Commentary By Patrick C. Lucia, PhD, PE, GE, M.ASCE

As I See It: Geotechnical Forensic Engineering in Defense of Geotechnical Engineers

I have been involved in forensic engineering for over 25 years of my more than 40 years as a geoprofessional, investigating over 50 geotechnical failures, typically as an expert in defense of geotechnical engineers. Evaluating the cause of a geotechnical failure has always been exciting, at least at the beginning. Delving into the technical aspects of a failure is often like solving a murder mystery. Unfortunately, at the end of the mystery, the autopsy is far too often being conducted on the geotechnical engineer. Geotechnical forensic investigations are seldom intended just to advance professional knowledge; rather, they are, unfortunately, typically intended to assign responsibility for damages caused by the failure. For the geotechnical engineer, this is always an evaluation of their compliance with the "Standard of Care" (SOC) and ultimately the degree to which they may be negligent.

In developing insights into the factors contributing to geotechnical failures, I realize that 50 data points is a small percentage of the projects built over the past 25 years. However, certain factors consistently contribute to a failure, allowing an opportunity for insight that will contribute to improving the professional practice of geotechnical engineering. In my experience, the single most important factor contributing to failures is lack of process in conducting the geotechnical engineering studies. Almost universally, I find a lack of documentation and a lack of formal peer review of all aspects of the work.

The second major factor is a lack of understanding by geotechnical engineers on what constitutes the SOC. Often, the engineer learns the concept of SOC when it's explained to them by their lawyer or, almost equally as bad, they define the SOC as what they do without regard to their peers. Nearly every geotechnical report includes a disclaimer that work described in the report was done within the SOC without the author understanding what that term means or somehow believing that including that statement makes it true and absolves them from liability.

In geotechnical engineering, the definition of SOC is more subjective than in other engineering disciplines due to the nature of working in the subsurface. Every geotechnical engineer relies on their judgment on every project. When a failure occurs, the engineer's judgment is questioned on every facet of the work. Too often, in my experience, the engineer's explanation of the application of their judgment comes across as arbitrary and after the fact, particularly when the explanation is given to a lay jury or judge without the supporting documentation in the files.

Geotechnical engineers' decisions are seldom arbitrary; they are typically backed by years of experience, knowledge of local geologic conditions, past performance of similar structures in similar conditions, and other factors. The problem lies in the lack of documenting that experience at the time an assumption is made in the project. Why are three borings okay when the plaintiff's expert defines the SOC as 10 borings? As a defense expert on behalf of the engineer, I can argue the reasons why three borings are within the SOC, an argument that sounds better to a lay jury or judge when the assumption behind it was included in the report or in the files at the time the judgment was applied.

The problems I see in geotechnical engineering don't lie in our ability to get samples, test them, and perform analyses. When we have problems in geotechnical engineering, they are typically the result of the decisions we make about where to sample, what to test for, what parameters to use in analyses, and how to interpret the results—in other words, the application of our judgment. Too often, problems occur as a result of judgment exercised in a vacuum without the vetting that occurs in the process of peer review and documentation.

No amount of documentation will prevent all claims from occurring, but when the process of engineering is properly done and properly documented, it will far reduce the number of claims and make the defense of those claims much easier. Engineers learn the technical details of engineering at universities quite well, but not the practice of engineering; teaching that has always been considered to be the responsibility of business. The engineer of the future must not only learn the technical details of our profession but also how to convey the exercise of judgment in a way that quantifies the geotechnical practice of engineering.

AUTHOR

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