

## THE IMPORTANCE OF PERFORMANCE-BASED GEOTECHNICAL PARAMETERS FOR NONLINEAR ANALYSIS

Mark Murphy<sup>1</sup> and Marshall Lew<sup>2</sup>

<sup>1</sup> Senior Engineer/Project Manager, MACTEC Engineering and Consulting, Inc., 5628 E. Slauson Avenue, Los Angeles, CA 90040, U.S.A. Tel: 323-889-5300, Fax: 323-889-5398, E-Mail: [mamurphy@mactec.com](mailto:mamurphy@mactec.com)

<sup>2</sup> Senior Principal Engineer/Vice President, MACTEC Engineering and Consulting, Inc., 5628 E. Slauson Avenue, Los Angeles, CA 90040, U.S.A. Tel: 323-889-5300, Fax: 323-889-5398, E-Mail: [mlew@mactec.com](mailto:mlew@mactec.com)

### ABSTRACT

Traditional geotechnical engineering practice typically utilizes a wide variety of empirical correlations which contain varying degrees of epistemic and aleatory uncertainty. The source of the uncertainty varies from the use of poorly controlled field test methods to sample disturbance prior to laboratory testing. When accounting for uncertainties such as these, the geotechnical engineer may be influenced by a desire to give “conservative” values or “better” values to the structural engineer. However, when considering performance-based design, rather than accounting for the uncertainties in empirical formulae and test results through the use of poorly understood and inconsistently applied factors of safety, there is a need for a reduction in the uncertainties themselves. This can be accomplished through the use of high quality field and laboratory testing methods.

It is important that the uncertainties in the geotechnical parameters be reduced and that arbitrary safety factors not be applied so that the actual performance of the structure can be accurately modeled by the structural engineer. The best estimate of geotechnical performance is what is required. Overly conservative or overly aggressive foundation stiffness and/or bearing capacity values, which may seem desirable to some engineers, can lead to the incorrect predicted failure mechanism of the structure and result in a misguided retrofit scheme. Accurate estimates of geotechnical parameters and reduced uncertainties can help owners build safety and cost savings into the analysis and retrofitting of existing buildings.

A case history is presented where performance-based design concepts were utilized in obtaining geotechnical parameters for the nonlinear analysis of an existing hospital building.