Public Abstract

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Graduation Term:FS 2017

Department:Civil Engineering

Degree:MS

Title:Reliability-Based versus Allowable Stress Design of Foundations for the Center for Missouri Studies Building

Uncertainty in design parameters is inherent to the field of geotechnical engineering. Allowable stress design has conventionally been used for foundation design and accounts for uncertainty in geotechnical parameters and consequences of failure by assigning a global factor of safety. Allowable stress design is typically a conservative approach and may result in increased construction costs. The objective of the thesis is to compare allowable stress design with reliability-based design of foundations. The secondary objective is to initiate a 'living' database of geotechnical parameters for the University of Missouri – Columbia Campus, which will be expanded by future graduate students.

A geologic history and site investigation results are presented to characterize subsurface conditions for the Center for Missouri Studies building in Columbia, Missouri and are entered into the geotechnical database. The existing foundation system of the Center for Missouri Studies building is evaluated using allowable stress design methods. The existing foundation system is reconsidered using reliability-based design. In a reliability-based design, uncertainty is quantified by evaluating the distribution of geotechnical strength parameters and structural loads. Two alternative foundation types are also considered.

Reliability-based design was shown to be less conservative than allowable stress design. Both methods produced safe and reliable results, but foundation costs were reduced by seven (7) to thirty-five (35) percent when reliability-based design was used. The probability of failure of the foundations was acceptable from both design methods, but was unnecessarily conservative when using allowable stress design. A final objective of the thesis is to provide a template for future geotechnical engineering students to assemble an interactive geotechnical database and detailed subsurface profile for the University of Missouri-Columbia Campus. Appropriate use of the database and increased implementation of reliability-based design can reduce future design and construction costs of local foundations while assuring acceptable levels of reliability.