

## **2010 ULAG MEETING SUMMARY**

Utah Liquefaction Advisory Group

Monday, February 8, 2010

Utah Department of Natural Resources Building, Room 2000

Steven Bartlett, Facilitator

Michael Hylland, UGS liaison

### **Members present:**

Steven Bartlett, U of U

Anthony Crone, USGS

Travis Gerber, BYU

Grant Gummow, UDOT

Jim Higbee, UDOT

Michael Hylland, UGS

David Simon, SBI

Aurelian Trandafir, U of U

Les Youd, BYU

### **Guests:**

M. Leon Berrett, USSC & SLCo.

Steve Bowman, UGS

Chris DuRoss, UGS

Dan Hinkley, U of U

John Masek, WBWCD

Greg McDonald, UGS

Mark Petersen, USGS

Robert Snow, URS

Ivan Wong, URS

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

The meeting commenced at 1:00 p.m. Introductions included the announcement that Anthony (Tony) Crone has replaced Mark Petersen as the National Earthquake Hazards Reduction Program (NEHRP) Intermountain West Regional Coordinator; Mark will continue to be involved in NEHRP administration at the national level. Steve Bartlett then summarized the objectives of the Utah Liquefaction Advisory Group (ULAG), work undertaken in previous years, completed products (NEHRP deliverables), and work in progress.

### **ULAG objectives:**

- Development of probabilistic liquefaction hazard maps (including liquefaction triggering, lateral spread, and seismically induced ground displacement) 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 (presently contains data from 930 boreholes)
- Education and public outreach

### **Work undertaken in previous years:**

- Development of mapping techniques for under-sampled units, and uncertainty analysis (U of U graduate research [Dan Gillins]; see Technical Presentations below)
- Development of performance-based local-government geohazard ordinances (Draper City)

- Seismic assessment of Salt Lake Valley transportation network (UDOT; made use of the geotechnical database and developed a NEHRP site class map)
- Probabilistic liquefaction potential mapping of Salt Lake Valley (U of U graduate research [Michael Olsen, now at Oregon State University])

Completed products:

- Deterministic (M7) lateral spread displacement map for Salt Lake County
- Probabilistic liquefaction potential maps for Salt Lake County, 500- and 2500-yr return periods
- Deterministic (M7) ground settlement map for Salt Lake County
- Probabilistic ground settlement 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
- Downtown Salt Lake City ground-failure investigations (cone penetration testing [CPT]) (including along 400 South and the south side of the Salt Lake City Library block). Initial work completed, but more CPT soundings requested by ULAG to fill in data gaps.

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 2010 NEHRP proposal to extend the 400 South CPT line eastward was not funded. No liquefaction research projects in Utah have received NEHRP funding since 2007.

## **TECHNICAL PRESENTATIONS**

### **Ground-settlement Mapping for Salt Lake Valley Dan Hinckley, University of Utah**

Dan's work has produced three ground-settlement maps for Salt Lake Valley: a deterministic map based on a scenario M 7.0 earthquake, and two probabilistic maps (for 2% and 10% probability of exceedance [PE] in 50 years). The hazard categories shown on the deterministic map are based on a 15% exceedance threshold, meaning that at least 15% of the data fall within the range of values for the assigned hazard category (i.e., the majority of the data fall below the minimum value for the assigned hazard category). This approximates a mean value plus one standard deviation and is a conservative criterion. The 2% PE 50 yr map predicts a mean settlement value of 0.07 m; log-normal analyses predict mean settlement values of 0.06 m (zero-values excluded) and 0.03 m (zero-values included). Ivan Wong suggested that median, rather than mean, values would be appropriate for the log-normal analyses.

**Mapping and Uncertainty Analysis of Liquefaction-induced Lateral Spread  
Displacements for Geotechnically Under-sampled Geologic Units  
Dan Gillins, University of Utah**

Dan was unable to attend this year's meeting, so his work was summarized by Steve Bartlett. Dan is developing a statistical approach to characterizing surficial geologic units for which little geotechnical data exist. The basic model being used to determine lateral spread displacements is the multiple linear regression model developed by Steve and Les Youd. One approach to modeling lateral spread displacements where geotechnical data are limited is to use a "reduced" model, where the variables for mean grain size and fines content are replaced by a soil classification term. Another approach is to use surrogate data from geologic units sampled elsewhere if those units have demonstrably similar geotechnical characteristics to the under-sampled units. Les Youd suggested that the use of CPT data in addition to, or as a substitute for, standard penetration testing (SPT) data should be looked into. He also recommended that aging effects be incorporated into the mapping method and suggested reviewing recent research by Ron Andrus of Clemson University. Dan's efforts to develop the mapping procedure and uncertainty analysis are presently being slowed by difficulties in obtaining funding to complete his research.

**PRIORITIES FOR FY2011 RESEARCH**

After extended discussion of NEHRP review panels' comments on last-year's proposals, ways to improve the chances for success of new NEHRP proposals, and other possible sources of funding for research, the ULAG members agreed on two priorities for FY2011:

- Investigation of the structural relation between the Warm Springs and East Bench faults (sub-sections of the Salt Lake City segment of the Wasatch fault zone) (proposed last year by U of U). New proposal should address review panel's recommendations to better resolve the location of identified faults by infill CPT soundings along 400 South, and location of a new CPT line south of 400 South. Tony Crone and Mark Petersen suggested that the proposal would benefit by establishing the work as a shared priority with the Utah Quaternary Fault Parameters Working Group, and by including letters of support from government agencies (e.g., the Utah Geological Survey).
- Establish a publicly-accessible electronic geotechnical database (in particular, Utah County UDOT data), and expand liquefaction-hazard mapping into Weber County (using Weber County as a test case for uncertainty analysis). John Masek (Weber Basin Water Conservancy District) expressed interest in providing support (including funding) for liquefaction research in Weber County.

The meeting was adjourned at 4:00 p.m.