

Note# 0002

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Why Strong Subsurface Investigations are so Important

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Much of the information presented in this article should be considered common knowledge by those who are regularly engaged in geotechnical design or construction. This article was developed to provide the reader an overview of the author’s thoughts and opinions about this important topic. The target audience is engineers or owners that are not commonly engaged in construction involving geotechnical components.

The earth provides the foundation upon which construction is performed. Soil can be a cost effective and sustainable building material or the most problematic aspect of a project. Despite the widespread understanding of the importance of a strong foundation, the pre-construction investigations needed to characterize, understand, and define the subsurface are often underfunded and undersized. Anyone who has worked in the construction industry has probably been involved in a claim relating to misunderstandings, misinterpretations, or incomplete presentations of ground conditions. So, why is there a hesitation to perform the studies needed to properly define the baseline conditions? There are three contributing factors:

1. Up-front cost,
2. Up-front schedule
3. Risk aversion.

Clearly, the cost of these investigations is borne early in the project, the studies are seemingly expensive, and the investigations take time. However, when compared to the potential long term cost and schedule savings, the up-front cost and schedule of properly performed studies are quite small. In addition to the cost and schedule, some industry stakeholders don’t want to outline baseline conditions for fear of claims when, in reality, not doing so actually sets the stage for claims.

Although we’re not aware of an exact figure, we think it’s reasonable to expect that an additional \$1 spent on pre-construction ground investigations can result in a \$2 reduction in the final construction project cost. In some cases, it may be closer to \$10 in savings for each \$1 spent. One study, Halligan, Hester, and Thomas 1987, estimated that unforeseen site subsurface conditions resulted in \$100s of millions in claims each year. We would expect that this figure is greater than \$1 billion today. Even in the rare cases where additional investigations do not result in tangible cost savings, the additional information collected makes cost projections easier and more accurate. As contractors that work almost exclusively with soil, we’re often tasked with reviewing subsurface investigation reports to identify baseline conditions, to outline potential risks (to us, the “contractor”), and to use the baseline conditions and risks to estimate the costs to

perform various work tasks. Unfortunately, we are not frequently engaged on projects during the investigation phase so our reviews are of documents prepared by others. Expectedly, the quality and quantity of information collected in geotechnical studies ranges widely depending on the owner, engineer, contract structure, and project size. In many cases, missing data or inconclusive recommendations result in large gaps in the overall data set.

More information gaps = higher potential risk = higher cost

In addition to uncertainty, unfair or unclear risk allocation in the contract can also have a large effect on the final project cost. In many instances, the owner will present the information and ask the contractor to bear the risks associated with uncertainty or to draw his own conclusions based on the given information. This approach is often unfair, does not result in a cost effective proposal, and leaves a large potential for claims associated with contractor misinterpretations. A more complete and accurate approach is to present the information collected in a geotechnical baseline report (GBR). Such a report outlines the information that is known and unknown, presents clear conclusions drawn from the known information, and provides contract vehicles for dealing with variations in observed conditions. This approach was originally presented in 1974 in an article titled "Better Contracting for Underground Construction" and is outlined in detail in ASCE's 2007 publication titled "Geotechnical Baseline Reports for Construction, Suggested Guidelines". Despite numerous publications describing why GBRs are important, how to write a complete report, and how to use the report, this approach is not utilized as frequently as it should be.

Construction is a balancing act between cost and schedule. This is true of all types of construction and even more so for construction projects involving soil. Subsurface construction is unique in that ground conditions are ever changing and can even vary substantially across an individual project site. In order to get any construction project successfully off the ground, one must understand the ground conditions and the uncertainty therein. The only way to understand the ground is to collect information and use past experience and engineering judgment to draw conclusions. Ideally, the subsurface study should be completed well before bid stage and the summary information presented at bid stage in the form of a GBR. This approach results in a clear presentation of the known and unknown information, an equitable risk allocation between parties, and ultimately should result in the lowest overall construction cost. Finally, if possible, it's always good to involve knowledgeable contractors early in the investigation and reporting process to help identify and correct issues prior to bidding.

USEFUL INFORMATION

The authors recommends the following references for additional information on this topic. This list is not meant to be exhaustive as there are certainly many other useful resources addressing aspects of this topic.

1. National Academy of Sciences (1974) “Better Contracting for Underground Construction”, Report of a study conducted by Standing Subcommittee No. 4, Contracting Practices, of the U.S. National Committee of Tunneling Technology, ISBN 0-309-02321-1
2. American Society of Civil Engineers (2007) “Geotechnical Baseline Reports for Construction: Suggested Guidelines”, Permalink: <http://dx.doi.org/10.1061/9780784409305>.

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