EERI Ad Hoc Committee Report on Soil Liquefaction During Earthquakes

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LIQUEFACTION

- Transformation of Granular Soil from a Solid to Softened or Liquid-Like Material during Earthquake Ground Shaking
IMPORTANCE OF LIQUEFACTION

- Waterfront Structures
- Earth Dams & Embankments
- Nuclear Power Plants
- Levee Systems
- Foundations of Buildings & Facilities
- Underground Lifelines
BRIEF HISTORY OF LIQUEFACTION ASSESSMENT

• *Ground Motions & Soil Liquefaction During Earthquakes*, EERI MNO-5 (Seed & Idriss, 1982)

• NRC Workshop (1985)

• NSF/NCEER Workshops (1996, 1998)

• *Liquefaction & Undrained Strength Strength Assessment* (Seed et al., 2003)

• *Liquefaction During Earthquakes*, EERI MNO-12 (Idriss & Boulanger, 2008)
CONCERNS & CONTROVERSIES

- Strong Objections Raised About *Liquefaction During Earthquakes* by R.B Seed, UC Berkeley
- Strong Differences of Opinion, Often Personalized & Polarized
- Important Ramifications for Critical Infrastructure and Cost of Infrastructure Projects
Liquefaction During Earthquakes

AD HOC COMMITTEE ON SOIL LIQUEFACTION DURING EARTHQUAKES

- W.D. Finn, University of British Columbia (Emeritus)
- S.L. Kramer, University of Washington
- T.D. O’Rourke (Chair), Cornell University
- T.L. Youd, Brigham Young University (Emeritus)
COMMITTEE OBJECTIVES

- Review Technical Issues in Dispute with *Soil Liquefaction During Earthquakes*
- Advise EERI Board of Directors on Ways to Resolve Technical Issues
- Review & Advise on ERRI Monograph Preparation & Review Process
KEY ASPECTS OF LIQUEFACTION ASSESSMENT

• Relies Heavily on Empirical Evidence through Case Histories and Interpretations of Past Performance
• Variable Soil & Groundwater Conditions
• Complex Processes are Simplified
• Variability and Uncertainties Associated with Assessment Procedures
DIFFERENCES AMONG LIQUEFACTION ASSESSMENTS

• Considerable Differences, Especially for Earth Dams Where Depths of Liquefiable Zones May Be Considerable

• Differences May Affect Scores of $ Millions on Yearly Basis
DIFFERENCES AMONG LIQUEFACTION ASSESSMENTS
Liquefaction During Earthquakes

TECHNICAL ISSUES IDENTIFIED BY COMMITTEE

• Liquefaction Triggering
  • Definition of liquefaction, plasticity effects, depth-dependent factors ($r_d$, $K_0$, etc.), silts, SPT/CPT procedures, dense soil behavior

• Liquefaction Consequences
  • Post liquefaction strength, lateral spread, & settlement

• Liquefaction Modeling
  • Data, documentation, & treatment of data
COMMITTEE OBSERVATIONS

- EERI Monograph Does Not Represent Consensus; It Represents Authors’ Views

- Geotechnical Earthquake Community has Good Record in Convening for Consensus Views on Liquefaction

THE WAY FORWARD (MAIN COMMITTEE RECOMMENDATIONS)

• Provide Forum for Discussion of Alternate Views, Consensus Development Where Possible, and Presentation & Comparison of Differing Approaches

• 3rd Major Liquefaction Workshop and Report on Engineering Practices

• Workshop Organized through National Academies
THE WAY FORWARD
(OTHER COMMITTEE RECOMMENDATIONS)

• Organizing Committee Screened to Promote Constructive Interaction and Avoid Conflicts of Interest

• Interim Measure: Invitation to Publish 1 or 2 Papers in *Earthquake Spectra* to Seed & Coworkers and Idriss & Boulanger

• Reviewers Carefully Chosen and Discussions & Closure Published