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EARTHQUAKE HAZARDS PROGRAM

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STRONG-MOTION INSTRUMENTATION IN UTAH

by William F. Case
Utah Geological & Mineral Survey

In 1977, the Utah Legislature established the Utah Seismic Safety Advisory Council to assess earthquake hazards and risk, and to recommend mitigative actions. Council recommendations included an addition of 11 strong-motion instrument sites to the 6 existing sites (Ward, 1980). There are now 31 strong-motion instrument sites in Utah including the 6 in-place in 1980 (table 1, figs. 1, 2). Three of the locations recommended by the Seismic Safety Advisory Council (Sanpete County, Beaver County, and Hansel Valley) have not been instrumented. The instruments are maintained by the U.S. Geological Survey and the U.S. Bureau of Reclamation. To date, the Utah strong-motion data base consists of records from only three earthquakes; 1962 M_L (Richter magnitude) 5.7 earthquake in Cache Valley (Smith and Lehman, 1979), 1988 M_L 5.3 San Rafael Swell earthquake (Case, 1988), and 1989 M_L 5.4 Salina earthquake (University of Utah Seismograph Stations, 1989).

Strong-motion Instruments

Strong-motion instruments record ground motion at frequencies which are in the range of resonant frequencies of buildings. The instruments are physically robust enough to survive a major earthquake and have low gain to record large amplitude ground motion. They turn on only when a pre-set threshold acceleration is exceeded. Typical threshold acceleration settings range from 0.01-0.1 g (g = gravitational acceleration). A swift kick will not trigger an instrument set at 0.1 g.

A strong-motion instrument consists of a pendulum or mass, a recording media, and, in some instruments, a clock and/or timer. The pendulum or mass serves as a reference point in space which tends to remain stationary during an earthquake. The strong-motion instrument is coupled securely to the earth on a concrete pad or floor. During an earthquake, the ground and instrument move around the reference point and the motion is recorded on the media. Actual ground motion is derived from the recording after instrument response characteristics are removed.

Utah Instrumentation

Seismoscopes and accelerographs are used in Utah. Seismoscopes have a pendulum needle which scribes a trace showing direction and amplitude of relative movement onto a smoked watch-glass. They record horizontal ground movement only. Usefulness of the data obtained is limited because there is no time history of the motion. Seismoscopes are used because they are inexpensive and require no local power source.

Strong-motion accelerographs models SMA-1 and CRA-1 have been installed in Utah. Accelerographs sense motion with an accelerometer, a coil which moves around a magnetized rod during shaking. The rod serves as a reference point similar to the pendulum in seismoscopes. A mirror, electrically connected to the accelerometer, deflects a light beam to record accelerations on photographic film. A receiver in the instrument tuned to WWVB (UTC, coordinated universal time, is transmitted by radio station WWVB by the U.S. National Bureau of Standards) provides the time base recorded on the film. Strong-motion accelerographs are triaxial, that is they record vertical as well as 2 directions of horizontal motion. Time histories of acceleration, velocity, and displacement of the ground can be derived from the recordings. Model SMA-1 instruments have one triaxial sensor situated within the machine; model CRA-1 instruments have multiple remote sensing units. The Salt Lake City and County Building (No. 11, table 1, fig. 2) and Hyrum Dam (No. 2, table 1, fig. 1) are the only two sites in Utah that have model CRA-1 instruments.

Location of Instruments

The siting of a strong-motion device depends on the type of data that is needed. If the device is intended to record ground response only during an earthquake (free-field response), it must be located away from multi-storied or massive buildings which may affect ground motion at the instrument. An accelerograph array consisting of six instruments (Nos. 9, 10, 13, 14, 15, 18, table 1, fig. 2) and a seismoscope array consisting of six instruments (Nos. 14, 16, 18, 17, 20, 22, table 1, fig. 2) were sited to determine the free-field ground response over varying thicknesses of unconsolidated (Quaternary-age) sediment in the Salt Lake Valley. The locations are indicated in table 1 by an (F). The sites are over unconsolidated sediment thicknesses that range from zero (bedrock) at the eastern border of the valley to 1200 ft (366 m) near the center of the valley at the airport (table 1).

The response of buildings or dams plus the ground is recorded when devices are located within the structures. Response varies within the structure; during the San Rafael Swell earthquake, strong-motion instruments on Joes Valley Dam recorded a peak acceleration of 0.11 g at the crest of the dam and 0.06 g midslope (Case, 1988). The Salt Lake City and County Building (No. 11, table 1) has accelerometers located on several floors to record total building response (including ground motions) as well as sensors away from the building to obtain free-field data.

Application of Strong-Motion Seismograms

Strong-motion seismograms provide: 1) basic seismological data such as source mechanisms, attenuation and propagation of seismic waves, and time history of seismic waves; 2) engineering seismological data such as site effects of soil type and thickness, water-table depth, and geologic structure and topography; and 3) earthquake engineering data such as the dynamic response of structures for seismic design and modeling (Panel on Strong-Motion Instrumentation, 1987). All of this data can be used to better evaluate strong-motion hazards and serve to improve engineering practices and building codes.

Future Strong-Motion Instrumentation in Utah

The University of Utah Seismograph Stations, Utah Geological and Mineral Survey, and Utah Division of Comprehensive Emergency Management are presently evaluating the future earthquake instrumentation needs (including strong-motion instruments) of the State. A conference of agency staff and invited national experts was held in Alta, Utah, from 23-25 August, 1989 to recommend an instrumentation program, determine costs, and identify funding sources. The results of this conference are summarized in the following article by Susan S. Olig of the Utah Geological and Mineral Survey.

Table 1: Location of strong-motion instrument sites; Map number keyed to figures 1 and 2.

Map No.	Strong-motion instrument sites in Utah (instruments: SMA-1,CRA-1,seismoscope; contact agency: I, II, III, see footnotes)	Latitude ddmmss	Longitude dddmmss
1	Logan; Utah State University Administration Building basement: SMA-1 (I)	414427	1114849
2	Hyrum Dam; SMA-1 on right abutment,CRA-1, 9-channel system in dam, (III).	413824	1115212
3	Brigham City; Fire Station, basement: SMA-1 (I).	413110	1120052
4	Ogden City; Fire Station #2, basement: seismoscope (II).	411344	1115648
5	Ogden City; Fire Station #1, storage shed: seismoscope (II).	411308	1115820
6	Ogden City; Weber State College: SMA-1 (I).	411140	1115622
7	East Canyon Dam; SMA-1's downstream, on center crest, and right crest (III).	405519	1113600
8	Flaming Gorge Dam; SMA-1's in upper and lower gallery of dam (III).	405454	1092515
9	Salt Lake City; NOAA Weather Service building, east airport: SMA-1, (I), (F).	404702	1115748
10	Salt Lake City; UP & L building, Temple Sq.west, (40 North First West): SMA-1 (I), (F).	404614	1115341
11	Salt Lake City/County Building: two 12-channel CRA-1's (I), (F).	404534	1115310
12	Salt Lake City; V A Hospital Building #1; SMA-1 in basement and on 9th. floor (I).	404527	1115023
13	Salt Lake City; Mountain Fuel Sunnyside Training Center garage: SMA-1, (I), (F).	404437	1114849
14	Salt Lake City; Salt Lake Junction, A T & T Communications garage, bedrock site (3100 Kennedy Dr.):SMA-1, seismoscope, (I,II), (F).	404500	1114829
15	Salt Lake City; Liberty Park Horseshoe storage building: SMA-1, (I), (F).	404449	1115217
16	Salt Lake City; Sugar House Fire Station #3, Fairmont City Park (1085 Simpson Ave) solvent storage room: seismoscope (II), (F).	404320	1115135
17	South Salt Lake; Fire Station #1 (90 East Oakland Ave): seismoscope (II), (F).	404253	1115316
18	Salt Lake City; Roosevelt Elementary School shed (800 East: Springview Dr.)SMA-1, seismoscope, (I, II), (F).	404103	1115157
19	Salt Lake City; Eastwood Elementary School (3305 Wasatch Blvd.): SMA-1, (I).	404059	1114734
20	Salt Lake City; Olympus Junior High School (2217 East 4800 South): seismoscope (II), (F).	404009	1114042

21	Salt Lake City; Cottonwood Elementary School storage building* (5205 Holladay Blvd.): SMA-1, (I), (*soon to be moved).	403922	1114854
22	Kearns, Salt Lake County; Sheriff's posse building: seismoscope (II), (F).	403911	1115947
23	Jordanelle Dam site: upstream from right abutment SMA-1 (III).	403542	1112525
24	Upper Stillwater dam; field station SMA-1(III)	403332	1104157
25	Deer Creek Dam; SMA-1 on toe and left abutment (III).	402400	1113148
26	Provo; Utah State Hospital: SMA-1 (I).	401401	1113755
27	Soldier Creek Dam; SMA-1 on left abutment,slope, and crest (III).	400813	1110134
28	Nephi; Juab High School (555 East 800 North): SMA-1 (I).	394239	1115005
29	Joes Valley dam; SMA-1 on crest, midslope, and toe (I).	391724	1111612
30	Richfield; Utah Dept. of Highways garage (100 West 708 South): SMA-1 (I).	384529	1120509
31	Cedar City; Southern Utah State College Library, seismic vault: SMA-1 (I).	374032	1130406

SMA-1 and CRA-1 are manufactured by KINEMATICS, Pasadena, California)

I. United States Geological Survey, Menlo Park, California: Arnold Acosta (213-297-1672), Richard Maley (415-329-5670).

II. United States Geological Survey, Denver, Colorado: Dave Carver (303-236-1618), Ken King (303-236-1591).

III. Bureau of Reclamation, Denver: Andy Viksne (303-236-4196), Bureau of Reclamation, Salt Lake City: Dan Grundvig, (801-524-4161).

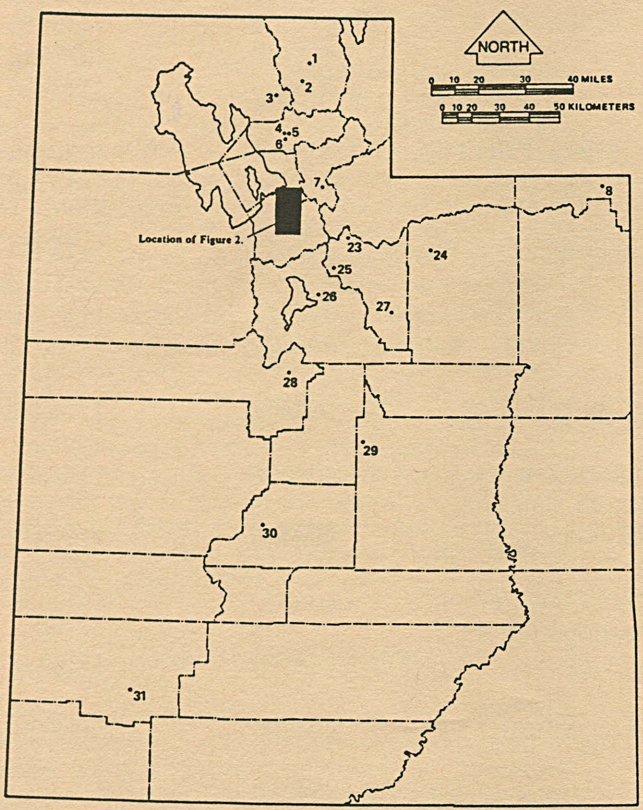

Figure 1. Map of Utah showing location of strong-motion instruments.

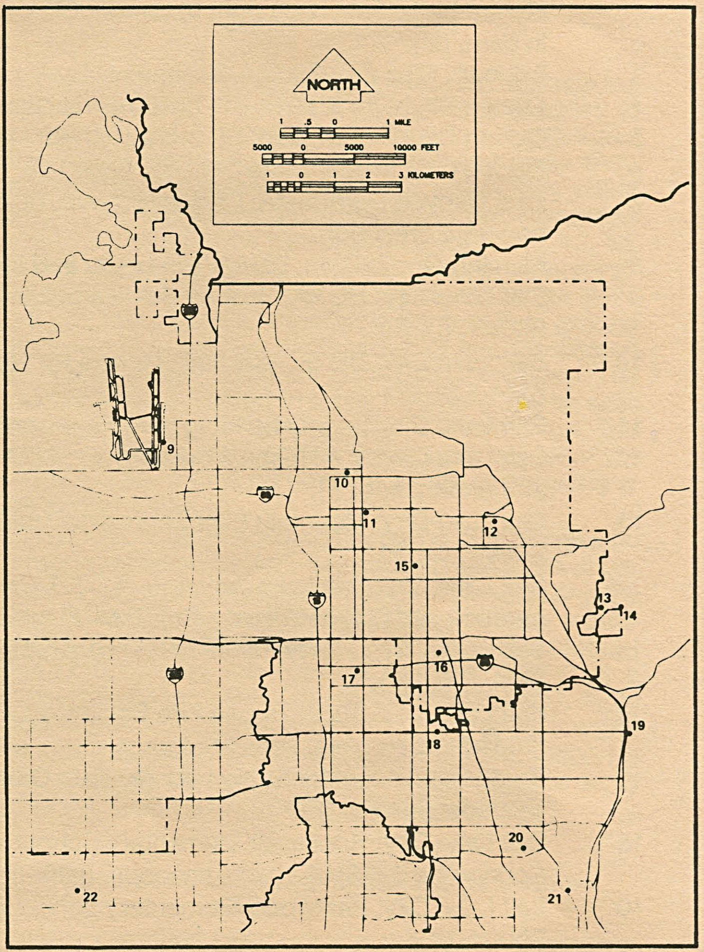

Figure 2. Inset map of Salt Lake Valley from figure 1 showing location of strong-motion instruments.

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MEETING ON EARTHQUAKE INSTRUMENTATION FOR UTAH

by Susan S. Olig
Utah Geological and Mineral Survey

A panel of national and international experts met in late August at Alta, Utah, to provide state legislators with objective advice on what earthquake-related instrumentation is really needed to further define and reduce earthquake hazards in Utah. The Utah Policy Panel on Earthquake Instrumentation was brought together as part of a legislative study that resulted from a resolution filed by Representative Ray Nielsen in February, 1989. The "blue ribbon" panel was cochaired by State Senator Craig A. Peterson and former State Representative Jack Redd, and it included leaders in seismology, earthquake engineering, and earthquake policymaking:

Clarence R. Allen, California Institute of Technology
Richard Andrews, California Office of Emergency Services
Robert M. Hamilton, U. S. Geological Survey
Christopher Rojahn, Applied Technology Council
Anthony F. Shakal, California Division of Mines and Geology
David W. Simpson, Lamont-Doherty Geological Observatory of Columbia University
James H. Whitcomb, National Science Foundation
John H. Wiggins, Crisis Management Corporation

Additional expertise from the U. S. Geological Survey was provided by Roger D. Borcherdt and Thomas H. Heaton.

In addressing Utah's earthquake instrumentation needs, the panel was asked to give careful consideration to cost effectiveness and the state's best interests. An executive summary of the panel's recommendations follows.

The Problem

Earthquakes pose the greatest natural threat for destruction of life and property in Utah. Thousands of lives are at risk. Existing construction in Utah is particularly vulnerable to earthquake damage. Building losses alone may exceed $4.5 billion in a large Wasatch Front earthquake (total new construction in Utah approaches a billion dollars per year). To avoid an Armenian-like tragedy, more complete and better technical information is needed to provide the basis for various hazard-reduction strategies, including proper siting and construction practices and effective emergency preparedness.

The strategies will only be effective if they are based on information specific to Utah, and much of this information can only be collected by sophisticated instrumentation. Existing earthquake-related instrumentation in Utah is either out-of-date and/or seriously inadequate for meeting the state's needs-for earthquake monitoring, research, hazard identification and mitigation, earthquake engineering, risk and crisis management, emergency response, and public safety.

Primary Recommendations

The panel unanimously urges the State of Utah to invest in a minimal, integrated 5-point program for earthquake instrumentation that will make Utah a better, safer place to live and work. Funding totaling $2.65 million (one-time) and $382,000/yr (ongoing) is recommended for:

- **Modernizing seismic-network instrumentation**-to upgrade and modestly expand the essential but technologically obsolete network of seismographic stations and computerized recording facilities operated by the University of Utah Seismograph Stations, including expanded use of the state microwave system (one-time cost = $673,000; ongoing cost = $190,000/yr).

- **Strong-motion instrumentation for earthquake engineering**-to develop a new instrumentation program designed to provide information specific to Utah about (1) strong ground shaking close to large earthquakes, (2) the rate of decrease of strong ground shaking with distance, (3) amplification of ground motion due to local conditions, (4) threshold conditions for soil liquefaction, and (5) the effects of earthquakes on buildings and other structures (one-time cost = $1,600,000; ongoing cost = $120,000/yr).

- **Potable seismographs for strategic data collection**-to enable the cost-effective gathering of high-quality data needed for earthquake science and engineering but not readily obtainable with Utah's regional seismographic stations because of their inadequate number and distribution (one-time cost = $160,000; ongoing cost = $22,000/yr).

- **Communication systems for information transfer**-to enable the rapid transfer of earthquake information to emergency-management personnel, other state and local officials, the news media, and the general public by adapting existing technology for more automated and more reliable communication links (one-time cost = $85,000; ongoing cost = $10,000/yr).

- **Earthquake deformation monitoring from global positioning satellite measurements**-using new-technology surveying instruments useful for both monitoring pre-earthquake ground deformation and serving the needs of the state engineering community for statewide surveying and mapping (one-time shared cost = $135,000; ongoing cost = $40,000/yr).

The complete plan for the recommended program will be available soon as an open-file report from the Utah Geological and Mineral Survey. For further information on the program contact: Walter Arabasz, University of Utah Seismograph Stations, 581-6274; Genevieve Atwood, Utah Geological and Mineral Survey, 581-6831; or Jim Tingey, Utah Division of Comprehensive Emergency Management, 584-8370. The legislative report on the program will be prepared by Stan Eckersley of the office of the Legislative Fiscal Analyst. For further information on the legislative report contact: Glade Sowards, c/o Utah Engineering Experiment Station, 263-8000; or Senator Craig A. Peterson, 373-2749.

UTAH ADVISORY COUNCIL FOR INTERGOVERNMENTAL RELATIONS LOOKS AT EARTHQUAKE HAZARDS

by Gary E. Christenson
Utah Geological and Mineral Survey

At the May 26, 1989, meeting of the Utah Advisory Council for Intergovernmental Relations (UACIR), the UGMS, Utah CEM, and University of Utah Seismograph Stations (UUSS) made a presentation regarding earthquake hazards and steps toward loss reduction. The UACIR is an advisory group to the Governor's Office of Planning and Budget for science and technology. It is composed of State and local government agency heads and public officials and has 20 members. As a result of this meeting, the presenting agencies were asked to formulate a priority list of actions that government could take to reduce potential earthquake losses.

Such a list was compiled from recommendations of the 1983 Governor's Conference on Geologic Hazards, Utah Seismic Safety Advisory Council, and 1983 5-year Workplan for Hazards Reduction developed for FEMA, and was presented to the Council on June 23. Additional recommendations resulting from more recent studies were also incorporated. Although not a specific or comprehensive list, it includes government actions that these agencies (UGMS, Utah CEM, UUSS) believe to be the most important in terms of earthquake loss reduction. For Forum readers, the list is reproduced below. It is broken up into a top and second priority listing, but all are considered to be very important. It is interesting to note that many do not require significant funding, but rather a commitment on the part of government to consider earthquake hazards with some reallocation of resources to fulfill that commitment.

LIST 1. TOP PRIORITIES

1. Require all <u>new</u> school construction to conform to modern seismic building codes and require inspection during construction by local government building inspectors.
2. Mandate seismic safety evaluations of <u>existing</u> government buildings, including schools and health-care facilities, and develop a plan to retrofit or retire unsafe buildings.
3. Provide for geologic hazards evaluations of proposed sites for <u>new</u> government buildings or government-funded construction prior to site selection and design.

4. Include geologic hazards elements in local government master plans and/or land-use ordinances.
5. Adopt UBC annexes which include provisions for strong-motion instrumentation in new buildings.
6. Require disclosure of geologic hazards information in real estate transactions.
7. Modernize seismographic instrumentation operated by the University of Utah Seismograph Stations to meet State needs, and expand instrumentation to address needs of the engineering community for strong-motion information and public-safety officials for emergency response information.
8. Set increased individual, student, and teacher earthquake awareness and planning as a State goal.
9. Consider geologic hazards and progress toward hazard reduction as an annual agenda item of the Utah Advisory Council on Intergovernmental Relations, with presentations by the Utah Geological and Mineral Survey, Division of Comprehensive Emergency Management, University of Utah Seismograph Stations, and any other groups making significant progress.
10. Encourage higher levels in governments to identify their top concerns regarding geologic hazards based on loss estimation studies and risk evaluation.

LIST 2. SECOND PRIORITIES

1. Provide for earthquake resistance in regulated public utility, water supply and waste disposal, and transportation systems.
2. Review seismic safety of existing dams; provide guidelines and review seismic considerations for new dams and diked water impoundments.
3. Develop guidelines for engineering geologic reports for major government-funded construction projects.
4. Actively participate in the International Decade of Natural Disaster Reduction, including passage of a resolution and development of a plan of action.
5. Acquire new and more detailed geologic hazards mapping for use by State and local governments.
6. Promote involvement in earthquake hazard reduction by the banking and insurance communities by considering hazards in lending and insuring.
7. Define engineering geologists by statute, register or certify engineering geologists, or otherwise provide for assurances that geologic hazards work is done by qualified geologists; strengthen licensing requirements for architects, engineers, and building inspectors with regard to earthquake-resistant design and construction.

EARTHQUAKE RISK AND DEFENSIVE POLICIES AS PERCEIVED BY COMMUNITY LEADERS AND THE PUBLIC

by Gary E. Madsen; Dept. of Sociology, Utah State University

Loren R. Anderson; Dept of Civil Engineering, Utah State University

Jerold H. Barnes, Salt Lake County Planning Division

Craig V. Nelson, Salt Lake County Planning Division

The potential for damaging earthquakes along Utah's Wasatch Front has been well defined by a number of scientific and engineering studies. Earthquake hazard maps have been developed to identify areas that are particularly vulnerable to such causes of damage as strong ground shaking and surface rupturing. The implementation of plans to reduce earthquake losses are now underway in many communities in Utah. To maximize these efforts, however, it is considered important that scientists, planners and public officials be aware of how supportive the public and community leaders are for such actions.

This paper presents the results of two surveys of residents in the Salt Lake Valley. The first consisted of randomly drawn male and female adult residents, and the second of community leaders. Both surveys were conducted in the latter part of 1988 and the early part of 1989.

The community leaders included mayors, city councilpersons, and county commissioners (n=59), elected community councilpersons (n=16), county planning commission members (n=5), and the leadership of the Salt Lake Board of Realtors and the Salt Lake Home Builders Association (n=28). The total number of community leaders sampled was 108, or 71% of the 152 participants identified in the study. Each person was asked to fill out an anonymous self-administered questionnaire.

The public survey consisted of 409 adult men and women who lived in the Salt Lake Valley. They were randomly drawn from telephone listings and interviewed by telephone. The sample represents a 70% completion rate from the sampling frame. These anonymous telephone interviews were conducted by the Survey Research Center at the University of Utah. The margin of error for both community leaders and public samples is $\pm$ 5%. The results include information for assessing three factors: perceptions of earthquake risks, priorities for earthquake risk reduction, and opinions concerning who should be involved in the mitigation process.

Respondents were asked about their perceptions concerning the likelihood of a future major earthquake affecting the Salt Lake Valley during three periods: the next 100 years, 50 years, and 10 years. The alternatives for each case were very high, high, moderate, low and very low. Results are presented in figure 1. Responses of high and very high were combined to form the "high" category in the figure, and responses of low and very low were combined to form the "low" category.

Survey results from community leaders and the public indicate a great deal of concern about the likelihood of a major earthquake affecting the Salt Lake Valley during the next 50 to 100 years. Over 50% of the respondents perceive a high likelihood during the next 50 years and almost 70 percent a high likelihood during the next 100 years. It can also be seen that the responses of both groups are quite similar.

Next we wanted to see what levels of support existed for various actions to help reduce earthquake risks. During the spring of 1988, local government planners and building officials were interviewed to see what actions they felt would be most effective in reducing earthquake risks in the Salt Lake Valley. [See Wasatch Front Forum, v. 5, no. 1, p. 5-6. Ed.] Over forty different actions were evaluated. The actions presented to the community leaders and the public for their evaluations were those ranked highest by these planners and building officials.

The results are presented in figure 2. Each action was evaluated according to the following response alternatives: very high importance, high importance, moderate importance, low importance, and not at all important. Responses of very high and high were combined to form the "high" category in the figure, and responses of low importance and not at all important were combined to form the "low" category. The results indicate general overall support for all eleven actions. A high level of importance was identified by more than 50% of both samples for all policy items. The policy item that received the highest level of support from both groups was "controlling the location and specific design requirements of new hospitals, schools, police facilities and fire stations."

Lastly, who should be responsible for reducing earthquake risks? The results presented in figure 3, provide a comparison of differences and similarities between the opinions of community leaders and the public. Both groups feel that the federal government, state government, local governments and the private sector all share some responsibility. However, the public was most likely to identify major responsibility with local governments (74.3%), and community leaders were most likely to identify major responsibility with state government (67.9%).

How do these survey results apply to earthquake risk reduction in Utah? First, the Salt Lake Valley surveys indicate a high degree of shared opinion between the public and community leaders. There is widespread perception that a major earthquake is highly likely within the next 50 to 100 years in Utah's largest population center. There is also strong support for specific risk reduction actions, with government and public entities sharing responsibility. We feel that these results are applicable to other urban centers lying along the Wasatch Front.

FIGURE 1. HOW LIKELY DO YOU THINK IT IS THAT THERE WILL BE AN EARTHQUAKE CAUSING WIDESPREAD AND SEVERE DAMAGE IN THE SALT LAKE VALLEY WITHIN THE NEXT:

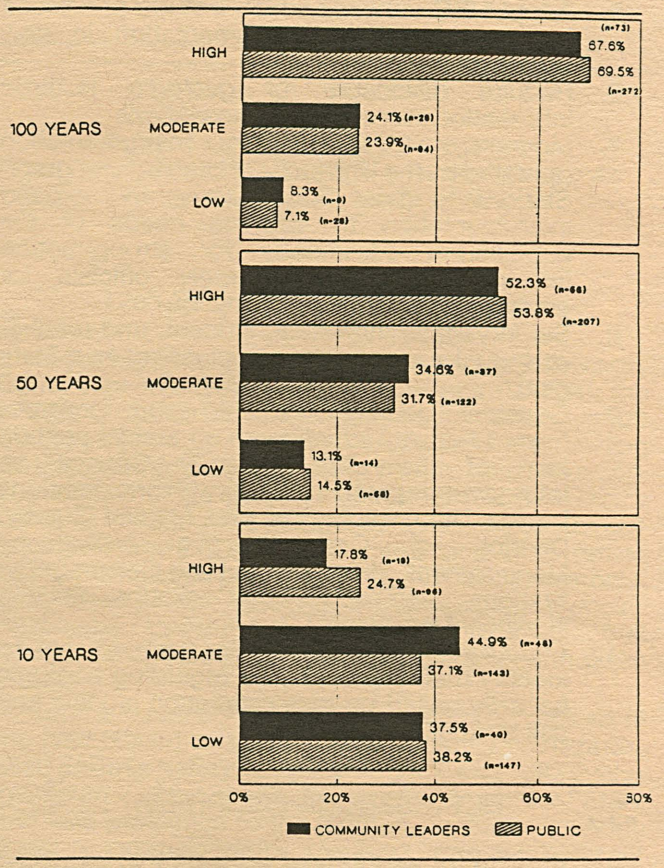


FIGURE 2.a. HOW IMPORTANT IS CONTROLLING THE LOCATION AND DESIGN REQUIREMENTS OF <u>NEW</u> HOSPITALS, SCHOOLS, POLICE AND FIRE STATIONS?

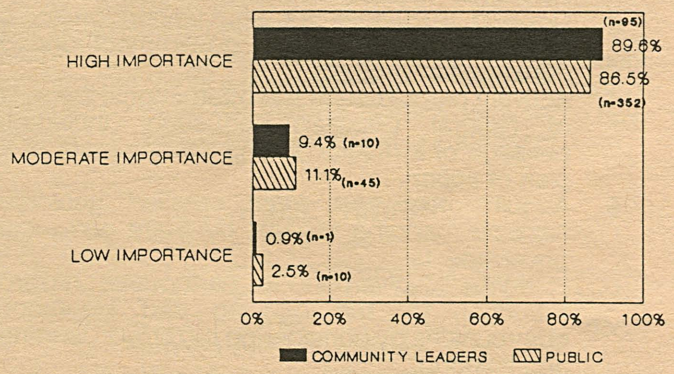


FIGURE 2.b. HOW IMPORTANT IS STRENGTHENING EXISTING HOSPITALS, SCHOOLS, POLICE AND FIRE STATIONS?

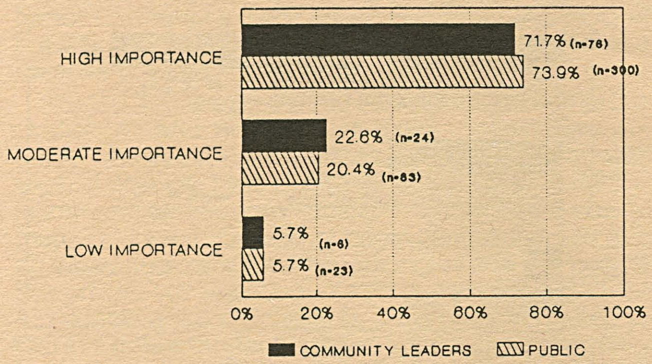


FIGURE 2.c. HOW IMPORTANT IS PUBLIC EDUCATION AND INFORMATION ABOUT EARTHQUAKE HAZARDS AND PREPAREDNESS?

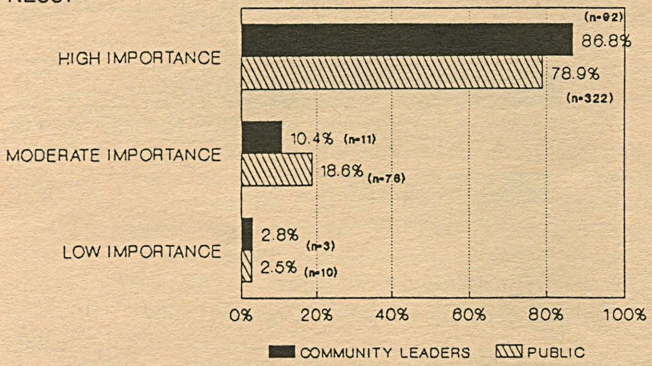


FIGURE 2.d. HOW IMPORTANT IS PROVIDING PUBLIC OFFICIALS WITH EARTHQUAKE HAZARD INFORMATION?

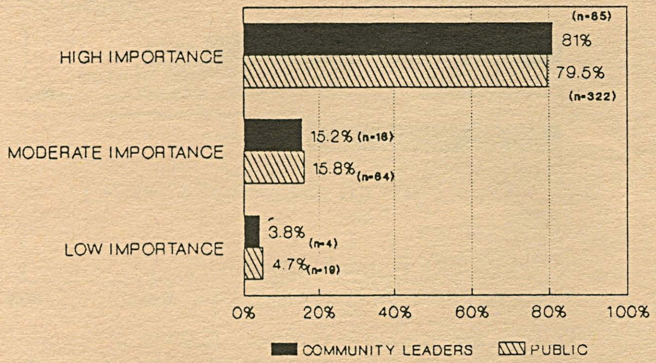


FIGURE 2.e. HOW IMPORTANT IS PROVIDING PUBLIC OFFICIALS WITH TECHNICAL ASSISTANCE?

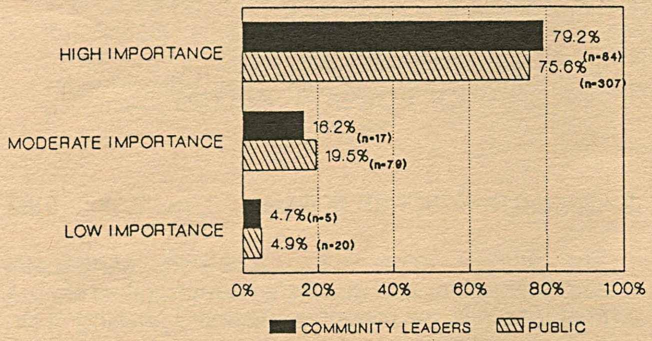


FIGURE 2.f. HOW IMPORTANT IS PROMOTING LAND USE PLANNING WHICH CONSIDERS EARTHQUAKE HAZARDS?

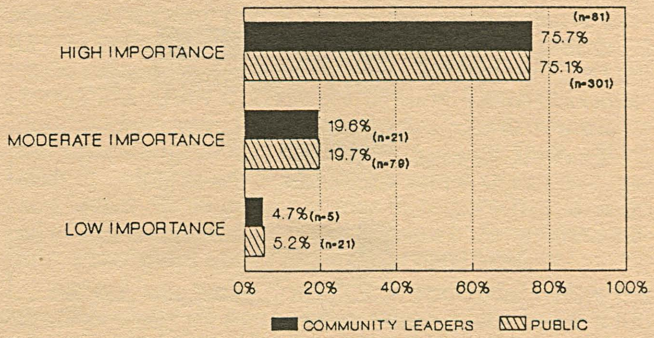


FIGURE 2.g. HOW IMPORTANT IS ADHERING TO EXISTING EARTHQUAKE RELATED BUILDING CODES AND ZONING?

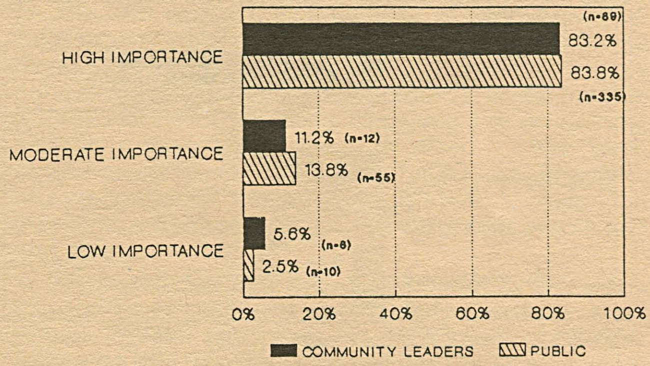


FIGURE 2.h. HOW IMPORTANT IS ESTABLISHING MORE STRINGENT BUILDING CODES AND ZONING ORDINANCES?

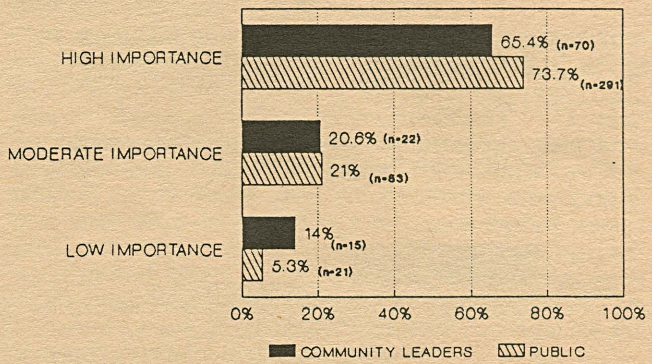


FIGURE 2.i. HOW IMPORTANT IS ADOPTING UNIFORM BUILDING CODES AND ZONING ORDINANCES?

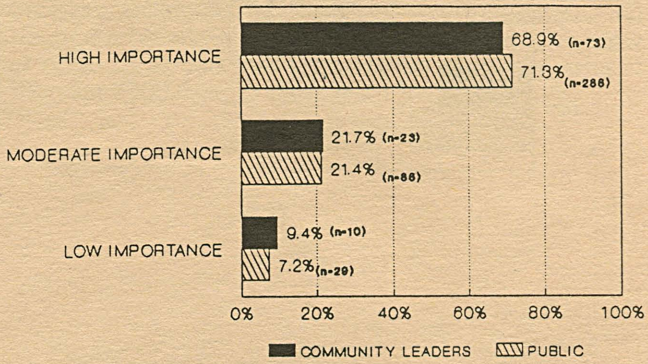


FIGURE 2.j. HOW IMPORTANT IS REQUIRING DISCLOSURE OF THE EARTHQUAKE HAZARD(S) TO REAL ESTATE BUYERS?

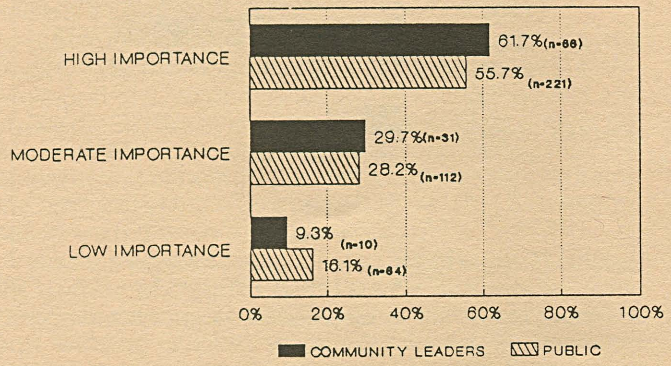


FIGURE 2.k. HOW IMPORTANT IS ENCOURAGING PROGRAMS WHICH IMPROVE EMERGENCY RESPONSES TO EARTHQUAKES?

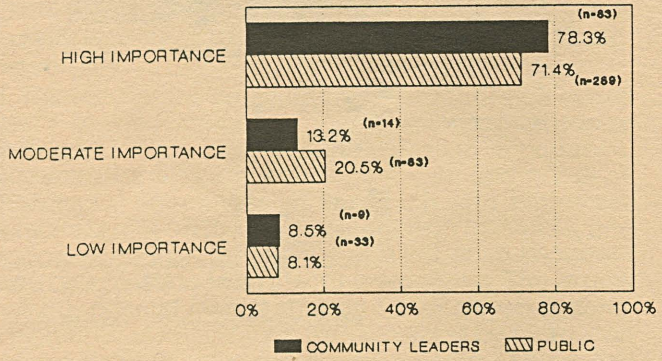
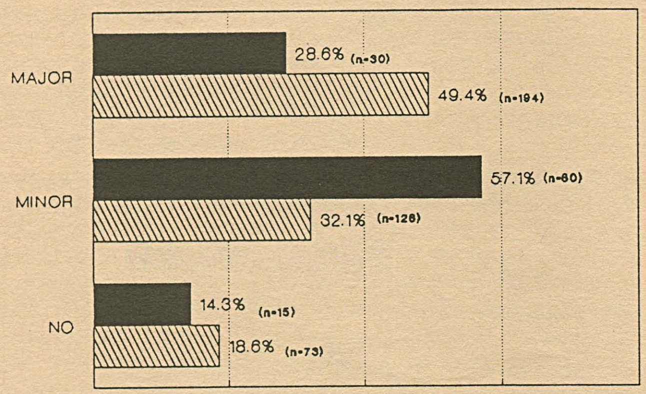
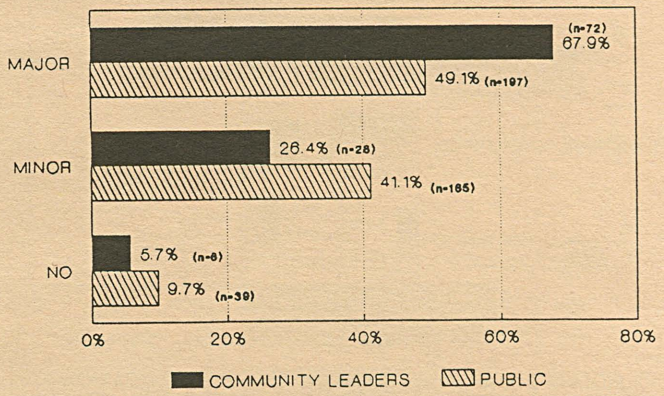


FIGURE 3. WE ARE INTERESTED IN KNOWING YOUR OPINION ON WHO HAS A RESPONSIBILITY FOR REDUCING THE RISK OF ECONOMIC DAMAGE AND/OR LOSS OF LIFE FROM EARTHQUAKES.

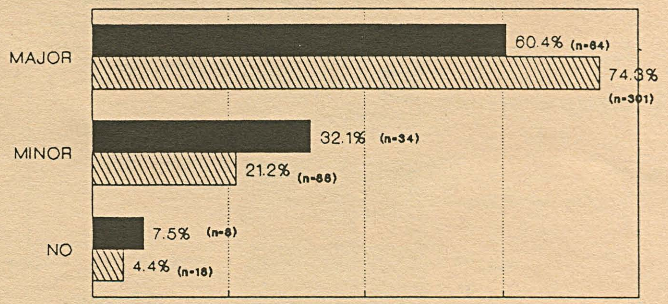
DO YOU THINK THE FEDERAL GOVERNMENT HAS A MAJOR, A MINOR OR NO RESPONSIBILITY?



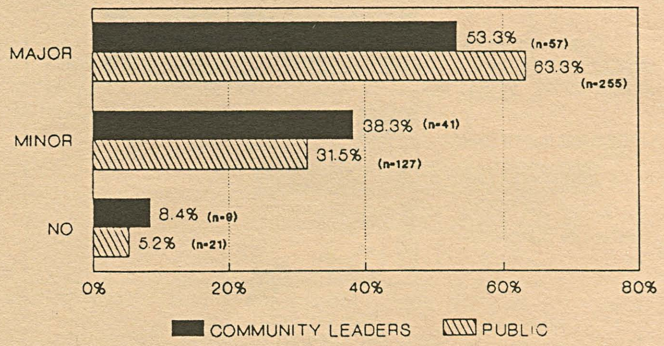
DO YOU THINK THE STATE GOVERNMENT HAS A MAJOR, A MINOR OR NO RESPONSIBILITY?



DO YOU THINK LOCAL GOVERNMENTS (CITIES, COUNTIES) HAVE A MAJOR, A MINOR OR NO RESPONSIBILITY?



DO YOU THINK PRIVATE BUSINESSES AND PRIVATE CITIZENS HAVE A MAJOR, A MINOR OR NO RESPONSIBILITY?



IN MEMORIAM

DR. ROBERT L. KETTER
1928 - 1989

Excerpted from NCEER Bulletin, v. 3, no. 3, July 1989

The world's engineering, research, earthquake hazard mitigation, and academic communities shared a great loss with the recent unexpected passing of Dr.

Robert L. Ketter. Dr. Ketter, a world-renowned earthquake engineer and Director of the National Center for Earthquake Engineering Research (NCEER) at the State University of New York at Buffalo, died of a massive coronary on April 18, 1989.

During his lifetime, Robert Ketter took on numerous challenges and professional roles - researcher, engineer, statesman, administrator, educator - and with each challenge, he met with great success. A natural leader and skilled communicator, Ketter had a charismatic presence capable of captivating hundreds in a crowded auditorium, or influencing one or two people in a private conversation. Yet, those impressed by his formidable accomplishments were often surprised to find just how unpretentious and approachable he really was. As an administrator, he brought out the best in his people, often leading to accomplishments that others may have thought impossible. While onlookers said, "it can't be done," Ketter did it.

In 1986, Dr. Ketter added to his long list of achievements by successfully leading a team of researchers from several prestigious Northeast universities to capture a National Science Foundation $25 million grant to establish the National Center for Earthquake Engineering Research at the University of Buffalo. Under Ketter's guidance, the Center developed a research program involving more than 80 researchers nationwide, and established cooperative agreements with Japan, the People's Republic of China, Mexico and Taiwan, helping to unify the fight against the risk of earthquakes.

While the impact of his vast accomplishments will long be remembered, it is undoubtedly Robert Ketter, the man, who will be missed the most and remembered the longest.

LOOKING FORWARD TO THE U.S. DECADE

by Genevieve Atwood, Director
Utah Geological and Mineral Survey

Reprinted from Natural Hazards Observer, v. 13, no. 5, p. 5.

The following is the first article of a series in which individuals in government, academia, and the private sector will discuss their visions and concerns regarding the upcoming Decade for Natural Disaster Reduction.

When asked what Utah is doing as part of the International Decade, I could not immediately point to particular actions, although I know our state is preparing to do quite a bit. So far, our governor has declared the 1990s the "Utah Decade for Natural Disaster Reduction," and we have brainstormed needs and dreams for the upcoming years. My hopes are that Utah will be able to celebrate and showcase some of our successes, make additional headway to reduce risk, and do all of this better and faster while we exchange information with others about hazards experiences.

As yet, we really don't know specifically how the State of Utah will accomplish these goals, but it is fun to think about the showcase aspect of the Decade. I wonder why it is that people like to claim their area's hazards are more impressive or "more unique" than other areas. For instance, I love to explain the geologic causes and exotic consequences of (as well as the legislature's inability to deal with) Utah's earthquake hazards or the Great Salt Lake's rise and fall. I know John Rold, my counterpart in Colorado, is jealous that the 1983 landslide at Thistle, Utah, was the single most expensive landslide in the U.S. when he has "even bigger" landslides in Colorado. I even hear intrastate hazard competition, e.g., "my area's hydrocompaction problems are worse than your swelling soils problems," and so on.

I've concluded that it is quite human to enjoy discussing one's problems - particularly disasters. Most people like the scariness and excitement of disaster scenarios and the existential gamble that "it won't happen to me." This natural human trait makes showcasing local hazards inviting to state and local officials and thus a logical activity of the Decade.

Fortunately, the Decade will not just showcase the effects of natural hazards; it will do something about them. We here in Utah have plenty to learn from others, and we think, plenty to share with others. Our most important needs during the Decade are: 1) to learn how to implement; and 2) to implement reduction strategies. Utah is ready--technically, intellectually, emotionally, and financially--to implement far more than it has. I have heard what great progress we are making (and we are) and how special some of our programs have been (and they have), but we have a long way to go before we have adequately prepared our state for the inevitable natural disasters to come.

So I look forward to the Decade for Natural Disaster Reduction, and even though I do not know exactly what projects, initiatives, showcases, and exchanges will occur, I am certain the Decade will provide a "window of opportunity" so that Utah will be markedly safer in the year 2000 than in 1990.

Utah Earthquake Activity

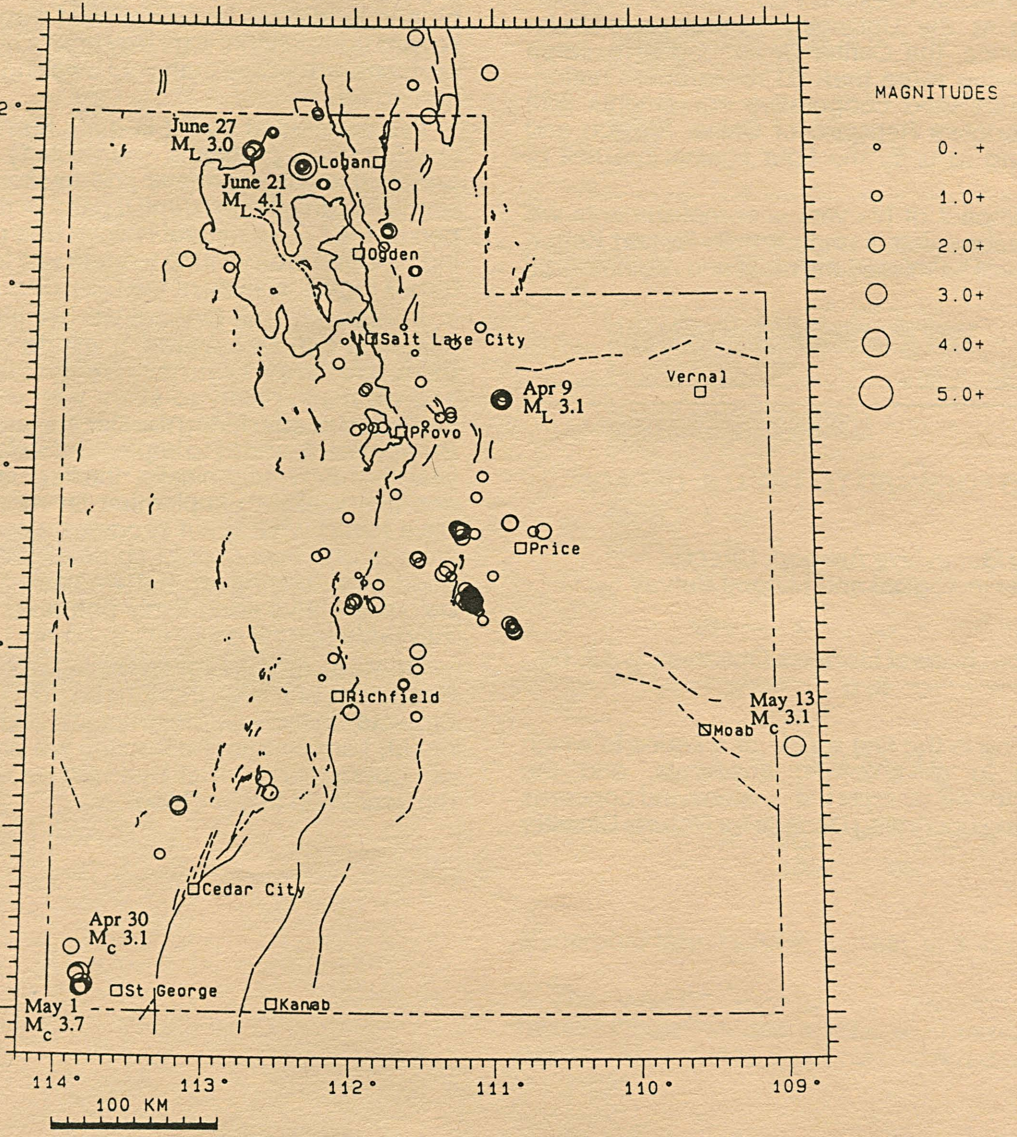
by Susan J. Nava
University of Utah Seismograph Stations, Department of Geology and Geophysics

During the three-month period April 1 through June 30, 1989, the University of Utah Seismograph Stations located 190 earthquakes within the Utah region (see accompanying epicenter map). Of these earthquakes, 97 had a magnitude (either local magnitude, M_L, or coda magnitude, M_C) of 2.0 or greater, six had a magnitude of 3.0 or greater, and four were reported felt.

The largest earthquake during the report period was a shock of M_L4.1 on June 21 at 03:54 PM MDT, 16 km west of Tremonton, in the Blue Springs Hills of north-central Utah. This earthquake was reported felt in Tremonton, Howell, Riverside, Corinne, Garland, Plymouth, and at the Thiokol Plant. During the report period, ten earthquakes associated with the Blue Springs Hill sequence have been located.

Five other earthquakes of magnitude 3.0 and greater occurred in the Utah region during the report period: an M_L3.1 event on April 9 at 05:24 AM MDT, felt in Tabiona; an M_C3.1 event on April 30 at 03:20 AM MDT, located 10 km west of Santa Clara; an M_C 3.7 event on May 1 at 12:35 PM MDT, which was felt in Santa Clara; an M_C 3.1 event on May 13 at 03:01 PM MDT, located 50 km east-southeast of Moab; and an M_L 3.0 event on June 27 at 09:51 AM MDT, located 25 km south of Snowville. One additional earthquake was reported felt in Utah during the report period: an M_L 2.7 event on April 3 at 09:06 PM MDT, which was felt in Emery County.

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



REPORT OF THE COLORADO WORKSHOP ON HAZARD MITIGATION IN THE 1990s

Toward the U.S. Decade for Natural Disaster Reduction

For two and one-half days in October 1988, 40 hazards researchers, practitioners, and policy makers gathered to generate ideas and make recommendations for a U.S. Decade for Natural Disaster Reduction. The workshop occurred at a propitious time: before formal institutional structures for the U.S. Decade were established and before the idea had been widely discussed within the U.S. hazards community. Since the Decade was still undefined, the participants had great opportunity to make suggestions for the USDNDR.

The discussions ranged from philosophical, theoretical, and applications perspectives on hazard reduction to details on institutional relationships and structures for the Decade. Tensions sometimes erupted over how to move the Decade forward; who should take the lead; where funding would come from; and what social, economic and political constraints needed to be overcome. Yet, the group agreed broadly that a U.S. Decade offered a rare and potentially fruitful vehicle for making great strides in hazard reduction for raising consciousness about the problems posed by hazards, and for strengthening the sense of mission within the hazards community. The group also felt that the Decade needed quick and high-level support and steering from government, research institutions, and leaders in the hazards field as called for in the Congressional mandate. The participants also recognized that the Decade would succeed only through solid participation and implementation at the state and local level and through collaboration with the private sector; and that participants needed quickly to identify clear-cut, realistic program goals for the Decade.

What follows is the Executive Summary reprinted from this report prepared by the Natural Hazards Research and Applications Information Center, Sherry D. Oaks, Editor.

EXECUTIVE SUMMARY

> Whereas the natural hazards of earthquakes, tsunamis, volcanoes, floods, hurricanes, typhoons, tornadoes, landslides, and wildfires have caused great loss of life, enormous property damage, and untold suffering in the United States and throughout the world;
>
> Whereas Congress, recognizing that natural and technological hazards may not be independent of one another in any given disaster...
>
> Now, therefore, be it Resolved...
>
> That Congress strongly endorses the establishment of a United States Decade for Natural Disaster Reduction as a means of supporting the goal of the International Decade for Natural Disaster Reduction to enhance existing cooperative efforts and promote new cooperative efforts to reduce the devastating impact of natural hazards in the United States and throughout the world.
>
> From legislation establishing the United States Decade for Natural Disaster Reduction, 100th Congress, 2nd Session

Background

In 1988, the U.S. Congress passed legislation establishing the United States Decade for Natural Disaster Reduction (USDNDR) (H. Con. Res. 290, S. Con. Res. 131, 100th Congress, 2nd Session). In doing so, the Congress also endorsed the International Decade for Natural Disaster Reduction (IDNDR) established by a unanimously passed resolution of the 42nd Session of the United Nations General Assembly in December 1987.

The U.N. resolution urges each member nation to establish its own national program for a decade of hazard reduction within its boundaries and, unilaterally or multilaterally, with other member nations. The USDNDR, therefore, serves two purposes: 1) it focuses on natural hazard reduction within the United States and 2) it forms the frame work in which the United States can cooperate with other U.N. member nations to reduce natural disasters throughout the world.

As spelled out in the U.N. resolution on the IDNDR, the goal of hazard reduction is to be accomplished through the application of extensive, existing physical science, social science, and engineering knowledge; through the identification of gaps in knowledge; through the implementation of mitigation measures, preparedness planning and hazard awareness; and through the timely and effective transfer of information and knowledge on hazard reduction.

In establishing the USDNDR, the U.S. Congress called for the enhancement of existing programs and new cooperative efforts between governmental and nongovernmental groups.

In mid-October of 1988, 40 hazards researchers, practitioners, and policy makers gathered near Estes Park, Colorado, to generate additional ideas, to make recommendations for better cooperation through existing mechanisms, and,to make suggestions for new cooperative efforts aimed at hazard reduction in the United States during the 1990s.

Recommendations of the Workshop

Participants at the U.S. Decade workshop contributed to five working groups which examined: 1) Integration of Disciplines, 2) Social, Economic, and

Political Constraints, 3) Technology Transfer, 4) Private Sector Role, and 5) State and Local Role.

The goal of each working group was to suggest approaches, strategies, and goals for hazard reduction in the 1990s in the United States, keeping in mind the status of hazard reduction at present, trends that may affect future efforts, and short- and long-term hazard reduction goals. The workshop produced several cross-cutting suggestions and recommendations, including:

- That the USDNDR should identify a limited number of specific goals to be achieved by the end of the Decade, and that these goals should include:

  1) providing effective hazard mitigation at the state and local level;
  2) assessing the status of hazard research and applications to provide a baseline for the Decade; and,
  3) assessing and strengthening existing programs that can contribute to the Decade.

- That the USDNDR will succeed only with broad, early, and concrete participation by state and local institutions with hazard responsibilities, and that it is at this level that implementation will have to occur;
- That the USDNDR must involve the private sector in all planning and implementation. The Decade offers a special opportunity to construct private-public partnerships for hazard reduction built on the incentive of long-term benefits rather than the disincentive of regulation or loss;
- That the USDNDR must rely on effective technology and information transfer from those able to generate information and research findings and those who know how to implement hazard reducing efforts;
- That the USDNDR needs an integrated plan from the beginning for monitoring and evaluating its progress, along with a set of criteria for measuring actual hazard reduction; and,
- That the USDNDR should focus on domestic hazards and needs of U.S. regions and communities facing the most serious threats from natural extremes while complementing and supporting the International Decade for Natural Disaster Reduction where possible.

Next Steps and Goals

Several important next steps were identified at the workshop. Workshop participants urged federal agencies and the National Academy of Sciences to agree on an organizational structure for the U.S. Decade for Natural Disaster Reduction at the national level. The development of a process to keep hazard groups at different governmental levels and institutions informed of USDNDR program developments was also suggested. That process would also allow these entities to contribute to a nationally coordinated USDNDR effort.

The need to develop a set of broad goals in the U.S. for hazards reduction programs during the next decade was identified as another important "next step." A set of broad goals gives each level of government and all relevant institutions a focus, but allows each entity to organize a subset of goals and objectives to complement the national effort. Such program planning could include short-range (1-3 years) and long-range (5-10 years or more) horizons.

There were many suggestions for possible steps in the near future, including:

- Recognition by the executive branch of federal government in the form of an executive order or presidential proclamation;
- Establishment of a program to nurture state, local, and private sector contributions to the USDNDR;
- Creation of a national steering committee or advisory group broadly representative of the hazards field;
- Assessment of knowledge about and efforts being made in hazard reduction, including actual regional comprehensive hazard assessments; and,
- Creation of local or regional demonstration projects.

To obtain copies of the full Report, contact the Natural Hazards Research and Applications Information Center Publications Clerk, Institute of Behavioral Science #6, Campus Box 482, University of Colorado, Boulder, CO 80309-0482, (303) 492-6819.

REDUCING DISASTERS' TOLL
The United States Decade for Natural Disaster Reduction

by the Advisory Committee on the International Decade for Natural Hazard Reduction

The concept of a cooperative international program to reduce natural hazards was first presented by Dr. Frank Press, president of the National Academy of Sciences, at the Eighth World Conference on Earthquake Engineering in 1984. The growing interest in establishing an International Decade led to the appointment of the National Research Council Advisory Committee on the International Decade for Natural Hazard Reduction. It was charged with evaluating the potential for such an effort and how best to realize that potential. The committee, composed of natural hazard experts from many disciplines, was drawn from academia, the private sector, and the federal government.

The benefits of an International Decade, its possible structure, and some of its suggested projects are described in "Confronting Natural Disasters: An International Decade for Natural Hazard Reduction" (Advisory Committee on the IDNHR, National Research Council, 1987). That report recommends that each concerned country organize its own National Decade for Natural Disaster Reduction. The essential features of such a U.S. effort are described in this companion report, "Reducing Disasters' Toll", which is intended not only for individuals in the hazard reduction field but also for the broader audience of policy makers and the interested public. It presents the rationale and framework for the United States Decade for Natural Disaster Reduction (USDNDR), commencing in 1990. Such a Decade would initiate an integrated U.S. program in natural hazard reduction and would form the U.S. contribution to the recently designated International Decade for Natural Disaster Reduction (IDNDR), also to begin in 1990.

The Advisory Committee recommends that the United States establish and fund a vigorous, goal-oriented United States Decade for Natural Disaster Reduction to provide a national focus for hazard reduction activities. This will not only be the most fruitful mechanism for contributing to and receiving full benefit from the International Decade, but it also reflects the nation's need to assess its rising hazard risk and to forge comprehensive national policies and programs to reduce that risk.

Such a Decade would offer the United States the benefits of national programs of research and application developed in other nations facing risks similar to its own. It would also offer an unparalleled opportunity to work with other nations toward the objective of saving lives and property, and maintaining economic vigor in the face of mounting worldwide exposure to natural hazards. The nation faces a choice of continuing its current practice of responding to natural hazards primarily through disaster relief efforts, or of acting on the philosophy of hazard management that recognizes the vital role of mitigation efforts to reduce the consequences of hazards, while continuing to provide relief and recovery assistance. In addition, government at all levels can seize this opportunity to take stock of the nation's current hazards programs, to assess their strengths, and to determine where they must be realigned or augmented to function efficiently.

For a variety of reasons, the present hazard management system to a large degree consists of an array of independent programs undertaken by a host of different local, state, and federal authorities - many with conflicting responsibilities - as well as by many private organizations. Coordinating these programs into an integrated hazard reduction system pursuing nationally accepted goals is a challenge that will require an increased and concerted effort from the nation's hazard reduction community - an effort best undertaken in the form of the United States Decade for Natural Disaster Reduction.

To best achieve this effort, the Advisory Committee recommends that a national committee for the Decade be established to : (a) provide leadership for U.S. national efforts; (b) seek support for the national program of loss reduction research and implementation from federal and state governments, foundations, and professional, scientific, and other organizations; and (c) coordinate U.S. participation in the international program in support of the IDNDR. The National Research Council, in consultation with the U.S. government, could establish such a committee. It is desirable that the committee be appointed as early as possible in order to plan adequately the USDNDR program before its recommended start in 1990, in concert with IDNDR. The committee should include participation from professional organizations, government agencies, universities, and other interested parties.

Limited copies of this report are available from: U.S. National Committee for the Decade for Natural Disaster Reduction, Commission on Engineering and Technical Systems, 2101 Constitution Avenue, N.W., Washington, D.C. 20418.

EARTHQUAKES AND BUILDING CODES

The 1988 Uniform Building Code (UBC) contains the most significant changes in seismic design provisions since 1973. Because of these changes, the International Conference of Building Officials (ICBO) has a one-day seminar available to interested organizations that spotlights these changes. The seminar provides an overview of the new regulations and discusses changes in building design and construction for locations where seismic risk exists. It also presents a new base-shear formula, a new seismic zone map, new definitions for regular and irregular structures, new rules for dynamic analysis, and special design and detailing for masonry, wood, concrete, and steel. The seminar will be useful to all engineers, architects, planning officials, and building inspectors involved with seismic safety. It is available at a base rate of $1,312, plus $20 per student. For further information, contact Jay Woodward, ICBO Education Department, 5360 South Workman Mill Road, Whittier, CA 90601, (213) 699-0541.

Reprinted from the Natural Hazards Observer

FHWA SHORT COURSE: SEISMIC DESIGN OF HIGHWAY BRIDGES

The Federal Highway Administration (FHWA), through the National Highway Institute (NHI) and in cooperation with the Office of Implementation and the Bridge Division, is sponsoring up to 20 presentations of this 4-1/2 day course. Instructional material was developed for FHWA by Imbsen & Associates, Inc. The course will be taught by staff from this firm. Supplementary material to be used in the course will include "Seismic Design and Retrofit Manual for Highway Bridges," (FHWA-IP-87-6), "Seismic Retrofitting Guidelines for Highway Bridges" (FHWA-RD-83-007), and the 1983 American Association of State Highway and Transportation Officials (AASHTO) "Guide Specifications of Seismic Design of Highway Bridges."

COURSE DESCRIPTION: The 1971 San Fernando earthquake was the major turning point in the development of seismic design criteria for bridges in the United States. It started a chain of events which led to AASHTO adopting a set of guidelines in 1983 to establish design provisions for bridges to minimize their susceptibility to damage from earthquakes.

The AASHTO Guide Specification was developed to be applicable to all parts of the United States. Since the seismic risk varies from very small to high across the country, four seismic performance categories (SPC) are defined. Seismic design and analysis of different degrees of complexity and sophistication are specified for each SPC.

Between 1984 and 1987, the FHWA produced the "Seismic Design and Retrofit Manual for Highway Bridges" which synthesized previous recommendations and incorporated the latest research and information from post-earthquake field investigations. This training course is a follow-up to this document.

The course includes background material on seismology, structural dynamics, and limited computer applications but the main purpose of the course is to familiarize designers with the AASHTO Guide Specifications. The course will be tailored to the extent practical for the design of bridges in the seismic region of the country where it is presented. Other topics include: seismic loading, seismic response analysis, design concepts, retrofitting and advanced topics.

NUMBER OF PARTICIPANTS: Class size is limited to a maximum of 40 participants. Up to 15 percent of the maximum number may be reserved for FHWA employees.

COST: The cost of sponsoring this course is $4,000.

COURSE REQUESTS: Pilot courses have been conducted in Sacramento, California, and in Olympia, Washington. The course is now available for scheduling in response to requests from State highway agencies and others.

Info: Mr. Larry E. Jones; Federal Highway Administration; National Highway Institute (HHI-22); 6300 Georgetown Pike; McLean, VA 22101. Telephone (703) 285-2779.

Reprinted from EERI Newsletter.

GRANTS

Utah's earthquake threat. "Expert Synthesis and Translation of Earthquake Hazard Results - A Book for Non-Scientists in the Wasatch Front Region," U.S. Geological Survey, $55,550, 12 months. Contact: Walter J. Arabasz, Department of Geology and Geophysics, University of Utah, Salt Lake City, UT 84112-1183, (801) 581-6274, or Don R. Mabey, c/o Utah Geological and Mineral Survey, 606 Black Hawk Way, Salt Lake City, UT 84108-1280, (801) 581-6831.
This grant will enable the writing and publication of a book, aimed at the non-earth-scientist, presenting an understandable and up-to-date distillation of scientific information concerning Utah's earthquake threat. Besides the principals listed above, a social scientist and a professional planner will collaborate in producing the book. The work will involve: 1) interviews and discussion with the scientific investigators who have worked in the Wasatch Front earthquake hazards program in order to synthesize the existing technical information; 2) formulation of intermediate level summaries from these discussions; and 3) translation of the technical information into a nontechnical book for the general public, teachers and students, and decision makers.

Earthquake damage reduction. "Assistance in Implementing Seismic Safety Programs in the Wasatch Region, Utah, USGS, $55,220, 12 months. Principal Investigators: Martha Blair-Tyler and George G. Mader, William Spangle and Associates, 3240 Alpine Road, Portola Valley, CA 94025, (415) 854-6001.
As part of the implementation element of the National Earthquake Hazards Reduction Program (NEHRP), the principal investigators will conduct a series of workshops in Utah for planners and public officials in order to present methods of using geological and seismic information in local programs to reduce earthquake hazards. In addition, Blair-Tyler and Mader will be available in person or by phone to offer assistance regarding specific problems in specific areas. USGS and Utah state officials hope that this innovative approach of transferring research information and experience through personal contacts rather than written reports will maximize the use of already existing information and experience.

Land use and earthquake hazards. "A Demonstration Project with Salt Lake City and Salt Lake County on Risk Analysis, Land Use Planning and Earthquake Hazard Reduction," USGS, $104,385, 20 months. Principal Investigators: Philip Emmi and Eugene Carr, Department of Geography, University of Utah, Salt Lake City, UT 84112, (801) 581-5562 or (801) 581-8218.
The urbanized areas of Utah's Wasatch Front are exposed to a variety of seismological and related geological hazards. This demonstration project will involve a team of researchers, planning consultants,

and members of planning commission staffs who will help develop accurate and responsive local hazard mitigation policies. The project has two major goals. The first is to translate available geotechnical information into useful, policy-relevant forms. The second is to assist in the assimilation of technical information into local policy decision-making processes through reformulation of local land-use plans, development regulations, building codes, and capital improvement programs. The project will review, compile, and create digital maps of geologic hazards and human-made systems. This information base will be easily modified and manipulated as new research becomes available, and will permit development of computer-based damage scenarios for use in defining risk and evaluating mitigation measures. A final task is to develop and distribute a complete geologic hazard educational package.

Earthquake mitigation. "The Implementation of an Earthquake Hazard Mitigation Program in Salt Lake City, Utah," USGS, $119,038, 18 months. Principal Investigator: Gary Madsen, Department of Sociology, Utah State University, Logan, UT 84322, (801) 750-1233.
This project will develop an earthquake hazard preparedness program for Salt Lake County involving public officials, community groups, and the general public. The program will create heightened awareness of earthquake problems, generate public acceptance of earthquake hazard reduction programs, and establish an earthquake hazard mitigation plan for the county. Project managers have already accomplished three primary tasks: 1) assessing earthquake hazard reduction priorities of public officials in the county, 2) assessing public awareness and understanding of earthquake hazards, and 3) developing an educational program for Salt Lake community groups. [See article by Gary Madsen in this issue of the Wasatch Front Forum. Ed.] With a supplemental grant of $66,585, the investigators will start a second, 12-month phase of the project beginning January 1, 1990. The final tasks are: 4) implementing the education program with materials designed for three distinct audiences (volunteer organizations, the business community, and local government officials), and 5) evaluating the program's effectiveness.

Risk communication. "State-of-the-Art Assessment of Risk Communication of Earthquake Hazards," National Center for Earthquake Engineering Research, $25,000, 12 months. Principal investigator: Sherry D. Oaks, National Center for Earthquake Engineering Research, State University of New York at Buffalo, Red Jacket Quadrangle, Buffalo, NY 14261, (303) 440-4445.
The major objective of this project is to provide an integrated baseline assessment of risk communication concerning earthquake hazards. The findings should be useful to researchers, practitioners, decision makers, and others involved in the management and mitigation of earthquake hazards. Effective governmental and nongovernmental efforts in earthquake hazard risk communication will be examined, and the study will also analyze successful communication of other risks to assess applicability to earthquake risk communication. The research will identify gaps in knowledge and practice, thereby contributing to the setting of priorities for future problem-focused research and applications.

Earthquake research. "A Program to Maximize Learning from Destructive Earthquakes," National Science Foundation, $168,242, 18 months. Principal Investigators: Frank E. McClure and Susan Tubbesing, Earthquake Engineering Research Institute (EERI), 6431 Fairmount Avenue, Suite 7, El Cerrito, CA 94530-3624, (415) 525-3668.
This grant will enable EERI to continue its program of studying destructive earthquakes. The effort includes conducting immediate postearthquake investigations to discover information that can improve construction practices, providing a clearinghouse for such postearthquake studies, and disseminating the information gained by holding public briefings and publishing special reports. EERI will continue the program for at least the next three years. Over that time the institute hopes to obtain increasingly focused information on the performance of structures in earthquakes, to determine concomitant effects on humans and their behavior, and to improve the data collection and dissemination processes.

MEETINGS AND CONFERENCES

November 16-19, 1989, Eighth national congress on seismic engineering and Seventh national congress on structural engineering, held in Acapulco, Mexico. For information, contact Sociedad Mexicana de Ingenieria Sismica A.C., Camino Santa Teresa No. 187, Col Bosques del Pedregal, 14020 Mexico, D.F., telephone 573-80-11 ext. 141 and Sociedad Mexicana de Ingenieria Estructural, A.C., Av. Nuevo Leon No. 54-2 Piso, Col. Condesa, 06140, Mexico, D.F., telephone 553-85-68 and 553-55-96.

March 14-16, 1990, Cordilleran Section, Geological Society of America, 86th annual meeting, held at the University of Arizona in Tucson, Arizona. For more information, contact General Chairman William R. Dickinson, Department of Geosciences, Univeristy of Arizona, Tucson, AZ 85721, (602) 621-4051.

April 9-11, 1990, Structural Stability Research Council's 1990 annual technical session and meeting, held at the Marriott Pavilion Hotel, St. Louis, Missouri. For further information, contact the Secretary, SSRC, Fritz Engineering Laboratory #13, LeHigh University, Bethlehem, PA 18015.

May 20-24, 1990, Fourth U.S. national conference on earthquake engineering, sponsored by the Earthquake Engineering Research Institute, NCEER, NSF, USGS, FEMA, ASCE, and NIST, held at the Palm Springs Resort Radisson and Convention Center in Palm Springs, California. The purpose of this conference is to address recent advances in earthquake engineering and earthquake preparedness and to respond to the needs of the future by providing a safer seismic environment. The participants at this meeting will discuss both the state-of-the-art in seismic risk reduction through earthquake engineering as well as the most current approaches to earthquake preparedness. Future trends and needs will also be addressed. For additional information, contact Dee Czaja, 4NCEE Office, Civil Engineering Department, University of California, Irvine, CA 92717, (714) 856-8693.

September 11-16, 1990, Ninth European conference on earthquake engineering, held in Moscow, USSR. This conference will provide an opportunity for earthquake specialists to acquaint conference participants with recent work on seismic hazards and to take part in discussions on developing trends in research and design. Sessions are planned to examine seismic risk and the development of seismic codes and standards; design of seismic-resistant buildings; strong ground motion and soil/structure interaction; experimental methods for testing structures; earthquake response of structures; engineering analysis of structural damage after stong earthquakes; repair and strengthening of structures after earthquakes; low-cost housing in seismic regions; reliability of lifelines in earthquakes; prediction of building behavior in earthquakes; lessening seismic risk in populated areas; and social and economic aspects of earthquake engineering. For information, contact 9ECEE Organizing Committee, Gosstroy USSR, Pushkinskaya 26, IO3828, Moscow, USSR.

March 11-15, 1991, Second international conference on recent advances in geotechnical earthquake engineering and soil dynamics, held in St. Louis, Missouri. Abstracts (500 words) are due by November 1, 1989. For more information, contact Shamsher Prakash, Conference Chairman, Civil Engineering, University of Missouri-Rolla, Rolla, MO, 65401, (314) 341-4489 or -4461.

August 21-23, 1991, Fourth international conference on seismic zonation, sponsored by the Earthquake Engineering Research Institute, will be held at Stanford University in Palo Alto, California. The conference will provide a stae-of-the-art assessment of the advances in seismic zonation integrating earth sciences, engineering, planning, social sciences, and public policy. It will emphasize results pertinent to disaster mitigation on local, regional and national scales at locations throughout the World. The recent tragic earthquakes in Mexico City (1985) and Armenia (1988) have emphasized the importance of using zonation techniques to reduce earthquake damage. These events raise numerous social science and public policy issues as well. Lessons learned from these events have led to multidisciplinary advances pertinent to reduction of life and property losses in future earthquakes. For further information, contact the Earthquake Engineering Research Institute, 6431 Fairmont Avenue, Suite 7, El Cerrito, CA 94530-3624, (415) 525-3668.

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