

# Line 132 Liquefaction Analysis

## Exponent Biographies

### Summary

In support of PG&E's efforts to assess the fitness for service of Line 132, Exponent assembled a team of experts in the areas of site seismicity, soil liquefaction, probabilistic evaluation of liquefaction potential, geotechnical earthquake engineering, soil-structure interaction, pipeline system performance and failure, and seismic vulnerability assessment. A short biography of each team member's related experience is provided below.

Redacted

Redacted is a Principal Engineer and Exponent's Civil Engineering Practice Director. Redacted has over 18 years of experience in geotechnical and earthquake engineering. Redacted has experience in the investigation and analysis of pipeline system performance and failure, including sanitary sewer pipelines, water supply pipelines, storm drain pipelines, natural gas pipelines, and irrigation pipeline systems and is knowledgeable about the documentation methods for operational pipeline systems. Dr. Wren also has expertise in dynamic soil properties and testing, analysis of the behavior of retaining structures, slopes, foundations, and pipelines during earthquakes and has evaluated sites and structures following natural disasters, such as earthquakes and floods, including the Loma Prieta, Northridge, San Simeon, and Hawaii earthquakes.

Redacted has served as a Lecturer and Teaching Assistant in the Civil and Environmental Engineering Department at Stanford University, a part-time faculty member in the Department of Civil Engineering and Applied Mechanics at San Jose State University, and as an instructor for the U.S. Army Corps of Engineers. He currently serves on the Industrial Advisory Board for the University of California Los Angeles (UCLA).

### **Academic Credentials and Professional Honors**

Ph.D., Geotechnical Engineering (minor: Mechanical Engineering), Stanford University, 1994

M.S., Structural Engineering, Stanford University, 1989

B.S., Civil Engineering, University of Notre Dame (with High Honors), 1988

### **Licenses and Certifications**

Registered Professional Civil Engineer, California

Registered Professional Civil Engineer, Hawaii, #

Registered Professional Civil Engineer, Massach

Registered Professional Civil Engineer, Florida, #

Registered Professional Civil Engineer, Colorado

Redacted

Redacted

Redacted Senior Engineer in Exponent's Civil Engineering practice. She specializes in the fields of geotechnical engineering, foundation engineering, and geotechnical earthquake engineering. Her experience includes design of foundation and retaining wall systems, evaluation of soil liquefaction using various in-situ testing methods, and estimation of static and dynamic slope stability using finite element analyses. Her doctoral research includes the probabilistic development of an empirical model of liquefaction-induced lateral spreading based on a case history database. In addition, she has laboratory soil testing experience, particularly in the cyclic simple shear testing of highly plastic clays. She has conducted numerous post-disaster inspections, including 2005 Southern California Landslides and Hurricane Katrina.

#### **Academic Credentials and Professional Honors**

Ph.D., Civil and Environmental Engineering, University of California, Berkeley, 2004

M.S., Civil and Environmental Engineering, University of California, Berkeley, 1999

B.S., Civil and Environmental Engineering, University of California, Berkeley, 1998

#### **Licenses and Certifications**

Registered Professional Engineer, California Redacted

Certified California Office of Emergency Services (OES) Safety Assessment Program Evaluator

#### **Publications**

Redacted Probabilistic models for engineering assessment of liquefaction-induced lateral spreading displacements. Ph.D. Dissertation, University of California, Berkeley, 2004.

Redacted

Redacted specializes in soil mechanics, geotechnical engineering, foundation engineering, and earthquake engineering. He has extensive experience in the evaluation of flood control systems, including canals, dams, and levees. He has completed a full range of geotechnical studies for levee systems, involving the development of exploration plans, site characterization, seepage evaluation, strength characterization, static slope stability analyses, erosion potential evaluation, probabilistic risk assessment, liquefaction analyses, and seismic vulnerability assessments. In addition, he has worked on the development and evaluation of preliminary alternative designs for remediation of levee deficiencies and liquefaction mitigation through ground improvement. Redacted has also experience in conducting studies on ground vibrations, site amplification, wave propagation, liquefaction, and lateral spreading.

### Academic Credentials and Professional Honors

Ph.D., Ocean Engineering (Civil and Environmental Engineering and Mechanical Engineering), University of California, Berkeley, 2007

M.S., Civil and Environmental Engineering, University of California, Berkeley, 2006

M.S., Ocean Engineering, University of California, Berkeley, 2003

M.S., Civil Engineering, Politecnico di Torino, Italy, 2002

B.S., Civil Engineering, Politecnico di Torino, Italy, 2002

### Licenses and Certifications

Registered Professional Civil Engineer, California, [Redacted]

Licensed Professional Civil Engineer, Italy

[Redacted]

[Redacted] is a Principal Engineer and the Director of Exponent's Buildings and Structures practice. [Redacted] specializes in structural analysis and design, material behavior, and construction technology with focus on issues surrounding structural damage assessment and repair methods.

[Redacted] has investigated structures damaged by wind, snow, explosion, fire, construction problems, design defects, decay and corrosion, as well as hundreds of structures damaged by the Loma Prieta, Northridge, San Simeon and Hawaii earthquakes. In addition to damage investigations, [Redacted]

[Redacted] also provides peer review services for structural design of complex structures, including safety-critical nuclear power plant structures. [Redacted]'s work often includes nonlinear and dynamic structural analysis; instrumentation and full-scale testing of structures; seismic risk assessment and retrofit; and material failures including fracture and plasticity analyses.

### Academic Credentials and Professional Honors

Ph.D., Civil Engineering, University of Wisconsin, Madison, 1988

M.S., Engineering Mechanics, University of Wisconsin, Madison, 1989

M.S., Civil Engineering, University of Wisconsin, Madison, 1984

B.S., Civil Engineering, University of Wisconsin, Madison (*with distinction*), 1982

### Licenses and Registrations

Registered Professional Civil Engineer, California, [Redacted]

Registered Structural Engineer, California, [Redacted]

Registered Civil and Structural Engineer, New Mexico, [Redacted] Washington, [Redacted]

Registered Structural Engineer, Illinois, [Redacted]

Registered Professional Civil Engineer, Wisconsin, [Redacted] New York, [Redacted] Hawaii, [Redacted]  
Oklahoma, [Redacted]; Alabama, [Redacted]  
Registered Professional Engineer, Colorado, [Redacted]; Maryland, [Redacted]; Missouri, [Redacted]  
Registered Structural Engineer, Oregon, [Redacted]  
Registered Civil Engineer, Maine, [Redacted]

[Redacted]

[Redacted] is a Managing Engineer in Exponent’s Buildings and Structures practice. He specializes in the areas of non-linear structural analysis, performance-based design and assessment of structures, earthquake engineering, and soil-structure interaction. [Redacted] has performed analyses of structures under extreme loading conditions including those imposed by seismic, wind, flood and snow loads. [Redacted] has assessed damage to structures due to earthquake, wind, fire, ground settlement and material degradation.

**Academic Credentials and Professional Honors**

M.S., Civil and Environmental Engineering, University of California at Berkeley, 2004  
B.S., Civil and Environmental Engineering, California Polytechnic State University at San Luis Obispo, 1999

**Licenses and Registrations**

[Redacted]  
Registered Professional Civil Engineer, California [Redacted]  
Safety Assessment Evaluator, California Office of Emergency Service [Redacted]