U.S. – New Zealand – Japan International Workshop
Liquefaction-Induced Ground Movements Effects
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A Few Observations / Comments & Recommendations

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Knowledge Sources / Investigation Tools

- ***Field observations.***
- ***Case histories.***
- ***Laboratory testing.***
- ***Physical modeling.***
- ***Numerical modeling.***

Topics

- ***Triggering.***
- ***Post-liquefaction "strength".***
- ***Numerical modeling.***

Triggering

- ***Assessment:***
  - ✓ ***Stress-approach.***
  - ✓ ***Strain-approach.***
  - ✓ ***Energy-approach.***

- ***Field-based proxies.***
  - ✓ ***CPT.***
  - ✓ ***SPT.***
  - ✓ ***Vs***
  - ✓ ***Others.***

- ***Time for collecting data.***
  - ✓ ***More frequent collection of data; one year after the event; two years ... ?***

Post-liquefaction "strength"

1. ***Field case histories (future / past):***

2. ***Physical modeling***

3. ***Field testing:***

Post-liquefaction "strength"

1. ***Field case histories (future / past):***
   - ❖ ***Investigate selected new site(s).***
   - ❖ ***Instrument these site(s).***
   - ❖ ***Wait for earthquake.***

2. ***Physical modeling***

3. ***Field testing***

Post-liquefaction "strength"

1. ***Field case histories (future / past):***
   - ❖ ***Investigate selected site(s) "before".***
   - ❖ ***Instrument site(s).***

2. ***Physical modeling***
   - ❖ ***Large shaking tables.***
   - ❖ ***Centrifuges.***

3. ***Field testing:***

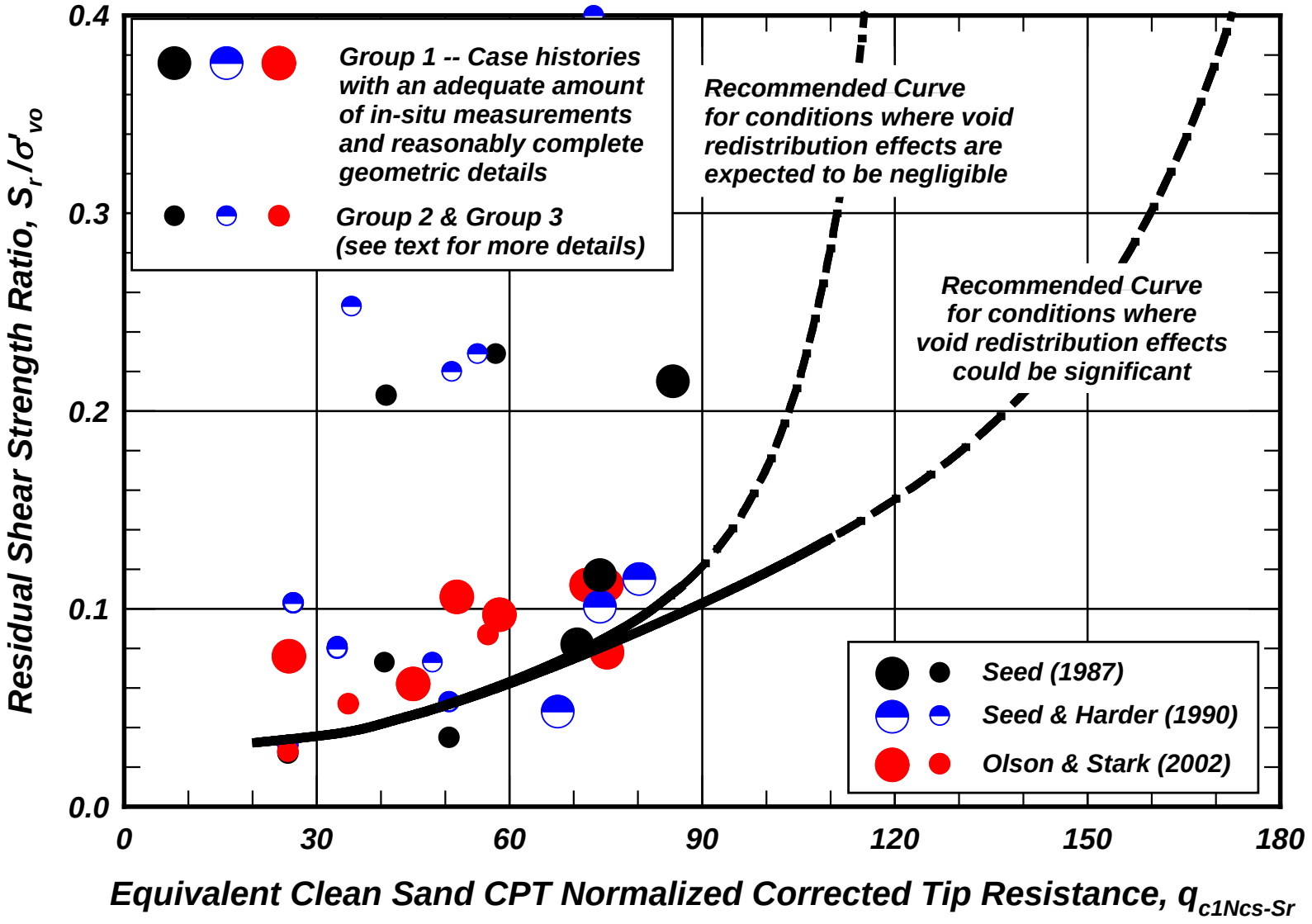

Figure 90 – Correlation between normalized residual shear strength ratio for liquefied soils and overburden-corrected CPT penetration resistance (σ'_{vc} < 400 kPa)

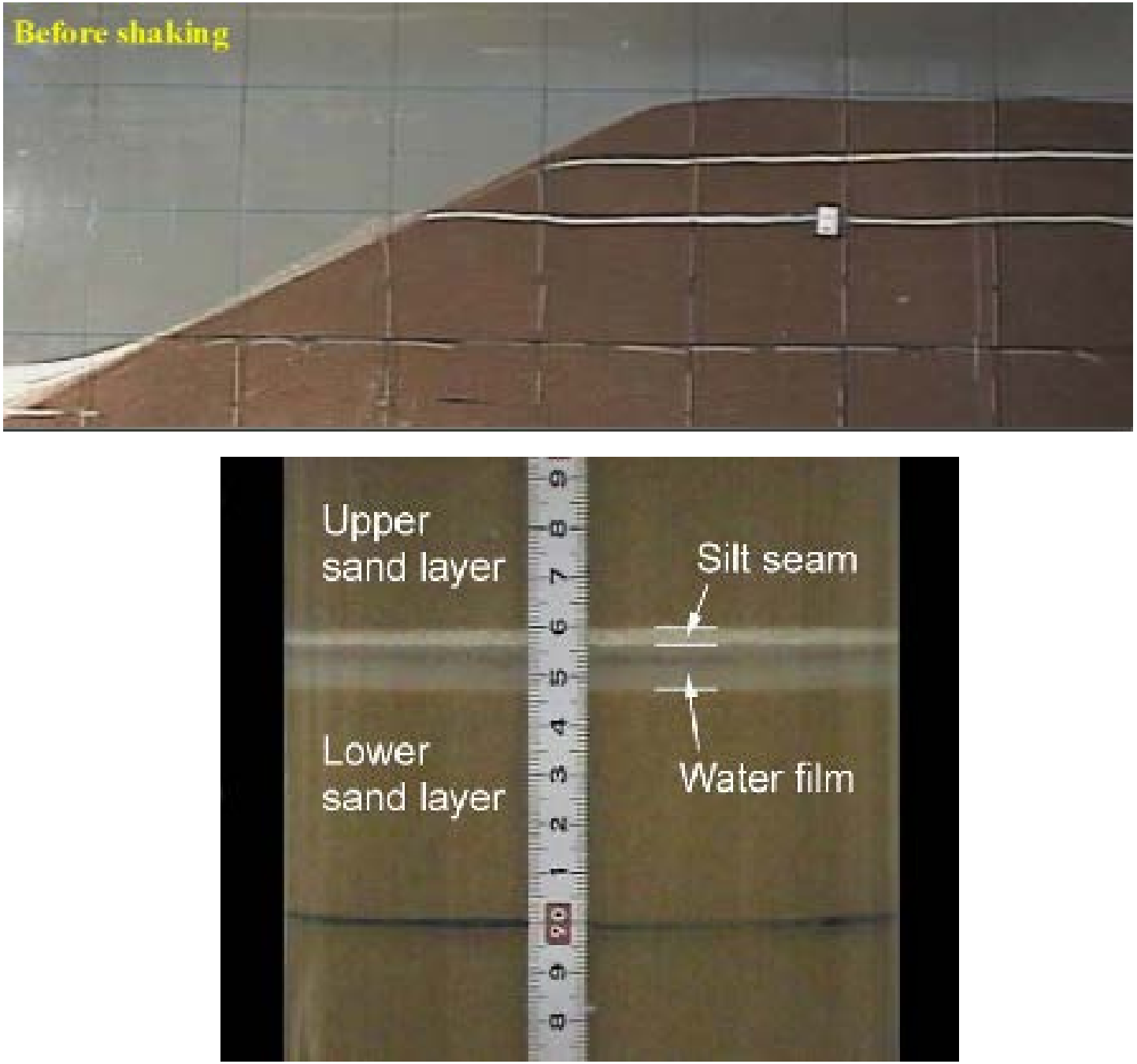

Figure 44 – A water film that formed beneath a silt seam in a cylindrical column of saturated sand after liquefaction (Kokusho 1999)

Post-liquefaction "strength"

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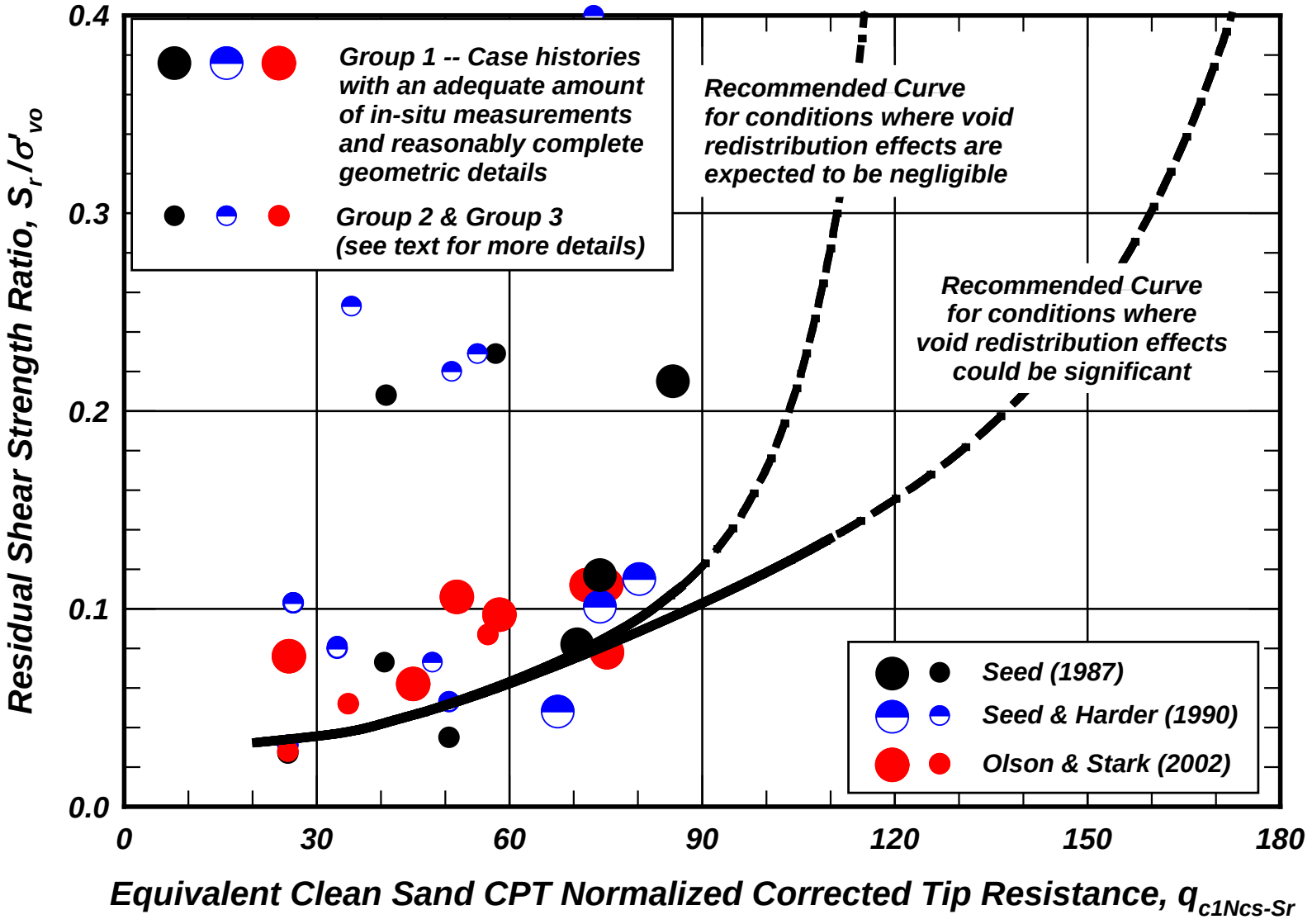

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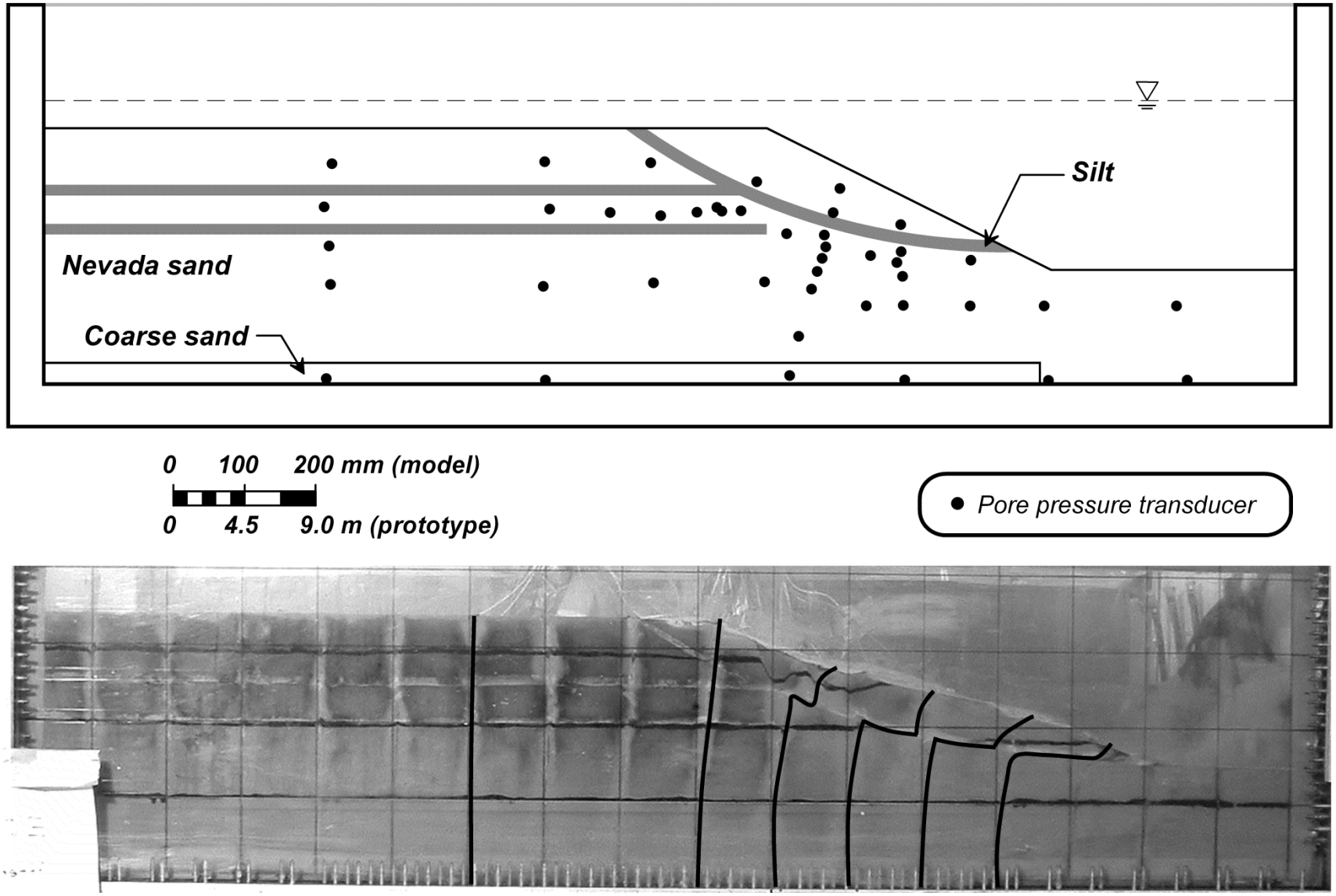

Localization of shear deformations along a lower-permeability interlayer within a saturated sand slope tested in a centrifuge (Malvick et al. 2008).

Post-liquefaction "strength"

Field case histories (future / past):

- ***Investigate selected site(s) "before".***
- ***Instrument site(s).***

2. Physical modeling

- ***Large shaking tables.***
- ***Centrifuges.***

3. Field testing:

- ***Large model***
- ***Can accommodate testing of SP, SW, SM, SC, GP … soils.***
- ***Blasting-induced liquefaction (duration effects?; frequency content.?)***

Numerical modelling

- ***Constitutive models (NL)***
  - ***KISS approach***

- ***Calculation platform***
  - ***Finite difference***
  - ***Finite element***

Concluding remark

Consider & utilize the geological attributes.

Thank You