The Central US Earthquake Threat

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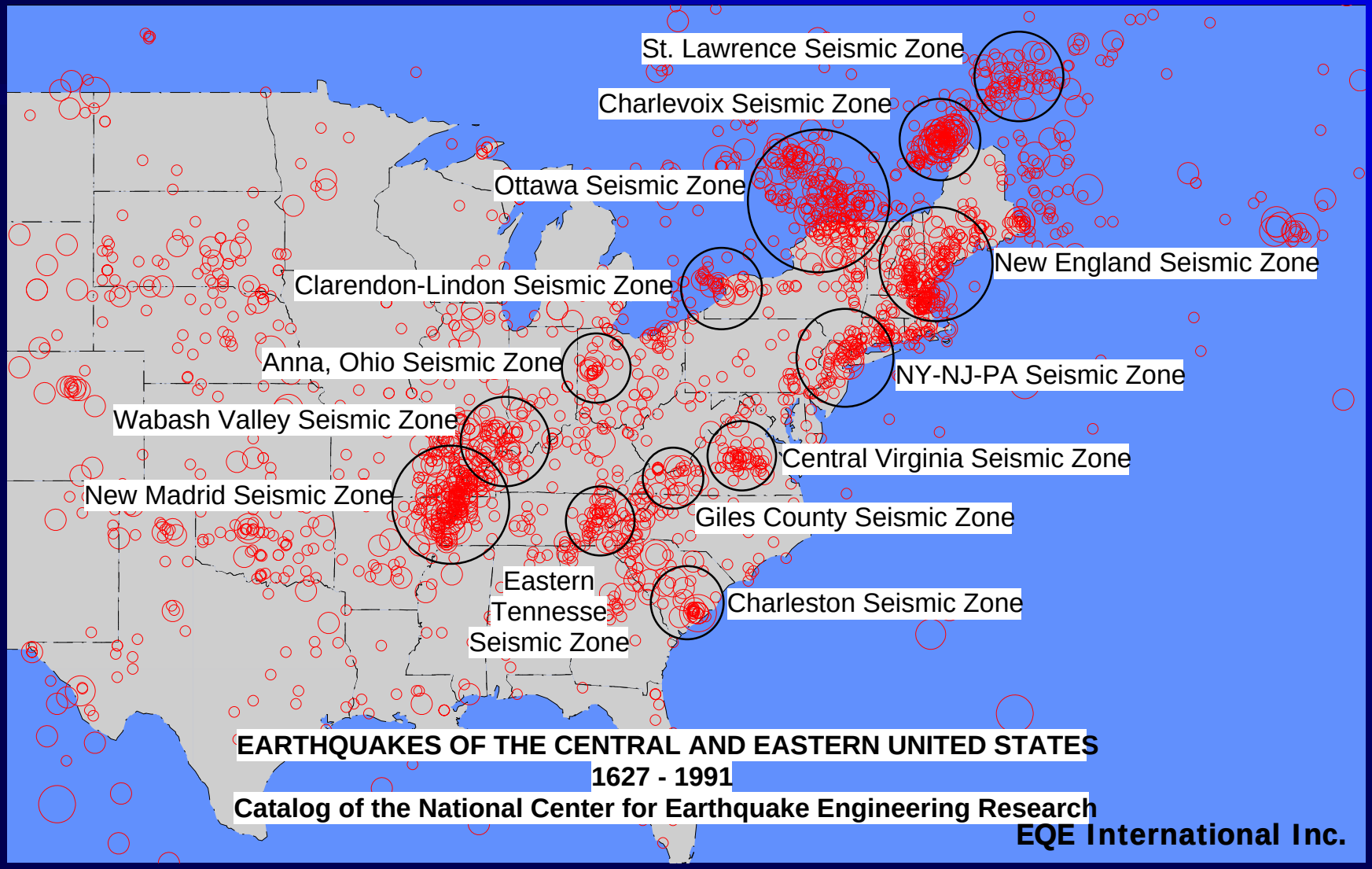
Earthquakes - Where? When? No Advance Warning!

- Tornadoes are more common in the Midwest, but impact far less area.
- Some equivalence with other rapidly developing hazards: high wind threats, seismic related hazards (liquefaction, lateral spreading, slope instability), terrorism, ...
- An all-hazards approach is best.

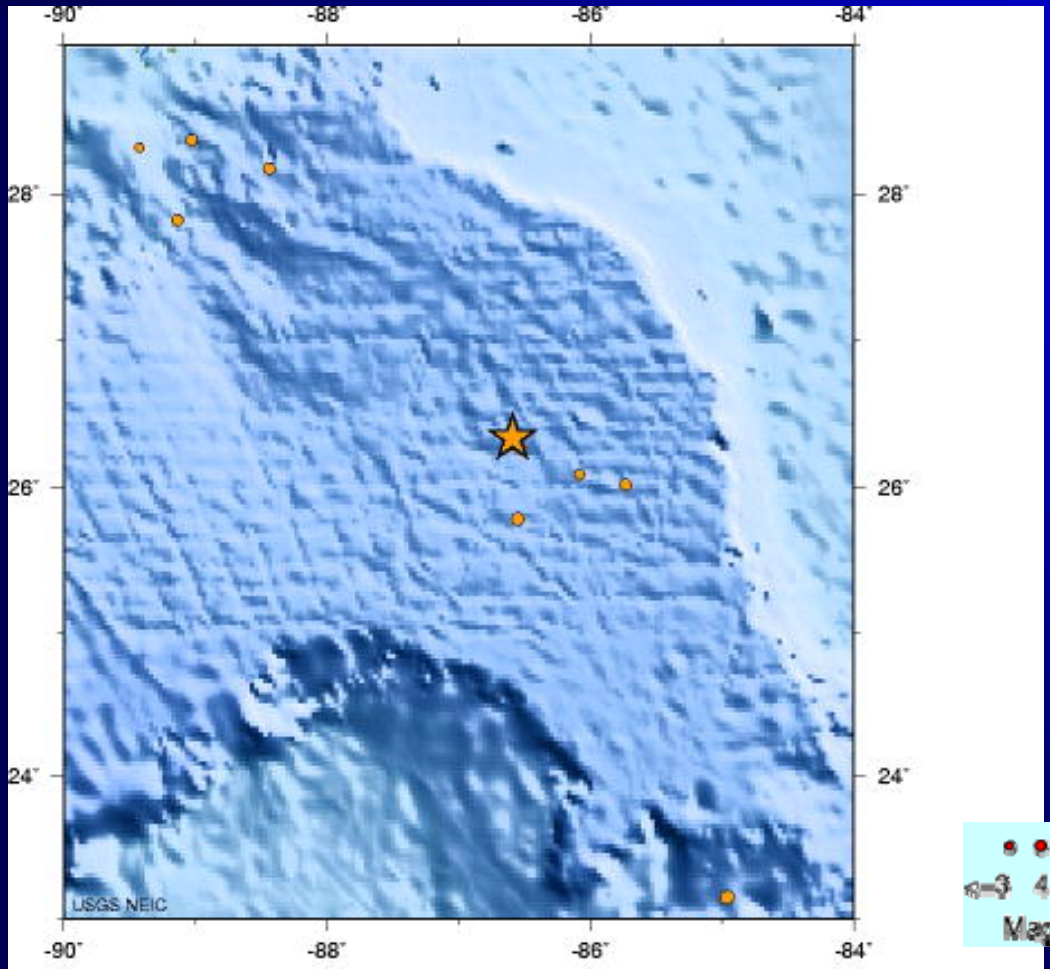
Where? Epicenters & Sources



20 APR 02, M_L 5.1, Plattsburgh NY Earthquake

(COURTESY WPTZ)

10 SEP 06, M 5.8, Gulf of Mexico Earthquake



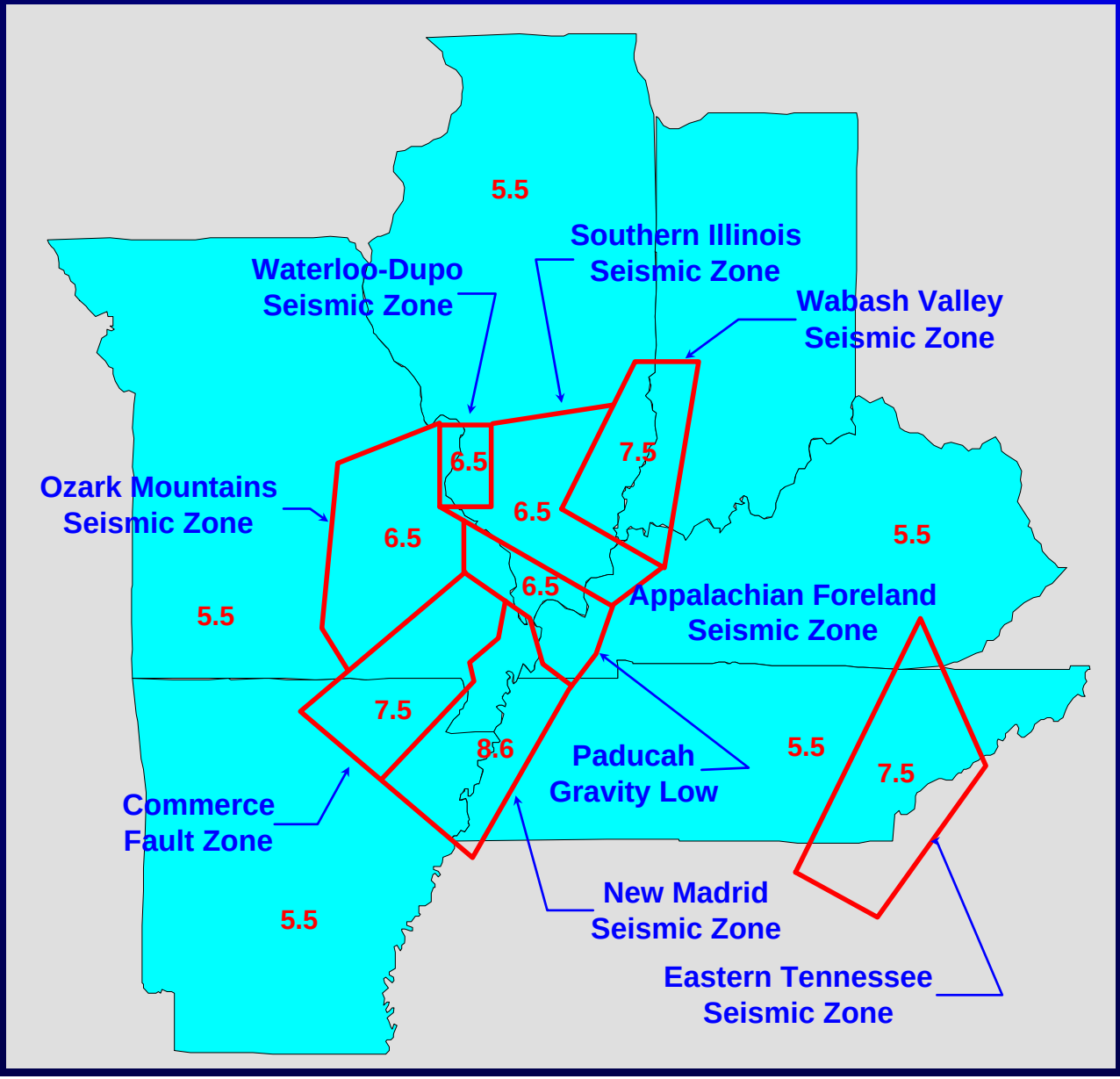
GULF OF MEXICO

2006 09 10 14:56:08 UTC 26.34N 86.59W Depth: 14 km, Magnitude: 5.8

Seismicity 1990 to Present

USGS

CENTRAL US SOURCE ZONES

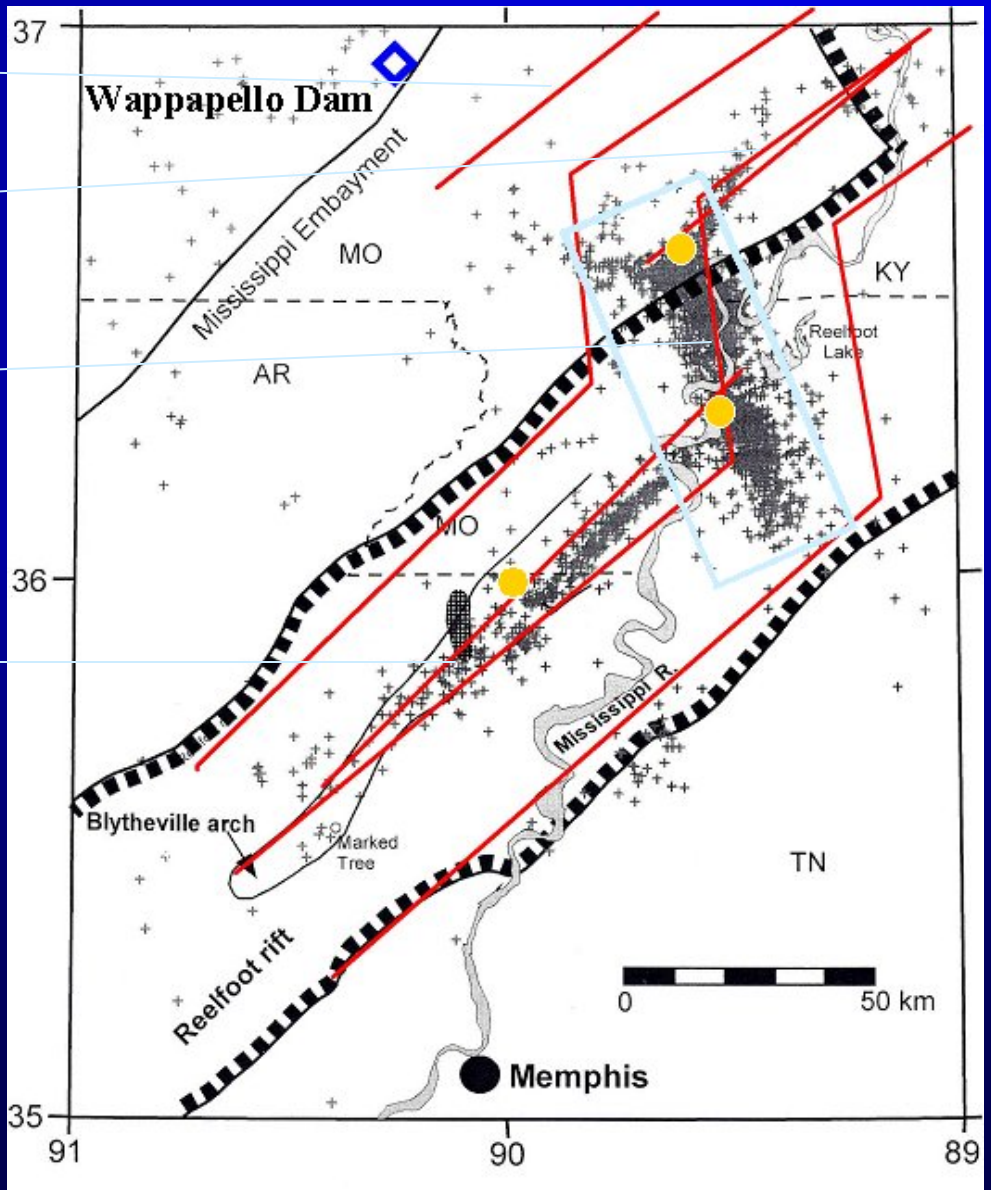


New Madrid Seismic Zone

- **Commerce-Benton Hills**
- **East Prairie Limb, NMSZ**
  - **M:** a **8.1,** b **8.1,** c **7.2**
- **Reel-foot Thrust Limb, NMSZ**
  - **M:** a **8.0,** b **8.0,** c **8.0**
- **Blytheville Arch Limb, NMSZ**
  - **M:** a **7.8,** b **7.0,** c **7.8**

Tuttle, et al, 2002

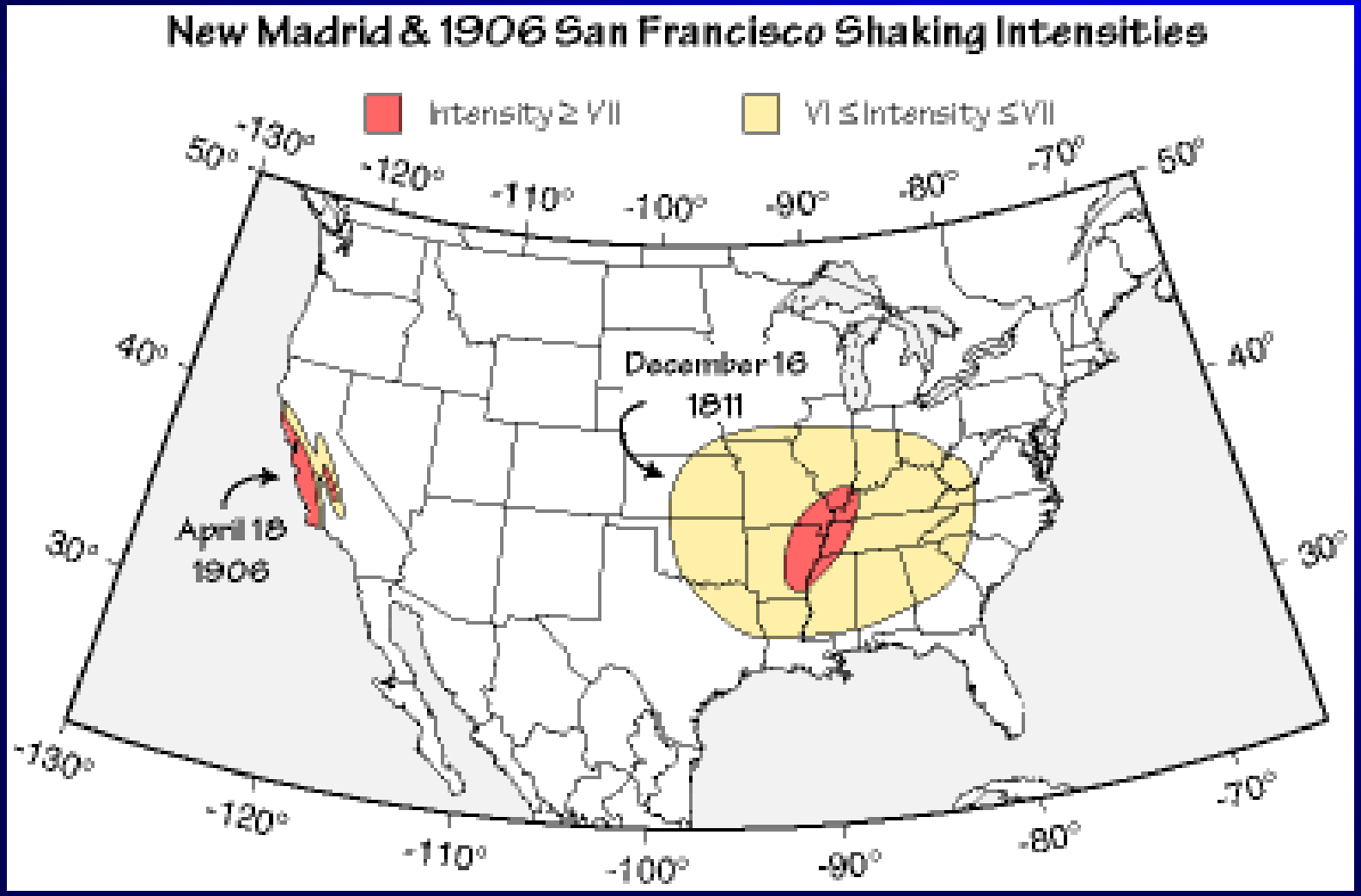
- a **1811 – 1812 AD**
- b **1450 AD**
- c **900 AD**



Special Central US Concerns

- Complacency
  - Preparedness
  - Similarities to Katrina Disaster
  - Use of Eqk Codes
- Low attenuation
  - Great area of significant ground shaking
  - Dispersion – long/tall structure impacts
- Liquefaction / Lateral Spreading and Foundation impacts

CA & CENTRAL US MMI



Structures & Risks

- Significant ground motion at greater distance in the Central US wrt W US.
- Due to dispersion of the waves, distant structures may be placed into resonance.
  - Long or tall structures are particularly susceptible to resonance effects.
  - More distant towns: tall buildings in Chicago; bridges across major rivers; dams; pipelines.
- Evaluation of geotechnical issues: activation of slides, liquefaction/lateral spreading, bearing capacity, differential settlement.

SEISMIC DAMAGE TYPES

- Fault displacement (rupture)
- Ground motion (induced inertia)
- Indirect Physical Impacts
  - Tectonic Changes (seiches / tsunamis)
  - Liquefaction
  - Triggering Landslides
  - Foundation Failures (Diffrt'l Settlement)
  - Tertiary Lifeline Impacts

IMPACTED EPICENTRAL DISTANCES (km)

M_W / Failure Types	5.8	6.3	7.6	8.3
Foundation	40	70	170	270
Liquefaction	15	40	230	400
Slope	60	110	280	450

OTHER SEISMIC HAZARDS
(not only the ground motion value)

- Fault displacement
- Tectonic Changes [seiches (waves) / tsunamis]
- Foundation Impacts
  - Dynamic Bearing Capacity
  - Differential Settlement
  - Liquefaction (Flow Liq, Cyc Mobility, Cyc Liq)
- Triggering Landslides
- Tertiary Lifeline or Project Subsystem Impacts

Learning the SEISMIC SAFETY DANCE

- Unfortunately my wife cannot be here to ***teach*** the Seismic Safety Dance, the evidence of having heard this talk.
- Several musical styles are available. The music to accompany the dance may be:
  - "Earthquake" by Ronnie Milsap,
  - "Earthquake Shake" by Jesse Lane,
  - "I Feel the Earth Move" by Carole King,
  - "All Shook Up" by Elvis Presley, and
  - "Shake, Rattle & Roll" by Jerry Lee Lewis.

SUMMARY

- Earthquakes should be regarded as a significant and special hazards, particularly near the New Madrid Seismic Zone.
- For the Central US, damaging earthquakes may occur less often than in Western US. The damage in the Central US will occur at greater distances for the same size earthquake.
- An all-hazard approach would be most prudent.
- Seismic Ground Motion appraisal may be developed from accepted code procedures.
- Other seismic impacts for the sites should be considered.