Fault Line Forum
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WSSPC Awards in Excellence to Three Utah Programs

by Bea Mayes
Utah Geological Survey

The Western States Seismic Policy Council (WSSPC) recognized the University of Utah Seismograph Stations Earthquake Education Services, Utah Division of Comprehensive Emergency Management, and Utah Geological Survey in their Awards in Excellence program. The 1997 awards were presented in a ceremony at the WSSPC Annual Conference, November 4-7, in Victoria, British Columbia. WSSPC will also publish a volume describing the award-winning programs, in January 1998. Brief descriptions of the award-winning programs follow.

The University of Utah Seismograph Stations Earthquake Education Services (EES) received the award for **Excellence in Outreach to Schools** and was a co-recipient of WSSPC's award for **Overall Excellence**. EES 1) encourages earthquake science and safety instruction in Utah schools by meeting teachers' needs for activities, materials, and workshops, and 2) develops earthquake education products for the general public. EES's goal is to help Utah residents successfully handle earthquake risk by increasing their understanding of earthquake's causes, dangers, and effects. Two major EES projects, described below, support this goal; both are on-going and require a collaborative effort from state agencies, university departments, and a non-profit agency to achieve their objectives. The semi-formal partnership includes the Utah Geological Survey, Utah Division of Comprehensive Emergency Management, University of Utah Seismograph Stations, College of Mines and Earth Sciences, Department of Geology and Geophysics, and the American Red Cross. Deedee O'Brien has been the principal investigator and coordinator for all EES activities. Deedee credits Walter J. Arabasz, Director of the Seismograph Stations, for providing vision and support for EES, and for helping set up the informal partnership with the other groups. With Deedee's retirement, EES continues under the direction of Paula Wilson, Assistant Research Professor, Department of Geology and Geophysics. EES projects include:

Deedee O'Brien, EES coordinator.

1. *Earthquakes in the Utah Core Curriculum* is a two-year project funded by FEMA which has brought teachers and geologists together to develop grade-level appropriate lessons and hands-on activities in grades 3, 5, and 9. The teacher-geologist teams also travel to individual school districts to instruct teachers and distribute activity packets and teaching materials.

2. *Personalizing the Earthquake Threat* is a project funded by the U.S. Geological Survey

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WSSPC Awards in Excellence

Presented to

University of Utah Seismograph Stations

for

Earthquake Education Services

for

Overall Excellence and Excellence in Outreach to Schools

November 1997

Awards... *Continued from page 1*

National Earthquake Hazard Reduction Program (NEHRP). EES has compiled information from 48 Intermountain West earthquakes and produced a number of public-education products: 1) photographs, newspaper articles, and individual accounts were collected and archived, and are available on the Seismograph Stations' website (http://www.seis.utah.edu); 2) an activity packet for secondary students was written; 3) annotated slide sets, *Utah's Earthquake Threat* and *Utah's Earthquake Threat—How We Know*, were made from photos and are available through teacher workshops; 4) a colorful, professional-quality traveling exhibit, *Earthquakes in the Intermountain West*, was produced and has begun a schedule of public display.

The WSSPC Award for Excellence in Mitigation Efforts was awarded to the **Utah Division of Comprehensive Emergency Management** whose EPICenter group funded and published *The Utah Guide for the Seismic Improvement of Unreinforced Masonry Dwellings.* The volume fills a need for information dealing with unreinforced masonry homes and the means by which to seismically retrofit them, and provides homeowners, engineers, and general contractors with guidelines to assist in seismic retrofitting activities. Robert Carey is the EPICenter manager and headed the project; Reaveley Engineers and Associates, Inc. authored the *Guide*.

The 1997 Award for Excellence in Outreach to the General Public was given to the **Utah Geological Survey (UGS)** for increasing earthquake awareness in Utah. The UGS highlights earthquake hazards and risks in Utah in a series of maps and brochures specifically for the layperson, including the general public, realtors, and public officials. These maps and brochures are distributed at scientific conferences, teachers' workshops, and state and local fairs. Additionally, the UGS staff gives talks on earthquake hazards and risks to a wide variety of audiences. Sandy Eldredge, UGS Extension Service Manager, heads the program and authored many of the publications.

In addition to these three programs, six other programs in other WSSPC states were also recognized for Excellence in various other topical categories. From the nine award winners, WSSPC selects an overall winner to receive the **WSSPC Award for Overall Excellence**. This year the Overall Award was shared by **EES** and the **California Seismic Safety Commission, Seismic Retrofit Practices Improvement Program.**

Congratulations to EES and the other Utah award winners!

Utah's Projected Growth Highlights Need for Action Now

News of the October 10, 1997 Meeting

Utah Seismic Safety Commission

by Gary E. Christenson
Utah Geological Survey

At the October 10, 1997, meeting of the Utah Seismic Safety Commission (USSC), Chairman Arabasz outlined his view of the challenges to the USSC. Utah's dramatic projected growth over the coming decades provides an opportunity and an impetus for the USSC to move now to ensure that future development is "earthquake safe." In planning the coming year's activities, Arabasz charged each of the USSC standing committees to identify their critical growth-related issues and set their goals accordingly. Suzanne Winters, who is assembling the Intergovernmental Relations Committee, was tasked to include members, such as representatives of Utah's Quality Growth Partnership, who are involved with pertinent growth issues.

After discussion at the July 2, 1997, USSC meeting, the issue of structural plan checks and inspections of schools and other public buildings (see FLF, v. 13, no. 3, p. 6.) was referred to the Engineering and Architecture Committee for further consideration. Jim Bailey reported that the committee will be meeting soon, but that it appears a plan check is needed later in the design process to supplement the "value-engineering" review done early in design. Senator Peterson suggested that it would be preferable to add such a step through administrative rulemaking by the Utah State Office of Education, rather than by state statute. Representatives of school districts will be included in further discussions of this issue by the Engineering and Architecture Committee.

Dr. Robert D. Smith, Professor of Geophysics at the University of Utah, was given an opportunity, at his request, to make a presentation to the USSC relating to results from deformation monitoring and other research he is involved in. During the presentation, he outlined his proposal for "A Unified Utah Earthquake Master Model," which is intended to be a vehicle for integrating various types of earth-science information for earthquake research and practical applications. Among the various research results he summarized, Dr Smith described new measurements from Global Positioning System (GPS) monitoring which indicate higher-than-expected rates of extensional strain across a 55-km-wide area encompassing the Wasatch fault. He said these results should be factored into, and would increase, probabilistic estimates of the ground-shaking hazard in the Wasatch Front area. The USSC referred his "Master Model" proposal to the Geoscience Committee for evaluation and further discussion, and asked that they report back to the USSC.

Ann Becker, Chair of the Awareness and Education Committee, reported that the September 9, 1997, USSC Earthquake Conference was a success with about 140 in attendance (see FLF, v. 13, no. 3). Plans are under way to co-sponsor next year's conference, probably in October, with the Association of Contingency Planners.

Representative Knudson invited the USSC to hold its spring 1998 meeting in Brigham City, and the USSC accepted. The next (winter quarter) meeting is set for January 9, 1998, at 9:00 a.m. in the State Office Building. Anyone interested in attending is welcome. For more details contact Janine Jarva, Utah Geological Survey, (801) 537-3386, fax (801) 537-3400, e-mail - nrugs.jjarva@state.ut.us.

Utah's dramatic projected growth over the coming decades provides an opportunity and an impetus for the USSC to move now to ensure that future development is "earthquake safe."

Benefits and Costs of Natural Hazards Mitigation:

Case Studies—Building Codes and Seismic Retrofitting

If all the buildings in the Los Angeles area had been built to current seismic design standards, Northridge losses would have been $11.3 billion less.

The following is prompted by and adapted from the Report on Costs and Benefits of Natural Hazard Mitigation, prepared by the Federal Emergency Management Agency (FEMA) Mitigation Directorate.

FEMA director, James Witt, introduces the topic of cost-effective natural-hazard mitigation in his foreword to the report:

> Effective emergency management *response* to disaster events is crucial. It saves as many lives as can be saved, provides shelter to disaster victims, and diminishes the number of ancillary problems than can arise. Yet the central problem of disasters, the amount of losses, is not addressed by *response*. Many of these losses can be avoided through *mitigation*. We have always instinctively known that mitigation makes sense, saves money, and ultimately saves lives...these examples [reported in *Report on Costs and Benefits of Natural Hazard Mitigation*] show that it's in the best interest of everyone to take action before a disaster. Experience has shown us that lives can be saved and damage to property significantly reduced by consistently building safer and stronger buildings, enforcing building codes, and making the proper preparations before the disaster occurs. These examples demonstrate that mitigation is a cost-effective means of limiting the damages that can result from natural hazards and the costs individuals, businesses and governments must pay in recovering from these events...[and] mitigation reduces important indirect costs, such as the disruption of daily routines, community services, commerce, and industry. Local officials, individuals and businesses must work together to plan and prioritize mitigation actions that protect citizens, businesses, and public infrastructures before disasters strike. Pre-disaster mitigation is common sense preventive medicine.

Natural hazard mitigation is defined as a sustained action taken to reduce or eliminate the long-term risk to people and property from natural hazards and their effects. FEMA's *Report on Costs and Benefits on Natural Hazard Mitigation* reviews the types of benefits that can accrue to different segments of society from mitigative measures, the types of costs that can be incurred by undertaking the actions, and the types of analyses needed to evaluate the cost-effectiveness associated with the mitigation measure. It includes 16 case studies of mitigation measures that were implemented in various locations across the nation. For copies of the 52-page report contact FEMA, Attn: Publications, P.O. Box 70274, Washington, D.C. 20024. Below are two case-study reports modified from the FEMA brochure.

Direct Economic Losses in a Northridge-like Event for Three Los Angeles County Building-Code Scenarios, a HAZUS Simulation

One of the most important tools of earthquake mitigation is the building code. These codes require buildings to be strengthened during construction, the time when earthquake-resistant strengthening is most cost effective. HAZUS (Hazards U.S.) is a decision-support geographic information system (GIS) tool developed by the Institute of Building Sciences (NIBS) under cooperative agreement with the Federal Emergency Management Agency (FEMA). HAZUS, a nationally standardized methodology for estimating earthquake losses at the regional or local scale (see *Fault Line Forum,* v. 13, no. 2, p. 6, 8), was used in this example to demonstrate the benefits of mitigation.

Using HAZUS, simulations of the 1994 Northridge earthquake were conducted under three different assumptions about the type of building code used in construction of Los Angeles area buildings. The simulations produced damage estimates, expressed as direct economic losses, under three assumed conditions:

1. "Best case" scenario, all structures are designed to current (high) seismic design stan-

G Christenson

Building damage in Northridge area.

Direct Economic Losses for Three Los Angeles County Scenarios in a Northridge-Like Event

Scenario	Economic Losses ($ Billions)			
	Buildings	Contents	Income	Total
1. High seismic design standards	10.2	3.9	2.5	16.6
2. Current mix of design standards	15.8	4.8	7.3	27.9
3. No seismic design standards	24.9	5.7	14.4	45.0

dards. The entire building stock is assumed to conform to current design and construction standards.

2. "Baseline" scenario, a best effort to represent the current structural composition of Los Angeles County. The area has undergone a series of seismic design code changes and construction practice changes over the time period in which the buildings were built and renovated.

3. "Worst case" scenario, a situation in which all structures in Los Angeles are constructed without any consideration given to seismic design standards. The assumption is that no seismic design standards were ever adopted in Los Angeles County.

The table above shows the HAZUS estimated economic losses from these three scenarios. Although HAZUS can estimate long-term, indirect losses, indirect losses are not included in the figures. The model predicts direct losses in the form of income lost to individuals and businesses, and losses due to damage of buildings and their contents. The simulations show that if all buildings in the Los Angeles area had been built to current (high) seismic design standards, an event similar to Northridge would result in $11.3 billion less in losses than if the buildings represented the present mix of design standards. A full $28.4 less in losses would result comparing a situation with no seismic standards in place.

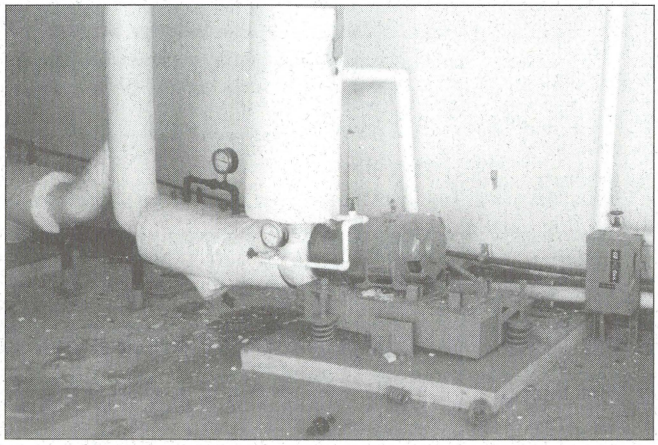
The figures do not include the cost of building to higher seismic design standards. Typically, to upgrade construction code adherence from seismic zone 3 to seismic zone 4 increases building costs from 0.5 percent to 1.5 percent for regular buildings, and roughly 3.5 percent for parking structures (in which structure represents most of the cost of the building) (VSP Associates, Inc., 1994, The effects of changing the Uniform Building Code Seismic Zone from Zone 3 to Zone 4 on the Wasatch Front of Utah (Brigham City to Nephi), final report: Sacramento, California, VSP Associates, p. 13, 14, and table 1.).

The retrofitting of the Davis Water Pumping Station will prevent an estimated loss of $1.4 million in services per day in the event of an earthquake.

Seismic Retrofitting to Protect Lifelines: Davis Water Pumping Station, Memphis Light, Gas, and Water Division, City of Memphis, Tennessee.

In many high and moderate seismic risk areas, earthquakes pose a tremendous threat to lifeline services, such as power, water, and infrastructure systems. Such a threat is clearly present in the City of Memphis, Tennessee. Memphis is located within the impact area of the New Madrid fault system, and the Center for Earthquake Research and Information at the University of Memphis reports a 40 to 60 percent probability of a New Madrid Seismic Zone earthquake of magnitude 6.0 to 6.3 within the next 15 years. Therefore, it is only a matter of time before lifelines in Memphis experience the impact of a significant earthquake.

In recognition of the risk posed to lifelines in the New Madrid area, Memphis Light, Gas, and Water Division has initiated a seismic retrofit project to protect its Davis Water Pumping Station, and to enhance the survivability of connections between the water distribution lines in one-third of the city's production wells. The seismic retrofit of the Davis Water Pumping Station will involve the strengthening of supporting structures



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Damaged pump anchored in a penthouse.

See **Mitigation** *page 8*

New Programs Foster Community Disaster Resistance

by Bea Mayes
Utah Geological Survey

"The concept is simple: Help communities come together to identify the dangers they face—from floods to hurricanes to earthquakes"
—James Witt

Two major players are piloting programs to foster disaster resistance in local communities. The benefits of these preventative measures accrue after a disaster. Given the number of communities where it is only a matter of time before another disaster strikes and the mounting costs of disasters, the programs allow communities to guide themselves to disaster preparedness and thus reduce damage costs and suffering in the future. Both programs encourage the 'ounce of prevention.' The Institute for Business & Home Safety (IBHS) (formerly the Insurance Institute for Property Loss Reduction) and other representatives of the insurance industry have initiated a Showcase Communities program to illustrate the benefits of risk reduction. The IBHS program complements a Federal Emergency Management Agency (FEMA) program, Project Impact, which FEMA is testing in seven communities across the nation. While none of Project Impact's seven pilot communities are in FEMA Region VIII (Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming), during 1998 a "disaster-resistant community" will be selected in each Region-VIII state.

IBHS Showcase Communities Program

IBHS's Showcase Communities includes specified criteria for a comprehensive disaster protection program which they are piloting in two communities. Evansville, Indiana and the surrounding Vanderburgh County is the first officially designated "showcase community" in the United States, according to the *Natural Hazards Observer (Making communities disaster resistant, Natural Hazards Observer, v. 22, no. 2, p. 4)*. In July 1997, the Evansville City Council and the Vanderburgh Board of County Commissioners approved resolutions to implement the IBHS program. This is the first agreement to reduce natural hazard losses between the insurance industry and a local government.

Under the agreement, Evansville and Vanderburgh County will:

- assign responsibility to a single official to coordinate the project and insure its continued success;
- undertake a variety of education, training, and outreach programs to homes and businesses;
- incorporate natural hazard awareness and reduction programs into school curricula;
- maintain up-to-date emergency response and recovery plans; and
- modify existing city and county land-use practices to incorporate consideration of natural-hazard vulnerability into land-use decisions.

Jim Russell of IBHS says that Showcase Communities criteria are being tested for practicality and effectiveness, but two program requirements will be constant: 1) the community council or other governing body must formally commit to participation by adopting a formal resolution to that effect, and 2) the jurisdiction must complete a land-use plan that delineates the relevant hazards and incorporates them as factors in all land-use decisions. IBHS sponsors the Showcase Communities program to demonstrate the benefits of taking specific, creative steps within the entire community to reduce deaths, injuries, property damage, economic losses, and human suffering caused by natural disasters. As part of a locally implemented program, incentives to businesses and homeowners to implement mitigation measures might take forms such as insurance considerations or reduction of sales taxes on mitigation purchases. The program has three key objectives:

- help a community help itself by reducing its vulnerability to hurricanes, earthquakes, tornadoes, wildfires, floods, or whatever natural disasters threaten it;
- generate a "me too" attitude among other communities by showcasing the successful efforts of particular jurisdictions;
- learn what works and what does not work to reduce the emotional and financial devastation caused by natural disasters.

For more information on the IBHS Showcase Communities initiative, contact IBHS, 73 Tremont Street, Suite 510, Boston, MA 02108; (617) 722-0200; fax (617) 722-0202, e-mail: info@ibhs.org; WWW: http://www.ibhs.org

FEMA's Project Impact

"We need to build communities strong enough to make disasters of all kinds less dangerous..." notes FEMA Director James L. Witt. He

See **Disaster Resistance** *page 8*

NSF Creates New Earthquake Engineering Centers

Reprinted from Natural Hazards Observer, v. 22, no. 2, November 1997, p. 19.

In a major new earthquake research initiative, the National Science Foundation (NSF) has named three centers to conduct and coordinate earthquake engineering research for the U.S. NSF will provide approximately $2 million a year for five years to each center, for a total of $30 million. The centers are expected to match the federal funds, dollar for dollar, with nonfederal funds and must form consortia of research organizations linked through electronic networks.

Pacific Earthquake Engineering Research Center (PEER Center)

The PEER Center, a consortium of nine institutions, will conduct research in five basic areas: 1) policy, planning, and economics; 2) seismic hazards; 3) performance assessment; 4) systems reliability; and 5) innovative technologies. The center will develop a business and industrial partnership program, conduct urban demonstration projects to test research, and provide education programs for both K-12 students and undergraduates. For more information, contact the principal investigator, *Jack P. Moehle, Earthquake Engineering Research Center, University of California-Berkeley, 1301 South 46th Street, Richmond, CA 94804-4698; (510) 231-9554; fax: (510) 231-9471; e-mail: moehle@euler.berkeley.edu.*

Mid-America Earthquake Center (MAE)

The MAE will work to reduce potential earthquake losses in the central and eastern U.S., concentrating on problems associated with less frequent seismic events and their consequences for individuals, economic systems, and infrastructure. Projects will focus on identification and evaluation of seismic hazards and development of loss-reduction strategies for the built environment. This center will also work to educate the next generation of earthquake engineers and provide outreach to industry, government, precollege schools, and potential user groups. For more information, contact the principal investigator, *Daniel P. Abrams, Department of Civil Engineering, 3148 Newmark Celab, MC 250, 205 North Matthews, University of Illinois-Urbana-Champaign, Urbana, IL 61801; (217) 333-0565; fax: (217) 333-0565; e-mail: d-abrams@staff.uiuc.edu.*

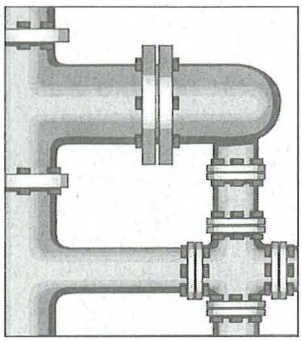
Center for Advanced Technologies in Earthquake Loss Reduction (ATEL)

ATEL, a nine-institution consortium, will develop and apply advanced and emerging technologies for design, construction, and retrofitting of buildings and infrastructure to reduce earthquake losses. It will focus on three major elements: performance assessment of the built environment, rehabilitation of critical facilities, and response and recovery using new loss-estimation methods and technologies. Like the other centers, it will also provide outreach to students of all ages, as well as to the public and private sectors. For more information, contact *George C. Lee, National Center for Earthquake Engineering Research, SUNY Buffalo, 109 Red Jacket Quadrangle, Buffalo, NY 14261-0025; (716) 645-3391; fax: (716) 645-3399.*

***Note:** The NSF proposal submitted by the Utah-Oregon consortium (see Fault Line Forum, v. 12, no. 3, 1996, p. 9, 10) was unsuccessful; however, the University of Utah is one of the Affiliated Universities that will participate in **PEER-Center** research, education, and outreach.*

The University of Utah is one of the Affiliated Universities that will participate in PEER-Center research, education, and outreach.

Increasing the well connectors to withstand a 6.5 to 7.5 earthquake, at a cost of $9,280 per connector, prevents an estimated loss of $188,000 a day for each connector damaged in a future earthquake.



Flexible water well connectors, between the rigid well pipe and the collection main, better withstand seismic ground motion and displacement.

Mitigation...*Continued from page 5*

and tying together of components so that they will vibrate as a unit during an earthquake. To achieve this mitigation objective, Memphis Light, Gas, and Water, plans to reinforce and anchor masonry walls, strengthen steel frames, improve the connection between concrete walls and roof systems, secure and/or anchor pipes and valves, brace pipelines and equipment for water treatment and control, and protect an overhead crane. The retrofitted Davis Water Pumping Station's useful life is calculated to be over 100 years.

The total cost for the Davis Water Pumping Station project is $448,000. A grant through FEMA's Hazard Mitigation Grant Program will provide 75 percent of the funding. By comparison, the estimated cost to replace the pumping station in the event of a large earthquake is over $17 million. Additionally, each day the water pumping station is not in service costs $1.4 million in lost services. The total projected savings due to loss of services, factoring in the probability of an earthquake, is $112 million.

The second half of the earthquake mitigation project is to replace 55 of the city's 170 rigid production well connectors with flexible connectors which better withstand the ground motions and displacement often caused by seismic activity. The project involves installing a flexible connection between the rigid well pipe and the collection main. The flexible connectors will allow for a 30-degree rotation and an 8-inch expansion of the connection without breakage. It has been estimated that depending on the location of the earthquake in the New Madrid fault system, the connectors will increase each well's capacity to withstand a 6.5 to 7.5 magnitude earthquake. The cost for engineering, parts, and labor of retrofitting each well's connectors is $9,280 and total project cost $510,400. FEMA's Hazard Mitigation Grant Program will supply 75 percent of these costs. The investment will help Memphis Light, Gas, and Water to avoid estimated losses of $188,000 per day for each well connector damaged in a future event. While the direct economic benefit of this mitigation effort more than justifies its expense, it is important to recognize the Memphis Light, Gas, and Water project will also provide substantial indirect benefit to the community at large. Area homes and businesses will benefit from a more reliable water supply in the aftermath of an earthquake, reducing the need for communities to import potable water, and allowing many business to remain open after an earthquake. These benefits, in turn, reduce economic and social costs caused by business interruption, and also help ensure the availability of adequate water resources for emergency services, such as firefighting and maintenance of public health and sanitation, immediately after an earthquake. The Memphis Light, Gas, and Water mitigation project is a strong example of mitigation that provides substantial community protections while still making good economic sense.

Photo of damaged pump, reprinted with permission, appeared in EERI's, 1994 publication, Northridge Earthquake, January 14, 1994, Preliminary Reconnaissance Report.

Disaster Resistance...*Continued from page 6*

explains:

> It's not enough to help victims after disaster has occurred. Not with disaster costs of $21.3 billion after 1989—not with the need that still remains after people's property has been restored but the fabric of their lives is still in tatters...For the first time ever, Congress has appropriated funds in [the 1997] budget for mitigation projects before disasters happen...We have the full support of President Clinton, and leaders in Congress from both parities. And we plan to use these funds in support of FEMA's newest initiative—Project Impact—promoting what we call "disaster resistant communities."
>
> The [Project-Impact] concept is simple: Help communities come together to identify the dangers they face—from floods to hurricanes to earthquakes. Then, determine how to reduce those risks. And then chart a course to do what must be done...At FEMA, we are ready to offer assistance in every way; but communities must take the first step

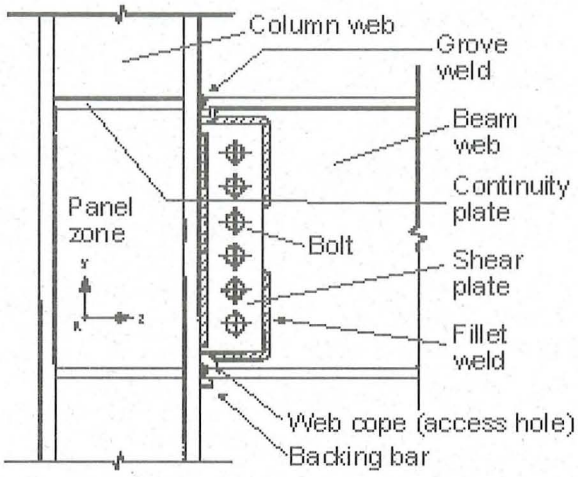
See **Disaster Resistance** *page 9*

Research Throws Light on Failures at Northridge and Kobe

Adapted from Ostertag, C.P., 1997, Microstructural Characteristics of Failed Steel Moment-Resisting Beam-Column Connections, Earthquake Engineering Research Center News, v. 18, no. 3, p. 1-3.

The failure of steel moment-resisting frames (SMRFs) during the Northridge, California, earthquake on January 17, 1994, was both surprising and alarming to the structural engineering community. Although SMRFs are designed to behave in a ductile manner, in more than 100 steel buildings that were inspected in the Los Angeles area after the earthquake, connections exhibited brittle fractures. The most serious occurred at welded beam-to-column connections (see diagram). Fractures of thick large sections of steel members were also observed following the 1995 Hyogoken Nanbu (Kobe) earthquake, and in large-scale laboratory tests. Despite extensive laboratory testing of large- and small-scale structures in both the U.S. and Japan since these earthquakes, the factors that lead to brittle fracture have not yet been identified.

Brittle fracture in steel may be caused by engineering factors, microstructural characteristics of the steel, and/or residual stresses. The engineering factors are mainly those that can be controlled by the designer, or that are imposed by the operating conditions and environment (i.e., strain rate, temperature, stress concentrations, and notch effects, and the triaxial tensile stress state). Microstructural characteristics, on the other hand, may be inherent in the material, whether as initially supplied or as changed by fabricating processes and/or welding procedures. Residual stresses result principally from nonuniform cooling of hot-rolled shapes, from cold straightening of bent members, and from the welding process. To date, the focus of understanding brittle fracture in SMRFs has been mostly on the engineering aspects. There has been little research on the influence of microstructural factors or residual stresses.



Typical welded beam-to-column connections.

Disaster Resistance...*Continued from page 8*

> and then follow through. We know from experience what can happen if we don't focus on the threats that face us—the magnitude of our losses in recent years is a clear example of that...(*James L. Witt, 1997, Creating Disaster Resistant Communities: EQ—Earthquake Quarterly, Fall 1997: San Francisco, Western States Seismic Policy Council, p. 11.*)

FEMA's effort includes the Project Impact Guidebook, a workbook guide for individuals and local entities, which gives a comprehensive approach to disaster resistance. The Guidebook and other information about Project Impact are available on the internet: http://www.fema.gov.about/impact.htm. The agency received a $2 million appropriation from Congress to support Project Impact in 1997, and is requesting $50 million in 1998 to fund mitigation projects before disasters happen. FEMA cautions, however, that funds for local communities will be scarce in 1998. Individual and community mitigation will be financed by the private sector and creative local incentives.

"A key part of building a disaster-resistant community is creating the alliances that will make it happen," notes Richard P. Weiland, FEMA Region VIII director. Other criteria for selection as a 1998 Disaster-Resistant Community include 1) complete and total commitment by the community, including government entities, quasi-governmental bodies, and appropriate private organizations; 2) the risk potential for disaster; and 3) the disaster history of the community. Additionally, FEMA holds local risk-planning meetings for government officials which are open to the public. Earthquake risk will be the topic at the next meeting in Salt Lake City, scheduled February 3 and 4 at the Olympus Hotel. Project Impact is on the agenda.

Communities interested in participation, contact FEMA Region VIII director's office, (303) 235-4800, and mention Project Impact. For general information on Project Impact, contact FEMA Office of Public Affairs, 500 C Street, S.W., Washington, DC 20472; e-mail eipa@fema.gov; WWW: http://www.fema.gov/about/impact.htm.

Portions of this article are reprinted from "Making Communities Disaster Resistant," Natural Hazards Observer, v. 22, no. 2, p. 4.

> ***"A key part of building a disaster-resistant community is creating the alliances that will make it happen."***

Portland Task Force Studies Earthquake Risk Perception

Adapted from "Portland studies public perception of risk and attitudes toward seismic rehabilitation," EERI Newsletter, v. 31, no. 8, 1997, p. 1, 3.

Since 1993, the Portland (Oregon) Task Force on the Seismic Strengthening of Existing Buildings has been engaged in research and planning efforts toward the development of a new seismic rehabilitation policy for the City of Portland. In 1996, as part of this effort, the City of Portland Bureau of Buildings commissioned a telephone survey of 400 Portland residents concerning their perceptions of earthquake risks and their attitudes toward various seismic rehabilitation strategies. The survey's purpose was to provide the Task Force with information that will help guide them in their charge to recommend a policy for strengthening existing buildings' resistance to earthquakes within the City of Portland.

The Task Force's charge... to recommend a policy for strengthening existing buildings' resistance to earthquakes.

The survey instrument was developed jointly by Decision Research of Eugene, Oregon; Portland City staff; and members of the Task Force. The data were collected by Moore Information Services, a Portland survey research firm. Decision Research, a firm that specializes in the analysis of risk perception, conducted a statistical analysis of the survey data. Respondents were asked a series of 65 questions. Following are highlights of some of the results:

- Respondents ranked earthquakes fifth in a list of 15 risk categories including risks from natural disasters and other environmental, health, and social risks. The risk categories ranked above earthquakes were crime and violence (highest), cancer, motor vehicles, and fire.
- A majority of respondents (80%) reported that they believe a major earthquake in the Portland area was likely or very likely to occur within their lifetime.
- A majority of respondents (75%) disagreed with the statement "there is nothing much the city or community can do to lessen the effects of an earthquake."
- A majority of respondents supported seismic retrofit for existing government buildings (56%), but respondents were split regarding a mandatory rehabilitation program for privately owned buildings (45% supported this option and 47% were opposed).
- When asked how they would rank spending on seismic rehabilitation, a majority of respondents placed hospitals first. Hospitals were followed by hazardous buildings, emergency communication buildings, bridges, gas and power lines, schools, and fire stations. Apartment buildings, office buildings, and public arenas were ranked lowest.
- Just over half of the respondents expressed support for public disclosure of information on a building's ability to withstand a quake.

Results of a multiple regression analysis indicated that the perception of earthquake risk as a community and individual hazard (represented by the combined results of three questions in the survey), was the strongest indicator of support for various seismic rehabilitation strategies. The statistical analysis also found that the respondent's belief that community mitigation actions have the ability to lessen potential negative effects of an earthquake was a significant predictor of support for seismic rehabilitation policies. Long-term residents of Oregon were less supportive of mandatory seismic rehabilitation programs than those who have lived in the state for a shorter period of time. Overall, the survey findings indicated an awareness of seismic risk on the part of Portland residents and at least some support for limited seismic rehabilitation efforts.

If you would like a copy of this study, or more information, please contact Cathie Carlisle, City of Portland, Bureau of Buildings, 1120 SW 5th Ave., Room 930, Portland, OR 97204, phone 503-823-7399.

Meetings and Conferences

- January 22 - 23, 1998, **ATC-29-1 Seminar on Seismic Design, Retrofit, and Performance of Nonstructural Components**, San Francisco. Sponsored by Applied Technology Council, 555 Twin Dolphin Drive, Suite 550, Redwood City, CA 94065; fax (415) 593-2320.
- February 4 - 7, 1998, **EERI 1998 Annual Meeting,** San Francisco, California, at the Fairmont Hotel. Information: Earthquake Engineering Research Institute, 499 14th Street, Suite 320, Oakland, CA 94612-1934; (510) 451-0905; fax (510) 451-5411; e-mail eeri@eeri.org; WWW: http://www.eeri.org
- March 9 - 14, 1998, **4th International Conference on Case Histories in Geotechnical Engineering,** St. Louis, Missouri. Information: fax 573-341-6553; e-mail: prakash@novell.civil.umr.edu; web: http://www.umr.edu/conted/conf8926.html
- April 27 - 30, 1998, **Modern Preparation and Response Systems for Earthquake, Tsunami, and Volcanic Hazards**, Santiago, Chile. Sponsored by International Association of Seismology and Physics of the Earth's Interior (IASPEI) and International Association of Volcanology and Chemistry of the Earth's Interior (IAVCEI). For information contact Bruce A. Bolt, Department of Geology and Geophysics, University of California, Berkeley, CA 94720; fax (510) 845-4816; e-mail: boltuc@socrates.berkeley.edu
- May 31 - June 4, 1998, **6NCEE - Sixth U.S. National Conference on Earthquake Engineering**, Seattle, Washington. Information: Earthquake Engineering Research Institute

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(EERI), 510-451-0905.

- July 26 - 31, 1998, **"Gender in Disaster Research: Are the Experiences of Women Really Different?" XIV World Congress of Sociology—Session of the Research Committee on Disasters, International Sociological Association,** Montreal, Canada. For information contact Joseph Scanlon, 117 Aylmer Avenue, Ottawa, Ontario, Canada KIS 2X8; (613) 730-9239; fax (613) 730-1696; e-mail: jscanlon@ccs.carleton.ca
- August, 1998, **ASCE Geotechnical Earthquake Engineering and Soil Dynamics Conference,** Seattle. For information contact ASCE, (800) 548-2723 or (703) 295-6029; fax (703) 295-6144; e-mail: conf@asce.org
- September 21 - 25, 1998, **8th Congress of the International Association of Engineering Geology**, Vancouver, British Columbia. Contact: Kim Meida, Secretariat, 8th Congress IAEG, (604) 528-2421, fax (604) 528-2558, e-mail: kim.meidal@bchydro.bc.ca; web: http://ewu.bchydro.bc.ca/IAEG/IAEG98.html
- October 7 - 9, 1998, **Risk '98: First International Conference on Computer Simulation in Risk Analysis and Hazard Mitigation**, Valencia, Spain. Organizers: Wessex Institute of Technology and Universitat Jaume 1. Palau de Pineda. For information, contact C.A. Brebbia, Wessex Institute of Technology, Ashurst Lodge, Ashurst, Southampton SO40 7AA, U.K.; tel: 44 (0)1703 293223; fax 44 (0)1703 292853; e-mail: wit@wessex.ac.uk.

Recent Publications

Anderson, J.C., and Bertero, V.V., 1997, Implications of the Landers and Big Bear earthquakes on earthquake resistant design of structures, EERC Report 97/08: Berkeley, California, Earthquake Engineering Research Center, 105 p. $20. Available from News, Earthquake Engineering Research Center MC 3580, 1301 South 46th Street, Richmond, CA 94804-4698; e-mail: eerclib@eerc.berkeley.edu; WWW: http://www.eerc.berkeley.edu

Applied Technology Council, 1997, ATC-34: A critical review of current approaches to earthquake resistant design: Redwood City, California, Applied Technology Council, 94 p. $30. Available from ATC, 555 Twin Dolphin Drive, Suite 550, Redwood City, CA 94065, 650-595-1542; fax 650-593-2320, e-mail: act@atcouncil.org. Orders from within California must include applicable sales taxes.

Brumbaugh, D.S., and Bausch, D.B., 1997, Determination of focal parameters of early twentieth century Arizona earthquakes, Abstract S51E-11, AGU 1997 Fall Meeting abstract supplement, Eos, Transactions, v. 78, no. 46: Washington, D.C., American Geophysical Union, p. F497.

Earthquake Engineering Research Institute, 1997, Proceedings from the 5th US Japan workshop on urban earthquake hazard reduction, January 15-17, 1997, Pasadena, California: Oakland, California, Earthquake Engineering Research Institute, 455 p. $25. California residents add 8.25% sales tax. Send prepaid orders to EERI, 499 14th Street, Suite 320, Oakland, CA 94612-1934; fax (510) 451-5411. Fax orders should include Visa or MasterCard number, expiration date, and authorized signature.

Federal Emergency Management Agency, Mitigation, Directorate, 1997, Report on Costs and Benefits of Natural Hazard Mitigation: Washington DC, Federal Emergency Management Agency, 52 p. For copies of the report contact FEMA, Attn: Publications, P.O. Box 70274, Washington, DC 20024.

Gilbert, H.J., Sheehan, A.F., Deuker, K.G., 1997, Upper mantle discontinuity structure below the eastern Basin and Range and Colorado Plateau from teleseismic receiver functions, Abstract S51C-4, AGU 1997 Fall Meeting abstract supplement, Eos, Transactions, v. 78, no. 46: Washington, D.C., American Geophysical Union, p. F492.

Lynch, Damian, Smith, R.B., Villasenor, Antonio, and Benz, H.M., 1997, Three-dimensional p-wave inversion of the crust and upper mantle structure from the Basin and Range to the Colorado Plateau-Rocky Mountains using earthquake and controlled source data, Abstract S51C-10, AGU 1997 Fall Meeting abstract supplement, Eos, Transactions, v. 78, no. 46: Washington, D.C., American Geophysical Union, p. F493.

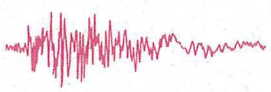
National Seismic Safety Advisory Boards' Directory, 1996, 190 p. $10. Purchase from California Seismic Safety Commission, 1900 K Street, Suite 100, Sacramento, CA 95814, (916) 322-4917; fax (916) 322-9476; e-mail: SSCbase@aol.com

Pechmann, J.C., Brumbaugh, D.S., Nava, S.J., Skelton, T.G., Fivas, G. P., Arabasz, W.J., and Jackson, S.M., 1997, The 1994 Draney Peak, ID, earthquake and its aftershocks, Abstract S41B-11, AGU 1997 Fall Meeting abstract supplement, Eos, Transactions, v. 78, no. 46: Washington, D.C., American Geophysical Union, p. F480.

SAC Steel Project, FEMA Program to Reduce the Earthquake Hazards of Steel Moment Frame Structures, 1997, FEMA 267A, Interim guidelines advisory No. 1: Federal Emergency Management Agency. FREE. Document contains updates to the previously published FEMA 267, Interim guidelines: Evaluation repair, modification and design of welded steel moment frame structures. Advisory No. 1 is only a supplement to, and cannot be used without, the Interim Guidelines, which are also free from FEMA. Available by calling FEMA at 1-800-480-2520.

——-1997, FEMA 288, Background reports: Metallurgy, fracture mechanics, welding, moment connections and frame systems behavior: Federal Emergency Management Agency. FREE. Available by calling FEMA at 1-800-480-2520.

——-1997, FEMA 289, Connection test summaries: Federal Emergency Management Agency. FREE. Available by calling FEMA at 1-800-480-2520.



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