20TH GERALD A. LEONARDS LECTURE

Professor Jonathan D. Bray

University of California, Berkeley

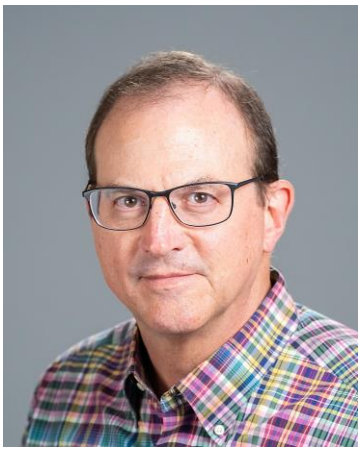
Seismic Design Considerations for Tailings Storage Facilities

April 12, 2024 - 5:00 p.m.

Krannert Auditorium, 403 Mitch Daniels Blvd, West Lafayette, IN (free, open to the public)

Lecture will be followed by Reception and Banquet at 6:30 p.m., John Purdue Room, Marriott Hall, 900 Mitch Daniels Blvd, West Lafayette, IN (registration required)

The seismic design of a tailings dam requires several levels of analysis informed by the site geology, seismic hazard, groundwater, surface water management, and material characterization, among other factors. Firstly, the potential for materials to lose significant shear strength due to earthquake ground shaking should be evaluated. Tailings are often composed of materials that have cyclic responses like that of sand, silt, and clay. Post-liquefaction shear strengths should be used to estimate the dynamic resistance of the dam. The seismic coefficient used in a pseudo static slope stability analysis must be compatible with the allowable amount of seismic slope displacement. The seismic coefficient can be selected to achieve an assessment consistent with the amount of seismic slope displacement that would have been calculated with a seismic slope displacement procedure based on a calibrated sliding block analysis. A robust seismic slope displacement procedure can capture the dynamic response characteristics of the slope with its fundamental period and the seismic demand with the 5%-damped spectral acceleration at the degraded period of the potential sliding mass and the moment magnitude of the governing earthquake. The uncertainty in the estimates of these parameters should be considered. With this approach, the engineer considers in a rational manner the amount of seismic displacement judged to be allowable and the seismic hazard at the site in the selection of the seismic coefficient. Given their criticality, a nonlinear effective stress-deformation analysis of the tailings dam should be performed. If properly calibrated, it can capture key mechanisms of deformation and provide important insights regarding the potential seismic performance of the tailings dam. A tailings dam breach analysis is required to assess the potential runout and its consequences**.**



Jonathan Bray, Ph.D., P.E., NAE is the Faculty Chair in Earthquake Engineering Excellence at the University of California, Berkeley. Dr. Bray is a registered professional civil engineer and has served as a consultant on important engineering projects and peer review panels. He has authored more than 450 research publications on topics that include liquefaction and its effects on structures, seismic performance of dams, earthquake ground motions and site effects, and earthquake fault rupture propagation. He created and led the Geotechnical Extreme Events Reconnaissance (GEER) Association. Dr. Bray is a member of the U.S. National Academy of Engineering and has received several honors, including the Seed Medal, Terzaghi Award, Ishihara Lecture, Peck Award, Joyner Lecture, Middlebrooks Award, Huber Research Prize, Packard Foundation Fellowship, and NSF Presidential Young Investigator Award.

20TH GERALD A. LEONARDS LECTURE

The Leonards Lecture was established in 2003 in honor of Professor Gerald A. Leonards, one of the giants of the geotechnical engineering profession.

Professor Gerald A. Leonards was born on April, 29, 1921 in Montreal, Quebec, Canada. He obtained his BSCE at McGill University in 1943 and received both MSCE and PhD from Purdue in 1948 and 1952, respectively. He was a full-time faculty member at Purdue from 1952 to 1991, when he was named Professor Emeritus.

Professor Leonards' research interests were very wide and he made pioneering contributions to knowledge on strength and compressibility of compacted clay soils, strength and consolidation of natural deposits, cracking of earth dams, frost action, analysis of buried conduits, pile foundations, stability of slopes and embankments on soft clays, stress-deformation and liquefaction of sand, and methodologies for investigating failures. He published extensively nationally and internationally. His 1962 book on "Foundation Engineering" quickly became a standard reference worldwide.

Throughout his career, Dr. Leonards' insight and expertise was sought on earthwork and foundation projects all over the world, a number of which involved the investigation of failures. He was appointed as the only non-European to sit on an official government commission in Italy to investigate ways to stabilize the Tower of Pisa.

Over his career Dr. Leonards received numerous awards from professional societies. In 1980 he was honored by the American Society of Civil Engineers by being asked to present the Terzaghi Lecture and also received the Terzaghi Award in 1989. In 1988 he was elected to the National Academy of Engineering.

From the students' perspective, "GAL" was a dedicated professor and researcher, who never missed an opportunity to learn more about his chosen field and to share his views on new developments. His influence continues to be felt through the lasting influence he had on his students and colleagues.
Adapted from text by V.P. Drnevich

Previous G.A. Leonards Lecturers
Milton Harr (2003), Victor Milligan (2004), Robert Holtz (2005), Michele Jamiolkowski (2006), Suzanne Lacasse (2007), Jean-Lou Chameau (2008), Bernard Amadei (2009), Richard D. Woods (2010), Herbert Einstein (2011), Carlos Santamarina (2012), Craig Benson (2013), Lyesse Laloui (2014), Richard Goodman (2015), David Frost (2016), Patricia Culligan (2017), Eduardo Alonso (2018), Steve Kramer (2019), Rick Deschamps (2022), Krishna Reddy (2023).

PGS-2024 Sponsors
At the time of this announcement, the following sponsors provided their generous support. ***Gold level****: Mundell & Associates, Nicholson Construction, Rizzo International, Stantec;* ***Silver level****: Gannett Fleming, Terracon Consultants;* ***Bronze level:*** *Geosyntec consultants, GeoTill Engineering.*

2024 - Purdue Geotechnical Society Program and Leonards Lecture Committee
Antonio Bobet, Philippe Bourdeau, Vincent Drnevich, Marika Santagata (Chair), Joseph Sinfield, Eirini Christoforidou, Kanika Gupta, William Hurdle, Daniel Muschett, Juliana Pereira, Juan Esteban Jimenez Pirajan, Luis Garzon Sabogal (Purdue University, Lyles School of Civil Engineering), Amanda Schields (Purdue Conferences).

The PGS was founded in May 2003 to enhance the strong bond and working relationship among alumni, faculty, students, and staff of the Geotechnical Engineering group at Purdue University for the benefit of all.

https://engineering.purdue.edu/PGS https://twitter.com/Purdue_PGS