Project 17
Development of Next-Generation Seismic Design Value Maps Issue Webinar

Maximum Direction Motions

Ronald O. Hamburger, SE, SECB
Senior Principal
Simpson Gumpertz & Heger Inc.

Chair
Project 17 Planning Committee
GMPEs (or attenuation relationships)

- GMPEs, statistical “fits” of recorded ground motion data to various parameters are a key input to seismic hazard analysis.
- The data can be organized in different ways, and give different answers.
Typical Recordings

• Two data points for each instrument
  – Treat independently
  – Combine as SRSS
  – Combine as geomean
  – Compute at each azimuth and take a statistic (Rot-50. Rot-90, etc)
  – Max direction

1994 Northridge Earthquake
Santa Monica City Hall
90° and 360° components
Ground Motion Directionality

- Prior to 2007, most Ground Motion Prediction Models used "geomean"

\[ S_{a-gm} = \sqrt{(S_{a-x})(S_{a-y})} \]

- For this motion: X=0.28g, Y=0.5g, GM=0.37g

- The Project 07 team felt geomean had no particular relevance and felt more comfortable with a max direction definition as being more consistent with designing for a target probability of collapse
Issues with Maximum Direction

- T=0.2 second
- T=0.5 second
- T=1 second
- T=1.5 second
- T=2.0 second
Issues with Maximum Direction

• Seismic hazards experts argued this effectively increased the hazard to a more rare motion
Potential Resolutions

• Retain maximum direction
• Use geomean or other measure
• Apply a “direction” coefficient similar to wind loads, to account for the probability that maximum direction will align with a building’s vulnerable direction