

**RESULTS OF THE MARCH 1, 2007  
UTAH LIQUEFACTION ADVISORY GROUP MEETING**

Steve Bartlett, Facilitator  
Barry Solomon, UGS liaison and recorder

Members present:

Steve Bartlett, U of U  
Travis Gerber, BYU  
Grant Gummow, UDOT  
Jim Higbee, UDOT  
Mark Petersen, USGS  
Dave Simon, SBI  
Barry Solomon, UGS  
Aurelian Trandafir, U of U  
Les Youd, BYU

Guests:

Bob Carey, UDHS  
Gary Christenson, UGS  
Ryan Cole, IGES/U of U  
Chris DuRoss, UGS  
Ashley Elliott, UGS  
Griffen Erickson, U of U  
Ed Fall, UDWResources  
Mike Hylland, UGS  
Bart Leeftang, U of U  
Bill Leeftang, UDWResources  
David Marble, UDWRights  
Greg McDonald, UGS  
Barry Welliver, SEAU

**ACTION ITEMS**

1. Steve Bartlett – Determine availability of Utah Transportation Research Advisory Council (UTRAC) funding from the Utah Department of Transportation for additional ARCGIS programming support and subsurface explorations to resolve question of potential faulting and lateral spreading in downtown Salt Lake City.
2. Steve Bartlett, Travis Gerber, Dave Simon, Barry Solomon, Loren Anderson – Develop NEHRP 2008 proposal.

**PRIORITIES FOR 2008 STUDIES**

- 1) University of Utah
  - a) Complete probabilistic and scenario maps for Salt Lake Valley including: (1) probabilistic liquefaction potential map for Salt Lake Valley and (2) probabilistic lateral spread displacement map for Salt Lake Valley. (These tasks are from 2007 funded items, but their final version is being postponed pending release of USGS 2007 National Seismic Hazard Maps.)
  - b) Request funding for probabilistic scenario event maps with input ground motion at 2%, 5%, and 10% probabilities of exceedance in 50 years. These maps will include: (1) probability of triggering liquefaction for the probabilistic scenario events and (2) the probability of lateral spreading exceeding displacement thresholds for the probabilistic scenario events

- c) Develop an ARC-GIS tool to calculate the probability of liquefaction and lateral-spread displacement and their associated return intervals for using the same strong motion hazard information and methods used in making Utah's maps. This will allow users to evaluate site-specific information for a given location and determine their level of hazard.
- 2) University of Utah, Brigham Young University, and Utah Geological Survey
  - a) Collect and analyze subsurface data to identify data gaps and data-collection requirements for hazard mapping in Utah Valley.
- 3) University of Utah and Brigham Young University
  - a) Develop fully probabilistic liquefaction and lateral spread displacement hazard maps for Utah Valley.
  - b) Develop deterministic and probabilistic liquefaction and lateral spread displacement scenario maps for M= 7.0 event and input strong motion at 2%, 5%, and 10% probabilities of exceedance in 50 years levels.
- 4) University of Utah and Simon-Bymaster
  - a) Conduct additional CPT subsurface investigations in downtown Salt Lake City to resolve the origin of potential fault vs. lateral spread offsets inferred in earlier studies and extend the 4<sup>th</sup> South CPT profile to the east.
- 5) University of Utah and Utah Geological Survey
  - a) Collect and analyze subsurface data to identify data gaps and data-collection requirements for hazard mapping in Davis County.
- 6) Utah State University and University of Utah
  - a) Develop an "Importance Matrix" to determine the appropriate level of ground shaking to use in liquefaction-hazard assessments based upon building use and displacement thresholds.

## MEETING SUMMARY

### PRESENTATIONS AND SPEAKERS:

- 1. Steve Bartlett – Review of 2006 ULAG items.
- 2. Griffen Erickson – Data collection and probabilistic liquefaction potential map for south Salt Lake Valley.
- 3. Steve Bartlett –
  - a. Probabilistic liquefaction potential for a M7.0 scenario earthquake, Salt Lake Valley.
  - b. Probabilistic lateral spread displacement for north Salt Lake Valley.
  - c. Lateral spread displacement for a M7.0 scenario earthquake, Salt Lake Valley.
  - d. CPT and SPT correlations, Salt Lake Valley
- 4. Bart Leeflang – CPT investigations and seismically induced ground displacement, downtown Salt Lake City
- 5. Steve Bartlett –
  - a. Completion of probabilistic lateral spread hazard maps and deterministic lateral spread hazard map for a scenario earthquake, southern Salt Lake Valley.
  - b. Development of a liquefaction-induced settlement map, Salt Lake Valley.

6. Aurelian Trandafir – Methods and new issues in evaluating liquefaction-induced large lateral deformations on gentle slopes.

DISCUSSION ITEM:

Appropriate seismic-input parameters for site-specific liquefaction analyses –

- Earthquake ground motions with a 10 percent probability of occurring in 50 years are typically used for analyzing the liquefaction potential of areas with frequent large earthquakes (for example, California). Similar large ground motions may occur in Utah, but are less frequent and, therefore, a lower probability level may be more appropriate for use in liquefaction analyses. Meeting participants proposed several alternatives, including:
  - 2/3 of the 2-percent level; although this is similar to the motion used for building design in the IBC, the use of 2/3 factor in the IBC is not meant to be used for soil evaluations and hence is not necessarily appropriate for liquefaction analyses.
  - A risk-based assessment that would consider ground shaking at several probability levels and assess the risk posed to specific construction.
  - A performance-based assessment that would set performance thresholds for lateral displacement and settlement and back-calculate ground-shaking levels at the threshold, resulting in appropriate design criteria to avoid threshold displacements.
  - Using ground motions with a 2 percent probability in 50 years in liquefaction analyses for critical facilities and a performance-based assessment to determine an engineering solution for other structures at an appropriate level of ground shaking.

Although participants did not arrive at a consensus, the last alternative had considerable support. The probabilistic liquefaction-potential map created by Griffen Erickson could be used in a performance-based assessment to determine minimum requirements for liquefaction special studies, and map techniques could then serve as the basis for creating the Web-based tool proposed as 2008 priority 1c, described above.