

Assessment and design implications of large ground deformations

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Large ground deformation effects

- ◆ Liquefaction & lateral spreading are major causes of foundation damage during earthquakes.
- ◆ Past 10 years ...



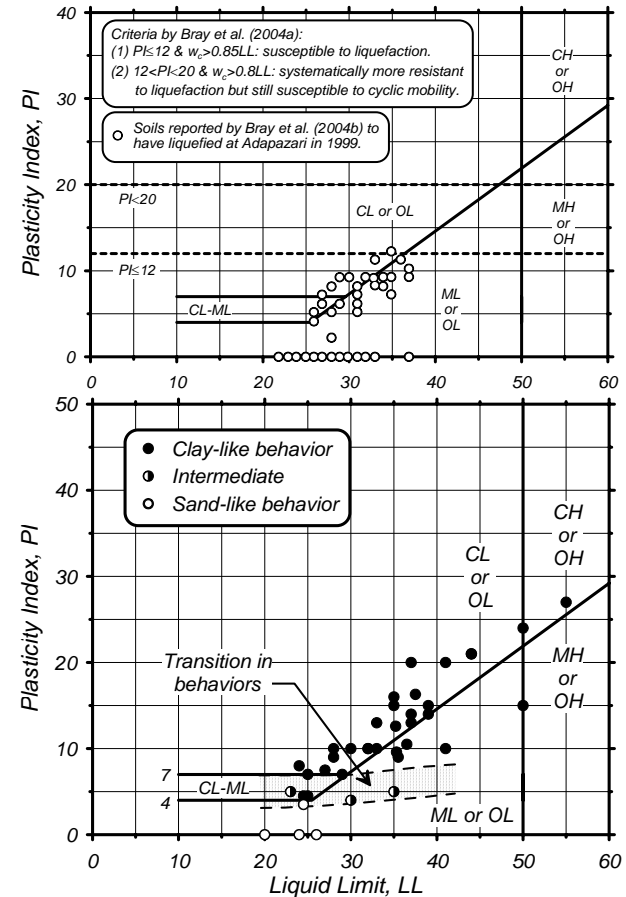
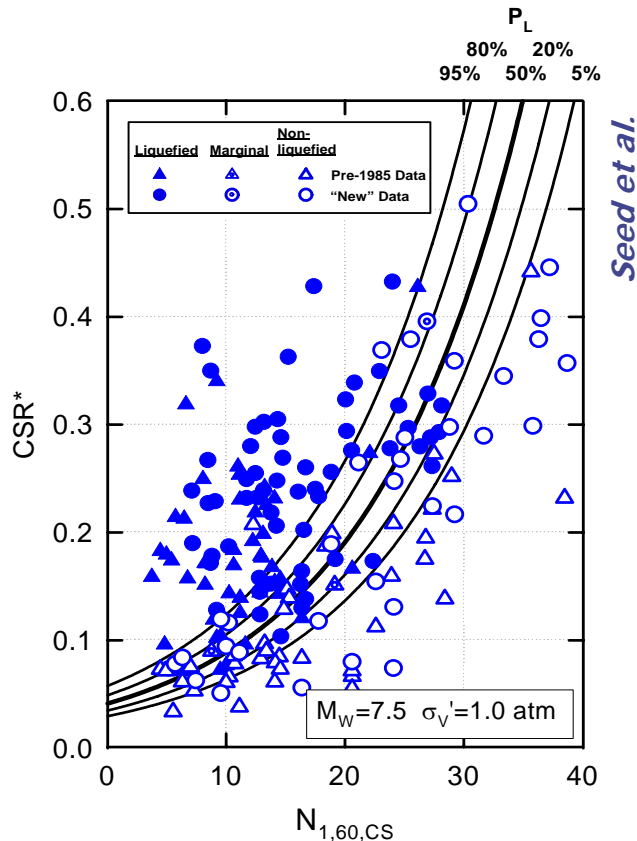
Field studies

- ◆ Detailed studies of unique cases involving fine-grained soils from the 1999 Kocaeli and 1999 Chi-Chi earthquakes.
- ◆ Basis for re-examination of broader databases.



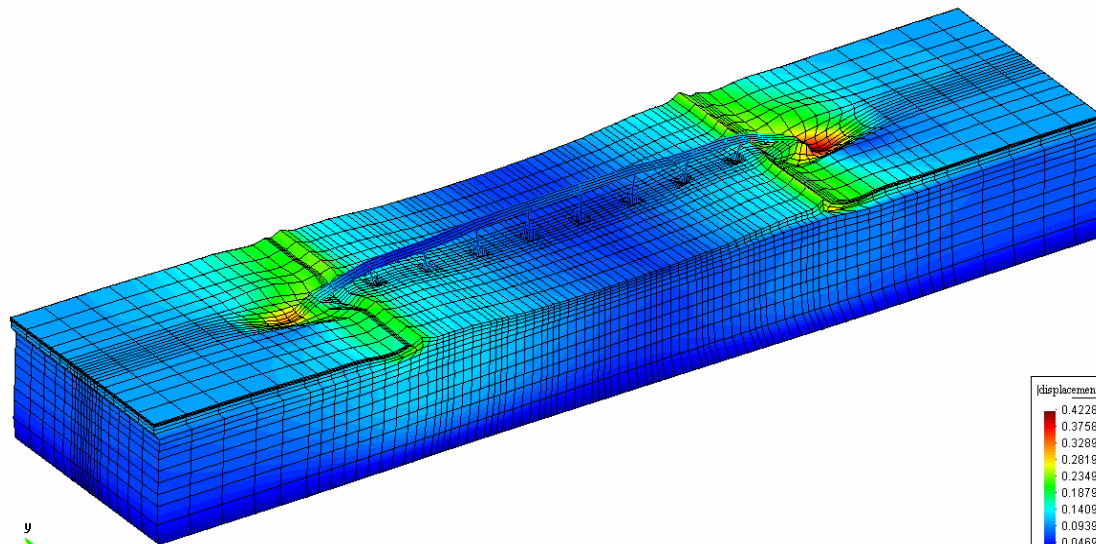
Field studies

- ◆ Findings led to advances in design practices for:
 - Liquefaction susceptibility for fine-grained soils
 - Liquefaction triggering
 - Lateral spreading assessments

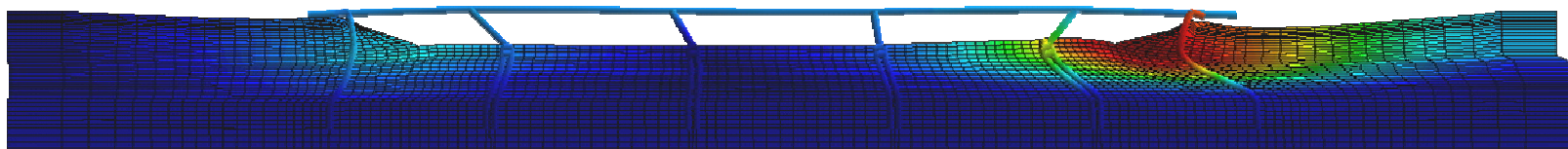
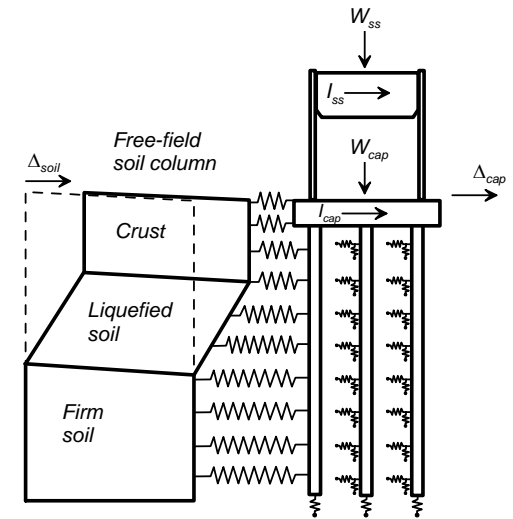
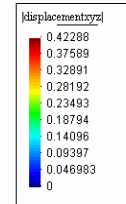


Simulation

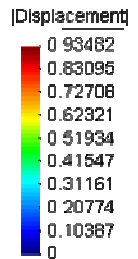
- ◆ Hierarchy of 2-D and 3-D modeling capabilities developed.



Elgamal et al.

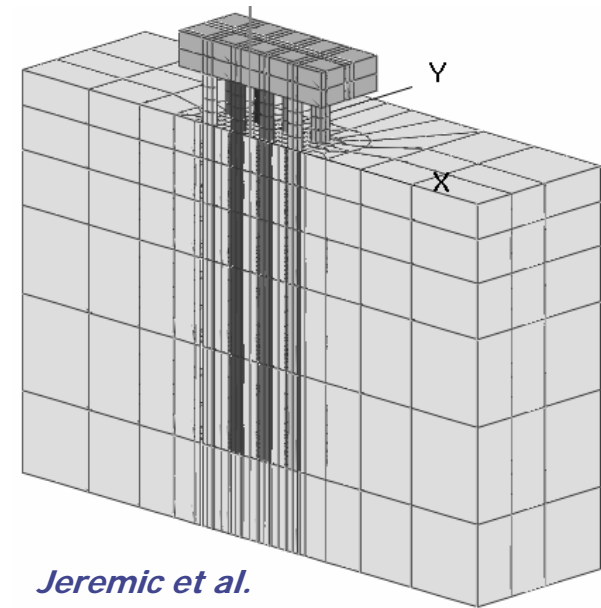
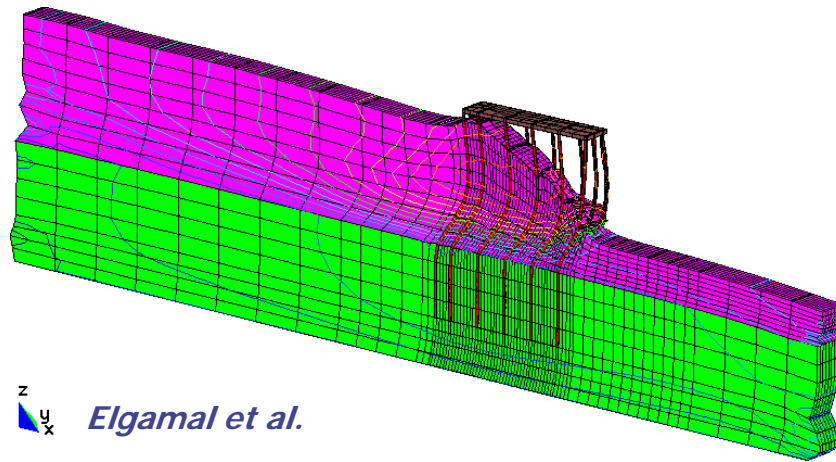


Arduino et al.



Simulation

- ◆ Enabled studies of deep foundation systems.
- ◆ Expanded practice through tools & design guidance.
- ◆ Opened new opportunities for future advances.



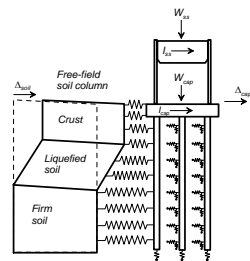
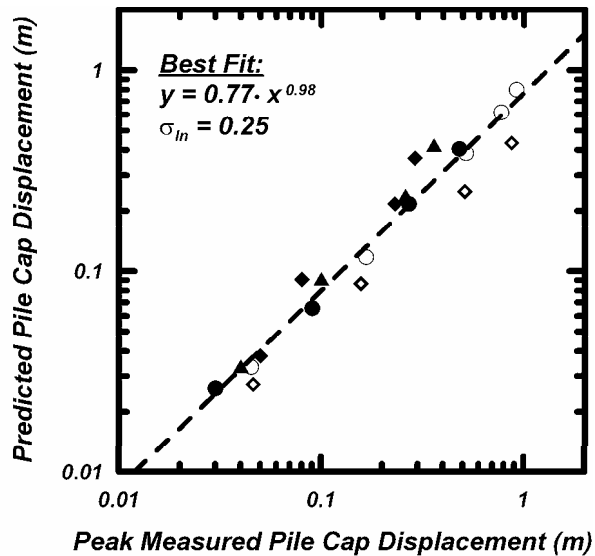
Validation

- ◆ Dynamic centrifuge, shake table, and field tests addressed knowledge gaps for deep foundations.

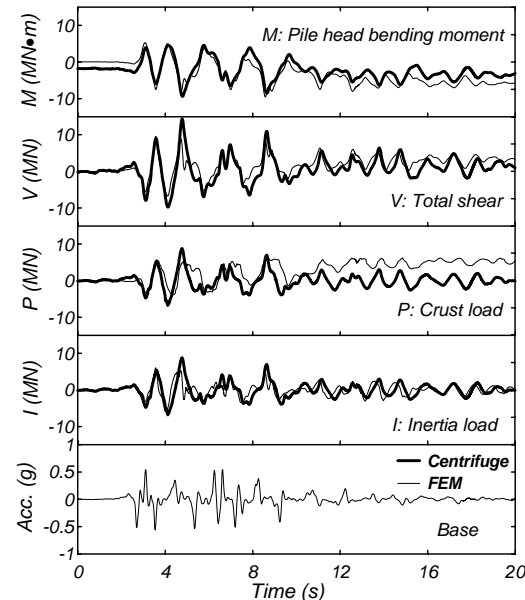


Validation

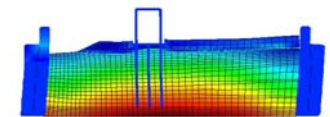
- ◆ Mechanisms of interaction.
- ◆ Provided for validation/evaluation of analysis methods
 - Equivalent static design methods, and
 - Nonlinear dynamic analyses.



Brandenberg et al.



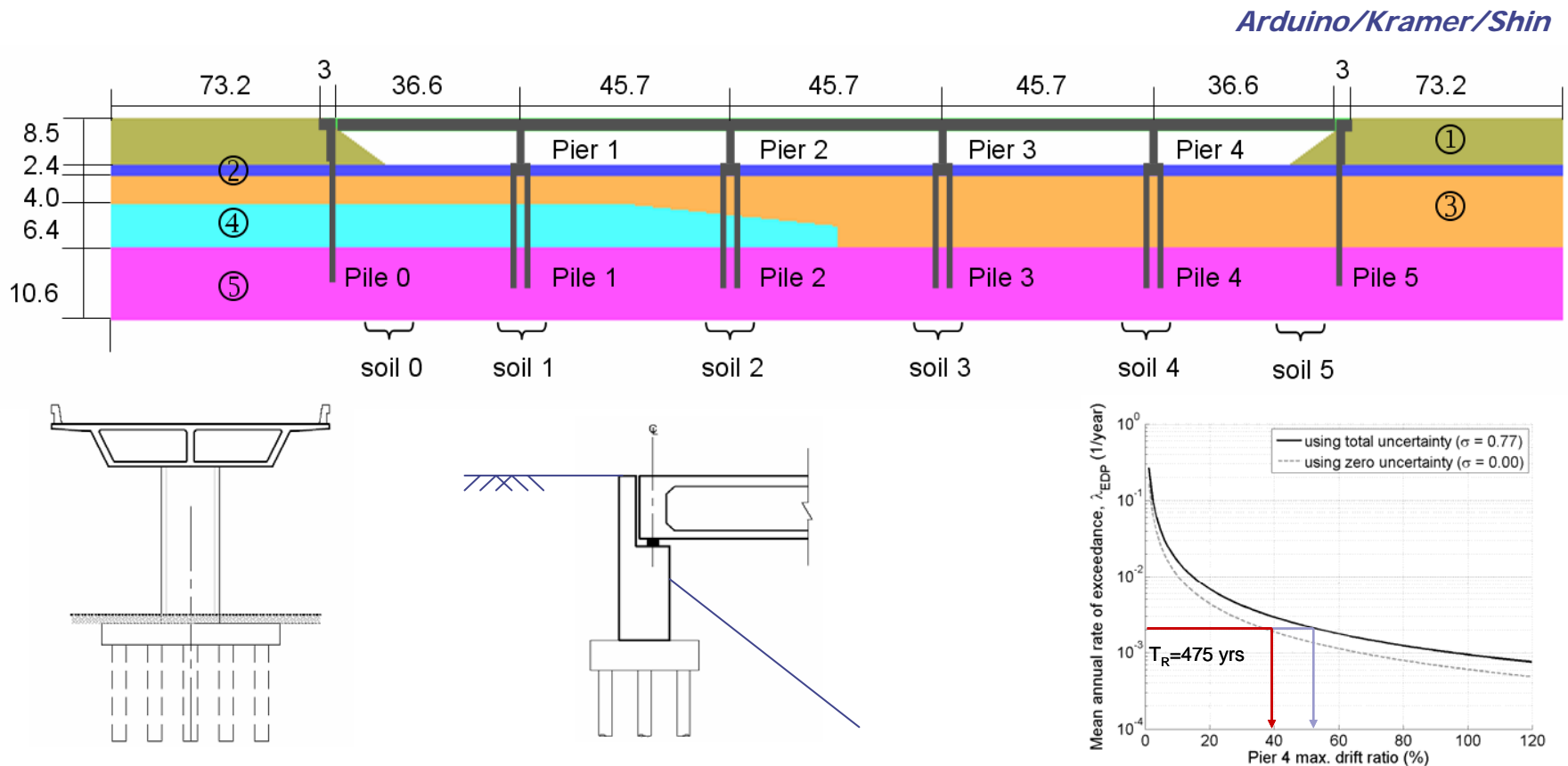
DDC01 in Large Kobe Motion



Chang et al.

Design

- ◆ Benchmarking studies to demonstrate methodologies and facilitate early adoption in practice.



Partnerships

- ◆ Rapid advances through numerous strong collaborations across:
 - PEER and PEER Lifelines
 - Engineering practice – private and government
 - National and international researchers



PEER Achievements

- ◆ Diverse contributions on science & design practices for the effects of large ground deformations
 - Field studies
 - Simulation
 - Validation
 - Design
 - Partnerships
- ◆ Significant impacts on PBEE and decision making for risk mitigation.
- ◆ Strong "foundation" for continuing contributions.