Faculty awarded for research that could improve reliability of foundation designs, reduce costs

November 7 2011

A professor at the University of Texas at Austin's Cockrell School of Engineering and a graduate of the school have been awarded the Norman Medal, the most prestigious award given by the American Society of Civil Engineers (ASCE).

Granted annually since 1874, this year's award recognizes Robert Gilbert, a geotechnical engineering professor in the school's Department of Civil, Architectural and Environmental Engineering, and Shadi Najjar, a Ph.D. graduate from the Cockrell School and now an assistant professor of civil engineering at American University of Beirut, for a research paper that could improve the reliability and efficiency of deep foundations in constructing bridges and other structures.

"Dr. Gilbert and Dr. Najjar's research provides a new approach for designing pile foundations, which support important structures such as bridges and offshore facilities," said Sharon L. Wood, chair of the Department of Civil, Architectural and Environmental Engineering. "The new procedure increases the reliability of foundation designs and has the potential to dramatically reduce construction costs. Given the importance of the research results and its impact on industry, I think it's only fitting that Dr. Gilbert and Dr. Najjar join the impressive list of Norman Medal winners."

The paper, titled "Importance of Lower-Bound Capacities in the Design

of Deep Foundations," spawned from an engineering challenge to provide high reliability for an offshore oil and gas facility being built off the coast of West Africa. Construction of the facility was taking place in deep ocean water on soil that is lightweight but very strong and had never before been encountered by engineers.

Because of this, Gilbert said, there was uncertainty about the structure's foundation. Calculations of the facility's capacity – or amount of weight it could safely support in the soil – varied greatly when engineers used the standard methods of assessment.

"What struck me about it is, while there was this huge range in what the capacity might be, there was very little debate – almost none – about what the smallest possible or lower- bound capacity would be," Gilbert said. "And the lower-bound capacity is what is important because all that matters is whether the capacity is going to be greater than the largest possible load on the foundation."

Before their paper was published, the minimum capacity, or lower-bound capacity, was not formally or explicitly considered in reliability-based design and was typically used as a check for worst-case scenarios. However, Najjar and Gilbert found that it can play a big role in improving reliability and efficiency of a design, if incorporated properly. What adds to the practical contribution of the paper and its effect is that the proposed lower-bound capacity can be computed using simple physical models and can be readily verified during construction.

"We strongly believed that we had a creative and new concept at hand, and we made sure that we pursued it till the end. Being recognized for the idea, however, is the icing on the cake," Najjar said. "I really hope that the new concepts presented in the paper will be embraced by geotechnical design engineers in the near future."

In selecting the paper for the award, the ASCE committee noted its potential for significant practical contribution toward improving the load and resistance factor design (LRFD) methodology in civil engineering.

"It's a great honor to have our work recognized with the Norman Medal," Gilbert said. "We hope that this research will lead to better design and construction of future structures."

Provided by University of Texas at Austin