



Department of Civil Engineering  
The University of Hong Kong



Geotechnical Division  
The Hong Kong Institution of Engineers

# THE FIFTH LUMB LECTURE

## UNCERTAINTY, RELIABILITY AND FOUNDATION ENGINEERING

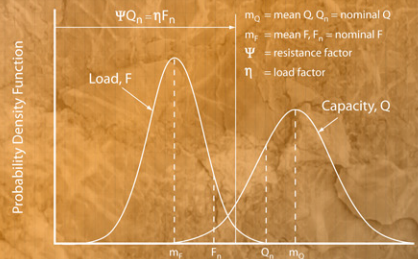
PRESENTED BY  
**FRED H. KULHAWY, DISTINGUISHED MEMBER, ASCE**

7:00 P.M. DECEMBER 1, 2008 (MONDAY)  
LECTURE THEATRE, THE HONG KONG CENTRAL LIBRARY, 66 CAUSEWAY BAY ROAD, HONG KONG.



### About the Speaker

**Dr. Fred H. Kulhawy** is Professor of Civil/Geotechnical Engineering at Cornell University, Ithaca, New York, USA. He received his BSCE and MSCE from the New Jersey Institute of Technology and his PhD from the University of California at Berkeley. His teaching and research focuses on foundations, soil-structure interaction, dams, soil and rock behavior, and geotechnical computer and reliability applications. He is the author of over 340 technical publications, and he has given nearly 1300 lectures around the world. He is licensed in several states as a Professional Engineer, Civil Engineer, or Geotechnical Engineer. He has extensive experience in geotechnical engineering practice with several consulting firms, and he has been a private consultant for major projects on six continents, with over 420 assignments completed to date. He has received numerous awards for his academic, research, and professional work from ASCE, ADSC, IEEE, and others, including election as Distinguished Member of ASCE and the ASCE Karl Terzaghi Award and ASCE Norman Medal.



### Synopsis

Peter Lumb was among the first civil engineers to focus on the role of uncertainty in geotechnical engineering practice and design. His seminal work on this topic illustrated clearly that proper geotechnical design should be based on probabilistic, not deterministic, principles. More than four decades later, our profession is still trying to address this reality. This lecture and paper traces the key developments to date in trying to achieve this goal. First, the topic of uncertainty in geotechnical characterization is discussed. The primary sub-topics include the inherent geologic variability, the variabilities introduced during site investigation and in-situ testing, and the variabilities associated with transforming a field or laboratory measurement into a needed design property. Second, the framework of geotechnical reliability-based design (RBD) is introduced, especially noting the very important differences from structural RBD. The geotechnical design equations need to be calibrated before use, and their variabilities need to be quantified. Then the complete design equation must be calibrated, including all of the relevant uncertainties, to assess the load and resistance factors rigorously to achieve specific design goals, such as the ultimate limit state (ULS) for capacity and the serviceability limit state (SLS) for displacements. Economic optimization also is included. Examples are given from foundation engineering practice, illustrating the very important differences between traditional deterministic design and properly-done RBD.

### About Professor Lumb

Professor Lumb became a lecturer in the Department of Civil Engineering, The University of Hong Kong in 1954. After 32 years of service at the University, he retired in 1986. Many of his ex-students have fond memories of him as a modest teacher who preferred to keep a low profile. He dedicated his life towards the 'bawning' of geotechnical engineering in Hong Kong and received numerous awards in recognition of his great contributions.

**FREE ADMISSION – ALL ARE WELCOME**

No prior registration is required  
Attendance certificates will be available.

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