

Instrumentation

John Dunicliff

Introduction

This is the fifteenth episode of GIN. The main content is a follow-up to the article "No More Judgment in Geotechnical Engineering: The Professional Legacy of ASTM?"

The ASTM Affair - A Reminder

The article about differences in views on the need for standards, with particular reference to the current plans of ASTM Subcommittee D18.23 to develop "standard guides and practices" for instrumentation, was in the December 1997 issue of *Geotechnical News*. The article included a questionnaire, which was repeated in the March 1998 issue.

The ASTM Affair - Responses to Questionnaire

I've divided responses into two categories: those from ASTM members and those from non-members.

How significant is a sampling of 40? If you think it is significant, you will acknowledge that there is a very substantial majority who vote for a change of direction by ASTM, even among ASTM members who voted.

Allen Marr and Gary Durham (Co-Chairmen of Subcommittee D18.23): please try to have open minds, and listen to the voice of the people.

The following are some comments included with the responses (see also Michael Byle's article on pages 28 and 29 of the March 1998 issue of *Geotechnical News*: he was one of the voters). Many people expressed the view that standards are essential for "testing and materials," but not for professional approaches, practices and techniques.

- I hope that ASTM will be able to see the incredible contradiction: "...a standard should never stand in the way...of professional judgment".
- While I am in agreement with standard test methods, I am definitely against practice standards as would

QUESTION	% VOTING YES (absentions not included)	
	10 ASTM MEMBERS	30 NON-MEMBERS
2. Are you a member of ASTM Subcommittee D18.23?	20	0
3. Do you think that our profession would benefit from having guide documents?	100	85
4. Is a document with "standard" in the title likely to stand in the way of engineering judgment?	80	100
5. If a document has the word "standard" in its title, do you think that a juror will pay attention to a caveat which permits use of engineering judgment?	40	0
6. Do you believe that publication of documents with "standard" in the title would encourage an inappropriate "cookbook" approach to specification writing, and discourage the thoughtful development of detailed custom designs prepared for the specific purposes and installation conditions of the project?	70	100
7. Do you believe that there are sufficient "aspects of instrumentation that are common to all installations" to merit standardization?	40	15
8. Do you believe that we should work towards removing "standard" from titles, and use a term such as "practice guide"?	80	100
9. If you answer "yes" to question 8, and if "we don't have the ability to alter ASTM's definition", do you believe that another professional organization, e.g. ASCE's Geo-Institute should develop guides?	70	95
10. Do you recommend that ASTM Subcommittee D1 8.23 limits its activities to "promote education, research, and exchange of information regarding field instrumentation for soil and rock?"	60	95

likely be published by ASTM. The interpretation of test data, boring log data, and site observations is what soil engineering is about. This cannot be adequately "standardized," since it is highly dependent on the site conditions, the experience of the technical personnel, including technicians, drillers, geologists, and engineers. There are no two sites or projects where all of these conditions will be similar enough to standardize, much less all sites or projects.

- I believe that installation of instrumentation varies from job to job substantially. The variation is so large that there would be no merit in "standardization." Clearly, each job will require engineering judgment, so much judgment that standards which may exist will be constantly relegated and continuously varied, to the point that they will not be standards.
- As a member of...[Geo-Institute and ASCE Committees]...I have a responsibility to fight the trivialization of engineering practice for current and future engineers. As ASTM leaves "testing and materials" to pursue these practice issues, it is increasingly isolating itself from the profession it purports to standardize.
- How will ASTM differentiate between an instrumentation standard for a deep excavation versus a tunnel versus an embankment dam versus a highway cut versus a groundwater monitoring program, etc., etc.? Will there be a different "standard" for each type of project? Will there be a different standard for different soil types? What a nightmare that will be. Guidelines YES, standards NO!
- I agree with you that standards should not be written for instrumentation installation, collecting data, nor data reduction and analyses. However, some kind of guideline is needed. Something as simple as the type of backfill to use around inclinometer casings can be confusing to engineers and geologists not familiar with instrumentation installation. If ASTM does establish a guideline, the

guideline should be very general, and refer to available literature...extensively. The ASTM guideline, if too detailed, would be nearly a thousand pages in length.

- It is extremely difficult to arrive at universally agreed-upon standards that wouldn't leave many good solid professionals saying that they were wrong for a lot of projects "at this point in time"... Then, if you look beyond this point in time, what looks good today could quickly be outdated by the advance of technology. And if you have a "standard" - especially one promulgated by ASTM - it might prove impossible keep it updated and not have it overrun by the march of events. I plump for something that uses words like "guide," "guideline" and the like rather than a "standard."
- I have been strongly encouraging the Geo-Institute and ASCE to take a position that anything touching on geotechnical or civil engineering professional practice that requires application of professional judgment should be written by ASCE, not ASTM... I believe such documents can be prepared but they certainly will not be a "cook book" step-by-step highly prescriptive document like ASTM procedures for a lab test... My principal disagreement with Allen Marr and Gary Durham, and with ASTM in general, centers on their statement "a well-written standard...benefits the profession as long as it...permits professional judgment and innovative technology..."

I didn't find any "quotable" comments in the responses that supported the subcommittee's plan to go ahead with instrumentation standards that include professional approaches, practices and techniques.

The ASTM Affair - Update on Plans of Subcommittee D18.23

Allen Marr, Co-Chairman of ASTM Subcommittee D18.23 on Field Instrumentation, also received copies of responses to the questionnaire. I sent him a draft of this episode of GIN, and asked

him to let me have an update on the subcommittee's plans to "develop standard guidelines and practices for the selection, use, installation, and recording of field instruments critical to the performance monitoring of soil, rock, and man-made masses." As you may remember from the December 1997 article in *Geotechnical News*, drafts of two standards have been prepared:

- Standard Test Method for Monitoring Ground Movement Using Probe-Type Inclinometers
- Standard Guide for Specifying Level of Accuracy for Field Instrumentation

The update follows:

I appreciate the opportunity to provide this update on the activities of ASTM Subcommittee D18.23 on Field Instrumentation. The subcommittee met during the January 1998 ASTM meetings. The results from balloting of a draft standard for Monitoring Movement Using Probe-Type Inclinometers were considered. No negative votes were received; however the comments of several voters were reviewed and incorporated into the draft by subcommittee action. Representatives of manufacturers and users were present at the meeting and participated in the review. The draft should show up as a new standard within the next year. This brings to completion over two years of work by the subcommittee on this single standard.

The draft Standard Guide for Specifying Level of Accuracy for Field Instrumentation has received considerable debate for and against. After three years of discussion, no consensus has developed. It is highly unlikely that this effort will result in a standard of any kind in the foreseeable future. That is how the consensus process works.

A draft of a standard guide for settlement plates is being balloted. A number of excellent comments have been incorporated into a revised document that will be voted on by the main subcommittee soon.

Subcommittee D18.23 has also organized a two day symposium on field instrumentation for the June 1998,

ASTM meetings in Atlanta. Based on the submitted abstracts, we expect a very informative symposium and a useful publication.

I would like to take this opportunity to add a few personal comments on the standards debate. John Dunncliff continues to try to position me as a standard carrier for the official ASTM position on the standards debate. This is not the case at all. I am only one of many members of ASTM subcommittees who volunteer their time to try to advance our materials testing practice. I spend about three weeks each year on ASTM technical activities. I am personally opposed to efforts by some in ASTM to establish prescriptive standards for analysis and design. I am a vocal proponent of getting language in every appropriate ASTM standard that permits and encourages the exercise of professional discretion and opinion.

I continue to believe that our profession will benefit from consensus docu-

ments on the installation and use of instrumentation. Thirty-six of the 40 responders to John's questionnaire agree. The discussion provoked by this standards debate has certainly raised the interest level in the role of standards. I hope that interest translates to more involvement in the standards development process. Some of the best standards come from the situations with the most participation and discussion.

After receiving this update I discussed its contents with Allen Marr, and we concluded the following:

- We agree that caveat language should be included in the inclinometer document to make it clear that its purpose is not to replace sound engineering judgment. Allen will work towards gaining ASTM's acceptance of such language.
- We agree that the title should not include the words "Test Method."

Allen will work towards gaining ASTM's acceptance of a title that includes the words "Standard Guide."

- We agree that, at this time, the Subcommittee must choose between publishing the document with a conventional ASTM title (e.g. "Standard Guide"), or not publishing at all.
- If the word "standard" is causing confusion, Allen will work towards trying to clear the confusion.
- The published inclinometer document will be essentially the same as the January 1997 draft. Consideration will be given by the subcommittee to the many comments on that draft made by Gordon Green, Erik Mikkelsen and myself. (*Geotechnical News, December 1997*). [I had made a list of 65 issues which, in my view, should be addressed in a guide document, and made the following summary:



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- adequate coverage 26 issues
- some coverage, but insufficient 9 issues
- no coverage 30 issues]

A revised document will then be published within about one year.

- I had not intended to "position Allen Marr as a standard carrier for the official ASTM position on the standards debate." My expressed views on Allen's activities were intended to be limited to instrumentation documents.
- Our remaining difference relates to Allen's optimism, my pessimism, about the success of the caveat in compensating for the word "standard" in the title. Let's wait and see what specifiers, instrumentation practitioners, lawyers, witnesses and jurors will do.

I am disappointed (I could use a much stronger word) that the subcommittee is ignoring "the voice of the people", and going ahead with these standards. Note that Allen Marr uses the votes on Ques-

tion 3 to support the subcommittee's actions and says, "I continue to believe that our profession will benefit from consensus documents...", yet the subcommittee is going ahead with something quite different. He also indicates that he volunteers his time "to try to advance our **materials testing practice**" (emphasis added by me) - none of us are opposing standards on materials testing. I will not be able to go to the ASTM Symposium in Atlanta on "Field Instrumentation of Soil and rock", June 18-19, 1998, and try to convey 'my' side of this issue - is there anybody 'out there' who will do this?

The ASTM Affair - The Broader Issue

Published articles on the broader issue, the differences between views of ASTM and APJGP (Advocates for Professional Judgment in Geotechnical Practice) were listed on page 41 of *Geotechnical News, December 1997*. An update

"ASFE Battles on ASTM Front" is on pages 22-25, of *Geotechnical News, March 1998*.

I recently read a discussion on this same subject in the April 1997 issue of *The Professional Geologist*. Believing the discussion to be particularly clear, unemotional and helpful, I've arranged for it to be reprinted in the magazine, on pages 43 to 46.

One of the co-chairmen of Subcommittee D18.23 has, based on what he has read in this magazine, withdrawn his subscription, claiming "unprofessional, not particularly constructive, and bias."

A Yet Broader Issue

Demetrious Koutsoftas' article "Standards, Judgment, Litigation, and Other Issues of the Geotechnical Profession" (page 47) was originally a response to the *Geotechnical News* December 1997 article on the ASTM affair, and was submitted to me as editor of GIN. After substantial reworking, we realized that



it didn't fit under the GIN heading, so moved it elsewhere. Despite Koutsoftas' conclusion that "the current debate about standards is, in my opinion, mis-directed," I urge readers to keep focusing on that debate. Yes, there **are** yet broader issues, so let's take them one at a time and try to deal with them. Let's not belittle one just because there are others.

Instrumentation Book

In the last issue of GIN I reported that John Wiley & Sons, the publisher of *Geotechnical Instrumentation for Monitoring Field Performance* (the Red Book), had decided not to reprint the book after the present stock is sold. There has now been a change of mind and Wiley intends to reprint.

Educating Bill Gates

Have you used the spell-check option in MS Word when that wiggly line appears under 'borehole'? Should we tell him?

Piezometer Seals - A Reminder

I recently came across a recommendation about piezometer seals, which concerns me. In their manual on vibrating wire piezometers, a "leading manufacturer" recommends a seal consisting of

alternate layers of bentonite and sand, tamped in place. This procedure was used by Arthur Casagrande during the construction of Logan Airport in Boston in the 1940s, when the "bentonite" consisted of bentonite powder rolled into sticky balls. The sand was needed to prevent the bentonite from sticking to and being lifted up by the tamping hammer.

Long ago those balls were superseded by compressed bentonite pellets (what a relief- I'd spent many hours in my twenties rolling those sticky things!), which have now been superseded by granular bentonite. The pellets frequently bridge across a borehole before reaching their destination, whereas pit-run granular bentonite takes longer to get sticky, and when poured slowly will reach its destination much more readily (more major personal relief, having bridged many boreholes!). Commercial sources of granular bentonite include:

- **Enviroplug Medium**, - Wyo-Ben, Inc., P.O. Box 1979, Billings, MT 59103 Tel: (800) 548-7055
- **Holeplug**, 3/8 in. Size - Baroid Drilling Fluids, Inc., P.O. Box 1675, Houston, TX 77251 Tel: (713) 987-5067

They should **not** be tamped. Use a "sounding hammer" and follow the rule: "make sure that the bentonite is where it should be, and leave it alone" (see Red Book Section 9.17.8). For the grout above the bentonite seal, I have stopped using bentonite/cement mixes (too difficult to mix and control) and prefer to use Benseal/EZ-Mud Slurry, from Baroid, as above. Use 135 lbs of EZ-Mud per 100 gallons of water, not 150 lbs as in the Baroid product information. This sets up as a very soft clay.

Closure

As indicated in the last episode of GIN, I will be moving to England in June of this year. If you have contributions for GIN, please use the following contact information:

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Temporary Fax: +44-118-9394922

When I have permanent contact information, I'll leave an appropriate recorded message on my Massachusetts line: (508) 655-1775.
Bottoms up! (England)

STANDARDS

Standards— The Final Word



The debate surrounding the subject of "standards" has occupied significant amounts of column inches within recent issues of Geotechnical News. Thus, we are including, in this issue, a section devoted exclusively to the topic. We are reprinting, with permission, three articles carried in the Executive Director's Column of "The Professional Geologist", a publication of the American Institute of Professional Geologists, April, 1997, Volume 34, Number 4. The articles are by William V. Knight, CPG-0154; Robert J. Morgan, ASTM Director, Technical Committee Operations and James A. Thomas, ASTM President; John P. Bachner, ASFE Executive Vice President.

We have included also an article by Demetrious Koutsoftas, whose in-depth article deals with this matter. We have received a letter from Terry S. Hawke, P.E. which is reprinted in its entirety, and finally, we have a closing comment from John Gadsby, publisher, and Lynn Pugh, managing editor of Geotechnical News.

Standards

William V. Knight

Formal "standards" of practice are new to most geologists. We know about codes of ethics. Those of us who spent our lives in the petroleum industry are aware of "API" (American Petroleum Institute) "standards," or "specifications." The relatively few of us in the construction industry are familiar with various building codes. These are only three of the more prominent of the many systems of "standards" increasingly encountered by geologists and others in their professional work. Most of us have seen occasional references to ASTM (American Society for Testing and Materials) "standards" for testing of materials, etc., and we have a vague idea of what they are and represent. But, these have usually been peripheral to our professional practice and were generally regarded as "something engineers worry about."

ASTM "standards" have been around for about 100 years. They often are included in contracts for products or services and in regulations of government agencies. Expert witnesses fre-

quently encounter "ASTM standards" when testifying in trials and hearings. By and large, they are very highly regarded and have been the "standard" of quality in many industries for many years. There are thousands of ASTM "standards" on a multitude of subjects.

One thing that should be clarified here is the ASTM parlance. Unqualified use of the word "standard" has led to considerable confusion. For example, the heading of a "standard" document may read "Standard Z.000, Standard Guide For . . ." Thus, it may appear as either a noun (Standard Z.000) or an adjective (Standard Guide), or both, in the same title. Unfortunately, the distinction is often lost. As frequently used in ASTM documents, ". . . a 'Standard' is a document that has been developed and established within the consensus principles of the Society and that meets the approval requirements of ASTM procedures and regulations.

A 'Guide' is a compendium of information or a series of options that does not recommend a specific course of action. A Guide increases the awareness of information and approaches in a given subject area. A 'Practice', in contrast, is a definitive set of instructions for performing one or more specific operations that does not produce a test result." (See Form and Style for ASTM Standards, 10th ed. (1996).)

Frequently, the terms "Standard Guide" and "Standard Practice" are arbitrarily shortened to "Standard" in conversations or in non-ASTM documents. Unfortunately, in legal parlance, "standard" can have one of several meanings and it is sometimes difficult to determine which one applies in a particular context. (See Black's Law Dictionary, 5th ed. (1979).)

Geology, like other sciences, has traditionally been thought of by most of its practitioners as an investigative, interpretive science, unconfined by arbitrary limits, by definitive sets of instructions

or by "recipes" dictating how things are to be done. The end result or interpretation has been the important thing, and the design and justification of how it was reached has been left largely to the ingenuity and professional judgement of the individual practitioner.

Discipline has been primarily by the peer review process rather than by adherence to published "standards." Specific tests conducted in the course of an investigation may have utilized widely recognized and accepted methods or published "standards," but the over-all conduct of the investigation has usually been within the professional discretion of the investigator.

Of course, some companies and agencies have had their own ways of doing things that employees have been expected to follow, but new ideas and innovation commonly have been prized. In this context, public health and safety have seldom been direct issues and the users of the resulting reports have usually understood the terms used and the conclusions drawn (whether they agreed with them or not). Thus, geologists are often shocked and a bit irritated when they are required to adhere to "all applicable ASTM standards."

Enter the environmental movement and geologists' growing involvement in it, along with their increasing interface with the legal and engineering, or "design," professions. Environmental Impact Assessments and Statements (EIAs and EISs) appeared a quarter century ago. These followed rather broadly defined procedures spelled out in the statutes and regulations governing them. Water quality became a serious concern, and "standards" for this began to appear. Then, along came Environmental Site Assessments (ESAs).

Many organizations and individuals have attempted to write "guidelines," "policies," "standards," or whatever, for conducting them. While there has been a fair degree of similarity between these

attempts, none has been totally accepted by all of either those who produce them or those who use them.

For the benefit of the scientifically unsophisticated users of these documents, there was a need to bring some level of order into this perceived chaos. So, ASTM committees began writing "standard guides" for conducting both Phase I and Phase II ESAs and for planning, writing and reviewing hydrologic and geologic reports.

The "standards" for Phase I ESAs have been published. Those for Phase II ESAs are in process. Those for the reports were "shelved", but there is a movement to revive them. In addition, for the past several years, ASTM committees have been writing "standards"

for ground water investigations. Committee members for this effort are primarily geologists, hydrogeologists and hydrologists. AIPG Members are involved in many of these committees, but most of our Members are unfamiliar with them, what they are trying to do, and how they go about it. It behooves us to learn.

Recently, objections to these "standards" have been raised.

Leading the attack on these particular "standards," while endorsing and praising the general concept of "ASTM standards," has been ASFE (the Association of Engineering Firms Practicing in the Geosciences). AIPG has been watching this controversy develop, but has rarely taken an active role in it,

though a few Members have expressed support on both sides of the issue.

To try to reach some agreement, a parley was convened recently by the American Council of Independent Laboratories. Several organizations, including AIPG, were invited to send representatives. The principal spokesmen for the two points of view were James Thomas, President of ASTM, and John Bachner, Executive Vice President of ASFE. Each of these gentlemen kindly consented to prepare for TPG a summation of the statements which they presented at the parley. These follow. We hope that their efforts will shed some light on what has become a confusing and difficult problem for an increasing number of our Members.

Standards: A Tool for Professional Judgment

Robert J. Morgan - ASTM Director, Technical Committee Operations
James A. Thomas - ASTM President

Since 1898, ASTM has provided an opportunity for professionals to exchange ideas and express strong convictions within an organized system. Diversity of opinions has shaped the quality and performance of products and services that affect our lives. This latest opportunity is no exception.

The consensus process that brings together individuals with different opinions and experiences is the reason that ASTM standards enjoy world wide recognition. ASTM has provided a management system enabling affected stakeholders to have an equal say in the development of standards for nearly 100 years. ASTM has 35,000 members from 100 countries working in 132 technical committees developing standards that have marketplace acceptance because of its process.

This process allows the leading experts in their respective professions to exchange experiences, ideas and reach a consensus on needed information for their industries. Many industries and

professions have been able to improve performance, quality and safety by partnering with ASTM.

On February 12, 1997, representatives from a group of very well respected professional organizations met with ASTM to express their concerns over some of ASTM's environmental committee activities.

judgment."

With regard to the first concern, it was suggested that the word "Standard" in front of Guide or Practice in the title of ASTM documents is causing confusion, particularly in the courtroom because different people have different perceptions of the meaning of the word "standard".

... technical committees are exploring caveat language ...
 which will make it clear that the standards are not a replacement
 for professional judgement. ...

Specific concerns focused on the activities of Committee D18 on Soil and Rock and Committee E50 on Environmental Assessment. The subject of contention was twofold. First, is a concern over the use of the word "Standard" in the title of Practices and Guides and second is the prescriptive nature of these documents and how that stifles innovation and infringes on "professional

ASTM's response has been that the word "standard" *in the title of a document is* used as an adjective to describe that the consensus process has been followed to develop the document. While the definition may be different from Webster's, in ASTM, for nearly 100 years, the word standard in the title simply describes a consensus process.

For those that stop reading an ASTM

standard after the title, this can be confusing. However, ASTM Standard Practices and Guides are required to have scopes and significance and use sections, in these required sections, found within the body of the document, one can find a detailed description of its recommended use and limitations.

The word standard is not unique to ASTM. Documents being developed in the American Society for Civil Engineering (ASCE) for example covering engineering and design practice have the word "standard" in the title. If any one of the nearly 400 standards organizations in the United States seeking accreditation by the American National Standards Institute (ANSI), passes a guide or practice through their process, the result is an American National Standard. Those organizations seeking international approval from the International Standards Organization (ISO), end up with an International Standard. Public Law 104-113, signed into law in March 1996, requires federal agencies to use the private sector to develop standards for their regulatory needs. So the word "standard" is not exclusively used by ASTM.

The concerns raised by these professional organizations have not fallen on deaf ears. The technical committees are exploring caveat language to be incorporated into the scope of ASTM Practices and Guides which will make it clear that the standards are not a replacement for professional judgment.

The second concern expressed was about the prescriptive nature of ASTM standards. The claim is that the standards infringe on professional judgment. This claim has stimulated the interest of the professionals who have dedicated much time and resources in developing the standards. David Nielsen, Certified Professional Geologist and Professional Hydrogeologist and former chairman of ASTM Subcommittee D18.21 on Ground Water and Vadose Zone Investigations, speaking for many members states, "I firmly believe, as do many of my colleagues involved in ASTM Technical Committees, that the purpose of ASTM standards is not to replace sound professional judgment. These standards serve to assist practitioners in exercising their professional judgment by providing useful information upon which they can make decisions."

Nielsen and nearly 500 other professionals have spent the last decade volunteering their time to participate in the process and develop these standards. "What other options exist? We could all sit back and, as happened in the environmental sciences in the early 1980's, wait for bureaucrats with little or no experience in the field to prescribe outdated or unproven practices for us. I hope we can all agree that voluntary consensus standards, which represent input from experienced peers and colleagues with very *diverse* perspectives and represent true state-of-the-art-practice, are preferable to nonconsensus practices foisted on us in such a manner."

This discussion always goes back to the process. This process welcomes opposing points of view. It is because of that that the end result is a technically credible document with marketplace acceptance. Nielsen sums it up well, "If you choose not to participate in the process, if you lack the necessary concern to become actively involved in helping determine the direction in which your field is headed from a professional practice standpoint - you *have only yourself to criticize.*"

ASFE: Professional Firms Practicing in the Geosciences

John P. Bachner, Executive Vice President

ASFE: Professional Firms Practicing in the Geosciences has sounded the alarm relative to prescriptive professional practice standards developed and being developed by the American Society for Testing and Materials (ASTM).

ASFE leaders and others believe that, without safeguards, these standards will cause serious problems.

Why the uproar? Consider this scenario:

A client engages a consultant to evaluate the environmental conditions of a property the client plans to purchase. The consultant and client develop a project-specific scope of service. The consultant explains that even thorough studies are not fail-safe; risks remain. The consultant later submits a report of findings. Based on these conclusions, the client purchases the property.

A year later, while redeveloping the property, unexpected contamination is

found. It will cost more than \$1 million to eliminate it. In response, the client's attorney reviews the project documentation. He reports, "The consultant didn't follow ASTM standards." He notes the report's title was 20 words long. The ASTM standard says the title should be short.

"You mean too many words in a title makes a consultant negligent?" the client asks, incredulous. "Not really," the lawyer answers. "But when you add that violation to chapters in the wrong place, failure to perform certain tasks that probably didn't apply, and such, the jury will probably see things our way." The lawyer explains that environmental professionals usually base their defense on technicalities that juries don't understand well. "The jury will be terribly confused, and our arguments will be easier to understand."

After enduring months of the time-consuming, demoralizing, and costly "hoops" of our justice system, the weary consultant finally gets a day in court. He makes these points: ASTM standard practices and standard guides are suggestions professionals can consider. No ASTM standards are mandatory, (unless they are required by code, statute, regulation, or contract) nor can they ever be project-and client-specific. They do not define the applicable standard of care which professionals are required to uphold, and which the consultant followed.

given this scenario, clients will start to receive

(and be required to pay for) services they neither need nor want

... because consultants would fear to do otherwise...

Plaintiffs counsel responds, "Ladies and gentlemen of the jury, I imagine you're confused about all of this, so consider these facts."

"ASTM is the most respected standard-setting organization in the world. More than 1,000 experts developed each of the ten ASTM standards that applied to this project, none of which the defendant complied with in full. He says total compliance was not required. But our expert, the eminent Dr. Charlatan, noted

that ignoring ASTM is 'arrogant and unprofessional.' And because of the defendant's arrogance and lack of professionalism, my client suffered a loss of \$5 million. Please tell the defendant that professionals cannot thumb their nose at ASTM."

The jury obliges. As word of this spreads, others yield their professional independence and judgement to lower their risk. Even though an ASTM standard does not apply fully to a specific client and project; even though adherence prevents even modest innovation to lower costs and/or improve results; even though adherence requires hours of mind-numbing compliance verification and mountains of nonproductive documentary paperwork; even though adherence will raise costs while denying cost-effective choice to "consumers," the standard is followed.

This can happen because ASTM is developing more than 100 "standards" that specify the tasks professionals should perform to render a service; tasks that, heretofore, have been matters of professional judgement. Professionals especially worry that ASTM's prescriptive "standards" will deny them the ability to innovate. The standard of care professionals must observe is a moving target. It is the way a given activity is ordinarily performed at any given time by most area practitioners. Ordinary care, the law says, is all that professionals must provide. So long as they do,

minor errors or omissions are not considered negligence. Only when they fail to abide by the standard of care, and consequently injure or damage someone, are they negligent. This gives professionals the leeway they need to develop new and better techniques. That ability will be lost if practitioners must follow an ASTM "recipe." Most geotechnical reports would probably have to adhere to the ASTM standard report format, even if it is inferior to

what they used to follow. And what happens if you omit a chapter indicated in the standard table of contents even though it was irrelevant. A jury might be convinced that your omission was negligence.

Given this scenario, clients will start to receive (and be required to pay for) services they neither need nor want, because consultants would fear to do otherwise.

ASFE has some simple suggestions.

1. Do not label as "standards" documents intended for general guidance or which set forth specific suggested procedures ("standard practices") such as ASTM E 1527 on Phase I Environmental Site Assessments. Instead, call them "Consensus Guides" or something similar.
2. Include a clearly written, easily understood, prominently located user advisory in each of the two types of documents above, advising against misuse and also advising about proper application.

These suggestions are now being seriously considered by ASTM. ASFE hopes that work on a user advisory/caveat will move forward soon. Change is needed, ASFE believes, because professionals must have latitude to exercise judgement to advance professional practice. If professionals are reduced to implementers of others' procedures, they become little more than technicians.

While following a prescriptive professional practice may improve the output of those who practice in the "lower tier," as ASTM contends, the "improvement" will cost too much if it forces those who lead to become followers. In short, being forced to follow cookbook approaches creates a recipe for disaster. ASFE wants only to make the recipes optional, by modifying ASTM nomenclature and adding appropriate warnings.

The previous articles by William V. Knight, Robert J. Morgan and James A. Thomas, and John P. Bachner were reprinted from the Professional Geologist, April 1997, pages 20-23 with their permission and with the permission of the individual authors.

Standards, Judgment, Litigation, and Other Issues of the Geotechnical Profession

Demetrious Koutsoftas

Introduction

This article was prompted by the public debate that has been taking place recently regarding standards. Most notable among them are the following published articles:

- The article that appeared in the June 1997 issue of *Geotechnical News* entitled, "Concerns of Environmental and Geotechnical Professionals Regarding Development of Prescriptive Professional Practice Standards,"
- The article by David Thompson that appeared in *Civil Engineering Magazine* December 1997 issues entitled: ASTM "A Good Thing Going Astray,"
- The article by John Dunncliff that appeared in the December 1997 issue of *Geotechnical News*, entitled: "No More Judgment in geotechnical Engineering: The Professional Legacy of ASTM?"
- Two articles that appeared in the November 3, 1997 issue of *Engineering News Record*, in the Viewpoint Section; one by William F. Fanning and another by Michael Strogoff, regarding Design Fees.
- The article by Ralph B. Peck, entitled: "Our Expanding Geo Industry: Triumphs and Perils" that appeared in the December 1997 issue of *Geotechnical News*.
- Article entitled, "ASFE Battles on ASTM Front" that appeared in the March 1998 issue of *Geotechnical News*.

It is obvious that many in our profession are concerned about the issue of Standards and the rather recent attempts of ASTM to develop documents that are technically prescriptive and appear to be practice standards. There is a growing

fear that such documents could provide a basis for increased litigation against geotechnical professionals. ASFE and 12 other organizations formed a group called Advocates for Professional Judgment in Geoprofessional Practice (APJGP), whose mission is to oppose the development of standards by ASTM. Thompson (1997) argues that the development of standards by ASTM would replace professional judgment, innovative thinking and sound logic with cookbook approaches.

The debate about standards is very important to our profession. As I listened to the debate I developed a sense that our profession is in serious trouble. The focus on ASTM's efforts to develop standards and the fears that these standards will further erode the quality of geotechnical engineering may be valid, but in my view the geotechnical engineering profession has gotten into trouble long before ASTM began to develop standards of practice. To focus only on ASTM is to miss the opportunity to address the broader issues that are causing problems to the geotechnical profession. My concern is that perhaps people are looking for scapegoats and quick fixes rather than understanding the root of our problems and taking the necessary steps to restore quality into the practice of geotechnical engineering.

The purpose of this article is to address some of the broader issues that underlie the problems related to standards.

The Need for Standards

There is no question that there can not be high quality without high standards. I found myself wondering the following: What do we really mean when we refer to the standards of our profession? Does this profession have standards, or are we a profession without standards?

In many occasions, reference is made to the standard of care, which Thompson (1997) defines as that degree of care and skill ordinarily applied by peers working in the same community at the same time. But who decides as to what the standard of care is? Every expert can come up with his/her own assessment, and as is often the case, opposing experts have different views as to what the standard of care is. This is a very important issue, in litigation.

In any one location, at any given time, standards among geotechnical practitioners vary widely. The problem is that geotechnical engineers compete against each other under circumstances where, more often than not, our clients use price as the only criterion for selecting their geotechnical consultants. Whether we like it or not, standards affect price and generally when owners select the low price bid, they do not appreciate or are not willing to acknowledge that they in effect may be settling for a lower standard.

In a situation where consultants are selected on the basis of price, and where the competitive pressures continue to increase, there is no real mechanism of reversing the trend for deterioration of standards. Many professionals find themselves under pressure to do less and less in their site investigations, their engineering, and their monitoring of construction. Furthermore, there is a continually increasing pressure to complete everything faster and faster at lower and lower costs. Many geotechnical engineers, especially senior consultants, operate in the manner described by Peck (1973) for the overly busy consultant. One wonders whether, under these circumstances, there should be some minimum standards to stop the downward spiral of deteriorating standards.

In most professional organizations, mature senior professionals are charged

with the responsibility to set the standards and the example that junior staff must follow. However, it has become increasingly difficult to maintain high standards because the pressure to win work and keep staff busy is continuously increasing. It is indeed unfortunate, but it appears that without clearly defined minimum standards, the fear of litigation provides the only deterrent against continued deterioration of standards.

Is this where we want this profession to end? The root of the problem lies in the oversupply of geotechnical engineers that creates unreasonable commercial pressures that lead to deterioration of standards, both at the University level and in practice.

The only way to protect this profession from the many perils that it faces is to raise standards, beginning at the University level. ASFE and the other 12 members of APJGP must put all of their efforts into exerting pressure on Universities not only to maintain high standards, but to continually raise their standards. Otherwise the problems of litigation and cook-book engineering will continue to get worse.

Judgment

There is great emphasis in our profession on judgment and justifiably so. It is doubtful whether there is another profession that deals with the levels of uncertainty that face geotechnical engineers, or involves such a high degree of empiricism in developing design solutions. Thompson (1997) argues that standards would make professional judgment risky, would stifle innovation, and would promote cook-book solutions. ASFE and twelve other organizations joined forces to advocate judgment over standards. Judgment is key to everything geotechnical engineers do.

But I am concerned that the argument of judgment over standards has become an excuse for allowing everyone to decide what level of standards should guide their practice. Perhaps it has become an excuse for lowering standards and for promoting cook-book solutions rather than avoiding them. I am not an advocate of standards in the spirit that

ASTM is promoting them. But I believe strongly that high standards are essential in our practice, and I am further concerned that ASFE and APJGP are turning a blind eye to the present state of deteriorating standards.

I am particularly concerned that Peck's (1997) views about judgment might have been misinterpreted or inappropriately used to promote the wrong argument about standards.

Peck argues that if a standard is followed to perform a geotechnical investigation, **a defect or a field condition potentially fatal to the performance of the project may exist that escapes the standard investigation; experience leading to judgment is the best defense against the consequences of such a possibilitythat is, judgment is an essential ingredient in geo-engineering, and it cannot be standardized.** All that is true, and very wise advice. However, this aspect of our profession was far more important 40 or 50 years ago, when our profession was in its infancy, than in today's climate where in major metropolitan areas there is a great deal of experience, many precedents and widespread publications to guide the engineer. Cases that may involve **a defect or condition fatal to the performance of a project** are important but represent only one of the many risks that geotechnical engineers face all the time.

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Why is this risk more important than other risks that can also be potentially fatal to a project? In my view, geotechnical engineers take far more serious risks than the risk of not detecting a defect in foundation conditions during their exploration program. Judgment is vital to our profession, but geotechnical engineers need to exercise good judgment in their selection of assignments, the conditions under which they compete against each other, and how to manage their risks and liability. Obviously,

judgment is a very subjective thing, and when people operate under pressure, exercising good judgment becomes very difficult. I wonder whether minimum standards can provide the safety net when judgment becomes clouded under pressure.

The underlying assumption in Peck's argument is that a standard somehow prevents the engineer from doing a thorough investigation, or using his judgment to augment the standard requirements. In fact, the opposite is true. Those who are likely to follow blindly a standard, are also those who are likely to do far less in investigating the ground conditions in the absence of a standard; and those are the ones who are at greatest risk to suffer from the pitfalls pointed out by Peck.

The argument made by Peck also assumes that everyone involved in this profession (at least in a position of responsibility) has good judgment. This is far from being true. In today's highly competitive and highly specialized environment, there are less and less opportunities for the inexperienced engineer to be exposed to projects that provide **experience leading to judgment.** Many inexperienced engineers are forced to start their own business because it is more and more difficult to find good jobs and opportunities for career growth. In today's highly competitive market, the responsibilities for

design and construction monitoring are often divided for a variety of reasons. This leads to the loss of opportunity for design engineers to experience firsthand how well their design worked, or to participate actively in design changes made in the field during construction.

Thus, the opportunities for development of experience leading to judgment are curtailed significantly. These problems are not new. Terzaghi (1958) had addressed these problems in his classic paper, **Consultants, Clients, and Con-**

tractors, and argued for an integrated approach to geotechnical engineering. Peck (1973) reiterated many of the same concerns. Lambe's (1972) Integrated Civil Engineering Project (ICEP) concept was developed in recognition of the fact that our profession relies heavily on judgment, and that judgment comes from experiencing the full cycle of engineering: from conceptual design, to detailed design, to development of plans and specifications, and participation in construction monitoring.

But this idealized process rarely materializes in practice and development of **judgment based on real experience** is not as widespread as it may be assumed. Peck (1980), in his classic paper, *Where Has All the Judgment Gone?* sends a powerful message about the value of judgment in earth dam design and laments the emphasis and reliance placed on theoretical analyses in lieu of good judgment. If judgment is not as well developed as many of us would like to think it is, then how can we provide a means to shore up the deficiencies that come from inadequate development of judgment based on experience?

Peck's (1997) views were also directed towards the broader issues facing our profession, but those views apparently didn't receive the same attention as standards. In his lecture, Peck lamented the state of geotechnical engineering education. In my view, the failure of many Universities to teach the basics about site investigation, soil behavior, and how the results of careful tests are applied to solve practical problems, is one of the major reasons why there are so many failures and lawsuits.

Peck further points out to the economic pressures, of how the most qualified practitioners are forced to move upwards engaging in management rather than practicing their craft. These issues are far more important to the well-being of our profession, than the risk that standards could be abused.

Litigation

It seems to me that in the present debate the primary objection against standards is driven by the concerns of APJGP re-

garding liability of their members that would result from abuse of standards, and the concern that fear of litigation will stifle innovation in practice.

The argument against standards is that they may be mischaracterized in court. That is true, but let's consider the following: engineers who understand the standards and who use their **good judgment** to deviate from a standard are far less likely to find themselves in a position of being sued for negligence than others who follow no standard.

If one documents in an appropriate manner why in his/her judgment, he/she should deviate from the standard, it is unlikely that this person/organization will get in trouble in the first place, and even less likely that they will be judged negligent for not following a standard.

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The presumption is that everyone, at some time or another, may be tempted to cut corners to gain a competitive advantage. Thus, everyone would be at risk. We should not be so willing to accept this situation.

From my own experience from a few projects that involved litigation, my general observations regarding litigation are as follows:

1. In the majority of cases, the geotechnical exploration, laboratory testing, and field monitoring during construction were less than comprehensive, and sometimes simply inadequate.
2. Proposals and contract documents are often unclear about the detailed scope of services, and the allocation of risks among the various parties. Geotechnical engineers end up being stuck with more risk than they bargained for, because they did not make the effort to clarify the limits of their responsibilities, or in their desire to win the job, they overlooked the risks that they were assuming.
3. In practically every case there was poor, and sometimes no orderly

documentation of the basis for any of the assumptions or judgments that formed the basis for the design recommendations. Failure to document the thought process and rationale for a decision is often accompanied by clouded or confused assessment of the practical aspects of the problem, or failure to appreciate the real issues and risks that the project involves. Often the risks were not clearly communicated to the owner or other responsible parties, even when the geotechnical engineer had understood the risks. Peck (1973) had discussed those and other relevant issues in great detail. Today, 25 years later, it appears that things have gotten worse, not better. There is an urgent need to heed Peck's

advice and to address the human aspects that affect our profession.

4. Contrary to Terzaghi's (1958) advice, many geotechnical engineers take assignments that involve little or no participation by them during construction, to determine whether their recommendations are followed. Many times geotechnical engineers are blamed for the mistakes of others, especially when other designers do not have the financial resources to pay for their errors. Geotechnical engineers often fall victims of the deep pocket syndrome. Higher standards, careful selection of assignments, and fuller participation by the geotechnical engineer from planning to construction can reduce these problems.
5. Cases where a thorough investigation was performed and the project failed are rare.

It is my view that ASFE and APJGP will do much more good, discouraging cut-throat competition, using their resources to educate their members about the long-term risks, and exerting their influence to raise the standards of higher education and the standards of the pro-

profession, if they want to reduce the problems with failures and litigation. Unless we address these issues, problems with litigation will get worse, not better.

Compensation

The articles by Fanning (1997) and Strogoff (1997) that appeared in ENR are very timely. They address the problems that result from basing our design fees on time and expense. The advancements in our profession that come from new computational techniques that allow much greater volume of work to be accomplished in a shorter period of time than ever before, or the benefits of many years of accumulated experience by senior practitioners have not resulted in higher profits for geotechnical engineers. On the contrary, in today's market, people tend to do less and less of site investigation, laboratory testing, and engineering, relying more and more on: available information; our well-developed understanding of subsurface conditions and the behavior of major soil types, especially in highly developed metropolitan areas; and our experience with the performance of previously constructed structures.

The geotechnical engineers do not benefit from the accumulated wisdom that develops from many years of hard work. They take on increasing risks and liability, for lower profits. ASFE and APJGP can do something about this situation. In today's market bright young engineers with M.S. or Ph.D.s earn salaries that can barely afford them a reasonable living. Under these conditions it is difficult for them to save for the future needs of their families. This is a very very serious problem, because more and more of our bright, hard-working and energetic young engineers are turned away from geotechnical engineering. Many geotechnical engineers work between 50 and 70 hours per week for a salary based on a 40-hour work week. Geotechnical engineers do not benefit from their hard work, and neither do their employers.

We have an incredible oversupply of geotechnical engineers (at least on the West Coast of the United States) that needs to be addressed starting

from the University admissions requirements. We have an oversupply of professors teaching geotechnical engineering, and an oversupply of Universities competing for graduate students. That is the core of the problem, not standards. ASTM's attempt to standardize the practice of geotechnical engineering is a symptom, not the cause of our problems.

Conclusions

The current debate about standards is in my opinion misdirected. Our energies should be focused on improving standards, both at the University level and at the practice level. ASFE should focus most of its energies on educating its members to do the following:

- avoid unfair and unreasonable bidding situations,
- avoid accepting unreasonable terms and conditions, which result in higher risks for the geotechnical engineer without commensurate financial rewards,
- enforce a rigid quality control program that requires thorough peer reviews for each project, and to pass the costs for such reviews to the project owners,
- encourage frequent inter-company peer reviews for selected high-risk projects to facilitate better inter-company communications, to help raise standards and to help eliminate cut-throat competition,
- involve experienced, retired practitioners to mentor young engineers and to encourage them to raise standards,
- develop University-industry alliances, and encourage Universities to utilize seasoned senior geotechnical experts to teach graduate courses, to guide young faculty staff, and to lobby University administrators to focus on quality and raising standards rather than the numbers of their graduates,
- bring pressure on companies to develop meaningful professional development programs, and rewarding career paths for practicing engineers, and reduce the current over-emphasis on management,

- develop new approaches for billing for our services so that geotechnical engineers can get their deserved share of compensation for their contributions, for the high risks and liability they undertake, and for their hard work.

Finally, geotechnical engineers need to exercise good judgment in their selection of assignments and in managing their risks and liability. The argument of judgment over standards has become an excuse to avoid dealing with the real issues and to allow everyone to do whatever they feel is necessary to compete and stay in business. If the current situation is allowed to continue, litigation will get worse regardless of whether ASTM develops standards or not.

References

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Subject:

ASFE News Column -
March 1998 Edition

Managing Editor:

I am writing to express concern and to clarify issues raised in a column that appeared in your March 1998 edition. Specifically, I want to address the contents of the ASFE column. It appears that this column was provided to you by ASFE, however as managing editor of *Geotechnical News* you are responsible for the content of your magazine and its accuracy. As original recipient of a letter that was based on the e-mail message that was reprinted in that column, I am well aware of the facts behind this incident. The facts are that most of the actual parties involved in the incident discussed in that e-mail have indicated that the facts portrayed in that e-mail and subsequent [sic] letter sent to me are far from accurate and a retraction letter is being developed, which I understand that you are going to print in your next edition.

I also believe that it is important that you correct the impression about me that was printed under the heading "ASFE Responds" First when Mr. Johnston spoke to me at our January meeting I was concerned about what had happened. However, because the venison [sic] of the incident told to me by one of the actual participants was different than that expressed to me by Mr. Johnston I was not about to take any action until I could determine exactly what had happened. We did have a full agenda, however, I did not tell Mr. Johnston that he could only have three minutes. I did indicate that since neither of the parties that were actually involved in this incident were attending this meeting I was not going to allow a detailed discussion of this incident based only on second hand information. The retraction letter that you are printing indicates that Mr. Johnston's concern expressed at our meeting about this incident and ASTM's alleged heavy handed practices is misplaced and based on inaccurate information. Our minutes, which state what really occurred, indicate that Mr. Johnston spoke, however,

in light of the retraction letter our minutes do not repeat his remarks as they were an inaccurate account of the incident and it is my position that official minutes should not contain information that is known to be incorrect. I also want to point out that while we adjourned early, this was a result of the fact that there was little discussion of the items on the agenda, a fact that I could not predict before hand.

Is it common practice of *Geotechnical News* to print inaccurate or false information? This is a very important issue and I find the fact that *Geotechnical News* printed this information without making any checks on its accuracy to be very questionable. I was quoted, granted not by name but by position, and yet no effort was made to ask me what occurred. The e-mail message printed makes serious charges against ASTM and a member of ASTM and yet no effort was made to verify these charges, either with ASTM or apparently with the author of the e-mail. And definitely not with any of the actual participants of the phone call being discussed. Mr. Johnston requested an investigation into this incident, yet before such an investigation can even start you went to press with a version that was being retracted by the individual who wrote the original e-mail message quoted. This strikes me as irresponsible journalism, when a simple phone call to one or two other people would have indicated that it was premature to print this story.

Finally this letter is addressed to the managing editor of *Geotechnical News*; not to the author of the ASFE column. That column was printed without any attempt to contact ASTM or myself. Therefore, I would appreciate equal treatment and request a printing of my letter in your next edition without a response by ASFE printed below my letter. I will gladly discuss with you via phone any of the facts stated above before they are printed.

Sincerely,

Terry S. Hawk, P.E.

Chairman ASTM Committee D-18

Member ASCE

Closing Comment

The letter above has provided us with guidance on how the author believes we should edit and review materials for *Geotechnical News*. We accept these comments with interest and we appreciate his view.

We do, however, take this opportunity to remind readers of our editorial policy. When *Geotechnical News* was launched in 1983, we set out to provide a forum for all and any issues of concern that might or could affect professional engineers, geologists and scientists of the North American geotechnical community, without the requirement of peer review. All the persons we spoke to in 1983 encouraged us to have this policy. We were not attempting to be a learned journal. Over the past fifteen years this policy has been supported by our readers, who are members of the national geotechnical societies of Canada and the United States.

The comments expressed in any article are those of the authors. Our readers are registered professional members of the US and Canadian Societies. We have to assume that in their writings and submissions to *Geotechnical News* they act professionally, are prepared to stand by their opinions, admit their errors, and speak out (write) their views if they disagree with any article published in this magazine. We will gladly publish their articles and letters.

We appreciate the views expressed by Mr. Terry S. Hawk and we are pleased to have the opportunity to publish his letter.

Our editorial policy will, however, remain:

Geotechnical News provides an open forum for all professionals to express their views and opinions to their colleagues. They must, however, be prepared to stand by those views and accept the consequences if they are opposed.

John Gadsby

Publisher

Lynn Pugh

Managing Editor

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