Impacts of Geo-Spatial Data Resolution on the Uncertainty of Liquefaction-Induced Displacement Estimates

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with
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Liquefaction-Induced Failures of Buried Pipelines

1994 Northridge EQ

Balboa Blvd Pipes

Granada Trunk Line
O'Rourke & Palmer 1994
Geologic Data Levels at Different Scales

Level 1 Geologic Map

CGS Digital CA Geologic Map 1:750,000
(Jennings 1977; updated by Gutierrez et al. 2010)

Level 2 Geologic Map

Bedrossian (2012) Geologic Map 1:100,000

S. Lindvall
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<thead>
<tr>
<th>Lateral Spreading Model Inputs &amp; Outputs</th>
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<th>Level 3 – Site Specific</th>
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### Lateral Spreading Data Levels

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New Regional Lateral Spread Procedure

• Extend Holzer et al. (2011) “Liquefaction Probability Curves for Surficial Geologic Units” methodology

• Collect CPTs in study area for each surficial geologic unit

• Calculate Lateral Displacement Index (LDI) for 225 combinations of PGA, Mw, GWT

• Derive equations for Probability of LDI=“0” and Distribution of non-zero LDI

• Convert LDI to Lateral Spread Displacement (D) using existing topographic relationships

• Use maps of PGA, surficial geology, GWT, and topography to estimate D at regional scale
1989 Loma Prieta EQ in SF Bay

Artificial Fill over Bay Mud

Holocene Alluvial Fan Deposits
1989 Loma Prieta EQ in SF Bay

Prob(LDI="0")  Lateral Displacement Index (LDI)
1989 Loma Prieta EQ in SF Bay

Topography in Bay Area

Lateral Spread Displacement (D)
2010 Darfield & 2011 Christchurch EQs in New Zealand

Estimated Mean Displacements vs. Observed Displacements from Lidar Measurements - Christchurch EQ

Estimated Mean Displacements vs. Measured Displacements - Christchurch EQ
Conclusions

• Employ state-wide, regional, & site-specific data levels in OpenSRA to perform geo-hazard analyses

• Regional probabilistic liquefaction-induced lateral spread procedure developed as alternative to existing Level 2 Hazus method

• Back-analyses of Loma Prieta EQ in SF Bay Area and Darfield & Christchurch EQ in Canterbury region show promising results

• Ongoing work focused on reducing overestimation of spatial extent of lateral spreading, especially in areas with slightly sloping ground