Scenario for a Magnitude 7.0 Earthquake on the Wasatch Fault–Salt Lake City Segment

Hazards and Loss Estimates

Utah League of Cities and Towns
By
Brent Maxfield
President - EERI Utah Chapter
September 16, 2015

Developed by the
Earthquake Engineering Research Institute, Utah Chapter

Prepared for the
Utah Seismic Safety Commission

June 4, 2015
Earthquake Engineering Research Institute (EERI) Utah Chapter
http://utah.eeri.org
Message of the Scenario Report

- PREPARE!

- State
- County
- City or Town
- Community
- Family
- YOU!
Prepare!

- Prepare to WITHSTAND
- Prepare to RESPOND
- Prepare to RECOVER
Audience for Report

- Utah Seismic Safety Commission
- YOU!
Magnitude 7.0 vs Shaking Intensity
Shaking Intensity
(Acceleration)
V to X+

Size (Magnitude)
M7.0
What is the Scenario?

- Possible outcome
- Based on expected average
What the Scenario is NOT?

- Prediction
- Not the worst case
Figure 1. Map of Utah’s Wasatch Front urban corridor showing populated areas (in yellow) along the Wasatch fault (in red). Population data from 2010 (figure courtesy of the University of Utah Seismograph Stations).
Figure 4. Schematic plot showing the timing of large prehistoric earthquakes on the Wasatch fault (elements of the figure provided by the Utah Geological Survey).
Prepared to WITHSTAND

- Strengthen Weak Buildings
  - Unreinforced Masonry (URM)
  - Non-ductile Concrete (NDC)

- Retrofit government URM and NDC buildings!

- Private Sector
  - Mandatory retrofit?
  - Incentive funds?
  - Public outreach and information
  - Make building owner economics work
    - Safe = ↑ Rent
    - Unsafe = ↓ Rent

90,000

Majority of Deaths
Prepared to WITHSTAND

- The building code save lives
- It does not prevent economic damage and economic loss

- Encourage business owners to consider economic loss when constructing new buildings by building beyond the building code.
  - Loss goes beyond the cost to fix or rebuild
  - Lost business income
  - Income loss to employees who can’t work
  - Loss to community due to lost sales tax
  - How long can a business be closed before they go out-of-business?
Prepared to RESPOND

- YOU!
- Your Family
- Your Community
- Your City or Town
- Your County
- State
Prepared to RESPOND

- 2,400
- Inspectors
Prepared to RESPOND

- Encourage the adoption of BORP
- Building Occupancy Resumption Program
- (Salt Lake City & Murray City have adopted it)
- Allows business to preauthorize post earthquake inspection
Prepared to RESPOND

- 53,000
- Public Shelter Needs
High probability of moderate HOSPITAL damage
Lifelines

Utility System Performance

<table>
<thead>
<tr>
<th></th>
<th>Day 1</th>
<th>Day 3</th>
<th>Day 7</th>
<th>Day 30</th>
<th>Day 90</th>
</tr>
</thead>
<tbody>
<tr>
<td>Households without Potable Water</td>
<td>483,600</td>
<td>466,100</td>
<td>442,800</td>
<td>362,900</td>
<td>332,800</td>
</tr>
<tr>
<td>Households without Electricity</td>
<td>444,600</td>
<td>251,200</td>
<td>105,900</td>
<td>27,300</td>
<td>800</td>
</tr>
</tbody>
</table>

Transportation

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Impaired Roads</td>
<td>*</td>
</tr>
<tr>
<td>Impaired Bridges</td>
<td>595 out of 1,805</td>
</tr>
</tbody>
</table>

Debris Generated

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Tons</td>
<td>21,000,000</td>
</tr>
<tr>
<td>Truckloads (25 tons/truck)</td>
<td>821,600</td>
</tr>
</tbody>
</table>

* Insufficient data for Hazus calculation

\(^4\) At least "moderate" damage—or several inches of settlement or offset of the ground.
Prepared to RESPOND

- Understand the Scope of Needed Response
- Prepare to be Without Utilities
- Exercise for Response
- Prepare for Building Inspection
- Adopt Policies to Get Businesses, Schools and Essential Services Back Into Their Buildings
Prepared to RESPOND

Mutual Aid Agreements

Additional Response and Recovery Resources:

- National Disaster Recovery Framework designed to meet the needs of states and communities in their recoveries
- Public Assistance Grant Program provides assistance to State, Tribal and local governments
- Individual and Household Program provides assistance for individuals with limited resources
- Community Emergency Response Teams provide neighborhood teams for local response
- Disaster Recovery Center provides recovery services for individuals

All disasters start at the local level. Through the declaration of emergency process, lower level jurisdictions can request disaster assistance from the next higher level of government.
Prepared to RECOVER

- Recovery will take years and even a decade for some things
- Recovery will exceed 33 billion dollars
Prepared to RECOVER

- Ounce of Preparation = Pound of Response & Recovery
Prepared to RECOVER

- Damage Resistant Buildings = Less $ spent in recovery & Helps keep Businesses in Business

- Educate public on the benefits of more robust building design
Prepared to RECOVER

- Develop Business (or government, or school) Continuity Plans

http://www.utah.gov/beready/business/
Prepared to RECOVER

- Establish laws, rules, and Ordinances that address issues related to recovery.
Prepared to RECOVER

- Where will we put the debris?

Each dot represents 5,000 tons (10 million pounds) of debris.
Prepared to RECOVER

- How will essential utilities and services be restored?
  - Roadways
  - Power
  - Water
  - Natural gas
  - Sewage
  - Communications
How will the estimated economic losses of more than $33 billion be dealt with? How will the state cope with added long-term losses to its economic and social health? What will be done to keep large employers who have operations elsewhere from leaving? How are residents going to be able to take care of themselves if their businesses, or the companies they work for, are no longer viable? Our scenario does not seek to answer such questions but raises them to motivate pre-disaster planning at all levels of government.
Which line will we take to recovery?
Be PREPARED to prevent catastrophe!
Scenario for a Magnitude 7.0 Earthquake on the Wasatch Fault–Salt Lake City Segment

Hazards and Loss Estimates

Download from

- http://utah.eeri.org
- http://USSC.utah.gov