New Ground Failure Hazard Map Anchorage, Alaska

David Cole, DOWL Engineers
May 1, 2008

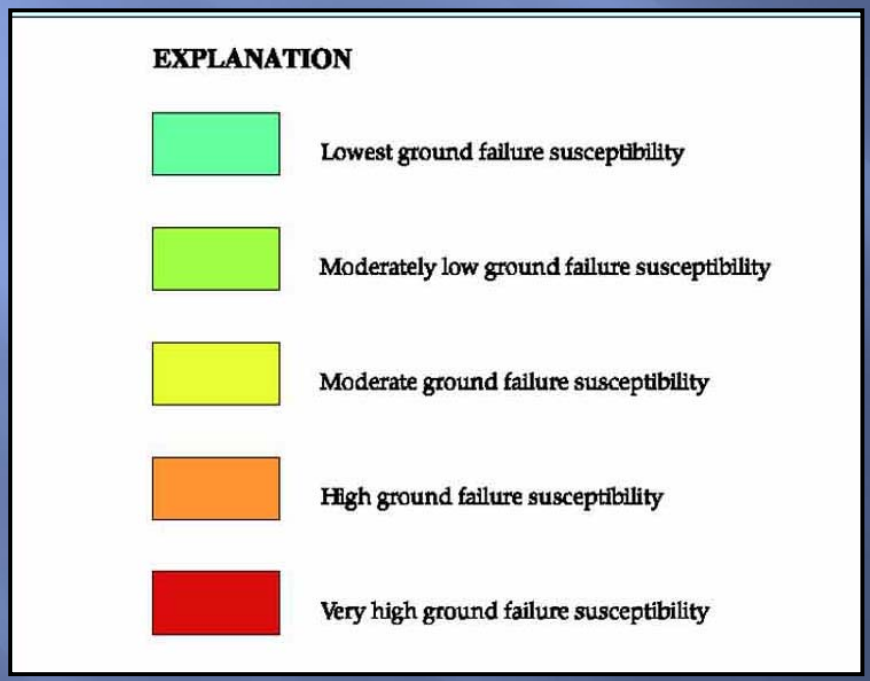
CURRENT MAP

- **Produced by Harding Lawson Associates, 1979**
  - ***Geotechnical Hazards Assessment Study***
- **Based on:**
  - **Geologic maps and soil data available at the time**
  - **Effects of 1964 earthquake**

HLA "DESIGN EVENT"

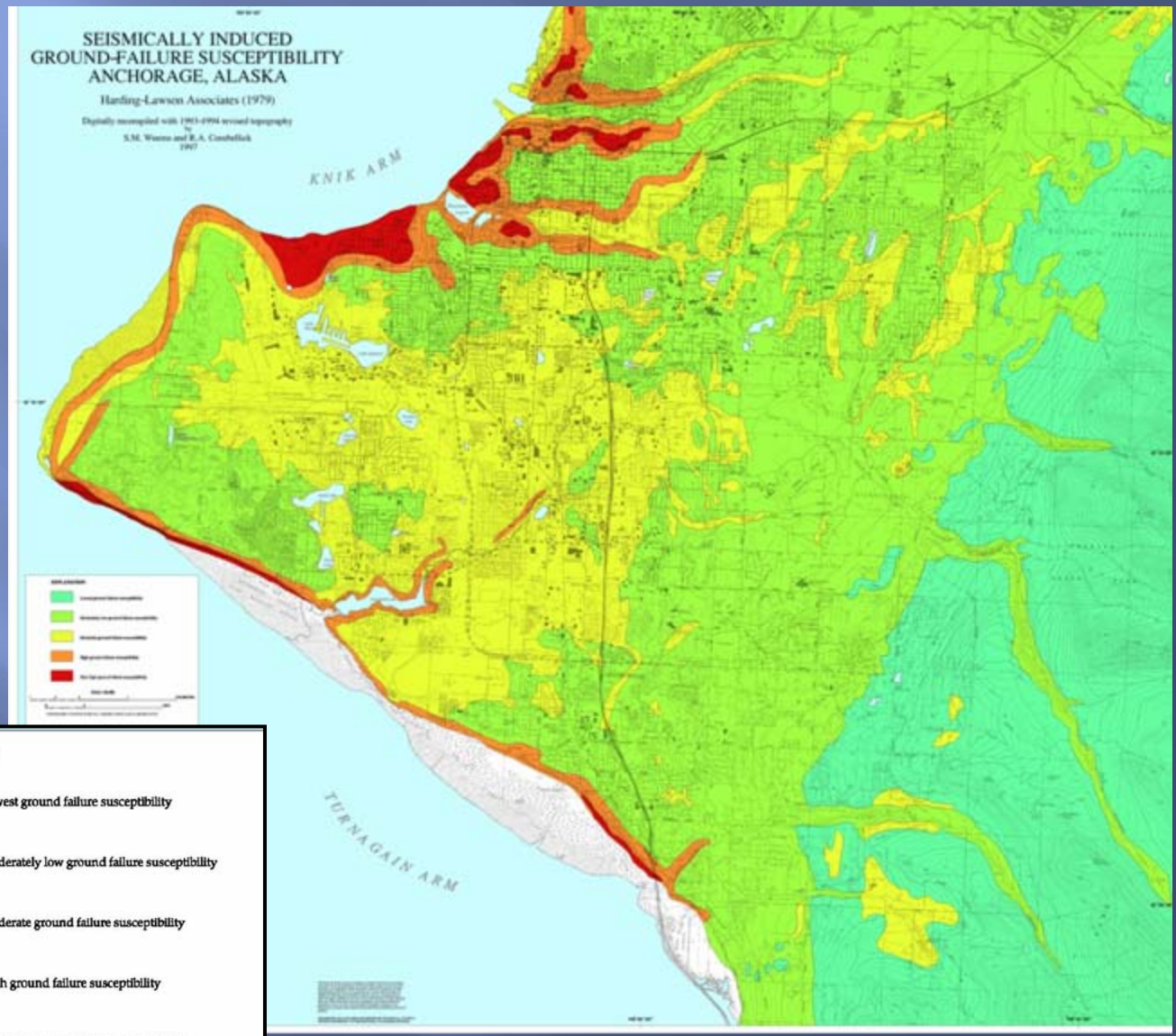
- Similar to 1964 earthquake
  - Subduction zone event
  - M ≈ 9
- Return period not considered
  - "Worst Case" event

HLA Description of Ground Failure Zones



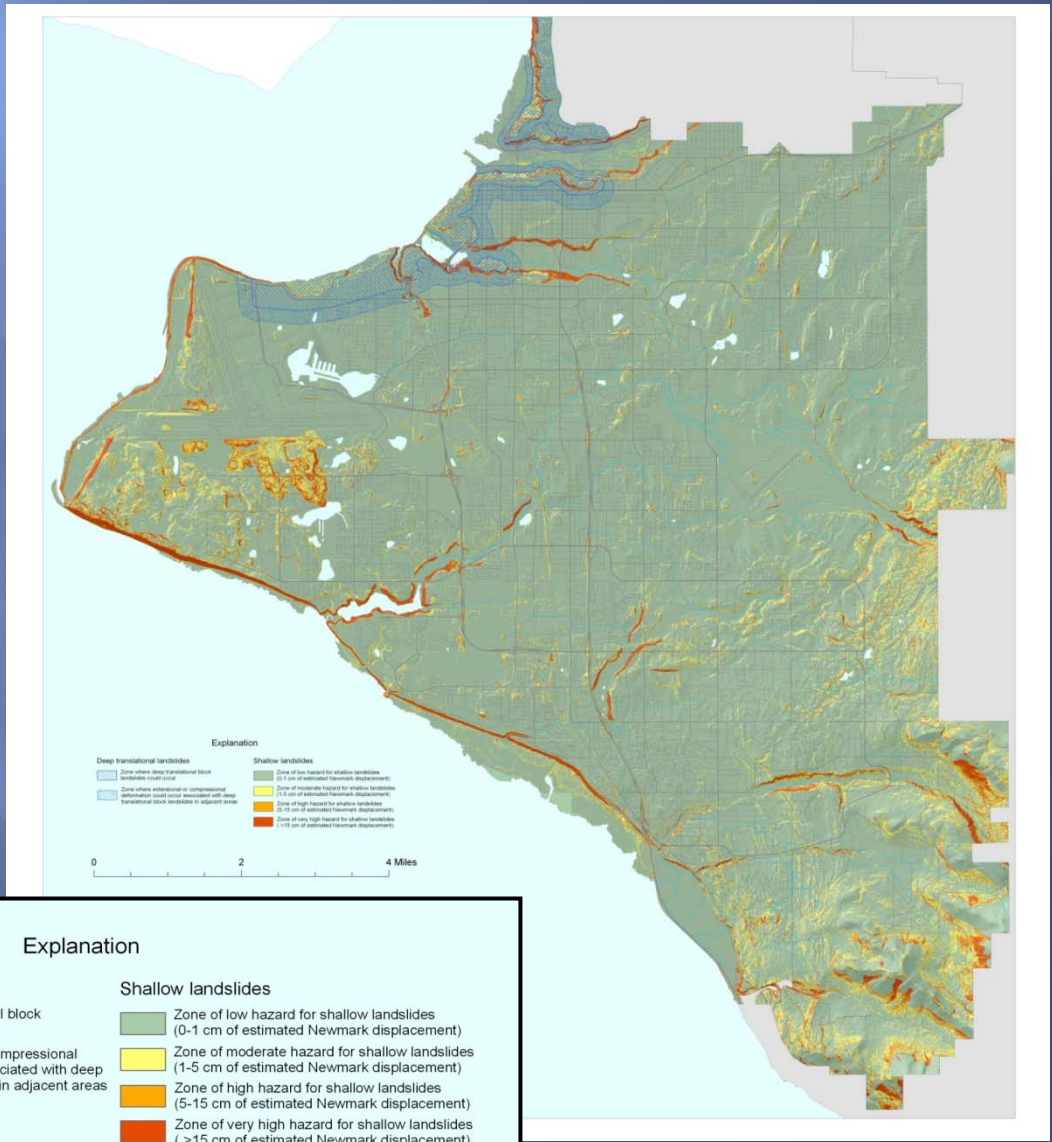
- No estimate of amount of ground displacement.

Current Ground Failure Map



NEW MAPS
(Randy Jibson – USGS, 2008)

New Ground Failure Map
(2% probability in 50 years)



Explanation

Deep translational landslides

- Zone where deep translational block landslides could occur
- Zone where extensional or compressional deformation could occur associated with deep translational block landslides in adjacent areas

Shallow landslides

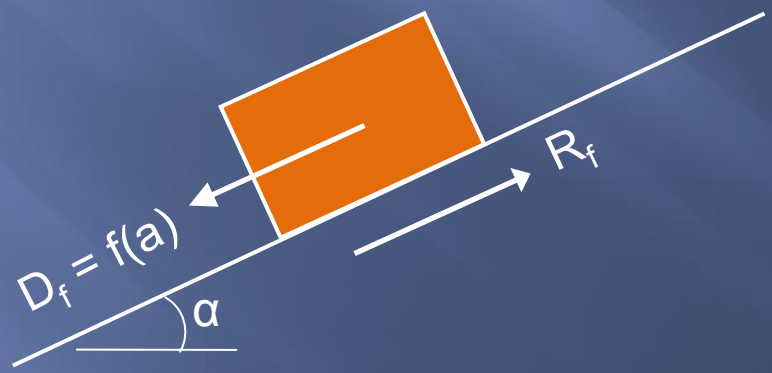
- Zone of low hazard for shallow landslides (0-1 cm of estimated Newmark displacement)
- Zone of moderate hazard for shallow landslides (1-5 cm of estimated Newmark displacement)
- Zone of high hazard for shallow landslides (5-15 cm of estimated Newmark displacement)
- Zone of very high hazard for shallow landslides (>15 cm of estimated Newmark displacement)

Basis for New Maps

- LIDAR Mapping of Anchorage (5 ft cells)
- Geologic Map of Anchorage (USGS/DGGS)
- Two Ground Failure Maps Produced
  - **USGS, P(E) = 10% in 50 years, PGA ≈ 0.43g**
  - **USGS, P(E) = 2% in 50 years, PGA ≈ 0.69g**
- Newmark Slope Displacement Model

Newmark Displacement Model
(Shallow Slope Failure)

- Rigid Block Slides on an Inclined Plane

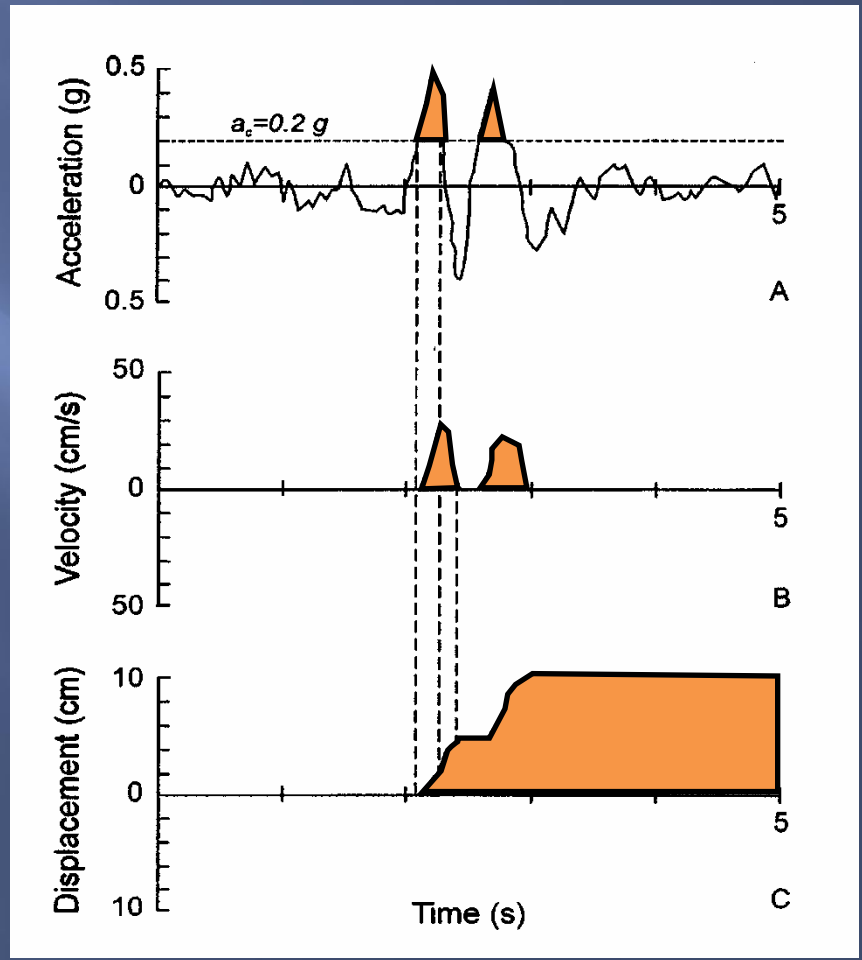


Newmark Method (cont'd)

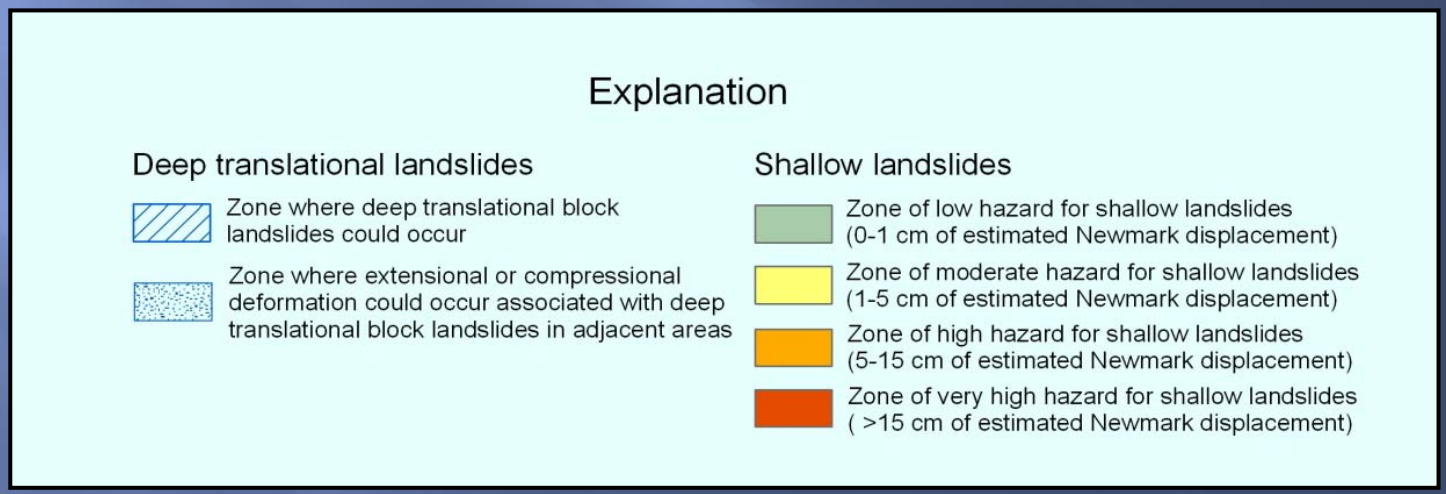
- Block has a known "critical" or yield acceleration (a_{crit}) where the inertial forces developed in the block (D_f) exceed the shear strength of the soil, (R_f)
- The analysis calculates the cumulative down-slope movement of the block as the critical acceleration is overcome by the ground shaking

Newmark Method (cont'd)

- Double integration of a ground acceleration record is conducted to determine the cumulative down-slope movement



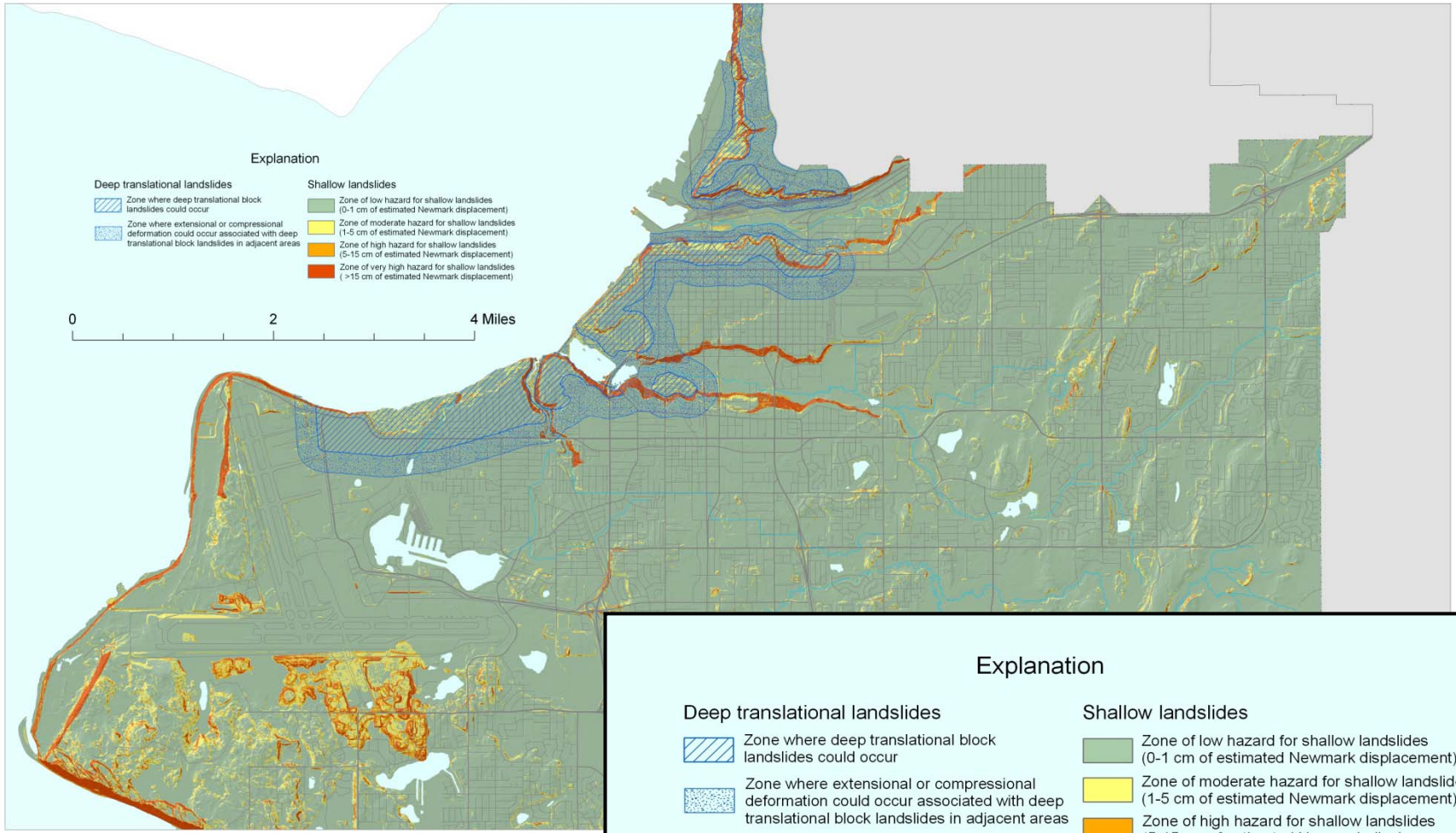
New Maps Estimate the Amount of Down Slope Displacement



New Hazard Map
(Deep Slide Areas)

- The deep translational slide areas shown on the new map are based on the areas shown on the old map.
- No additional work was performed to evaluate the areas that could be affected or the amount of ground displacement.
- No estimate of lateral displacement included

New Ground Failure Map
(P(E) = 2% probability in 50 years)



Explanation

Deep translational landslides

Zone where deep translational block landslides could occur

Zone where extensional or compressional deformation could occur associated with deep translational block landslides in adjacent areas

Shallow landslides

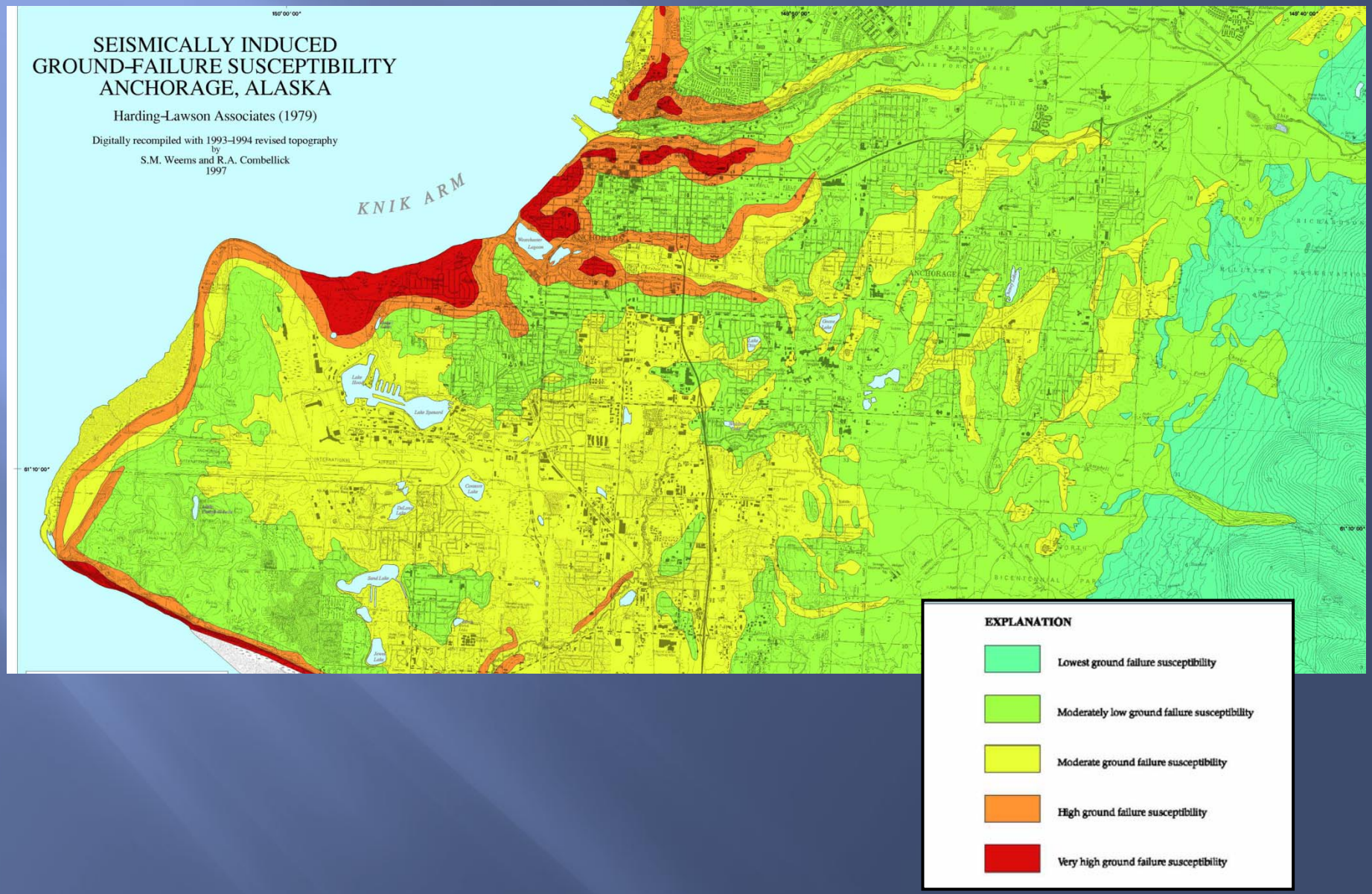
Zone of low hazard for shallow landslides (0-1 cm of estimated Newmark displacement)

Zone of moderate hazard for shallow landslides (1-5 cm of estimated Newmark displacement)

Zone of high hazard for shallow landslides (5-15 cm of estimated Newmark displacement)

Zone of very high hazard for shallow landslides (>15 cm of estimated Newmark displacement)

Current Ground Failure Map



Questions?