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EARTHQUAKE HAZARDS PROGRAM

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DEADLINES FOR FUTURE ISSUES

FALL 1986.................October 30,1986
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AWARDS GIVEN...

FIVE UTAHANS RECEIVE AWARDS FOR THEIR ACTIVITIES TO REDUCE EARTHQUAKE HAZARDS

Utahans received an award for their accomplishments in fostering implementation activities to reduce earthquake hazards in Utah. The recipients were:

1) ***Robert Madsen,*** Mayor of Ogden

2) ***Genevieve Atwood,*** Director of Utah Geological and Mineral Survey and State Geologist

3) ***Lorayne Tempest,*** Director of Utah Division of Comprehensive Emergency Management

4) ***Delbert Ward,*** Principal, Structural Facilities, Inc., Formerly Executive Director of Utah Seismic Safety Advisory Council (1977-1980)

6) ***Lawrence Reaveley,*** Vice President, Reaveley Engineers and Associates

The awards were presented by Dr. John R. Filson, Chief, Office of Earthquakes, Volcanoes, and Engineering, U.S. Geological Survey (USGS) and Gary Johnson, Chief, Earthquake and Natural Hazards Programs Division, Federal Emergency Management Agency (FEMA). The citation for each recipient read:

"In grateful recognition of your demonstrated leadership and recognized accomplishments in fostering the implementation of measures to reduce losses due to earthquakes in the State of Utah."

These awards are the first given for implementation activities under the auspices of the National Earthquake Hazards Reduction Program. This workshop, sponsored by the USGS and FEMA, marked the culmination of a 3-year cooperative effort that began in October 1983. This program of research and implementation will continue for two additional years.

Robert Madsen, Mayor of Ogden, provided strong leadership in the Utah Multihazards Project conducted in 1983-1985 under the sponsorship of the Federal Emergency Management Agency. His effective leadership made interagency communication and coordination a reality and was a major factor that lead to the enactment of zoning regulations to guide development along the Wasatch fault zone and on hillsides.

Genevieve Atwood, State Geologist, has provided dynamic leadership for more than a decade in the State of Utah to accomplish earthquake hazards reduction. Since 1983, she has effectively carried out research and implementation responsibilities in the Regional Earthquake Hazards Assessments Program, sponsored by the U.S. Geological Survey, making the program a model of how State and Federal Governments can work together to mitigate earthquake hazards. Under her guidance, Weber, Davis, Salt Lake and Utah Counties now have geologists to provide data and technical assistance to developers, planners, engineers, and emergency managers. She has forged effective communication and coordination links throughout the State with university researchers and State agencies.

Continued

Lorayne Tempest, Director of the Utah Division of Comprehensive Emergency Management, has provided leadership in emergency management for almost a decade. Her accomplishments include key roles in FEMA's Utah Multihazards project and USGS's Regional Earthquake Hazards Assessments Program. She coordinated the response to the flood and debris flow disasters in 1983. She has forged effective working relationships with other State agencies and the planning community and has played a major role in increasing the State's capability to respond to a damaging earthquake.

Delbert Ward, architect, and principal of Structural Facilities, Inc., served as Executive Director of the Utah Seismic Safety Advisory Council from 1977-1980. Overall progress in earthquake preparedness in Utah is directly related to his effective leadership during this period. Under his leadership, the council produced 15 reports recommending seismic safety policies for Utah, including schools, public buildings, critical facilities and lifelines. Since 1980 when the council completed its work, many of the council's recommendations have been implemented. He is active in earthquake-resistant design and is a strong advocate for earthquake preparedness.

Dr. Lawrence Reaveley, Structural Engineer and Vice President of Reaveley Engineers and Associates, is active in all aspects of the design and construction of earthquake-resistant buildings in Utah. He is a strong advocate for the adoption of a building code in Utah that contains modern seismic design provisions. He organized the postearthquake investigation of the 1983 Borah Peak, Idaho earthquake, considered by many to be a prototype of what can happen along the Wasatch fault. He is a member of the Board of Directors of the Utah Geological and Mineral Survey and an adjunct professor of Engineering at the University of Utah.

WORKSHOP...

UTAH EARTHQUAKE HAZARDS WORKSHOP

The Workshop on progress that has been made in the three-year-old federal-state program to reduce earthquake hazards along the Wasatch Front was held in Salt Lake City, July 14-18, 1986.

The highly successful workshop was sponsored by the U.S. Geological Survey, the Utah Geological and Mineral Survey , the Federal Emergency Management Agency and the Utah Division of Comprehensive Emergency Management.

Nearly 200 participants were involved in the discussions which focused on the research and groups, such as planners, architects, engineers, developers, financial institutions and news media. At the end of the workshop, a half-day field trip was given to acquaint participants and news media with various aspects of the earthquake hazard along the Wasatch Front.

Extensive media coverage of the workshop included interviews on local television news programs, feature articles and involvement of the media in the field trip.

From the Natural Hazards Observer Volume X, Number 6, July 1986

an invited comment

A deceptively simple question was recently posed to a conference panel: has the National Earthquake Hazards Reduction Program significantly increased seismic safety in the United States? This is the sort of question that legislative committees, top elected officials, program evaluators, budget analysts, and reporters like to pose. After the NEHRP's first decade, however, it is fair for us all to ask whether the program has made any difference. The words "hazard reduction" imply action, but how many fatalities and injuries have been prevented, and what is the value of property that has been protected from loss?

Around $550 million has been spent during the NEHRP's first decade. How many lives and buildings has that saved? Not many...yet. So far, the program has probably simply stopped things from getting worse. Without it, there would be no national policy or federal support; without research support, knowledge would be limited and highly specialized; we would lack even the small appreciation of the risks that we now have; and the existing frail network of people and organizations concerned about earthquake safety would be absent. The national program has helped to draw the line against further disregard of earthquake risk, but it has only begun to affect the status quo.

The investment of the last decade has brought us to the threshold of implementation. In the second decade's work, we must cross it. A recent National Research Council report on landslides states:

> The greatest need...is not for new knowledge or new engineering methods but for more effective implementation of the capabilities we have today.

Today there is a better and wider understanding of the seismic and geologic forces that threaten many areas of the United States, and earthquake risk has been portrayed in ways that have encouraged at least some mitigation activities. The NEHRP has helped to create a broader community of researchers, practitioners, managers, and citizens who take seriously the earthquake problem. The program has fostered the development of materials, processes, and techniques to improve design and construction, strengthen or eliminate dangerous buildings, improve preparedness and response capabilities, and organize for recovery. Last, but certainly not least, the earthquake issue is now on the agendas of more elected bodies, corporate boards, and interest group committees.

However, to cross the threshold of implementation, we must change our emphasis from research to action. Let us accelerate activities by arbitrarily setting a cluster of dates around 2000 for the hypothetical recurrance of some significant historical earthquakes. These could include quakes in southern California, the San Francisco Bay area, the New Madrid fault zone, Charleston, the Puget Sound area, the Wasatch Front, Boston, and others. Let us say then that, given what we now know, we will not accept more than 5% of the deaths, 10% of the injuries, or 20% of the property damage that would be caused by events of the magnitude or intensity of those historic disasters. Further, let us prepare sketch plans for the reconstruction of each area, and integrate those plans into long-term land use decisions that are being made right now. Finally, let us draw up an action plan for each area to insure that our promises are kept.

These action plans should contain mitigation, preparedness, and recovery strategies for each area's particular needs; and they must specify the programs, techniques, responsibilities, public and private resources, and research needed to meet each area's goals. This will make us better able to measure our progress. Thus, when we are asked at the end of 1997 if the National Earthquake Hazards Reduction Program has increased earthquake safety, we can be ready with impressive answers. That would be a far stronger position than we are in today.

Words like "application," "implementation," "knowledge transfer," and "pilot project" all suggest one purpose: action to reduce dangers to life and property. With increasing frequency I hear from researchers, practitioners, and officials that they are concerned about, and frustrated with, the failure to use much of the first decade's research. The National Academy of Sciences has created a panel as part of its Committee on Earthquake Engineering to find ways to accelerate research applications. A FEMA official stated recently that 74% ($52 million) of the 1985 NEHRP appropriation is allocated to research. He noted that:

> ...it suggests an imbalance of resources and priorities in a program the Congressional intent of which is to implement activities to reduce earthquake risk. If research is not

thoughtfully and effectively translated into results which can be implemented by municipal, state, and federal government agencies and the private sector, then it does not serve the goal of the Earthquake Hazards Reduction Act.

Whether this strategy means a reordering of priorities, a redistribution of funds, or a larger program is open to question. It is clear, however, that to achieve more action, concerted efforts must be made to influence public and private decision makers; they have to put earthquake safety on their agendas and keep it there. The national program must begin to reflect a better balance between research and application. Moreover, the user community must become better skilled at defining its needs so research can explore questions that contribute more directly to the solving of problems.

Robert A. Olson
President
V S P Associates, Inc.

Following are excerpts from draft reports submitted by three of the Research and Implementation Triad's during the July, 1986 Workshop.

TRIAD FOR TECTONIC FRAMEWORK AND EARTHQUAKE POTENTIAL OF THE WASATCH FRONT AREA AND OTHER PARTS OF UTAH

By Michael Machette, William Lund, Walter Arabasz

SIGNIFICANT ACCOMPLISHMENTS, OCTOBER 1983 TO PRESENT

Geologic Framework Studies (All Personnel)

* Quaternary geology of the Wasatch Front; Honeyville to Fayette, Utah: of the six maps being compiled, two are in final form. Personius (1986) has completed a map of the Brigham City segment at a scale of 1:50,000 and Scott and Shroba (1985) published a preliminary version of the Salt Lake City map at 1:24,000 scale. Information concerning large-scale changes in slip rate on the Wasatch fault zone was summarized by Machette (1984) and Machette and others (1986).
* Studies of segmentation of the Wasatch fault zone: Three independent approaches to this problem have yielded compatible results. Wheeler (1986) recognizes four persistent segment boundaries for the Quaternary, whereas Maclean (1985), Mayer and Maclean (1986) and Machette and others (1986) recognize as many as ten late Quaternary fault segments, eight of which have demonstrable Holocene movement.
* Paleoseismicity on the Salt Lake City segment of the Wasatch fault zone: Trenching at Dry Creek (the only remaining site suitable on the segment) has yielded new information on the two most recent fault events (Lund and Schwartz, 1986). When dating is completed, it will be possible to determine slip rate and recurrence interval for this segment of the fault zone.
* Structure of the Salt Lake City segment of the Wasatch fault zone: As a direct result of observations made from the Borah Peak and Hebgen Lake earthquakes, Bruhn and others (1986) developed two scenarios for rupture propagation during a large-magnitude earthquake on this fault segment. If shown valid, this type of analysis would allow others to make more accurate predictions of earthquake damage.
* The West Valley fault zone, Salt Lake urban area: Keaton and others (1986) investigation of two previously unstudied faults shows a history of multiple offsets not unlike the Wasatch fault zone. Slip rate versus time shows marked increase in faulting after withdrawal of Lake Bonneville.
* Neotectonics of the Hansel Valley-Pocatello Valley corridor, northern Utah and southern Idaho: McCalpin and others described evidence of prehistoric ruptures on two faults that have had recent activity (1934 and 1960). Faults in the Hansel Valley show 4-5 events in the past 65-140ka, and major offset seems to be associated with deep lake cycles in Bonneville Basin. Their thermoluminescence dating study shows potential for dating faulted deposits of less than 200,000 years age.
* Late Quaternary tectonic history of the James Peak and Strawberry faults, Utah: Although investigated as part of the Bureau of Reclamation program on dam safety, these studies have added to our appreciation of tectonics in the back valleys of the Wasatch Front. Nelson and Sullivan (1986) and Nelson and VanArsdale (1986) have shown that these faults have substantially lower slip rates and longer recurrence intervals than the Wasatch fault zone.
* Neotectonic framework of the central Sevier Valley area, Utah, and its relationship to seismicity: Anderson and Barnhard (1984 and 1986) have used paleoslip indicators to decipher the history and direction of slip on late Tertiary faults. These studies show that the area has concentrated microseismicity, suggestive of strike-slip faulting, at complex structural junctures. Although the results are not applicable to the Wasatch Front, the area's seismicity may be related to thin-skin detachments and the recently mapped strike-slip faults probably are not capable of generating large-magnitude earthquakes.
* Geologic studies of the 1983 Borah Peak, Idaho, earthquake: In addition to a multitude of significant papers in the Borah Peak volumes (USGS OFR 85-290), there have been several other papers that contribute to this program. Scott and others (1985) describe the geologic and tectonic setting for the earthquake on the basis of their regional study of the Snake River Plain and adjacent areas. Crone and Machette (1984) summarized the initial results of the USGS's investigation of surface ruptures associated with the earthquake.

Seismological/Geophysical Studies (USGS/UGMS)

* Regional geophysics and tectonic framework of the Wasatch Front region: Constraints on stress state (Zoback, 1984); compilation of Utah gravity data, investigation of crust-mantle structure beneath the Western U.S., and analysis of seismic reflection and gravity data from the Sevier Desert Basin in central Utah (summarized in OFRs).
* Interpretation of subsurface and geophysical data for filled valleys along the Wasatch Front: compilation of significant drill-hole data (Case, 1985); synthesis of gravity, magnetic, and seismic reflection data for investigation of basin-fill thickness and blocks of contrasting bedrock lithology (Mabey,1986)
* Subsurface geometry of late Quaternary faults (Crone and Harding, 1984; Zoback, 1986); also see OFR summaries by Crone and Harding.
* Monitoring tectonic deformation along the Wasatch Front (Wood, 1984)
* Strain measurement in the Wasatch Front area (Savage and others, 1985)
* Seismological, geophysical, and geodetic studies of the Borah Peak, Idaho, earthquake: Many reports printed in OFR 85-290(the Borah Peak volume A); some are in press in the Bulletin of the Seismological Society of America. Includes studies of seismicity (J.W. Dewey), source characteristics (J. Boatwright and G.L. Choy), intensity distribution (C.W. Stover), and geodesy (R.S.Stein and S.E. Barrientos).

Seismological/Geophysical Studies (Univ. of Utah)

* Seismological studies of the Borah Peak earthquake (Doser, 1985; Doser and Smith, 1985; Richins and others, 1985; Smith and others, 1985; Zollweg and Richins, 1985).
* Correlation of seismicity with geologic structure of the Wasatch Front area (Arabasz, 1984; Arabasz and Julander, 1986; Smith and Bruhn, 1984; also see reports of the University of Utah Seismograph Station.
* Geodetically, geologically, and seismologically determined strain rates (Smith and others, 1984; Snay and others, 1984; Eddington and others 1985).

Continued on Page 4

* Waveform analysis: Cross-correlation studies using digital data from the University of Utah seismic network for high-precision resolution of discrete loci of seismic slip and for waveform analysis of sequences of preshocks, mainshocks, and aftershocks (Pechmann and Thorbjarnardottir,1984).
* Pore fluid, seismogenic characteristics of faulted rock at depth, and long-term uplift rates on the Wasatch fault zone(Parry and Bruhn, 1986).
* Network seismology: upgrading, calibration, and modification of the University of Utah seismic network, including development of portable telemetry stations for special studies, and development of four-component, higher-dynamic-range stations for source studies. (Summaries relating to this seismic network appear regularly in OFR's, and an expanded description of accomplishments appears in the Proceeding of the Oct. 1985 Symposium and Workshop on Regional Seismographic Networks, convened by the National Research Council).
* Other network-related studies: Results and citations relating to other research accomplishments since Oct. 1983 are summarized in OFRs. Two notable projects involve studies of source properties of local earthquakes and investigations of crustal structure from network data.

(For a complete listing of references cited , contact the USGS,Public Inquiries Office,8105 Federal Building, Salt Lake City, Utah 84138-1177)

THE GROUND SHAKING HAZARD AND VARIOUS ASPECTS OF LOSS ESTIMATION IN THE WASATCH FRONT AREA OF UTAH

By Albert Rogers, Robert Smith, Delbert B. Ward

ACCOMPLISHMENTS OF THE PROGRAM TO DATE

Figures 1 and 2 (following article) were prepared to provide a synoptic view of research efforts during the past three years which was aimed at providing better understanding of the earthquake hazards and risks in Utah's Wasatch fault region. Figure 1 deals with the Ground Motion Modeling component of the draft work plan; Figure 2 deals with Loss Estimation Models for the study area.

The two figures, which have identical formats, represent an effort to compare research efforts with the priorities and tasks outlined in the 1984 draft work plan. Accordingly, we have recorded titles of research projects on the two components of which we are aware, and, using our best judgement, we have assigned these research efforts to one or more of the priority and task designations. The research projects are drawn from proceedings of previous workshops and this current workshop that have been convened as a part of the overall earthquake hazards program for the region.

To the extent that our judgements or assignments are correct, one can see at a glance how well the work priorities and tasks have been met. These figures are not intended to suggest anything about whether or not the research work has yielded reliable answers to the fundamental questions which remain to be answered concerning earthquake hazards and rocks in the study area.

Figure 1 reveals that considerable research attention apparently has been given to the general subject of deterministic and probabilistic hazard analysis, and, to a lesser degree, to zonation of the ground shaking hazard.

In contrast, Figure 2 reveals that less research has been directed to the Loss Estimation Models component of the work plan. Indeed, it seems fair to suggest, on the basis of research that has been reported, that attention to Loss Estimation Models has been somewhat neglected in the program effort to date. In particular, little seems to have as yet been published on the inventories of facilities, which earlier were deemed to be first and second priority efforts.

A PROGRESS ANALYSIS

EVALUATION OF EARTHQUAKE HAZARDS AND RISK IN UTAH

GROUND MOTION MODELING

RESEARCH SUBJECTS	PRIORITIES			TASKS				
	INSTALL STRONG MOTION ACCELEROGRAPHS	SYNTHESIS REPORT OF GROUND SHAKING DATA	DETERM. & PROBABILISTIC HAZARD ANALYSIS	SYNTHESIS REPORT OF GROUND SHAKING DATA	DETERM. & PROBABILISTIC HAZARD ANALYSIS	ZONATION OF GROUND SHAKING HAZARD	RESEARCH WITH HIGH FREQUENCY TECHNIQUES	REVISED ESTIMATES OF GROUND SHAKING HAZARD
REPORTED - 1984 WORKSHOP								
RECURRENCES ESTIMATED FROM GEOLOGICAL RATE ESTIMATES			•		•	•		
ANALYSIS OF GROUND SHAKING HAZARD FOR SALT LAKE — OGDEN — PROVO REGION			•		•			
PROBABILISTIC ASSESSMENT FOR UTAH MULTI-HAZARDS PROJECT			•		•			
NEAR-SOURCE ATTENUATION OF STRONG GROUND MOTION								•
POISSON'S RATIO IN SITU FOR NEAR-SURFACE LAYERS							•	
PRELIMINARY ESTIMATES OF GEOGRAPHIC VARIATION IN RELATIVE GROUND SHAKING			•		•	•		
GROUND FAILURE HAZARDS AND RISKS			•		•			
APPLICATION OF GROUND FAILURE MAPS TO EARTHQUAKE HAZARD REDUCTION						•		
TREATED - 1986 WORKSHOP								
CHARACTERIZATION OF GROUND-SHAKING HAZARD AND SITE AMPLIFICATION PHENOMENA			•		•	•		
INTEGRATING SEISMIC HAZARD, VULNERABILITY, AND RISK ASSESSMENTS: THEORY AND PRACTICE			•			•		
ANALYSIS OF THE GROUND-SHAKING HAZARD FOR SALT LAKE - OGDEN - PROVO REGION			•		•			
SUB-SURFACE GEOLOGY ALONG THE WASATCH FRONT								
GEOGRAPHIC VARIATION IN RELATIVE GROUND SHAKING IN THE WASATCH FRONT					•			
STRONG GROUND MOTION ATTENUATION IN UTAH								

Figure 1.

LOSS ESTIMATION MODELS

RESEARCH SUBJECTS	PRIORITIES			TASKS				
	BUILDING AND LIFELINES INVENTORIES — OTHER AREAS	BUILDING AND LIFELINES INVENTORIES — IN S.L.C.	REASSESS VULNERABILITY RELATIONSHIPS IN UTAH	BUILDING INVENTORY FOR SALT LAKE CITY	INVENTORY BUILDINGS IN OTHER PARTS OF STUDY AREA	REASSESS VULNERABILITY RELATIONSHIPS IN UTAH	DISTRIBUTION & VULNERABILITY OF LIFELINE SYSTEMS	ACQUIRE SAME DATA FOR OTHER UTAH COUNTIES
REPORTED - 1984 WORKSHOP								
NONE								
TREATED - 1986 WORKSHOP								
INTEGRATING SEISMIC HAZARD, VULNERABILITY, AND RISK ASSESSMENTS: THEORY AND PRACTICE			•			•		
LOSS ESTIMATES FOR UTILITY SYSTEMS AND STATE-OWNED BUILDINGS	•		•				•	

Figure 2.

COLLECTING, COMPILING, TRANSLATING, AND DISSEMINATING EARTHQUAKE-HAZARDS INFORMATION FOR URBAN AND REGIONAL PLANNING AND DEVELOPMENT IN THE WASATCH FRONT AREA, UTAH

By Gary Christenson, Jerold Barnes, Joseph Moore Craig Nelson, Robert Robison, Mike Lowe, William Kockelman

MOST SIGNIFICANT ACCOMPLISHMENTS

Much of the work planned under existing programs is in progress but will not be completed for one or two more years. Under the UGMS Wasatch Front County Geologists Program, a series of translated (interpretive) maps (1:100,000) depicting hazards along the Wasatch Front are planned along with a report describing these hazards. Collecting and indexing hazards information and providing technical assistance to planners are being emphasized under this program. Under the UGMS Applied Geology Program, statewide hazard maps (1:750,000) are being completed. Other projects emphasize specific hazards mapping, evaluation of reduction techniques, education, and information dissemination.

Some of the most significant accomplishments to date are:

* Education of planners and decisionmakers in the Wasatch Front area regarding earthquake hazards through meetings, workshops, and placement of geologists on planning staffs in five Wasatch Front counties.
* Creation of county hazard information libraries with ready access to existing hazards information in five county planning department offices.
* Quality control over geotechnical investigations, particularly seismic hazards studies, by providing geological review of reports submitted to local planning agencies.
* Compilation of liquefaction potential maps and reports for three counties.
* Increased communication between earthquake hazards investigators.
* Incorporation of the School Outreach Program into the Museum's overall program,staffing, and budget.
* Provision of educational, advisory, and review services to State and local units of government.

RECOMMENDATIONS AND PRIORITIES FOR THE NEXT TWO YEARS

Because technical and scientific information is a prerequisite for effective implementation, it is recommended that information collected during the first three years be made available for translation and dissemination. It is further recommended that emphasis during the remaining two years of the program be placed on implementation projects. Many of the projects that have been funded will extend into this period, but priority should be assigned to projects which:

- Continue the building excavation inspection program (UGMS staff)

- Continue the compiling of the statewide hazards bibliography (UGMS staff)

- Provide occurrence intervals and severity of various hazards to give planners and decisionmakers a basis for estimating risk (USGS staff and grantees)

- Provide State and local hazards susceptibility maps and reports (County geologists; UGMS staff)

- Develop guidelines for local governments to use in writing earthquake hazard ordinances(UGMS staff)

- Continue providing educational , advisory, and review services aimed at State and local planners and decisionmakers (UGMS staff; County geologists; CEM staff; Museum staff)

- Incorporate collecting, compiling, translating, and disseminating work into ongoing programs of State and local governments.

During the past two years, some additional needs have been identified; the following specific needs should be assigned priority:

- Developing model ordinances, which address earthquake hazards, for local governments

- Collecting examples of reduction techniques for each hazard, and evaluating them for effectiveness

GROUND MOTION ELEMENTS

(from a presentation by Al Rogers at July, 1986 Workshop)

SOURCE

* SIGNIFICANT ACCOMPLISHMENTS

> Revised segmentation of the Wasatch Front

> New segmentation slip rates for some segments

> Suggestion that slip rates are related to paleo-lake level

> Discovery that some scarps in the Great Basin may be terminated by detachment faults at shallow depths

> Successful testing of experimental high-frequency reflection techniques for studying Quaternary fault geometry and exploration for Quaternary faults.

> Discovery of strike-slip faulting in both the geologic and seismic records for a portion of the Colorado Plateau-Basin and Range Transition Zone.

> Borah Peak
Reaffirmation of segmentation

* KNOWLEDGE REQUIRED

> Continued segmentation studies and slip rate estimates

> Continued studies of active fault geometry

> Strong ground motion measurements in the vicinity of Great Basin earthquakes.

TRANSMISSION PATH

* SIGNIFICANT ACCOMPLISHMENTS

> Revised peak acceleration and velocity curves for western Utah based on regression models and a world wide strong motion data set

> High and Low Q versions

Continued on Page 6

* KNOWLEDGE REQUIRED

> Measurements of Q in the Wasatch Front region at frequencies of engineering importance

Using low level ground motions

Using strong ground motions

> Spectral attentuation functions

SITE EFFECTS

* SIGNIFICANT ACCOMPLISHMENTS

> Measurement of site effects in several Wasatch urban areas

> Replication of site response factors in Salt Lake City

> Testing of the capability of high frequency reflection techniques to map the thickness of reflectors in the upper 200 feet.

> Testing of P- and S-wave high frequency techniques to measure Poisson's ratio in near-surface sediments.

> Evaluation of geologic site conditions at some recording sites and strong motion instrument sites

Lithology
Shear Velocity
Thickness

* KNOWLEDGE REQUIRED

> Collection of additional response and reflection data

> Collection of additional borehole data

> Completion of geotechnical-site response correlations

> Completion of extrapolated site response maps for the principal metropolitan areas

PROBABILISTIC GROUND MOTION MODELING

* SIGNIFICANT ACCOMPLISHMENTS

> New probabilistic hazard maps completed

More realistic models of fault geometry, seismicity and earthquake depths

New attenuation functions

Parameter variability

* FUTURE MODIFICATIONS

> Evaluation of segmentation, segmentation rates, and site effects on mapped values.

PUBLICATIONS...

SEISMICITY MAP OF UTAH

A map that illustrates the earthquake history of Utah and pinpoints the locations and dates of nearly a thousand known earthquakes in the state has been published by the U.S. Geological Survey.

Most of the earthquakes shown on the map occurred in the mountainous spine of the state, running in a broad band from the Logan area south along the east side of the Great Salt Lake through the Wasatch Mountains and then southwest to the St. George area in the southwest corner of the state.

An accompanying chart lists 966 earthquakes from 1850 through 1982, all of them minor or moderate. Carl Stover, a geophysicist at the USGS National Earthquake Information Center in Golden, Colorado and the chief compiler of the map, said an additional 55 earthquakes have been recorded in the state since 1982. The latest was a magnitude 3.6 tremor June 5, 1986, near Provo.

The Utah map is one of a series of seismicity maps of the 48 conterminous states being published by the U.S. Geological Survey. Stover said that by displaying the earthquake history of Utah, the map shows the parts of the state most likely to have earthquakes in the future. "Thus the map can be used as a starting point by local, regional and state planners and administrators for land-use planning, siting and design of power plants and other facilities, analysis of environmental impacts of projects, establishing insurance rates and policies, and for other planning where earthquake history and frequency of occurrence are factors," Stover said.

The strongest earthquake shown on the map occurred November 14, 1901, a few miles south of Richfield. The tremor caused considerable damage to brick buildings and chimneys from Richfield south to Parowan. Extensive rock slides occurred in the mountains between Beaver and Marysvale, blocking some roads. The earthquake, which was followed by numerous aftershocks, was felt over an area of about 50,000 square miles.

Copies of the map (MF-1856) are available from the USGS, Public Inquiries Office, 8105 Federal Building, 125 South State St, SLC, Utah 84138-1177 at a cost of $1.50. Information on maps for other states is also available at that location.

FORUM FOR APPLIED RESEARCH AND PUBLIC POLICY...quarterly journal intended to present balanced discussions of scientific problems requiring management through public policy. Concerned mainly with energy, the environment, and economic development. One-year subscription - $20.00, Forum For Applied Research and Public Policy, P.O. Box 1750, Knoxville, TN 37901-1759, Tennessee Valley Authority publisher.

LAND USE PLANNING FOR EARTHQUAKE HAZARD MITIGATION: A HANDBOOK FOR PLANNERS, Special Publication #14,Natural Hazards Research and Applications Information Center, Institute of Behavioral Science #6, Campus Box 482, University of Colorado, Boulder, Colorado 80309.

...spells out both what information is necessary for a successful mitigation program and how it can be gotten. Cost is $7.00, 130 pages long

The OBSERVER has an excellent list of newsletters and journals in the July 1986 issue....following is a partial listing:

EARTHQUAKE INFORMATION BULLETIN
Superintendent of Documents, U.S. Government Printing Office, Washington DC 20402 Bimonthly - $15/year domestic

EARTHQUAKE SPECTRA
Earthquake Engineering Research Institute, 6431 Fairmount Avenue, El Cerrito, California 94530. Quarterly - $50/year individuals; $90/year institutions

EERC NEWS
Earthquake Engineering Research Center, University of California, 1301 South 46th Street, Richmond, CA 94804. Quarterly/no cost

FEMA NEWSLETTER
Federal Emergency Management Agency, P.O. Box 8181, Washington, DC 20024. Bimonthly/no cost

GROUND FAILURE
National Research Council, Committee on Ground Failure Hazards, 2101 Constitution Avenue NW, Washington, DC 20418. Triannually

HAZARD MONTHLY
P.O. Box 8438, Rockville, MD 20856. Monthly - individuals: $26/one year

NETWORKS
Earthquake Preparedness News
Bay Area Regional Earthquake Preparedness Project, MetroCenter, 101 8th Street, Suite 152, Oakland, CA 94607. Quarterly

SEAN Bulletin
Scientific Event Alert Network, National Museum of Natural History, Mail Stop 129, Washington DC 20560. Monthly

UPDATE
Southern California Earthquake Preparedness Project, 600 South Commonwealth Avenue, Suite 1100, Los Angeles, CA 90005. Quarterly.

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UTAH EARTHQUAKE ACTIVITY

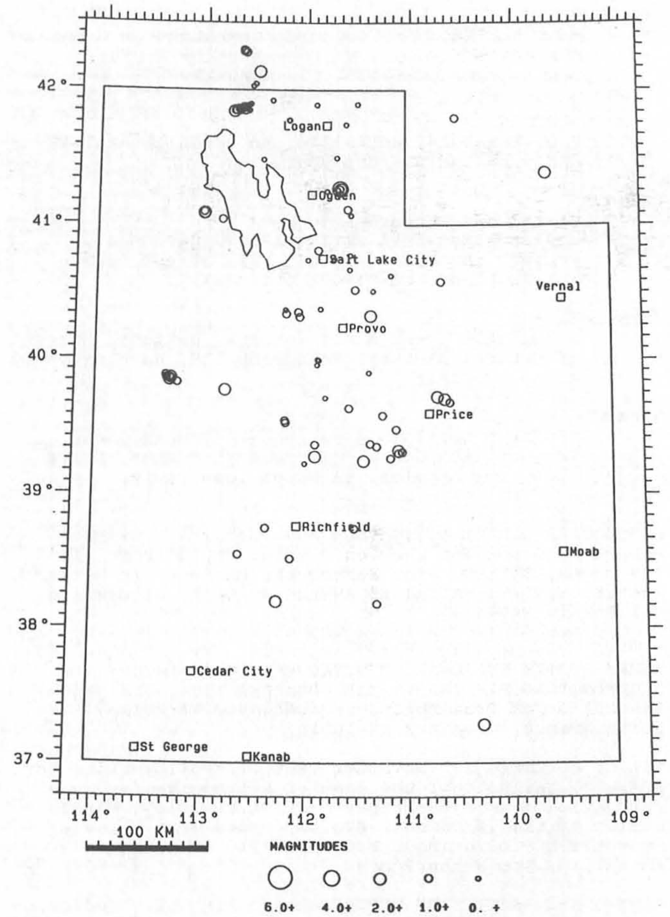
January through March 1986

By ETHAN D. BROWN
UNIVERSITY OF UTAH SEISMOGRAPH STATIONS
DEPARTMENT OF GEOLOGY AND GEOPHYSICS

The University of Utah Seismograph Stations records an 81-station seismic network designed for local earthquake monitoring within Utah, southeast Idaho, and western Wyoming. During April 1 to June 30, 1986, 100 earthquakes were located within the Utah region including 18 greater than magnitude 2.0. The epicenters shown in the seismograph map reflect typical earthquake activity scattered throughout Utah's main seismic region. The largest earthquake during this time period, M_L 3.6, occurred 25 km southeast of Ogden, Utah on June 5. Although this earthquake was close to a populated area it was not reported felt.

Three clusters of epicenters shown here warrant mention. A cluster of nineteen earthquakes (M_L 2.3) north of the Great Salt Lake occurred between April 5 and May 11. Spatial clusters in this area are common and have been observed since the 1975 Pocatello Valley earthquake. The cluster of five events located 25 km east of Ogden represents a sequence associated with the magnitude 3.6 earthquake mentioned above. All earthquakes in this group occurred on June 5, except for one preshock which occurred on May 24. A cluster of eight earthquakes ($M_L \leq 2.8$) shown in west-central Utah occurred between May 8 and May 28.

Additional information on earthquakes within Utah is available from the University of Utah Seismograph Stations, Salt Lake City, Utah 84112 (telephone 801-581-6274).



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