CENTER FOR INFRASTRUCTURE ENGINEERING STUDIES

GEOMO 2004: Geotechnical Uncertainty and Reliability

By

Dr. Richard Stephenson

University Transportation Center Program at
The University of Missouri-Rolla

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16. Abstract
One day seminar given by one of the leading authorities on foundation design for transportation structures and Reliability Based Design 1. Establish UMR as a source of high-level continuing education. 2. Acquaint important and influential professionals with UMR programs. 3. Establish collaborative arrangements with high profile researchers from other universities. 4. Forge ties with MoDOT personnel. Acquaint regional engineering professionals with the programs and facilities available at UMR.

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GeoMO 2004

Theme: Geotechnical Uncertainty and Reliability-Based Foundation Design

Date: May 21, 2004

Professional Development Hours: Individuals attending program will receive certificate documenting 6.0 hours of Professional Development.

Attendees: 64 professionals

Speaker: Dr. Fred Kulhawy-Professor, Cornell University

Reliability-based design (RBD) of foundations constitutes a potentially superior alternative to traditional deterministic design because:

- the design reliability can be maintained at a target value that is chosen rationally
- incompatibilities are minimized between structural and foundation design
- many of the complex relationships between uncertainties and risks can be assessed realistically, without resort to intuition and arbitrary decision-making processes

Current deterministic design is less specific than RBD and is more subject to considerable vagaries of individual use. Specifically, loading and geotechnical models rarely are specified in tandem, the specific way to use these models is rarely noted, guidance on selection of design parameters normally is lacking (i. e., should one use mean, upper range, lower range, etc.), and the selection of a factor of safety is not based on any degree of rigor or quantifiable function (tradition and experience tend to govern). The influence of varying design parameters and their ranges on design reliability is not addressed specifically, and subsequently the actual reliability level can vary substantially.

In this workshop, these issues are addressed in a fundamental, yet practical, manner. First, an overview is given of the development of geotechnical RBD for foundations in North America. Then necessary concepts and tools are presented, including basic issues of uncertainty, risk, judgment, and RBD formulation. The uncertainty and variability of design parameters are discussed in detail, including load modeling and geotechnical variability, which arises from geologic development, in-situ testing and sampling, correlations, and calculation models. All of these factors then are integrated into reliability-based equations for foundation design, with application examples. The resulting design equations have a "look and feel" that is familiar, but they actually are significant extensions and formalizations of current equations because they incorporate uncertainty explicitly. This approach puts the key design decisions in the hands of the design engineer, who is the only person who can truly assess the degree of confidence in the design parameters and their variability. This approach also gives designers direct means of assessing the relative value of lower variability in the geotechnical data.

For this workshop, comprehensive notes were used that facilitate technology transfer. These include organized copies of the course video materials and a bibliography of supplemental readings to provide further details.