ASCE Geo-Institute (G-I)

Risk Assessment and Management (RAM) Committee

Lectures on Offer from the RAM Committee (2018-2019)
Please Contact: D.V. Griffiths, d.v.griffiths@mines.edu

Towards a Better Quantification of Seismic Hazard
Haitham M. Dawood (Fugro USA Land, Inc)

The variability associated with predicting ground motion parameters, using a ground motion prediction equation (GMPE), tend to control the hazard levels obtained from a probabilistic seismic hazard analysis (PSHA). This is particularly relevant for facilities designed for long return periods. Many attempts were carried out over the years to reduce this variability, but the discrepancy between the results of the different models dictated the need for new research directions. In recent years, attention turned towards implanting what is known as the non-ergodic concept in PSHA. It represent a substantial improvement in the quantification of the seismic hazard when compared with the conventional (ergodic) PSHA. This presentation will introduce the concept of non-ergodic PSHA as well as its implementation in practice. Opportunities and obstacles associated with using this framework in practice will be discussed.

Case Histories in Forensic Geotechnical Engineering
R.B. Gilbert (University of Texas, Austin, TX)

The practice of geotechnical engineering is guided by lessons learned from failures and successes. This talk will describe recent case histories in forensic geotechnical engineering, including a landfill cover slope failure, a pile foundation failure and success, and a natural slope failure. The lessons learned from these cases histories include the importance of designing for interim conditions during construction, the importance of collaborating with versus working for structural engineers, and the importance of considering and communicating risk and uncertainty clearly.

Risk Assessment in Geotechnical Engineering
D.V. Griffiths (Colorado School of Mines, Golden, CO)

Geotechnical engineering has seen a rapid growth of interest in risk assessment methodologies. This seems a logical evolution, since soils and rocks are among the most variable of all engineering materials, and geotechnical engineers must often make do with materials they are dealt with at any particular site. A probabilistic analysis may lead to a “probability of failure”, as opposed to the traditional “factor of safety”, representing a fundamental shift in the way engineers need to think about the suitability of their designs. The seminar will review some of the benefits and potential pitfalls of these different approaches, and describe some introductory methods of probabilistic analysis.

A Probabilistic Approach for Earth Dam and Levee Filter Design and Internal Erosion Risk Assessment
Sangho Lee (East Bay Utility Municipal District, Oakland, CA)

Backward erosion or piping phenomena of fine particles within cohesionless soils cannot be predicted with current deterministic dam/levee filter design which simply compares two selective particle sizes from the base soil and filter gradations. Accurate evaluation of base soil internal stability is very important in order to predict filter performance after dam/levee construction. Many filter design failures have stemmed from ignorance of progressively changed field conditions, such as inhomogeneous seepage flow generation and a subsequent change of soil relative density and gradation, which contrasts unfavorably with the homogenous and uniform flow regimes presumed in the design stage. The author has introduced a new probabilistic filter design method for improvement of filter performances in terms of both retention and drainage purposes. This probabilistic method can handle entire particle size distributions (PSD) of base soil and filter material to compare the constriction size distribution (CSD) of pore structures between two discrete media, which is closely related to
the mechanisms of internal stability against "piping" and self-filtration process called "bridging". The reliability analysis of internal erosion risk
can cope with the full spectrums of non-homogenous and random features of alluvial soils, generally identified from the field investigation.

Infrastructure Lifelines Systems: Risk and Reliability
R.E.S. Moss (California Polytechnic State University):

This talk covers methods for analyzing civil lifelines systems (pipelines, canals, highways, etc) from a reliability perspective. Examples of different lifelines failures over the years are examined to learn from past mistakes. Then for back-analysis or forward-design the following topics are covered: spatially correlation of load and resistance, interconnectedness/ interdependence of lifelines, systems redundancy verses capacity, ageing and maintenance, multi-hazard susceptibility, and lifelines resilience. The goal of this talk is to raise awareness of systems specific engineering issues and provide a means for addressing them within a risk and reliability framework.

Performance based earthquake engineering.
A. Rodriguez-Marek (Virginia Tech, Blacksburg, VA)

Performance Based Earthquake Engineering (PBEE) is a framework that enables the design of a civil engineering systems based on stated performance objectives or annualized losses rather simple failure/no failure criteria. These performance objectives may depend on the frequency of the driving earthquakes. For geotechnical systems, PBEE often entails designs that are based on target deformations. In this talk we review the concept of PBEE and consider some illustrative examples of geotechnical design with the framework of PBEE. These examples include the computation of annualized losses due to liquefaction and the estimation of mean annual rates of exceedance of target displacement levels for an engineered slope.

Calibration and Full-scale Evaluation of Reliability-based Serviceability Limit State Design Procedures

A.W. Stuedlein (Oregon State University, Corvallis, OR)

This lecture describes the use of an existing reliability-based serviceability limit state (RBSLS) procedure to illustrate some of the critical elements in the calibration of RBSLS models and to serve as guide for future calibration work and application in practice. The application of the RBSLS described in this lecture centers on the performance of spread footings resting on aggregate pier (stone column) reinforced ground. The lecture begins with the introduction of the proposed ultimate and serviceability limit state design models that have been calibrated with full-scale test results. Then, the general reliability calibration framework and the implementation of a "lumped load and resistance factor", or pseudo-factor of safety, is introduced and illustrated with examples. The lecture then switches gears to introduce the idea of correlated serviceability limit state model parameters, and statistical simulation models to account for correlated model parameters is described. Examples demonstrating how certain decisions on statistical model selection can affect the resulting lumped load and resistance factor is presented to help designers ascertain appropriate reliability-based design procedure calibrations. The accuracy of the proposed RBSLS procedure is then examined by comparing predictions to new full-scale footing loading tests conducted at the field research site at Oregon State University, which included small (0.76 m) and large (2.7 m) footings.