2011 ULAG MEETING SUMMARY

Utah Liquefaction Advisory Group
Tuesday, February 15, 2011
Utah Department of Natural Resources Building, Room 1010

Steve Bartlett, Facilitator
Mike Hylland, UGS liaison

Members present:
Steve Bartlett, U of U
Tony Crone, USGS
Grant Gummow, UDOT
Mike Hylland, UGS
David Simon, SBI
Bill Turner, Earthtec
Les Youd, BYU

Guests:
Doug Bausch, FEMA
Zhenzhong Cao, BYU
Chris DuRoss, UGS
Dan Gillins, U of U
Dan Hinkley, IGES
Rich Giraud, UGS
Alan Taylor, Taylor Geotechnical

INTRODUCTION, OVERVIEW OF ULAG OBJECTIVES, AND SUMMARY OF COMPLETED WORK

The meeting commenced at 1:00 p.m. Steve Bartlett summarized the objectives of the Utah Liquefaction Advisory Group (ULAG), work undertaken in previous years, completed products, and work in progress.

ULAG objectives:

- Development of probabilistic liquefaction hazard maps (including liquefaction triggering, lateral spread, and seismically induced ground settlement) for the urban Wasatch Front counties.
- Development of GIS programs for implementing the probabilistic hazard maps.
- Establishment of a subsurface geotechnical database for public use.
- Education and public outreach.

Completed products:

- Deterministic (M7) lateral spread displacement map for Salt Lake County.
- Deterministic (M7) ground settlement map for Salt Lake County.
- Probabilistic ground settlement maps for Salt Lake County, 500- and 2500-yr return periods.
- Probabilistic liquefaction potential maps for Salt Lake County, 500- and 2500-yr return periods.

Work in progress:

- Aggregated probabilistic liquefaction and lateral spread potential maps for Salt Lake County.

- Lateral spread hazard mapping in Weber County, and development of a statistical approach to characterizing surficial geologic units for which little geotechnical data exist (under-sampled units).

Steve noted that the aggregated probabilistic liquefaction and lateral spread potential maps for Salt Lake County currently incorporate 2002 input data, but require updated 2008 U.S. Geological Survey strong motion estimates to be finalized. A 2011 National Earthquake Hazards Reduction Program (NEHRP) proposal to expand liquefaction-hazard mapping into Weber County was not funded; however, partial funding provided by the Weber Basin Water Conservancy District allowed Dan Gillins to begin mapping in Weber County and continue development of an approach for characterizing under-sampled units (see technical presentation summary below). No liquefaction research projects in Utah have received NEHRP funding since 2007.

TECHNICAL PRESENTATIONS

Liquefaction in the M 4.5 Randolph, Utah, Earthquake
Chris DuRoss, Utah Geological Survey (UGS)

Chris summarized the results of a brief field reconnaissance following the M_w 4.5 earthquake that occurred on April 15, 2010, near Randolph in northern Utah. Numerous sand boils were observed in Holocene Bear River floodplain alluvium along a 1-km stretch of the river in the epicentral area, indicating that this earthquake is one of the smallest instrumentally recorded earthquakes to generate liquefaction. The liquefaction is attributed to highly susceptible sediments near the earthquake's epicenter. However, Chris and Kristine Pankow (University of Utah Seismograph Stations) are investigating the possibility that anomalously high ground motions also contributed to the liquefaction.

Liquefaction-hazard Mapping in Weber County
Dan Gillins, Ph.D. Candidate, University of Utah

Dan summarized his lateral spread displacement mapping in Weber County, focusing on the development of an approach for characterizing under-sampled surficial geologic units. The basic model being used to determine lateral spread displacements is the multiple linear regression model developed by Bartlett and Youd. Available borehole data for Weber County include little to no information on fines content and mean grain size (F_{15} and $D50_{15}$ terms, respectively, in the Bartlett and Youd model). In a "reduced" model, these two terms are simply removed from the full model, but sensitivity analysis indicates significant over- and under-prediction relative to the full model. In a "modified" model, coefficients associated with soil names (derived from soil descriptions; e.g., gravel, poorly graded sanded, silty sand, and silt) are used as a proxy for fines-content and mean-grain-size terms, and sensitivity analysis indicates improvement in R^2 over the "reduced" model. Dan also indicated that CPT data (tip resistance and sleeve friction) can be

used to estimate soil type. Difficulties in obtaining funding for Dan's work are presenting challenges to completion of the mapping and uncertainty analysis.

ADDITIONAL PRESENTATION

BYU-IEM Collaborative Research
Les Youd, Brigham Young University

Les summarized a recent trip to China to meet with representatives of the Institute of Engineering Mechanics (IEM) to discuss possibilities for collaborative liquefaction research and mapping. The trip came about partly as the consequence of graduate research by Zhenzhong Cao (presently at BYU) conducted after the 2008 M_s 8.0 Wenchuan earthquake and involving dynamic penetrometer testing of liquefied gravels. Les is returning to China in May 2011 to follow up on proposed work, and indicated that the collaboration may present opportunities for other researchers in Utah.

REVIEW OF FY2011 NEHRP PROPOSAL AND PANEL COMMENTS

Steve Bartlett summarized the review panel comments and ultimate outcome of last year's NEHRP proposal to expand liquefaction-hazard mapping into Weber County. Although the proposal received favorable comments from the review panel, both in terms of technical merit and budget, the final ranking of the proposal resulted in it falling just below the NEHRP funding-level cut-off. The idea of resubmitting the proposal this year, with expansion of mapping into Davis County, was met favorably by the group. As a point of information, Tony Crone reviewed the President's budget proposal, which includes a $2 million cut to the USGS External Grants Program (which would translate into a 10% cut to the Earthquake Hazards Program).

MISCELLANEOUS PLANNING AND PRIORITIES FOR FY2012

The group discussed two new areas of activity for FY2012: (1) publication of the Salt Lake County liquefaction hazard maps, and (2) expanding the scope of the 2012 ULAG meeting to include an education/tech transfer/outreach component. The group also discussed the Weber County liquefaction hazard mapping as a continuing research priority. No additional CPT work is currently planned for the Salt Lake City Library Block or southern extension of the Warm Springs fault.

The group also discussed the relative lack of subsurface geotechnical data outside of the central Wasatch Front (i.e., Salt Lake and Utah Counties), and raised the issue of extensive data held by the LDS Church but which the church has been reluctant to make available to third parties. Les

commented that he occasionally provides *pro bono* consulting services for the church, and offered to follow up on the data-availability issue with the church's Building Department.

Summaries of the planning and priority discussions are as follows:

Publication of the Salt Lake County Liquefaction Hazard Maps

- The maps need to be finalized.
- The authors need to determine which liquefaction maps to publish.
- The group would like to have a model liquefaction ordinance available for local government staff; Bartlett and Simon expressed interest in generating a draft ordinance.
- The group is in favor of having the UGS publish the maps. UGS in-house support would likely need to include cartographic, GIS, editorial, and press release expertise.
- David Simon noted that one of the initial goals of the working group is dissemination of the maps to local municipalities and encouraging the municipalities to incorporate the maps into their respective ordinances. Currently, only Draper City has done that. In that regard, David suggested a formal presentation and explanation of the maps to municipalities at the 2012 ULAG meeting, or possibly at the 2012 AEG national meeting in Salt Lake City. David felt that educating the municipalities, a goal of the working group, is more important than educating local consultants, which is also important but NOT a goal of the working group. Without adoption by local municipalities, the maps are only academic in nature.

Expanding the Scope of the 2012 ULAG Meeting

- The 2012 ULAG meeting should be scheduled for a full day and should include an education/tech transfer/outreach component, to include the appropriate decision makers from local municipalities.
- The morning would consist of a workshop featuring a keynote address and possibly other invited talks from highly regarded liquefaction researchers. The afternoon would consist of the traditional ULAG meeting.
- If the Salt Lake County liquefaction hazard maps are published, the morning workshop would focus on showing local government representatives how to use the maps and implement a liquefaction ordinance.
- The group also considered the possibility of a workshop coinciding with map publication independent of the 2012 ULAG meeting.
- If the Salt Lake County liquefaction hazard maps are not published, the morning workshop would focus on technical liquefaction issues for consultants.
- The primary goal of the morning workshop is to provide outreach.

Weber County Liquefaction Hazard Mapping

- Steve Bartlett will resubmit the NEHRP grant proposal for Weber County liquefaction hazard mapping. Parts of Davis County will likely be included in the new proposal. Based on current discussions of the federal budget, funding from the USGS does not look promising.
- The current liquefaction hazard mapping being funded by the Weber Basin Water Conservancy District and Pacific Corp in Weber County will be completed.
- Maps for the remainder of Weber County may have to be completed without funding.

The meeting was adjourned at 4:45 p.m.