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# Differing Site Conditions are Here to Stay: A Roadmap to Manage

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## 1. ABSTRACT

Trenchless contractors are going to have an increasingly more difficult time dealing with differing site conditions. This is true for many reasons. First, owners don't have the necessary geotechnical analysis performed to evaluate the conditions in which the work is to be performed. This is because owners do not know what analysis should be done, do not want to pay for it, and/or believe the less analysis they do, the less liability they may have for differing site conditions claims. Second, too many of the experienced engineers are retiring. Third, owners have less project monies available to pay for differing site conditions. Fourth, as a consequence, owners are increasingly attempting to contractually disclaim liability for differing site conditions.

Contractors cannot and should not bear the costs and constructability risks of differing site conditions. Since contractors cannot stop the above trends, differing site conditions are here to stay. What contractors therefore require is a roadmap to effectively deal with this. This requires that contractors know, as a matter of law, what the owner's geotechnical analysis should include, how to read soil borings and geotechnical reports, the extent to which contractors can rely upon the geotechnical analysis, how to overcome contractual disclaimers, and what the contractor's pre-bid site investigation should include. This roadmap also requires that contractors know, as a matter of fact, how to document differing site conditions, calculate the impact in time and money, and effectively communicate this so as to cooperatively obtain an acceptable change order.

## 2. INTRODUCTION

D*iffering site conditions* arise when a contractor encounters subgrade conditions either *different than indicated in the contract documents* or *different than anticipated for the specific project.* The problem with this focus is it ignores the real reason 'why' differing site conditions arise. Trenchless projects, as well as open-cut, highway heavy and vertical projects, all have one thing in common—each has its foundation in the soils. As a consequence, the starting point for the design of any such project *should* be a thorough *geotechnical analysis.* Unfortunately, for the reasons discussed below, civil engineers are not having the required geotechnical analysis performed. The net result is that projects are being *under-designed*, whereby the subgrade

design is not based on the *actual subsurface conditions.* This, in turn, causes contractors to encounter differing site conditions and related constructability, cost and delay/liquidated damages issues. Absent a significant change in the *standard operating procedure for trenchless project design,* which I do not anticipate, this problem of differing site conditions are here to stay.

Set forth below is a discussion of the *reasons why the required geotechnical analysis is missing* and a suggested *roadmap for contractors to manage the resulting impact on construction.*

## 3. ANALYSIS

I. Why are structural engineers failing to perform the required geotechnical analysis?

There are *many reasons why* civil engineers are not having the required geotechnical analysis performed for the design of trenchless projects.

*A. Civil engineers do not adequately understand geotechnical engineering.*

Civil engineers are tasked either directly or indirectly to determine *scope* for the required geotechnical analysis: engineers cannot properly fulfill their duty to properly design a trenchless project and properly solicit pricing for that work without an understanding of the subgrade conditions in which the work will be performed. Of course, how can a civil engineer properly perform this task unless he/she understands what *is* the *required geotechnical analysis?*
In my thirty plus years of experience working on public and commercial construction projects, when projects fail or become more expensive, I have had the occasion to question civil engineers on their geotechnical training. To my surprise, most civil engineers who design utility and highway heavy projects have typically *taken just one geotechnical engineering class in college.* As a consequence, these engineers typically *do not sufficiently understand how the subgrade will affect the project design and the related construction.* There may be a misconception about geotechnical engineering because the belief stems from the fact that geotechnical analysis is necessarily based on *extrapolation versus empirical science.* Regardless, the net effect is that projects are under-designed from the bottom up! Often times, contractors are required to *construct* projects in subgrade conditions *different than shown in the contract documents or otherwise anticipated* (i.e. differing site conditions).

*B. Although civil engineers typically lack the requisite geotechnical engineering training, project owners fail to compensate for this by retaining the assistance of a qualified geotechnical firm.*

Since civil engineers typically lack the training and experience to understand how the subgrade should affect the project design (i.e. what the required geotechnical analysis should be) and how the subgrade should be investigated, they must necessarily depend on someone else who *is* qualified to analyze and evaluate the subgrade. Unfortunately, owners are often times even more unaware of the problem (which is why they hire civil and geotechnical engineers to tell them). And, to the extent that owners and civil engineers may have some vague idea, they nevertheless may fail to have the required geotechnical analysis performed. My experience shows this to be the result of two factors *beyond unawareness*.

The first factor is one of *budget.* While difficult to understand, owners and civil engineers too often limit the dollars for the required geotechnical analysis in order to save for the underlying design and/or construction. The phrase *penny wise pound foolish* is front and center with this thinking.

The second factor is one of *limiting liability*. Because the required geotechnical engineering analysis is not being performed, there are an increasing number of *differing site condition claims* (i.e. contractors encountering *subgrade conditions different than those indicated in the contract documents*). Based on the increasing *absence and insufficiency of subgrade conditions indicated in the contract documents,* it is my supposition that one reason for this may be that owners want to limit their liability for differing site conditions claims. Put simply, the less they say, the fewer bases there are for contractors to allege that they encountered subgrade conditions *different than those indicated in the contract documents.* While that might be true, the "cost" for this belief is that projects are *under-designed from the bottom* up, the required geotechnical analysis is not performed and contractors are *increasingly* required to perform construction in subgrade conditions *different than what anyone did or should have reasonably anticipated* (i.e. Type II Differing Site Conditions).

*C. When project owners do provide geotechnical engineers with sufficient latitude and dollars, these engineers often fail to comply with applicable industry guidelines with regard to the extent of their analysis.*

Geotechnical engineers often do not perform the required extent of soil borings and related project analysis because of owner and/or engineer concerns about budget and liability. Based on my experience, even if geotechnical engineers are provided sufficient discretionary latitude, they may still fail to perform the required subgrade analysis because of *another potential shortcoming:* they *are not familiar with applicable industry guidelines.*

It cannot be overemphasized that "[t]he most important step in geotechnical design is to conduct an adequate subsurface investigation."[i] To be clear, there are no "rigid rules."

> The number, depth, spacing, and character of borings, sampling, and testing to be made in an individual exploration program are so dependent upon site conditions and the type of project and its requirements, that no "rigid" rules may be established.[ii]

Having said that, both federal and state authorities have developed "reasonable 'guidelines' to follow to produce the <u>minimum</u> subsurface data needed to allow cost-effect geotechnical design and construction to minimize claim problems."[iii] Geotechnical engineers should review and familiarize themselves with the myriad of federal and state publications which set forth these "guidelines," including AASHTO and both federal and state geotechnical/construction manuals.

These publications set forth guidelines that generally prescribe the following:

- "Accepted standard procedures from ASTM, AASHTO, or as established by the agency should be followed in the investigation process."[iv]
- The required first part of *characterization for engineering and design purposes* is "reconnaissance."[v]

- Successful subsurface investigations are normally "based on the result of previous work."[vi]
- "The initial phase of a geologic and site reconnaissance investigation is to collect *existing* geologic background data through coordination and cooperation from private, Federal, State, and local agencies.*"*[vii]
- The key is to focus on obtaining information "through personal communication with individuals with local knowledge."[viii]
- It cannot be emphasized enough that the geotechnical investigation should encompass a "[r]eview of available information, both regional and local, on the geologic history, rock, soil and groundwater conditions occurring at the proposed location *and in the immediate vicinity of the site."*[ix] The project owner may have "considerable information" of the local conditions based on project work at "an adjacent site."[x]
- The required need for a geotechnical engineer to obtain and evaluate information from other projects remains the same *regardless of the type of project being constructed.*[xi]
- "Available technical data . . . from personal communication should be reviewed before any field program is started."[xii]
- Once the onsite investigation begins, it should include sufficient subgrade investigations at proper locations and depths to inform the structural engineer of the expected subgrade conditions where the work will be performed. Notably, the *kind* of project will influence the subsurface investigation program. One good place to start is the "Checklist and Guidelines for Review of Geotechnical Reports and Preliminary Plans and Specification," which the U.S. Department of Transportation Federal Highway Administration prepared. Table 2 of this sets forth the "GUIDELINE 'MINIMUM' BORING, SAMPLING, AND TESTING CRITERIA."[xiii] This is a great resource because it separately prescribes guidelines for each "geotechnical feature" (e.g. structure foundation, bridge approach, centerline cuts, etc.), which includes the "minimum number of borings" and the "minimum depth of borings." While not all states have their own guidelines, many do. The place to look is in state geotechnical, design and/or construction manuals. For example, if it is a *trenchless pipe installation in New York,* 1boring should be taken "every 50'- to 200' within the proposed area of trenchless pipe installation."[xiv]

Unfortunately, my experience is that many geotechnical engineers have not been trained on the existence and importance of these *standard geotechnical investigation guidelines.* Notwithstanding this, there are a number of ways contractors can still protect themselves against projects designed on the basis of an *inadequate subgrade investigation.* This includes:

- Learn what an *adequate subgrade investigation* should entail in the jurisdictions in which you perform work.
- Help ensure that the required subgrade investigation is performed by *educating* civil and geotechnical engineers on what that should require. For me, that has meant speaking to engineers at DOT and ASCE conferences about this.
- Learn how to evaluate subgrade investigation data, including both borings and soils reports. Learn what is meant by, for example, the soil's hydrology/conductivity, what proper dewatering should require, N-value, cohesive v. non-cohesive soils, aggregate

sizes, and reliability of the soils information depending on depth and location of soil borings.

- Learn how the various subgrade conditions affect the selection and use of the various trenchless methods of construction.
- Learn whether the language used by the civil engineer to define the trenchless work defines a particular method or is, in fact, properly construed as more generic in meaning (e.g. auger bore, jack and bore, dry bore).
- Before bidding on a project, ask the civil engineer what he *meant* by the term(s) he used to describe the trenchless work.
- Before bidding, ask the engineer the *basis* upon which he relied upon for the chosen trenchless methodology.
- One of the most critical questions to ask the engineer, both before bidding as well as at the preconstruction meeting, is about the *anticipated subgrade conditions:* what *subgrade conditions did the engineer anticipate when he designed the trenchless construction and from what geotechnical data did he reach that conclusion.*
- Recognize that the *reliability* of subgrade information, both as a matter of fact and as a matter of law, is tied to the *proximity* of the borings (both horizontally and vertically) as well as the *number* of borings. Whether to bid and at what price should necessarily reflect the reliability or lack thereof of subgrade information.
- Depending on the engineer's answer, consider recommending either additional geotechnical investigation and/or use of another method of trenchless construction.
- If the project involves either *replacing* an existing system or *adding* to it, the contractor should ask for plans, soil borings/report, and any other data (e.g. differing site condition claims/change orders) that were generated when the existing project was *originally constructed.* This can and should be done at both the *bid* stage as well as at the *pre-construction conference.*
- If the owner allows you, depending on the size, complexity and financial risk, a contractor can conduct its *own subgrade investigation before bid time.* For many, however, this is simply not financially practical. Also keep in mind that if you do conduct your own investigation and it reveals *subgrade conditions different than shown in borings included with the contract,* a contractor will likely not be able to successfully maintain a differing site conditions claim if it encounters subgrade conditions revealed by the contractor's own investigation. (Contractors should also recognize that unless the contract includes a *site investigation clause* which *requires* the contractor to conduct a subgrade investigation, even if the contract may *permit* such an investigation, it is normally *not required.* The *site investigation clause* normally limits the investigation to what a contractor can *see* from *above grade,* based on viewing the site and any *geotechnical information either produced with the contract documents or otherwise noted as 'available for review upon request.').*
- It should go without saying that the contractor should always ask for, both at the pre-bid phase as well as at the pre-construction meeting, for *any and all borings and other geotechnical information which the owner/engineer has.* Based on my experience, both owners and engineers often fail to produce relevant geotechnical information. This raises another important issue for contractors to evaluate: whether and to what extent owners and engineers have a *legal obligation* to produce geotechnical information at bid time. Insofar as courts have not uniformly addressed this issue, it is essential that contractors

have legal counsel evaluate what courts have determined in the jurisdictions in which you work.

- If the owner and engineer have *not undertaken any subgrade investigation*, contractors should strongly consider *not bidding the project.* I say that for a few reasons. First, without any subgrade investigation to support the cost and feasibility of a design, there is a much higher probability that the project will take longer to complete and cost more than anticipated. In addition, the project may also be *impractical* if not *impossible to construct as designed.* Second, as a consequence, if the contractor does not seek reimbursement and a time extension, it will have to bear financial responsibility which may include higher costs to initially construct and/or unanticipated costs to either correct or pay for others' work which is adversely affected (as well as the assessment of liquidated damages). Third, if the contractor does seek additional time and compensation through the claims process, this can be very expensive. In addition, it may also adversely affect relations with the owner and/or engineer. Finally, there is no guarantee that anyone other than the lawyer may win. When the owner has not made any representations on what to expect for the subgrade conditions, a contractor can only assert what is referred to as a *Type II Differing Site Condition Claim.* This requires a contractor to prove that it encountered different than what *should have been expected for the project.* This is a much harder burden to meet than simply proving that the subgrade conditions encountered were different than what the contract documents *actually stated.* As a consequence, more often than not, courts rule *against* contractors on *Type II Differing Site Conditions Claims.*

### *D. Civil engineers are increasingly attempting to hold contractors financially responsible for the results of an inadequate geotechnical investigation.*

In traditional bid-build projects, the owner retains a civil engineer to *design* the project, and the contractor is subsequently engaged to construct the project *as designed in the conditions indicated in the contract documents or otherwise anticipated.* In public construction, the plans and specifications typically dictate much of the *means* of construction, including what material and equipment to use, how to use it (e.g. lift size, moisture, density) and, with regard to *trenchless construction*, often what *specific technology* to use. If the contractor follows the civil engineer's roadmap, and the project cannot be built as designed or becomes more expensive and time-consuming because of differing site conditions, courts have long held that the owner should pay for the related extra costs and are, in fact, increasingly holding engineers liable as well (typically for professional negligence).[xv]

While this approach makes common sense (each is responsible for its own work), civil engineers are increasingly attempting to draft contracts so as to make contractors financially liable for *differing site conditions* as well as *end result defects.*

#### i. Differing Site Conditions

To place financial responsibility for *differing site* conditions on contractors, engineers are drafting contract language means that includes, for example"

- *Excluding* the differing site conditions clause; and

- *Including* any number of contract clauses which purport to *limit the extent to which the contractor can rely upon the geotechnical information.*

What is important for contractors to know is that the *absence* of a differing site conditions clause does not preclude recovery if such conditions are encountered. It may simply mean that contractors must proceed under other contract clauses that may include, for example, the *extra work clause.* If the *extent* of the differing site conditions *fundamentally* changes the *scope* of the contract obligations, the contractor may also be entitled to recovery outside of the contract under the court-created concept of a *cardinal change.*

What is equally important for contractors to know is that courts throughout the country are *increasingly not enforcing contract disclaimers which purport to limit or disclaim a contractor's right to rely upon geotechnical information.* This makes common sense: if the engineer relied upon the information to *design* the project, the contractor should not be any less entitled to rely upon it when *bidding* the project. Because, of course, we know that only reason engineers provide geotechnical information is for the sole purpose of contractors *relying upon it* to bid the project. Having said this, the extent to which courts have addressed this and what they have held varies. Contractors should therefore have legal counsel evaluate what the law is in the jurisdictions in which they are doing work.

### ii. **End Result Defects**

Although engineers *design* the projects and contractors normally are only required to *construct what has been designed,* engineers are increasingly including contract language which purports to hold contractors financially responsible for *end result defects*, *regardless of whether they arise because the project was under-designed.* So, for example, public contracts often provide that a contractor is responsible for *all cracking in concrete* (e.g. wastewater tanks, highways) and *settlement of asphalt*. Of course, both of these problems can arise because the subgrade on which the structure was constructed *failed to provide the required support* (be it *inadequate* or *non-uniform).* This creates huge financial responsibility for anyone performing work *below grade.* Assuming contract language is included as enunciated above, even if the contractor meets all contract requirements, it may be liable if either the *work performed* fails (e.g. pipe operating on the basis of 'gravity flow' subsequently *settles*) and/or the *work performed by another on top* fails (e.g. the road settles).

As with the use of *disclaimers* noted above, courts throughout the country have offered varying views on the *enforceability* of contract language that purports to hold contractors liable for *end result defects* if they arise from a *defective design.* Some courts have held that such contract language is *unenforceable* regardless of how it is written. A limited number of courts have held that engineers can make contractors liable for even a *defective design* provided that contract language is *clear* and *bolded*. And even more courts have not yet addressed the issue.

Insofar as contractors typically lack the time, financial resources and skill to *back-check a design,* they are *not able* to properly evaluate the design. And, of course, since most contractors do not carry *errors and omissions liability insurance,* even if a contractor *was* capable of evaluating the design, it would *lack financial protection* if it *improperly performed* this task. Given these considerations, in order to protect themselves from the engineer's use of such

contract language, contractors must ensure that they *closely evaluate* any project bid on the basis of whether and to what extent the contractor may be liable for *end result defects.* In addition, contractors should also have legal counsel evaluate how courts have addressed this issue in the jurisdictions in which they are working.

And, regardless of whether the owner gets the contractor to pay for the remedial costs to fix a design defect, the net result is still unacceptable. The owner will typically suffer in having project completion delayed, and the end product is often literally and figuratively "patched together." Moreover, because owners typically do not seek payment from structural and/or geotechnical engineers when such design defects occur, engineers are insulated from responsibility. Without financial consequences, there is no incentive for engineers to remedy the underlying cause of the under-design, which is often an inadequate subgrade investigation.

## 4. CONCLUSION

In summary, be it utility or highway heavy projects, no one can deny that the cost of construction, its feasibility, the time required to complete it, and the impact of this work on other work later constructed atop it is directly tied to the *subgrade conditions.* In order to determine how the subgrade structure should be both designed and constructed, and at what cost in time and money, the subgrade must be properly evaluated by a qualified geotechnical engineer. The subgrade cannot, however, be properly evaluated unless the civil engineer either understands what a proper subgrade investigation requires or is willing to learn from a geotechnical engineer who does know. This presupposes that the geotechnical engineer does know what is required, which may not be the case. Based on my experience, geotechnical engineers have not been trained on the applicable guidelines. In addition, owners must be willing to pay what is required and accept that it is better to have increased financial liability for differing site conditions claims by undertaking an appropriate subgrade investigation.

Insofar as the requisite subgrade investigation is often not conducted, contractors need to educate themselves on how to protect themselves. The starting point for doing this is learning what the subgrade investigation should include. Contractors will then know what is missing, and consider the various options available to address this. Part of this could involve educating the owner, civil and geotechnical engineers on what the geotechnical investigation should include. The more practical option is to seek relevant subgrade information both at the bid phase and at the preconstruction meeting. Contractors also need to have legal counsel evaluate how courts in which they work have ruled on a variety of issues that affect differing site conditions claims, including the enforceability of 'site conditions contract disclaimers.'

If contractors work to both educate themselves and engineers on what a proper subgrade investigation should entail, the industry can develop 'best practices' which more accurately have contractors constructing the same job which they bid. That means projects can be constructed more closely in time and dollars to what is anticipated both at the design and bid phase. Such a result is as much in the interest of owners and engineers as well as contractors. Given that, there is the very real opportunity for the increased design and construction of subgrade projects on the basis of proper subgrade investigations.

[i] U.S. Department of Transportation Federal Highway Administration, "Checklist and Guidelines for Review of Geotechnical Reports and Preliminary Plans and Specifications" (2003), Pub. No. FHWA ED-88-053 at 6.
[ii] *Id.*
[iii] *Id.*
[iv] U.S. Department of Transportation, "Geotechnical Engineering Notebook Geotechnical Guideline No. 15, Geotechnical Differing Site Conditions" (1996) at 10.
[v] ASTM Standard D420-98 (2003), "Standard Guide to Site Characterization for Engineering and Design Purposes" at 3.
[vi] AASHTO MANUAL ON SUBSURFACE INVESTIGATIONS (1988) at 19.
[vii] U.S. Army Corps of Engineers Engineering and Design, "Geotechnical Investigations Engineer Manual" (2001), EM 1110-1-1804 at 3-1. *See also* Montana Department of Transportation, "Geotechnical Manual" (2008) at 8.2-1.
[viii] AASHTO MANUAL ON SUBSURFACE INVESTIGATIONS (1988) at 21.
[ix] ASTM Standard D420-98 (2003), "Standard Guide to Site Characterization for Engineering and Design Purposes" at ¶ 5. *See also* Montana Department of Transportation, "Geotechnical Manual" (2008) at 8.2-1 (The first listed "useful source of important site, geologic and historic information that should be considered . . . [is] prior subsurface investigation (historic data) at or near the project site.").
[x] AASHTO MANUAL ON SUBSURFACE INVESTIGATIONS (1988) at 28.
[xi] *See, e.g.*, Federal Energy Commission, "Geotechnical Investigations and Studies (Dams, Dam Sites or Appurtenant Structures)" (1991) at 5-5 ("Geological investigations should be conducted for new projects and reviewed for existing structures to determine . . . [t]he general geologic setting of the area at and *near the project.)* (emphasis added); Structures Committee of the Foundation Performance Association, Houston, Texas, "Recommended Practice for Geotechnical Explorations and Reports," Document #FPA-SC-04-0 (2001) at 5 (site exploration should include "the area surrounding the site for any anomalies"); Pennsylvania Department of Transportation, "Geotechnical Engineering Manual" (2014) at 1, 15 (review of available geotechnical information on both roadway and structure projects "must" include "geotechnical data from adjacent projects that may be useful"); ACEC/PA, "Geotechnical Engineering Manual Publication 293 (2015) at 2-10 ("If a project is on or near an existing alignment, previous subsurface information may be available.").
[xii] ASTM Standard D420-98 (2003), "Standard Guide to Site Characterization for Engineering and Design Purposes" at 4.1.
[xiii] U.S. Department of Transportation Federal Highway Administration, "Checklist and Guidelines for Review of Geotechnical Reports and Preliminary Plans and Specifications" (2003), Pub. No. FHWA ED-88-053 at 6.
[xiv] New York State Department of Transportation, NYSDOT GEOTECHNICAL DESIGN MANUAL (2013) at 4-29.
[xv] *See, e.g., Beacon Residential Community Assn. v. Skidmore, Owings & Merrill LLP*, 59 Cal.4th 563, 173 Cal. Rptr.3d 372, 327 P.3d 850 (2014).