



From Research to Practice

On construction projects, it is common practice to prepare detailed specifications and drawings to solicit bids from qualified contractors. There are a number of factors that determine how the contractor will approach his bid on geo-construction projects. These factors include: contractor qualifications (capability and experience); understanding of the site conditions; understanding of the construction specifications and drawings; the need for work, and others.

It is also common practice to award the construction project to the contractor with the lowest bid. In a competitive market, the contractor's assumptions, for example based on the factors listed above, may leave the low bid with little margin for error. As a result, problems may arise during these geo-construction projects resulting in a disputed claim by the owner.

Based on my experience in forensic investigations, one condition, which is symptomatic of such disputed claims in a competitive bid forum, is the use of relative terms in the plans, specifications, and other contract information. What may result is the winning low bid contractor having made the least conservative assumptions in interpreting these relative terms. And when a claim is made, despite selecting the low bid, the owner alleges that the contractor made unrealistic assumptions in his estimate.

In summary, bid and actual costs, as well as quality of work are not always compatible with low bid solicitation.

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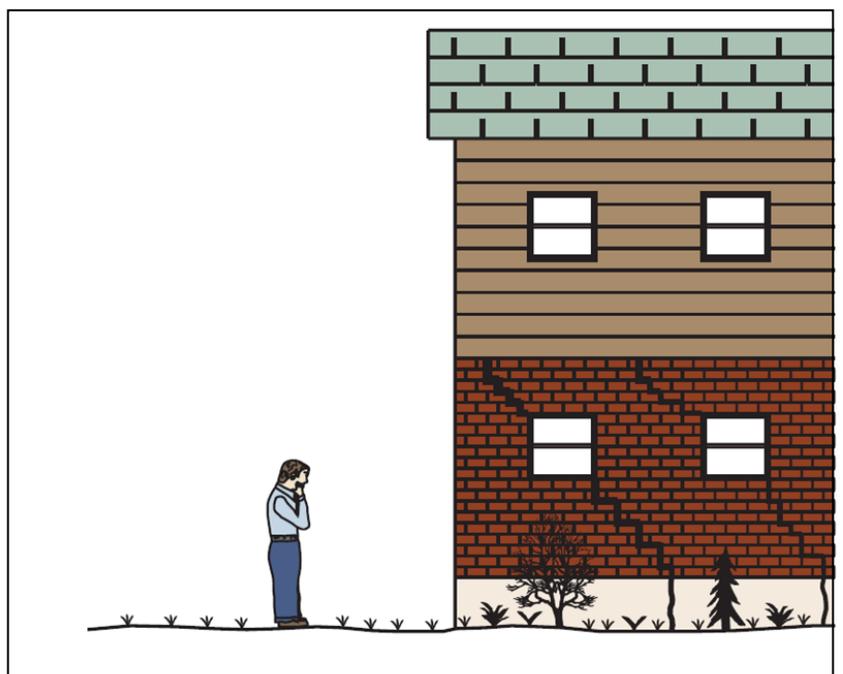
GEOTECHNICAL INVESTIGATION OF BUILDING DAMAGE

There are many reasons for building damage, some not as obvious as others. In fact, many engineers, architects, owners, and other associated parties do not appreciate or understand the geoforensic process when a structure may be damaged because of inadequate ground conditions. In addition to determining the specific cause(s) of the substantive error(s) that specifically caused the damage and recommending repairs, it may be important to assess responsible party(ies) leading to the damage. Reporting the latter can be an uncomfortable but necessary step. If insurance coverage is an issue, then the forensic investigation may extend into other technical questions regarding the causes or nature of the damage.

It is important to note that the constructed product is the result of a multi-staged process. This process proceeds from the acquiring of input data used in design, to the design, then to the construction of the structure. Therefore, there are a number of factors which could contribute to the site construction problem(s) or damage. A simple example may be the best illustration of the geoforensic process. Keep in mind, however, that each case has its own particulars.

EXAMPLE CASE

Let's take as an example the construction of a house. The owner, who is now living in the house, puts in an addition. Later he finds the basement and living quarters have substantial cracks in it and the owner wants to know what caused the damage, how to fix it, and who is at fault.



THE DESIGN STAGE

Premise: The designer retains a geotechnical engineering company to perform a foundation investigation for a house that he has been contracted to design. The designer reads the geotechnical testing company's report after their investigation and is told the foundation soil is a dry hard clay, but he still has questions. Consequently, he calls the testing company and asks the testing company if there are any water table problems and the testing company says they don't

think so. The foundation and basement are designed based on written and verbal information obtained from the testing agency. The designer (architect or engineer) uses some design procedures and building codes to determine foundation construction details and specifications.

Some Critical Questions: Did the designer use the appropriate procedures and building codes? (Examples would be a designer using antiquated formulas resulting in a substandard foundation or the designer improperly sizes the footing.) Did designer appropriately use all the relevant information at hand?

Premise: The owner decides to change the plan of the house. Plus, it is now winter and the designer verbally warns the owner that costs could be higher if the house is constructed then.

CONSTRUCTION-INSPECTION STAGE

Premise: This is an expensive house, so the designer has the inspector observe the foundation construction. The constructor and inspector work together to build a foundation to the designer's specifications and plans. The basement is being dug out and there are seams of sand in the clay and water is flowing into the excavation. The inspector makes the contractor pump water out but this becomes difficult because the water freezes and therefore adds to the cost of construction. The clay is checked prior to pouring the footing by the inspector. The inspector puts in his report the clay is acceptable and the contractor proceed to builds on it.

Some Critical Questions: Did the contractor and the inspector appropriately follow the plans and specification of the designer? Was there additional verbal communication between all parties? Did the contractor properly construct the footing? Was the clay too soft in the area of damage to be supported by the specified footing size? Further, did the owner not tell the designer about the new addition?

FORENSIC INVESTIGATION STAGE

Scope: A damage investigation is undertaken. The geotechnical forensic engineer inspects and maps the construction, damage, and other relevant site conditions to understand the problem(s). Also, interviews are conducted with all available parties involved in the design, construction, and damage stages. Design and construction records are reviewed, as well as all available testimony. Once a sufficient understanding of the project is obtained by the geotechnical forensic engineer, the appropriate subsurface exploration and associated laboratory testing are performed to determine the actual conditions in the area of damage. After an analysis of the above information is completed, an expert evaluation of the acquired data is made.

Results of Premise: The geoforensic investigation found after inspection of the site, review of the project documents, and from project discussions that the main cause was probably related to foundation settlement and not from other causes (such as failure of a building member; poor construction; or the foundation clay becoming wet and swelling upward). Also, the designer appeared to appropriately use the reported geotechnical information, proper foundation design methods, and appropriate building codes.

The follow-up subsurface investigation revealed that a pocket of soft clay was present within the building area which was not found during the original exploration of the site. The soft clay did not meet the construction specifications outlined by the designer and consequently was inappropriately left below the foundation by the contractor and accepted by the inspector.

As can be seen from the above example geoforensic investigation, the correct findings require a multifaceted study. Also, a well-qualified forensic engineer performing such a study best understands the level and type of investigation effort necessary.

Other Engineering UPDATES of Interest:

UPDATE 9: Hard Excavation Dispute

UPDATE 11: Foundation Recommendations Result in Unnecessary Large Cost

UPDATE 17: Landslide During Land Development

ABOUT MEA: Marino Engineering Associates, Inc. focuses on engineering research, practice and expert evaluations and is licensed in 27 states in the U.S. Our projects primarily have an emphasis on Geotechnical Engineering, however, we also have significant experience in projects involving transportation, subsidence engineering, laboratory testing, training, and geophysical exploration. Gennaro G. Marino, Ph.D., P.E., D.GE is president and principal engineer of Marino Engineering Associates, Inc., and has been a licensed professional engineer since 1984. To obtain additional information on MEA, one can also visit our website at www.meacorporation.com.

FOR MORE INFORMATION: There is a significant amount of additional information that is available on the above subject. For more information, please contact Dr. Marino at the address listed below.

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