Performance Based Earthquake Engineering and Assessment Tool for Gas Storage and Transmission Systems

Barry Zheng, PhD
Slate Geotechnical Consultants, Inc.
06/28/2022
Project Description

• Funded by the California Energy Commission (CEC) – 2020 to 2022 (end of this year)

• Principal Investigators:
  – Jonathan Bray (UCB), Norman Abrahamson (UCB), Jennie Watson-Lamprey (Slate)

• Goal:
  – Develop a quantitative seismic risk methodology using probabilistic data to evaluate and manage the seismic risk for natural gas storage and pipeline systems.

• Deliverables:
  – Updated models and methods for seismic risk assessment
    • PEER reports
  – An open-source software that will be easy to use by regulators and utility owners
    • Program, source code, user manual
  – User workshop
Natural gas infrastructure:
- Near-surface (pipelines, surface storage and wellheads)
- Subsurface (wells and reservoir caprocks)

Demands/Hazards:
- Strong shaking
- Liquefaction-induced deformation
- Landslide deformation
- Fault rupture and displacement

Component and System Response:
- Strains
- Moments
- Rotations

Assess performance of infrastructure (probability of rupture, leakage)

1. Method for efficient risk calculation
2. Guidance on technology available for monitoring and data gathering
Project Teams

**Hazards**

Liquefaction and Landsliding
- University of California, Berkeley (UCB)
- Dr. Thomas O’Rourke
- Lettis Consultants International, Inc. (LCI)

Fault Displacement Hazard
- Lettis Consultants International, Inc. (LCI)

**System Fragility**

Fragility of Buried Pipelines
- University of California, Berkeley (UCB)

Fragility of Wells and Caprocks
- Lawrence Berkeley National Laboratory (LBNL)

Fragility of Above Ground Systems and Components
- University of California, San Diego (UCSD)
- University of Nevada, Reno (UNR)

**Other Objectives**

Monitoring Technology
- University of California, Berkeley (UCB)

OpenSRA Development
- Slate Geotechnical Consultants, Inc. (Slate)
- NHERI SimCenter

Efficient Risk Calculation
- University of California, Berkeley (UCB)

**General**

Project Management
- Slate Geotechnical Consultants, Inc. (Slate)

Outreach and Upkeep
- Pacific Earthquake Engineering Research Center (PEER)