Fault Line Forum

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Utah Can Learn From Earthquakes in Turkey

Even with a professional lifetime spent investigating earthquakes and studying their often-horrific aftermath, the disaster in Turkey this past summer left T. Leslie Youd, Ph.D., profoundly saddened.

"It was one of the most depressing earthquakes I have ever investigated," he told the fourth quarterly meeting of the Utah Seismic Safety Commission on October 15. "Almost all of the casualties could be attributed to buildings that collapsed because they were not built to code. There are a couple of lessons for us: Building codes save lives initially, and competent emergency response systems can prevent further loss of life."

Although the structural integrity of some of the buildings was sound, liquefaction toppled them anyway

Long an ardent proponent of establishing construction and remodeling standards that would mitigate earthquake damage, Youd led a team of investigators to the Izmit, Turkey, earthquake site on behalf of the Earthquake Engineering Research Institute (EERI) of California.

What they found was massive destruction and loss of life (as many as 50,000 killed or injured, 600,000 homeless, at least 60,000 buildings destroyed, and damage estimates of up to $50 billion). Much of that could have been prevented, he said, and the response to the disaster by authorities was too often chaotic. According to published reports, the emergency response by Turkish authorities was often slow and unorganized because of breakdowns in communication, a lack of command and control, a shortage of equipment and materials, and a lack of training.

"Some contractors simply did not follow the codes. Their concrete was brittle, they used smooth

continued on page 2

Table of Contents

Earthquakes in Turkey

Continued from Page 1

reinforcing bars instead of ribbed ones, they ignored building requirements, and many of the buildings that toppled in liquefaction zones could have benefitted from pilings," he said.

Where requirements were followed, injuries to people and damage to buildings was considerably lessened. For instance, mechanically stabilized earth retaining walls for a bridge approach fill only meters from the primary fault rupture sustained only minor damage while the bridge span itself collapsed. The lifeline systems in the region came through the event comparatively well; only minor damage was reported at dams and reservoirs, water treatment plants were operational, some electric control systems were well-anchored and undamaged, and there was slight damage at telecommunications central exchanges.

This mechanically stabilized earth wall, supporting a roadway, was within few meters of the primary fault rupture. Although subjected to differential settlement, it suffered only minor damage.

The Izmit region, which extends 250 kilometers eastward from the Sea of Marmara along the North Anatolian fault, shares many similarities with our own Wasatch Front. It is the industrial heartland of Turkey, with major fuel storage, refining, manufacturing, telecommunications, health care, and transportation facilities. The earthquake caused surface faulting, flooding due to tectonic subsidence, and liquefaction — elements that can be expected along the Wasatch fault.

In his conclusion to the EERI report, Youd said, "This earthquake clearly demonstrated . . . that improperly constructed buildings kill people, and that accountability matters."

Utah Ranks in the Middle of the Pack for Earthquake Risk Reduction Efforts among Western States

Utah's local government actions to reduce risks from earthquakes ranks the state fourth out of 11 western states, a study funded by the Pacific Earthquake Engineering Research (PEER) Center in Berkeley, California, has concluded.

Authors Peter J. May, professor in the Department of Political Science at the University of Washington, and T. Jens Feeley, a Ph.D. student, published their findings in the October issue of the newsletter *PEER Center News*.

"The findings concerning the earthquake risk-reduction efforts of local governments in 11 western states can be interpreted in either an optimistic or pessimistic light," they write. "The positive points are that building officials appear to be responsive to the extent of earthquake hazard and that many local governments in high-hazard areas are serious about addressing the risks.

"The more pessimistic perspective relates to the wide variation in risk-reduction abilities and actions, both among and within states, even when accounting for the extent of earthquake hazard."

The researchers looked at two categories of six individual attributes in surveying 258 communities in Alaska, Arizona, California, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming. The first category, "Seismic Regulations," included "seismic review of plans in house," "detailed review of seismic provisions," "selective review of seismic provisions," and "no review of seismic provisions." The second category, "Priority for Seismic Enforcement," included the

continued on page 3

Utah Rank

Continued from Page 2

attributes of "high priority assigned to enforcement of seismic provisions" and "increased priority for enforcement of seismic provisions in the past five years."

"The role that states take is an important aspect of examining the variation in the earthquake risk-reduction efforts of local government," the research says. "To clarify this, the 11 states in the study were classified into three categories according to their regulatory roles. The first category contains California, the *aggressive state,* which stands alone in the extent of state mandates for local government action.

"The second category includes the *attentive states* — those that have strong state building codes with required local enforcement of seismic provisions. The third category comprises the *minimalist states,* which make provisions for, but do not necessarily require, local enforcement of seismic provisions."

For the "Regulatory" attribute, the states were classified by extent of the state regulatory role in mandating seismic reisk reduction by local governments. The higher the value, the higher the regulatory activity. Utah ranks above all but three western states in this section.

For "Enforcement," the researchers used a value that shows the percentage of local building officials who rated "enforcement of seismic provisions" at the top on a scale of 1 to 5, with 5 being the highest. The larger the number, the more attention is paid to enforcement. For Utah, the number indicates that 55.2 percent of local building officials consider enforcement to be a high priority.

The "Hazard" number represents a probabilistic level of earthquake ground shaking (mean peak ground acceleration having a 10 percent chance of being exceeded in a 50-year period). Higher values indicate increased seismic hasards. For comparative purposes, the states listed in the accompanying table are ranked by the "Hazard" attributes.

California is clearly the standard for both regulation and enforcment, and is also the state with the highest hazard value.

"Despite the risks posed by earthquakes — for some states borne out by costly occurrences — there is not much of a public constituency pushing for efforts to avert earthquake losses," the authors write. "The risks are not mass public issues that compel groups to the steps of state capitols or to city halls demanding to be saved. The lack of a public constituency, coupled with varied concerns of local officials about the risks, creates uncertain incentives for local governments to be pro-active in reducing these risks.

"The variation in effort among localities generally mirrors differences in state roles. Localities in California stand out from those in both the attentive and minimalist states with respect to both measures of local regulatory efforts. In the attentive states, local regulations average more than five times those of minimalist states, and nearly twice as many localities place a high priority on the enforcement of seismic provisions of building codes than do the localities in minimalist states. The differences in local regulator actions also reflect variation in the extent of earthquake hazards among states."

CATEGORY	SEISMIC ATTRIBUTES AND VALUES		
States	*Regulations*	*Enforcement*	*Hazard*
AGGRESSIVE STATE			
California	*2.3*	*82.5*	*47.4*
ATTENTIVE STATES			
Washington	*1.6*	*60.6*	*24.3*
Oregon	*1.7*	*29*	*22.5*
Alaska	*1.4*	*61.1*	*21*
Nevada	*1.3*	*50*	*20.2*
Utah	*1.5*	*55.2*	*19*
MINIMALIST STATES			
Montana	*0.5*	*16.7*	*14.3*
Wyoming	*0.0*	*0.0*	*11.5*
Idaho	*0.3*	*50*	*10.2*
New Mexico	*0.1*	*28.6*	*6.9*
Arizona	*0.2*	*27.3*	*6.5*

Commission Hears Report on State-Owned Buildings in Need of Seismic Safety Upgrades

The Utah Seismic Safety Commission (USSC), at its final quarterly meeting of 1999, heard details of ongoing efforts to bring state-owned buildings into compliance with the Uniform Building Code, including upgrades for seismic safety.

Commissioner Matthias Mueller of the state's Division of Facilities Construction and Management (DFCM) said the state assumes that 51 percent of state-owned buildings already meet the code, since they were constructed after the codes took effect in 1974. Of the 193 older buildings surveyed so far, 111 will need repairs or remodeling that will include upgrading for earthquake safety, he said. Commissioner James Bailey of Allen and Bailey Engineers noted, however, that buildings erected between 1974 and 1985 should not be presumed to meet code requirements, since quality control in the construction industry was not as good then as it is now.

Mueller acknowledged the value of current practices of quality assurance efforts in design compliance. He said technical accuracy, coordination, and review of planning documents actually saves money.

"Compliance built into the design and construction processes, rather that being change-ordered, saves about 3.5 percent on final construction costs," he said. "The state practices quality assurance on all construction projects of $1 million or more."

Mueller could not estimate what the needed repairs and remodeling would cost, but indicated the state legislature will probably appropriate about $35 million for next fiscal year. He said several structures — the Utah Industries for the Blind, Utah State University's Old Main Building, Weber State University's Browning Performing Arts Center, the Governor's Mansion, The University of Utah's Kingsbury Hall, Snow College's Noyes Building, and Salt Lake Community College's Grand Theater — have already undergone or are presently undergoing improvements that include seismic upgrades.

In other business:

- **Commissioner Bailey** reported that the Salt Lake County Commission is studying ways to upgrade county structures and has formed an ad hoc committee to consider the proposals.
- **Barry Welliver,** a structural engineer representing the Structural Engineers Association of Utah, reported that the Uniform Building Code Commission is moving toward adopting the Uniform Code for Building Conservation, 2000 Edition, for remodeling of older buildings in Utah.
- **Bob Carey** of the Division of Comprehensive Emergency Management (CEM) reported on the Hazards United States (HAZUS) Data Users Group. He said they held an organization meeting in July, and that the group is now awaiting training in the use of HAZUS.
- **Barry Solomon** of the Utah Geological Survey (UGS) reported that the state attorney general's office recommended a legislative mandate approving any fund-raising efforts by the USSC. Representative Don Bush (R-Davis), a USSC Commissioner, said he would sponsor a bill in the next session to allow the USSC to solicit funding.
- **Commissioner Earl Morris** of CEM reported that his agency has recommitted itself to the goals, concept, and mission of the USSC and wants to get more involved in developing initiatives, working with standing committees, and supporting workshops and conferences. He said the events of the summer, particularly the Salt Lake City tornado, solidified CEM's position with the governor and the legislature, since CEM worked well with city and county organizations in mitigating problems, and coordinated contact with federal agencies for disaster declarations. CEM, he said, is a support agency, not a directive one.
- **Gary Christenson** of UGS and Bob Carey reported on the recent Western States Seismic Policy Council (WSSPC). They reported that the organization is becoming more involved in seismic safety issues and wants to develop plans for a post-earthquake clearinghouse for information transfer following significant earthquakes in the western U.S.

The next meeting of the USSC will be Friday, January 7, 2000, at 9 a.m. in Room 1112 of the State Office Building. For further details, contact Brenda Nguyen at UGS, (801) 537-3390, fax (801) 537-3400, e-mail nrugs.bnguyen@state.ut.us.

Meetings and Conferences

January 29 -February 5, 2000, **12th World Conference on Earthquake Engineering, (12WCEE),** Auckland, New Zealand. Information: Conference Secretariat, 12WCEE Organising Committee, c/o Convention Management, P.O. Box 2009, Auckland, New Zealand; (649) 529-4414; fax: (649) 520-0718; e-mail: *12wcee@cmsl.co.nz; www.cmsl.co.nz/12wcee;* or *www.eeri.org/Meetings/12WCEE.html.*

May 21 - 25, 2000, **Eighth International Conference of the Natural Hazards Society,** Tokushima, Japan. Information: Natural Hazards Society, P.O. Box 49511, Concord, Ontario, Canada L4K 4P6; *www.es.mq.edu.au/NHRC/NHS.*

May 31- June 3, 2000, **Earthquake Engineering Research Institute 2000 Annual Meeting,** St. Louis, Missouri. Information: EERI, 499 14th Street, Suite 320, Oakland, CA 94612-1934; (510) 451-0905; fax (510) 451-5411; *e-mail: eeri@eeri.org; www.eeri.org.*

September 5 - 8, 2000, **Mid-America Post-Earthquake Highway Response and Recovery Conference,** St. Louis, Missouri. Information: Donald Neumann, Federal Highway Administration, 209 Adams, Jefferson City, MO 65101; (573) 636-6196, ext. 17; e-mail *donald.neuman@fhwa.gov.*

November 12 - 15, 2000, **Sixth International Conference on Seismic Zonation (6ICSA),** Palm Springs, California. Information: EERI, 499 14th Street, Suite 320, Oakland, CA 94612-1934; (510) 451-0905; fax (510) 451-5411; *e-mail: eeri@eeri.org; www.eeri.org.*

Recent Publications

Applied Technology Council/Structural Engineers Association of California (ACT/SEAOC), 1999, Built to resist earthquakes: the path to seismic design and construction for architects, engineers, inspectors. $75. ATC, 555 Twin Dolphin Drive, Suite 550, Redwood City, CA, 94065; (650) 595-1542; atc@atcouncil.org.

Brumbaugh, David S., 1999, Earthquakes: science and society. 251 p. $32.40 paperback. Prentice-Hall Inc., Upper Saddle River, NJ 07458; (800) 282-0693.

California Universities for Research in Earthquake Engineering (CUREe), 1999, Proceedings of the Peoples Republic of China-U.S.A. bilateral workshop on seismic codes, 307 p. $40. CUREe, 1301 S. 46th St., Richmond, CA 94804-4698; (501) 231-9557; curee@curee.org.

Earthquake Engineering Research Institute (EERI), 1998, Lijian, China earthquake: February 3, 1996, reconnaissance report. 34 p. $15 plus $5 shipping. EERI, 499 14th Street, Suite 320, Oakland, CA 94612-1934; (510) 451-0905; eeri@eeri.org.

Harris, Ruth A., 1998, The Loma Prieta, California earthquake of October 17, 1989 — forecasts. 32 p. $2.75. Professional Paper 1550-B. U.S. Geological Survey, Information Services, Box 25286, Denver Federal Center, Denver, CO 80225; (800) 275-8767 or (303) 202-4700; custserv@edcmail.cr.usgu.gov.

Holzer, Thomas L., 1998, The Loma Prieta, California earthquake of October 17, 1989 — earth structures and engineering characterization of ground motion. 84 p. $7.50. Professional Paper 1552-D. U.S. Geological Survey, Information Services, Box 25286, Denver Federal Center, Denver, CO 80225; (800) 275-8767 or (303) 202-4700; custserv@edcmail.cr.usgu.gov.

Lewis, James, 1999, Development in disaster-prone places: studies in vulnerability. 224 p. $29.95. Intermediate Technology Publications, 103-105 Southampton Row, London, WC1B 4HH, U.K.; (0) 171-436-9761; orders@itpubs.org.uk.

Palm, Risa, and Hodgson, Michael E., 1999, After a Califonia earthquake: attitude and behavior change. 127 p. $17.50 paperback. The University of Chicago Press, Chicago, IL 60637; (800) 621-2736.

Reasenberg, Paul A., 1997, The Loma Prieta, California earthquake of October 17, 1989 — aftershocks and postseismic effects. 315 p. $25. Professional Paper 1550-D. U.S. Geological Survey, Information Services, Box 25286, Denver Federal Center, Denver, CO 80225; (800) 275-8767 or (303) 202-4700; custserv@edcmail.cr.usgu.gov.

Schiff, Ansel J., editor, 1998, The Loma Prieta, California earthquake of October 17, 1989 — lifelines. 135 p. $12. Professional Paper 1552-A. U.S. Geological Survey, Information Services, Box 25286, Denver Federal Center, Denver, CO 80225; (800) 275-8767 or (303) 202-4700; custserv@edcmail.cr.usgu.gov.

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HAZUS UPDATE

HAZUS training has been tentatively scheduled for January 10-14, 2000, in the Command Center at the Division of Comprehensive Emergency Management. Formal announcement of the training start times should be finalized by the middle of December. The HAZUS training will be on the latest edition of the software, HAZUS 1999. The training being provided will focus on how to use the software and the different levels of analysis. If you are interested in HAZUS training, call to have a spot held for you, 538-3400. Ask for Amisha or Bob Carey.

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