Utah Liquefaction Advisory Group (ULAG)

Progress Report on Liquefaction Working Group

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Salt Lake City, Utah

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Utah’s Plan for Developing the Next Generation of Liquefaction Hazard Maps

Objective 1

Develop Probabilistic Liquefaction Hazard Maps for Urban Counties in Utah

Salt Lake County
Utah County
Davis County
Weber County
Cache County
Objective 1 (cont.)

Types of Maps

(1) Liquefaction Triggering Maps
(2) Lateral Spread Displacement Hazard Maps
(3) Liquefaction-Induced Ground Settlement Maps
Utah’s Plan for Developing the Next Generation of Liquefaction Hazard Maps

Objective 2

Develop ARC GIS Programs for Implementing Probabilistic Mapping Procedures for Other Regions in U.S.

- Strong ground motion hazard estimates from PSHA and National Strong Motion Mapping Program
- User methods based on ArcGIS algorithms
Utah’s Plan for Developing the Next Generation of Liquefaction Hazard Maps

Objective 3

Establish and Populate a Subsurface Geotechnical Database for Public Use

• Geotechnical Evaluations
• Land Use Planning
• Research
• Potential Partners
  • UDOT
  • Salt Lake County and Cities
Utah’s Plan for Developing the Next Generation of Liquefaction Hazard Maps

Objective 4

Education and Public Outreach

• User Friendly Maps
• Assist Counties in Implementation and Ordinances
• Outreach Seminars and Website
Status Previous Work

FY 2004

- Geotechnical Database (N. Salt Lake Co.)
- M7.0 lateral spread displacement hazard map (N. Salt Lake Co.) published in *Earthquake Spectra*.

FY 2005

- Geotechnical Database (S. Salt Lake Co.)
**Status Previous Work**

**FY 2006**

2.1.1 Development of CPT and SPT correlations (University of Utah) ................................................................. 7
2.1.2 Task 2: Correlation of Subsurface Geologic and Geotechnical ArcGIS™ Database with Surficial Geologic Mapping (Utah Geological Survey) ................................................................. 8
2.1.3 Task 3: Mapped mean annual probability of triggering liquefaction for southern Salt Lake County (University of Utah) ........................................................................................................ 8
2.1.4 Task 4: Mapped probability of triggering liquefaction for a scenario earthquake for Salt Lake County (University of Utah) ........................................................................................................ 8
2.1.5 Task 5: Mapped mean annual probability of lateral spread exceeding displacement thresholds of 0.1, 0.3 and 1.0 meters for northern Salt Lake County (University of Utah) ................................................................. 9
2.1.6 Task 6: Mapped lateral spread horizontal displacement for a scenario event for northern Salt Lake County (University of Utah) ........................................................................................................ 9
2.1.7 Task 7: Synthesis report of seismically induced ground displacement in Salt Lake County (University of Utah, Simon-Bynaster, Inc., and Utah Geological Survey) ................................................................. 9
2.1.8 Task 8: CPT subsurface investigations in downtown Salt Lake City (University of Utah and ConeTech) ........................................................................................................ 12
2.1.9 Task 9: Map production and report delivery (University of Utah and Utah Geological Survey) 12

2.1.1 Done
2.1.2 Done
2.1.3 Done
2.1.4 Done
2.1.5 Done
2.1.6 Done
2.1.7 Done
2.1.8 Done
2.1.9 Done
Downtown Displacement Investigations

Salt Palace Convention Center: 9ft Maximum Documented Displacement (Lower Bonneville)

Rose Wagner Performing Arts Center: 2ft Maximum Documented Displacement

Pioneer Park

Zone of Potential Faulting: 10ft Maximum Documented Displacement (Lower Bonneville)

Salt Lake City Library

City and County Building

Matheson Courthouse

Approximate CPT Sounding Locations

Possible Extension of the Warm Springs Fault
Status Previous Work

FY 2007

2.1 Methods and Tasks – Phase IV, FY 2007 ................................................................. 8

2.1.1 Task 1: Collection and preliminary geologic analysis of surface and subsurface data to identify data gaps and data-collection requirements for future hazard mapping efforts in Utah Valley (Brigham Young University, University of Utah, Utah Geological Society). ................................................. 9

2.1.2 Task 2: Completion of probabilistic lateral spread hazard maps and deterministic lateral spread hazard map for a scenario earthquake for southern Salt Lake County (University of Utah). .......................... 10

2.1.3 Task 3: Development of liquefaction-induced settlement map for Salt Lake County (Brigham Young University, University of Utah). .......................................................................................... 10

2.1.4 Task 4: Map production and report delivery (University of Utah, Brigham Young University and Utah Geological Survey). .......................................................................................... 10

FY 2008 (No Funding)  
FY 2009 (No Funding)  
FY 2010 (No Funding)  
FY 2010 (Partial Funding from WBWCD)  
FY 2011 (UGS –Funding)
Probabilistic liquefaction potential map – (2002 Input)

Projection: UTM NAD 83 Zone 12N
Scale: 1:300,000
Road basemap from UDOT

Legend
Liquefaction Probability
Return Period, yr
- > 2500 yr, Low
- 1000 - 2500 yr, Moderate
- 500 - 1000 yr, High
- 0 - 500 yr, Very High
- Special Study Area
Probabilistic liquefaction potential maps for 2500 and 500-year return periods
M 7.0 Lateral spread displacement map
15 percent change of exceedance
Probabilistic ground settlement maps for 2500 and 500-year return periods
M 7.0 ground settlement map
15 percent change of exceedance
Weber County Liquefaction Hazard Mapping

Figure 5.12. 50th percentile probabilities of lateral spread displacement exceeding 0.3 meters for a 2,500-year seismic event, Weber County, Utah
1. Develop a new model ordinance for liquefaction hazards based on input and feedback from municipalities, technical advisory groups, and others.
2. Educate various municipalities and their stake holders regarding risk-based decision making and hazard mitigation using the newly developed hazard ordinance that is coupled with the recently developed ULAG liquefaction hazard maps and support and encourage the implementation/adoption of the new liquefaction hazard ordinance in the various municipalities along the urban Wasatch Front.
3. Develop methods to apply the liquefaction hazard maps to assess post-event traffic interruptions resulting from liquefaction-induced damage.
4. Educate the next generation of Utahans about earthquake hazards by focusing on a secondary education outreach curriculum and program delivered to Salt Lake and Weber Counties.