Notes by Jeff Shultz (c:\wou\envgeo\wangtalk.doc)

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Earthquake Hazard and Mitigation in Oregon
Concentrated on Western Oregon - nobody lives in Eastern Oregon

Abbreviations: SJF - San Juan de Fuca
NA - North American
EQ - Earthquake

- Tectonic Setting and Earthquake
  - Earthquake source Zones, in the Pacific NW.
    - SJF plate subducting under NA Plates
      - 3 types earthquake
        - Interplate subduction: earthquake 8-9 Richter
        - Intraplate Earthquake up to 7.5 (inside of SJF plate) (no history in Oregon)
          - seen in Puget Sound, severe damage to Seattle/Tacoma
        - Crustal Earthquake to 6.5 (under our feet)
          - Portland Earthquake Sources (Triple Threat)
            - Upper plate (NA) Moderate magnitude
              Lower plate (SJF) large magnitude
              Subduction – locked subduction zones
              Fault zones around Portland (a map)
- Earthquake Hazards
  - Ground Motion (Shaking Hazard)
    - 90% damage caused by ground shaking
    - Willamette HS. (Eugene) took major damage to brick buildings in 1993 Spring Break EQ. (photo of damaged brick building)
    - Had to retrofit Capitol Dome for damage in that EQ.
      - Capitol Building location of State Governor, Senate, House - nothing like slapping a politician in the face with a wet fish to get his attention.
      - Major policy changes came out of that EQ.
  - Liquefaction Hazard
    - always happens during major earthquakes
    - buildings on soil that liquefies, fall over (Taiwan photo).
    - Lateral spreading **(this is when Tammy came in the room)** everything pulls apart.
  - Landslide Hazard
    - induced by ground shaking
    - sides of hills sunk (photos of Loma Prieta CA coast, Taiwanese hills)
    - ’65 Olympia - railroad embankments collapsed
    - steep slopes fail in land and rockslides. Road cuts are very vulnerable.
  - Tsunami Hazard (Coast)
    - “Tidal Wave”
  - Secondary Hazard
    - Fire
      - think of all the natural gas pipelines busted...
    - Hazmat leakage

- Earthquake Hazard Mapping
  - We aren’t in California - it can happen here, but awareness isn’t there.

- Geology/Geotechnical engineering combines to create hazard maps
- Areas that will get hit hard can be mitigated prior to event
- We saw these maps in class Tuesday

- Ground Shaking Mapping
  - General Ground Shaking Hazard (ground motion on bedrock from all seismic sources)
    - Probabilistic Method - building codes set on this
    - Deterministic Method - used on critical structures to determine max ground shaking hazard would occur.
    - Maps show the recurrence intervals in "probability"
    - Highest ground shaking hazard is on coast due to subduction EQ's..
    - 500 year recurrence interval... Willamette Valley is about 50% curve
    - Monmouth is at 20-25% on 500 year
    - Relative Seismic Hazards Maps
      - Composite maps "relative sense of hazard"
      - Amplification
        - Soil Characterization (SPT, S-wave velocity and thickness)
        - Ground shaking hazard
      - Liquefaction
        - Soil Characterization (SPT, S-wave velocity and thickness)
          - Sandy soil?
      - Induced Landslide
        - Soil and Rock Characterization (cohesion, friction angle, degree of weathering , fracture
          - slope failure potential
  - Liquefaction potential mapping
        - Soil Characterization (SPT, S-wave velocity and thickness)
          - Sandy soil?
  - Landslide mapping
        - Soil and Rock Characterization (cohesion, friction angle, degree of weathering , fracture)
          - slope failure potential
  - Tsunami inundation mapping
    - combination of theoretical model and study of past tsunami's.
    - Look at ground contour
    - Seaside will be underwater... temporarily.

- Earthquake Hazard Mitigation
  - Public Awareness
    - We've got the potential, prepare for it
  - Legislation
    - Building Code
      - UBC 97 - good building code, very advanced compared to other states.
    - Regulation
    - Education
      - Mandatory Tsunami drills on a yearly basis at schools in hazard zone
  - Retrofit/Rehabilitation
    - Campbell Hall "shock absorbers"
  - Insurance
    - It's available, get it.
    - In Portland, ~30% families have it.
  - Emergency Planning and Response
    - use the info we have.

- WOU, Monmouth, Independence - Earthquake Hazard map specific to this area.
  - >1000 students in dorms: Butler, Campus Estates...etc..
  - This guy was on the team that made the hazard assessment
  - Stuff is in GIS - 3D modeling GET THIS!!!
  - Combined 3 layers of hazard, assigned numeric hazard assessment.
    - Very general assessment, without specific threats.
    - 1st layer - Ground Motion & Amplification
      - Willamette Silt is what we sit on.
    - 2nd Layer - Liquefaction
      - moderate to low hazard with Willamette Silt (rather surprising)
    - 3rd Layer - Landslides
      - It's flat here.
  - Campbell Hall
    - Seismic retrofit - base isolation
    - Otherwise, brick is a concern

Base isolation -

when ground shakes, so does building. Base isolation lets the shock absorbers shake instead.

Hazard here:

Ground shaking: Moderate (D type soil 1.5-1.8 on UBC)
Liquefaction: Moderate (fine-grained Willamette Silt, water close to surface)
Too flat for landslide problems.

Intraplate EQ's - why not? We don't have a record, or activity that showed it.