission to disseminate a wide array of earthquake information to a broad multidisciplinary audience. Janine "spruced up" the publication in 1995 with help from a National Earthquake Hazards Reduction Program grant from the U.S. Geological Survey, and has maintained the look. She also changed the name of the publication from the *Wasatch Front Forum* to the *Fault Line Forum* to reflect its statewide coverage. The Utah earthquake community and we at the UGS owe Janine a debt of gratitude for her nine years of

service editing the *FLF*; particularly for her attention to detail and thoroughness in rooting out important information of interest to Utah readers. The *FLF* now has a circulation of over 650 and goes to 27 other states, the District of Columbia, and six foreign countries. Janine remains at the UGS and is heading up our GIS efforts in the Applied Geology Program.

Bea H. Mayes takes over as editor with this issue. Bea is a geotechnician in the Applied Geology Program at the UGS, and brings to the job her experience preparing UGS publications as well as editing newsletters and coordinating outreach activities for local professional organizations. I welcome her to the job, and look forward to continuation of this high-quality, informative publication. Bea and I welcome reader comments and submissions for publication, and look forward to working with you to keep information flowing to Utah's earthquake community.

Fault Line Forum Editor, Janine Jarva, Passes the Torch

by Gary Christenson
Utah Geological Survey



The Utah Seismic Safety Commission (USSC) met on June 6, 1996. The first order of business was to elect a new chairperson. Dr. Les Youd has served as founding chairman for the USSC's first two years. He admitted that the USSC's lack of success with the 1996 Legislature, in spite of the positive outcome of meetings with the Governor and his staff, had left him discouraged. Given that lack of progress, he questioned his effectiveness at motivating government leaders in Utah. However, the Commission felt strongly that Dr. Youd was the best possible choice to continue as Chairman and after much coaxing and a unanimous vote, Dr. Youd was elected for another year. He indicated that, although discouraged, he feels no less urgency regarding the state of earthquake safety in Utah and no less commitment to trying to improve that situation.

Dr. Youd's comments led into a discussion of how best to approach implementing the Strategic Plan for Earthquake Safety in Utah. Senate majority leader Craig Peterson, who represents the Senate on the USSC, recommended

that the USSC concentrate early efforts at the level of the legislative fiscal analysts for affected state agencies and the subcommittees that oversee the budget requests for those agencies. Senator Peterson believes that the Governor was genuine in his enthusiastic support of the USSC's highest priority recommendations but that the Governor found it hard to override the priorities lists coming out of his departments. Therefore the request for funding support needs to be at the top of the budget requests coming to the Governor from at least three departments: the request for a long-term program to improve the seismic safety of state buildings agencies from the Department of Administrative Services (Division of Facilities Construction & Management); the request for a long-term commitment to building a strong ground-motion instrumentation network from the Department of Natural Resources (Utah Geological Survey); and the request for improving earthquake education and awareness targeting schools, business, industry, local governments, professional groups, and citizens from the Department of Public Safety

Utah Seismic Safety Commission News

by Janine L. Jarva
Utah Geological Survey

Youd re-elected; Plan check proposal presented

*Chairman Youd
feels...
urgency
regarding the
state of
earthquake
safety
in Utah*

(Division of Comprehensive Emergency Management). If members of the USSC can work with Department directors and fiscal analysts to get Department priority for these earthquake issues, Senator Peterson believes that the USSC will have the Governor's wholehearted support in the 1997 Legislature. The USSC will again make presentations to the Utah State Building Board and the Utah Advisory Council for Intergovernmental Relations to gain their support for the priority issues in the Strategic Plan.

The Engineering and Architecture Standing Committee has chosen Objective 3.1 of the Strategic Plan, which reads, "Improve plan review procedures on new construction to ensure that buildings are being designed in accordance with current seismic code requirements," as the focus of their efforts this year. Carl Eriksson, Inspections Services Manager for Salt Lake County, presented the Engineering and Architecture Standing Committee's summary of the "problems with current code enforcement system:"

- Plan check departments vary in sophistication from city to city. The same plans submitted in several different cities will have totally different requirements imposed.
- Plans examiners are not required to be licensed by the State, although inspectors are.
- ICBO has standardized tests for certification of plans examiners. Only 10 to 12 persons currently work full time as plans examiners in the State. About 85-90 people in the State are certified as plans examiners.
- There is currently an Education Fund for building inspectors. Funding comes from a 1% surcharge on all building permit fees (not including plan review fees). Education is not mandatory, and attendance is regular by some, non-existent by others.
- One building department in the State has in-house capability for structural review of plans. Some cities or counties contract out for structural review. Many do no structural review at all.
- Last year's construction was valued at \$2,800,000,000 in the State of Utah. Between \$20,000,000 and \$25,000,000 was collected by local jurisdictions for code enforcement. Of this, about \$4,000,000 to \$8,000,000 was specifically plan review fees. Some of the monies collected for building permits goes into the city's or county's general fund to fix potholes, or cover other departmental expenses. The actual amount varies widely, but anywhere from 10% to 65% is used for purposes other than building-code enforcement. The average

amount for code enforcement may be around 35 percent of the total collected.

- School districts and state buildings are exempt from requirements for plan check by local plans examiners. The district's or State's inspectors may not be fully trained for plan check and site inspections.
- The State of Utah has no "approved fabricators." Steel fabrication, wood trusses, and pre-cast concrete are manufactured in plants or shops without regulation or oversight from the building department. The code requires the building department to provide such oversight, but none have the resources to do it.
- The Insurance Services Office (ISO) will begin evaluating building departments' performance in Utah in 1997. This grade or rating will affect homeowners insurance rates in that local jurisdiction. Implementation of this system in Florida has reportedly caused insurance rates to rise by a factor of two to ten. The inspection, plan review, and administrative functions will be rated as to their effectiveness according to the Building Code Effectiveness Grading Schedule (BCEGS).
- Special inspections are often not coordinated or evaluated for their effectiveness by the local building departments, and special inspections are often not even required by local building departments.

Mr. Eriksson's comments led to discussion about possible changes which would improve building-code enforcement and plan review in the state. The USSC then moved to develop a "white paper" on these issues. They are also considering sponsoring a one-day workshop to get the input and feedback of all who could be affected by such changes. Involving such "players" early on in the process of searching for a solution may mean the USSC will have more community support if concerted efforts lead to the drafting of legislation in the coming year. With that possibility in mind, Senator Peterson agreed to open a bill for possible building-code amendments in the 1997 Legislature.

The next meeting of the USSC will be on Tuesday, October 1 at 9 a.m., after the 1996 Earthquake Conference, scheduled for Thursday, September 26, at the State Office Building on Capitol Hill (see related article, this issue). Anyone interested in attending is welcome. Please contact staff for more details: Janine Jarva, Utah Geological Survey, (801) 537-3386, fax: (801) 537-3400, or Brenda Edwards, Utah Division of Comprehensive Emergency Management, (801) 538-3752, fax: (801) 538-3770.



1996 Earthquake Conference

“EARTHQUAKES IN UTAH: WILL YOUR BUSINESS SURVIVE?”

coincides with Earthquake Preparedness Week

On September 26, 1996, the Utah Seismic Safety Commission (USSC) is sponsoring a one-day conference in Salt Lake City to help business people and local officials from throughout the state begin to answer this question. The USSC 1996 Earthquake Conference is planned to coincide with the Salt Lake City and County week-long It's Our Fault - Earthquake Preparedness Week, September 22-28, 1996. Each day of Earthquake Preparedness Week will focus on a different segment of Utah's population. Thursday, September 26 is devoted to raising the awareness among the business community and local governments of the threat posed by Utah earthquakes, with the theme that mitigation now saves lives and money later.

A scenario earthquake, magnitude 6.7 centered in the Salt Lake Valley, around 9:30 a.m. on a mid-week business day during the school year, will be enacted through a panel of experts from Utah. Panel members will represent such specialty areas as insurance, finance, utilities, construction, and emergency response. They will report on the direct effects of the earthquake as well as the repercussions (insurance and financing issues, inspection and rebuilding, government assistance) for area business people and local officials, both personally and to their businesses and constituents. Effects and consequences during the day of the earthquake and one week, month, and year after the earthquake will all be covered. For many businesses, the most serious consequences only become obvious months after the event. Attendees will have the opportunity to question the expert panel, many of whom have experience with the 1994 Northridge earthquake and its aftermath.

During lunch, the USSC will present the first Utah Seismic Safety Commission Award for Achievement in Earthquake Safety. The lun-

cheon keynote speaker, Robert J. Grow, President and Chief Operating Officer of Geneva Steel, will discuss how and why Geneva Steel decided to construct and retrofit all their facilities to the code requirements of seismic zone 4 (the Wasatch Front area of Utah is currently classified in seismic zone 3).

Following lunch, participants will be able to choose among a number of breakout sessions organized around specific themes or problems including engineering and construction issues; the realities of business resumption; how area businesses have successfully addressed mitigation options through advance planning; personal, family, and co-worker preparedness; and community and business involvement through Community Emergency Response Team (CERT) training.

A final plenary session will summarize and focus the critical issues of the conference and include a presentation by the Utah Seismic Safety Commission of its Strategic Plan for Earthquake Safety in Utah. We will discuss how business people and local officials can influence the long-term path Utah takes in dealing with its earthquake threat and how they can participate in achieving the goals identified in the Strategic Plan. If you would like a copy of the Strategic Plan for Earthquake Safety in Utah before the conference, please contact Janine Jarva, Utah Geological Survey, (801) 537-3386, fax (801) 537-3400 or Brenda Edwards, Utah Division of Comprehensive Emergency Management, (801) 538-3752, fax (801) 538-3770.

Registration materials for the USSC 1996 Earthquake Conference will be mailed in August. If you would like to be added to the mailing list to receive further conference information and registration materials, please contact Janine Jarva at the above numbers.

*Thursday,
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It's Our Fault

Earthquake Preparedness Week

September 22-28, 1996

Salt Lake County

Monday, September 23

PROCLAMATION DAY

Tuesday, September 24

SCHOOL EARTHQUAKE PREPAREDNESS DAY

Wednesday, September 25

HOME AND FAMILY PREPAREDNESS DAY

Thursday, September 26

BUSINESS PREPAREDNESS DAY

Friday, September 27

EMERGENCY VOLUNTEER RESPONDERS

Saturday, September 28

COMMUNITY FAIR DAY

FEMA

Issues

NEHRP

Guidance

for New

Buildings

(- Reprinted from *Natural Hazards Observer*, v. 20, no. 4, p. 10.)

The National Earthquake Hazards Reduction Program (NEHRP) was created to support research and implementation of knowledge to reduce the impacts of earthquakes in the U.S. In an effort to update guidance for building codes in the U.S., the Building Seismic Safety Council (BSSC) recently released the 1994 NEHRP Recommended Provisions for Seismic Regulations for New Buildings. Because this document contains revisions of earlier versions, FEMA has revised a number of supporting documents as well.

For example, Nontechnical Explanation of the 1994 NEHRP Recommended Provisions (FEMA-99, 1995, 82 pp.), prepared by the BSSC, provides a simplified overview of the 1994 NEHRP Recommended Provisions. It explains ground motion generated by earthquakes, how this motion affects buildings, what design techniques resist earthquake forces, and how the Provisions translate this information for use by designers and builders.

Seismic Considerations for Communities at Risk (FEMA-83, 1995, 114 pp.), also developed

by the BSSC, provides information to individuals and community decision makers about determining seismic risk and appropriate mitigation activities. It includes information on the scope of earthquake risk in the U.S., the effects of earthquakes on buildings, structural design to mitigate impacts on buildings, seismic building codes, and the importance of the NEHRP Provisions. It also provides a checklist of factors to consider when determining whether and how to take action to mitigate risk, as well as suggestions for encouraging community action.

Guide to Application of the 1994 NEHRP Recommended Provisions in Earthquake-Resistant Building Design (FEMA 40, 1995, 467 pp.), prepared by J.R. Harris and Company, discusses various building materials and systems, including structural steel, reinforced concrete, timber, masonry, and nonstructural elements. It also provides charts that describe the processes for satisfying the NEHRP Recommended Provisions.

All of these documents are free and can be ordered from the FEMA Distribution Center, P.O. Box 2012, Jessup, MD 20794; (800) 480-2520; fax: (301) 497-6378.



Utah is developing a mutual aid compact with Idaho and Wyoming. The proposed compact, developed at an April 10 working group meeting at the Division of Comprehensive Emergency Management (CEM), would allow each state to access the resources of their neighbors. The states share natural and technological hazards which may extend beyond the borders of a single state, and a single disaster on the border of one state may be better accessed by a neighboring state.

When the new compact is signed, Utah will have mutual aid compacts with all adjacent states. The State of Utah began developing mutual aid compacts in March 1992, when a

compact with five other southwestern states was proposed. The purpose of the mutual aid compact with Arizona, California, Colorado, Nevada, and New Mexico, which Utah signed in October 1994, is "...to provide voluntary assistance among participating states in responding to any disaster, or imminent disaster, that over extends the ability of local and state government to reduce, counteract, or remove danger. Assistance may include, but not be limited to, rescue, fire, police, medical, communication, transportation services and facilities to cope with problems which require use of special equipment, trained personnel or personnel in large numbers not locally available."

Interstate Mutual Aid Compact

by Robert D. Carey
Utah Division of
Comprehensive Emergency
Management



Since last October, when it became apparent that the federal government would not pass a budget for fiscal year 1996, programs that depend on federal money were put on hold. As of April 15, CEM's EPICenter had received only 48 percent of its yearly funding from the federal government. The federal shortfall was doubled by the lack of matching state funds. To make matters worse, FEMA sources indicated that there was a strong possibility that the states should expect to receive only 75 percent of their yearly federal contribution. As a result of this forecast, EPICenter's planned activities were placed on hold and only essential work was carried out. EPICenter's role as a coordinating agency with other agencies in and out of state government was also cut back.

The first major casualty of the federal budget problems was the canceling of the annual

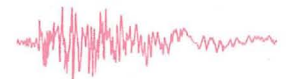
FEMA Earthquake Program Information Exchange Conference, a nationwide conference. The conference allows program managers from across the nation to get together to exchange ideas, learn from each other's successes and failures, and develop new ideas to take back to their states. In addition, lack of funding prevented FEMA managers from attending other conferences, both in and out of state.

As early as November 1995, EPICenter was canceling planned activities because of the uncertainty of federal funding. When not canceled outright, program activities such as workshops, projects, and travel were placed on hold.

With the final passage of the fiscal year 1996 federal budget, EPICenter can move forward. The agency's most notable project is the county earthquake hazard map project (see following article).

Federal Funding for CEM EPICenter

by Robert D. Carey
Comprehensive Emergency
Management,
Earthquake Preparedness
Information Center



GIS maps compiled by CEM's EPICenter showing hazards (faults, liquefaction potential, landslides) and critical facilities for Weber, Davis, and Salt Lake Counties are now available. The maps may be picked-up either at the CEM office in the State Office Building or at the UGS bookstore at the new North Temple location. The first printing of the maps was done by EPICenter under a FEMA contract and is free to the public. Later printings will be done by the Utah Geological Survey and will

be sold to cover printing costs.

The mapping project is a collaborative effort of EPICenter, Utah Geological Survey, U.S. Forest Service, Weber State University, and Utah Automated Geographic Reference Center. The maps were compiled by Pam Heman, CEM intern. EPICenter plans to complete similar hazard maps for Utah, Cache, Box Elder, Tooele, Morgan, Summit, and Wasatch Counties.

County Earthquake Hazard Maps Now Available

by Robert D. Carey
Utah Division of
Comprehensive Emergency
Management



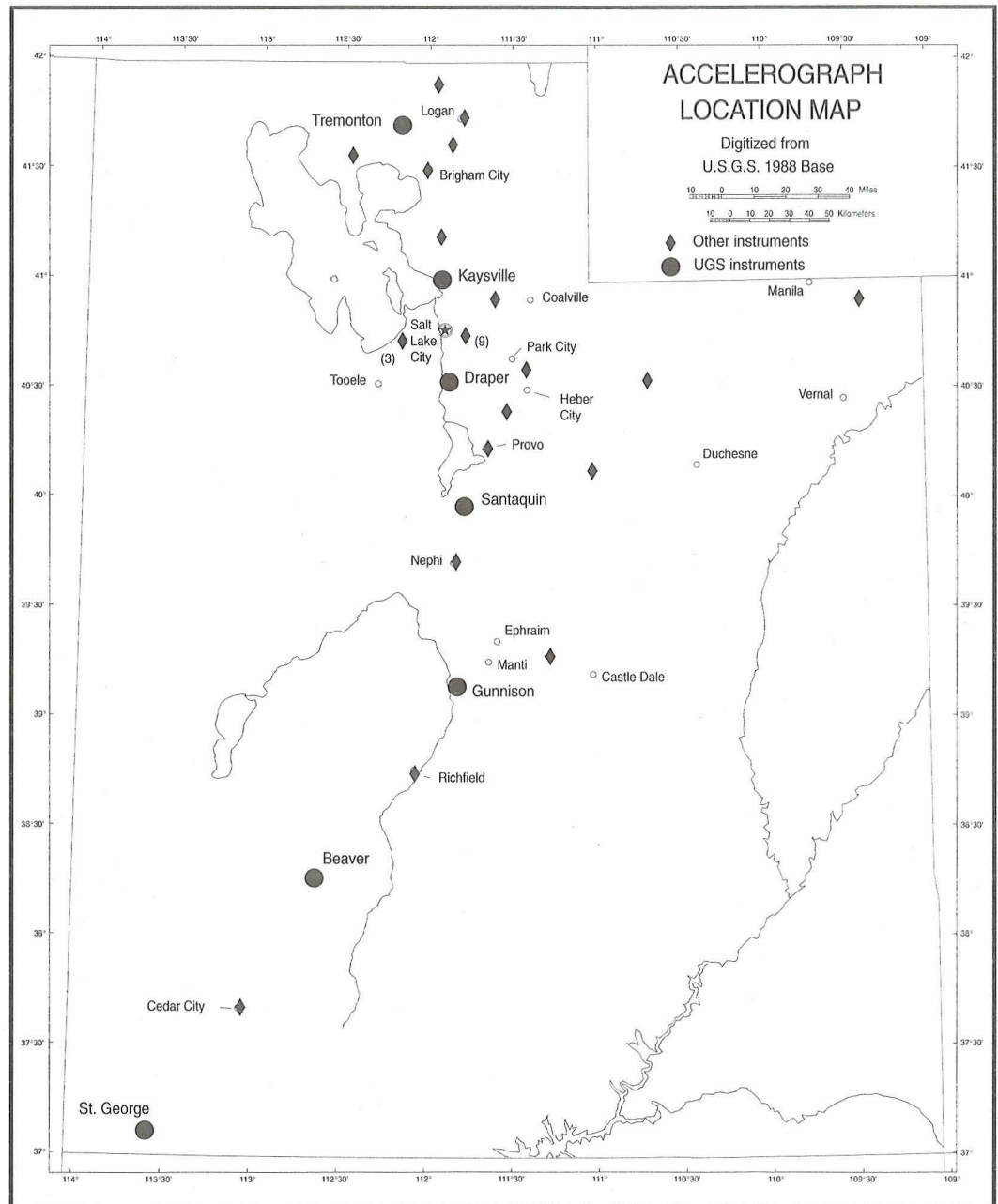
Seven New Strong-Motion Instruments Deployed Statewide

by Francis Ashland
Utah Geological Survey

Seven new strong-motion instruments... were installed to measure actual ground shaking... data essential... to ensure that buildings are neither under-designed nor over-designed.

This spring, the Utah Geological Survey (UGS) deployed seven digital Kinometrics SSA-2 strong-motion instruments (accelerographs) as part of an initial phase of the Utah Strong-Motion

Instrumentation Program (USMIP), a cooperative program with the University of Utah Seismograph Stations. Instruments were installed by Walt Jungblut of the U.S. Geological Survey's National



Map showing locations of new UGS strong-motion instruments (accelerographs) and other federally or privately owned instruments. Some instruments are in buildings and on dams, and are not free-field.

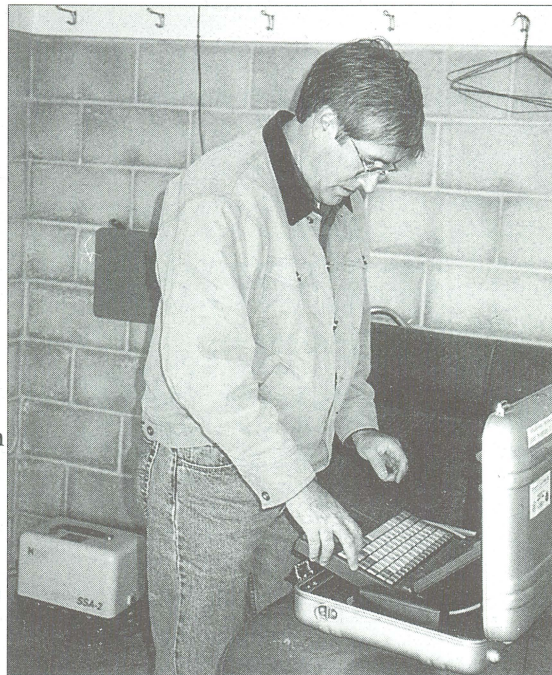
Strong-Motion Program (NSMP) with assistance from the UGS. The instruments will measure actual ground shaking during future earthquakes. Such data are essential to evaluate earthquake-engineering practices in Utah to ensure that buildings and structures are neither under-designed, posing a life-safety threat, nor over-designed, wasting precious resources.

Instruments were deployed in Tremonton, Kaysville, Draper, Santaquin, Gunnison, Beaver, and St. George. The UGS selected these sites to establish a skeletal network of instruments in Utah along a roughly north-south corridor in the Intermountain seismic belt (ISB), a broad zone of seismic activity where most of the magnitude 5 and larger earthquakes have occurred. The ISB is also where many of the known active faults like the Wasatch fault are found and is one of the areas of highest earthquake risk in the conterminous United States.

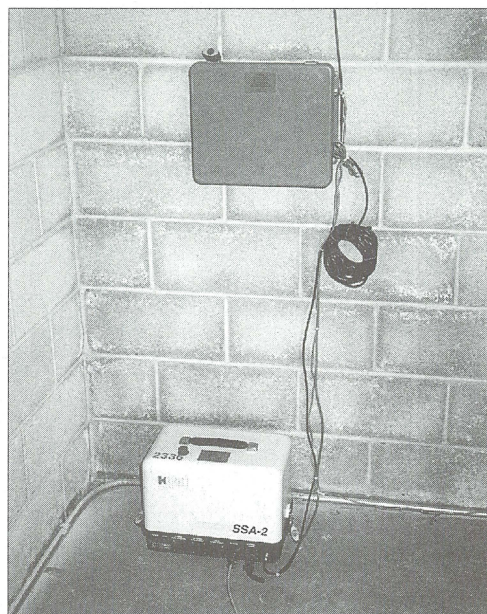
Each instrument is in a building or shed that meets the criteria for a "free-field" site. The building size and shape must not significantly affect the ground shaking so that the instruments can characterize the shaking as a function of important geologic and seismologic factors such as type and thickness of subsurface materials, distance to the earthquake source, and earthquake magnitude. A goal of the USMIP is to establish a statewide network of these free-field instruments to obtain enough strong-motion records to answer engineering-design questions critical to Utah.

Funding for these seven instruments was made available by a 1992 appropriation to the UGS by the Utah Legislature to begin the USMIP. At that time, an advisory committee of engineers and scientists was formed to guide the program. Unfortunately, funding was discontinued after only one year, thus idling the planned deployment of future instruments and eliminating funding for on-going maintenance of these seven instruments. As a result, deployment of additional instruments is on hold. The seven new instruments will be maintained and monitored by the NSMP as part of a cooperative agreement with the UGS.

At present, the number of free-field instruments, which includes about a dozen other federally or privately owned instruments, fails to provide adequate coverage to meet the goals of the



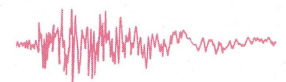
Walt Jungblut of the USGS NSMP checks input parameters of a newly installed strong-motion instrument (lower left corner of photograph).



Completed installation of a Kinemetrics SSA-2 accelerograph. Box mounted on wall holds instrument battery to ensure operation if electric power is lost. Cable attached to battery box is attached to WWVB receiver that provides accurate timing for the instrument.

USMIP. In 1989, a blue-ribbon panel recommended deployment of at least 108 instruments to obtain sufficient strong-motion measurements. Although the UGS is committed to achieving this goal, completion of the USMIP will only be possible if additional on-going funding is found.

Unfortunately, funding was discontinued after only one year, thus idling the planned deployment of future instruments and eliminating funding for on-going maintenance of these seven instruments.

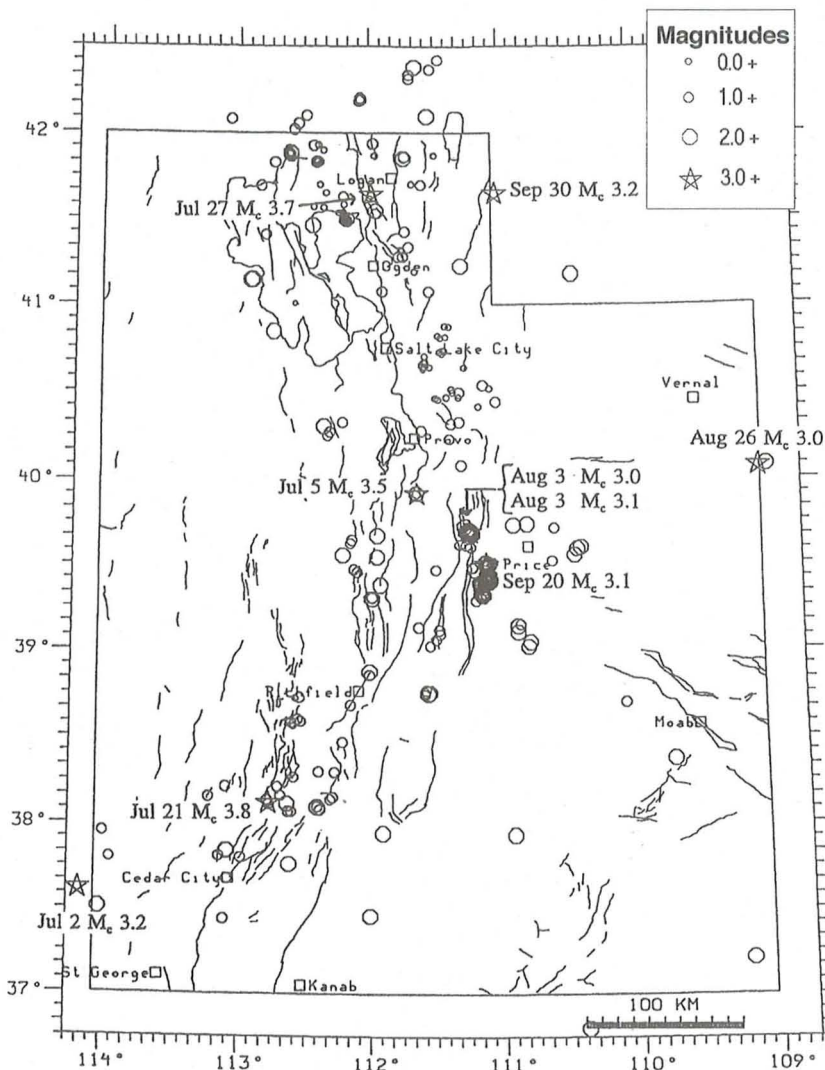


Earthquake Activity in the Utah Region

by Susan J. Nava

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July 1 - September 30, 1995



During the three-month period July 1 through September 30, 1995, the University of Utah Seismograph Stations located 373 earthquakes within the Utah region (see accompanying epicenter map). The total includes 9 earthquakes in the magnitude 3 range, and 150 in the magnitude 2 range. Earthquakes which have magnitudes of 3.0 or larger (plotted as stars and specifically labeled on the epicenter map) are described below. There was one earthquake reported felt during the report period. (Note: Magnitudes listed are coda magnitude, M_C . All times indicated below are local time, which was Mountain Daylight Time during the report period.)

Significant Main Shocks and Clusters of Earthquakes

• **Eastern Wasatch Plateau-Book Cliffs Area near Price** (coal-mining related): four clusters of seismic events (magnitude 1.3 to 3.1) make up 39% of the shocks that occurred in the Utah region during the period. These clusters are located (a) 25 miles WNW of Price, (b) 15 miles SW of Price, (c) 20 miles SSW of Price, and (d) 25 miles SSW of Price. Significant shocks include:

M_C 3.1	August 3	8:04 p.m.	11 miles ENE of Fairview
M_C 3.0	August 3	2:02 a.m.	11 miles ENE of Fairview
M_C 3.1	September 20	9:40 a.m.	14 miles NW of Huntington

• **Northern Utah:** A cluster of 25 earthquakes ($M \leq 2.2$) occurred 5 miles SSW of Corinne, Utah, throughout the report period. From July 4 to 9, a swarm of 11 shocks ($M \leq 2.7$) occurred 25 miles W of Garland, and from September 23 to 26, a separate swarm of 11 shocks ($M \leq 1.8$) occurred 14 miles WNW of Garland. Significant shocks include:

M_C 3.7	July 27	11:04 a.m.	3 miles W of Wellsville. Felt in Logan, Paradise, and Wellsville
M_C 3.2	September 30	3:25 a.m.	8 miles SE of Randolph

• **Central Utah:** Significant earthquakes include:

M_C 3.5	July 5	6:22 p.m.	9 miles ESE of Santaquin
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• **Utah/Colorado border:** Significant earthquakes include:

M_C 3.0	August 26	3:09 a.m.	12 miles S of Dinosaur, CO
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• **Southwestern Utah/Eastern Nevada:** Significant earthquakes include:

M_C 3.2	July 2	4:47 p.m.	18 miles SE of Panaca, NV
M_C 3.8	July 21	11:21 a.m.	11 miles ESE of Minersville

October 1 - December 31, 1995

During the three-month period October 1 through December 31, 1995, the University of Utah Seismograph Stations located 312 earthquakes within the Utah region (see accompanying epicenter map). The total includes 18 earthquakes in the magnitude 3 range and 132 in the magnitude 2 range. Earthquakes which have magnitudes of 3.0 or larger (plotted as stars and specifically labeled on the epicenter map) are described below. There were three earthquakes reported felt during the report period. (Note: Magnitudes listed are coda magnitude, M_C . All times indicated below are local time, which was Mountain Daylight Time from October 1 to 29, and Mountain Standard Time during the remainder of the report period.)

Significant Main Shocks and Clusters of Earthquakes

• Eastern Wasatch Plateau-Book Cliffs Area near

Price (coal-mining related): Seismic events in this region (magnitude 1.2 to 3.4) make up 42% of the shocks that occurred in the Utah region during the period. Significant shocks include:

M_C 3.3	October 9	3:51 p.m.	14 miles SW of Helper
M_C 3.0	October 11	7:36 a.m.	14 miles SW of Helper
M_C 3.4	November 8	12:32 a.m.	16 miles NW of Huntington
M_C 3.0	November 24	6:32 a.m.	11 miles NE of Fairview
M_C 3.0	December 6	12:41 p.m.	12 miles NE of Fairview
M_C 3.0	December 15	5:43 a.m.	13 miles NE of Fairview
M_C 3.0	December 31	11:23 a.m.	12 miles NE of Fairview

• Northern Utah:

M_C 3.4	October 8	12:25 a.m.	8 miles SSE of Morgan. Felt in Bountiful, Salt Lake City
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M_C 3.2	November 2	7:09 a.m.	7 miles E of Providence. Felt in Cache Valley
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M_C 3.1	November 5	3:20 a.m.	18 miles W of Lakeside
M_C 3.5	December 5	9:25 p.m.	7 miles NNW of Park City. Felt in Summit County, Salt Lake City

• Central Utah:

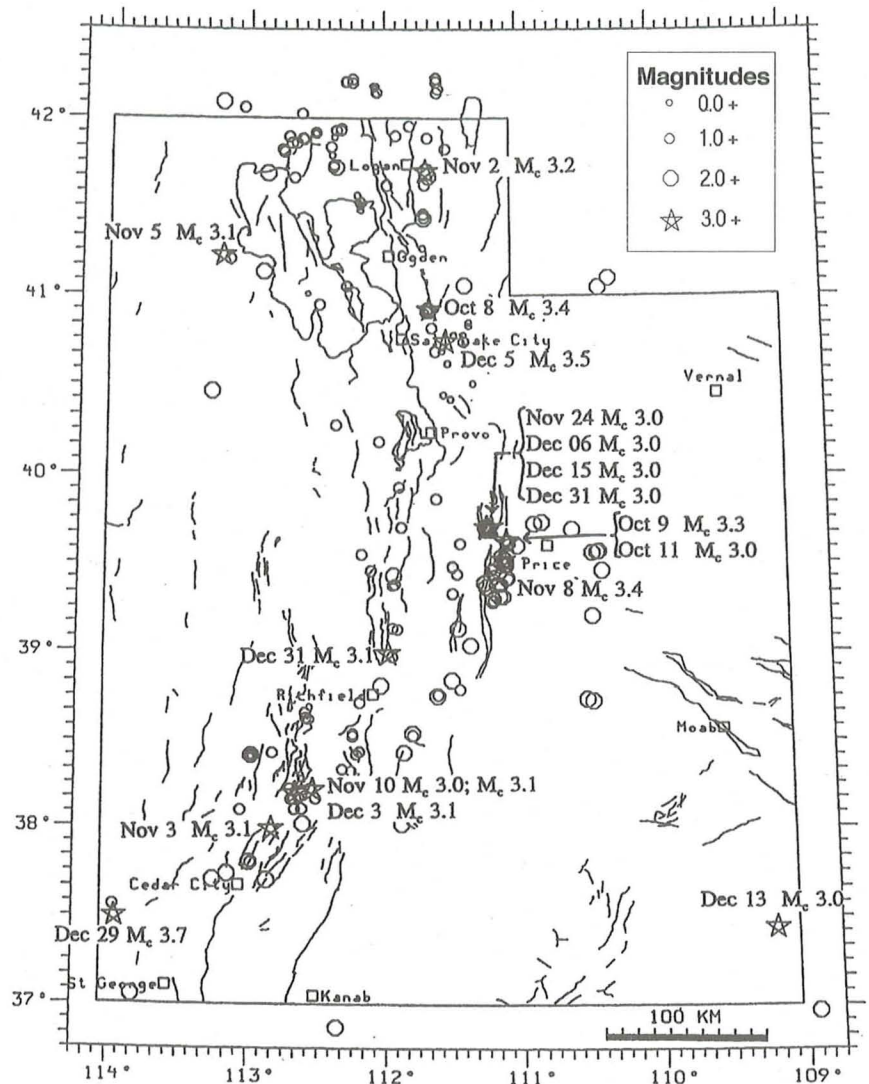
M_C 3.1	December 31	5:11 a.m.	5 miles NW of Aurora
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• Southeastern Utah:

M_C 3.0	December 13	3:25 p.m.	13 miles NNE of Montezuma Creek
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• Southwestern Utah:

M_C 3.1	November 3	12:09 a.m.	10 miles N of Parowan
M_C 3.0	November 10	4:44 a.m.	8 miles ESE of Beaver
M_C 3.1	November 10	4:59 a.m.	8 miles ESE of Beaver
M_C 3.1	December 3	4:05 p.m.	6 miles S of Beaver
M_C 3.7	December 29	3:41 p.m.	13 miles SW of Enterprise



Additional information on earthquakes within the Utah region is available from the University of Utah Seismograph Stations.

50,000 Records in Earthquake Engineering Abstracts Database

(- From Earthquake Engineering Research Center [EERC].)

The National Information Service for Earthquake Engineering at the Earthquake Engineering Research Center (EERC), University of California at Berkeley, is pleased to announce the completion of a project which has converted the 1971-1983 Abstract Journal in Earthquake Engineering to machine-readable form. These 19,899 records have been loaded into the already existing Earthquake Engineering Abstracts database and all are available for searching through a variety of systems. The database now provides comprehensive access to the literature of earthquake engineering, structural dynamics, and related disciplines, from 1971 to the present.

The Earthquake Engineering Abstracts data-

base is available:

- through the World Wide Web at <http://www.eerc.berkeley.edu>
- by telnetting to the University of California online catalog, Melvyl at melvyl.berkeley.edu; once in Melvyl, type use eea to enter Earthquake Engineering Abstracts
- on Earthquakes and the Built Environment, a CD-ROM jointly produced with the National Center for Earthquake Engineering Research in Buffalo, New York
- by modem

For more specific instructions on access to the database, please contact Katherine A. Frohberg, EERC, 1301 South 46th Street, Richmond, CA 94804-4698, (510) 231-9401, e-mail: katie@eerc.berkeley.edu.



Meetings and Conferences

- September 12 - 14, 1996 in Seattle, September 26 - 28, 1996 in New York, October 24 - 26, 1996 in San Francisco, **Passive Energy Dissipation for Seismic/Wind Design and Retrofit**, a short course, is offered by the National Center for Earthquake Engineering Research Professional and Continuing Education (PACE), University at Buffalo, Red Jacket Quadrangle, Buffalo, NY 14261-0025. Or contact at 716/645-3391 (phone); 716/645-3399 (fax); e-mail: nceer@acsu.buffalo.edu
- September 18 - 21, 1996, **Western States Seismic Policy Council Annual Conference** at the Kwa TaqNuk Resort, Polson, Montana. For information contact the Western States Seismic Policy Council, 121 Second Street 4th Floor, San Francisco, CA 94105, or, 415/974-6422 (phone); 415/974-1747 (fax); e-mail: wsspc@wsspc.org
- September 26, 1996, **USSC 1996 Earthquake Conference**, Salt Lake City, Utah (see related article, this issue).
- October 10 - 11, 1996, **Analyzing Economic Impacts and Recovery from Urban Earthquakes: Implications from Research on the Northridge Event**, Pasadena, California. Sponsored by the Earthquake Engineering Research Institute (EERI), and the Federal Emergency Management Agency. Contact EERI, 499 14th Street, Suite 320, Oakland CA 94612-1934; (510) 451-5411; e mail: eri@eri.com
- October 27, 1996, UBC '94 **Shearwall Design for Seismic Zones 3 and 4**, Salt Lake City, Utah. The Portland Cement Association, Concrete Reinforcing Steel Institute, and the International Conference of Building Officials (ICBO), in cooperation with the Structural Engineers Associations of California, Idaho, Utah, Oregon, Washington, and Alaska, are sponsoring a series of half-day seminars to introduce the new design procedures for reinforced concrete shearwalls that were adopted into the 1994 Uniform Building Code (UBC). For more information, contact ICBO Seminar Services at (310) 699-0541, extension 3244 or 3266.
- October 28 - 31, 1996, **Geological Society of America Annual Meeting, "Earth System Summit,"** Colorado Convention Center, Marriott City Center, Denver, Colorado. Abstract deadline is July 9, 1996. Submit abstracts to John D. Humphrey, Colorado School of Mines, Department of Geology and Geological Engineering, Golden, CO 80401, (303) 273-3800, fax (303) 273-3859, E-mail: jhumphre@mines.edu, or John E. Warne, same address, (303) 273 3565, fax as above, E-mail: jwarne@mines.edu
- October 30 - November 1, 1996, **Earthquake Resistant Engineering Structures 96**, Thessaloniki, Greece. Aristotle University of Thes-

saloniki and the Wessex Institute of Technology are organizing this symposium. Abstracts coordinator, Sue Owen, Earthquake Engineering 96, Wessex Institute of Technology, Ashurst Lodge, Ashurst, Southampton, S040 7AA, UK, phone +44(0)1703 293223, fax +44(0)1703 292853, e-mail: wit@wessex.witc-mi.ac.uk

- **Rescheduled:** December 3 - 5, 1996, **ASCE International Conference and Exposition on Natural Disaster Reduction**, Washington, D.C. Sponsor is the American Society of Civil Engineers. For information contact Natural

Disaster Reduction '96, ASCE, 345 47th Street, New York, NY 10017; (800) 548-2723; (212) 705-7285; fax: (212) 705-7975; e-mail: conf@ny.asce.org

- December 8 - 11, 1996, **Society for Risk Analysis Annual Meeting**, New Orleans, Louisiana. For information contact Society for Risk Analysis, 1313 Dolley Madison Boulevard, Suite 402, McLean, VA 22101; (703) 790-1745.
- February 12 - 15, 1997, **EERI Annual Meeting**, Austin, Texas. For information call the EERI office at (510) 451-0905.



Recent Publications

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- available from R. K. Dokka, AT Coordinator, Public/Agency Relations, Department of Geology and Geophysics, Louisiana State University, Baton Rouge, LA 70803-4101, or rkdokka@geode.geol.lsu.edu
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