Aren't specs terms supposed to be plain?

Moving toward a more uniform terminology

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Technical contract specifications are supposed to reflect good and proper design, and many do. Far too many, however, are bewildering due to the use of ambiguous terminology. Piling lingo, in general, contains an astonishing array of confusing vocabulary and nomenclature. The carefree vernacular of the job site includes slang, jargon and colorful phraseology. For example, a disinterested person may be amused by hearing the upper end of the pile referred to as the "butt." However, not so disinterested persons, such as design engineers, contractors and inspectors, are adversely affected by ambiguous terms and absurd definitions that abound in project specifications, contract documents and job reports. Lack of precise language and uniform terminology causes confusion, creates problems and is often the root of disputes and costly claims.

The February 2002 International Deep Foundations Congress organized by the Geo-Institute of the American Society of Civil Engineers (ASCE), Orlando, Fla., gathered more than 500 piling practitioners from across the United States and around the world. More than 100 papers were presented on the current state of the art and practice in deep foundations. A review of the 1,566-page, two-volume conference proceedings reveals that the terms used to communicate, qualify or quantify the related — but not identical — concepts of pile "capacity" and "resistance," resulted in more than 20 different definitions, descriptions, expressions and terms. Sometimes the terms were used interchangeably. The terms ranged from precise, vague and ambiguous, to outright careless. Some of the more nebulous expressions to quote from the papers include: foundation ground resistance, safe working load capacity, total allowable resistance, effective total pile resistance, useful capacity, dynamic capacity, pile resistance, and design safe working load.

Actually, the parade of confused and confusing phrases is, no wonder, considering that specialized engineering textbooks employ a similarly lax — if not directly erroneous and misleading — vernacular.

The following example taken from actual contract specifications demonstrates the desirability of devoting more thought toward terms and expressions used in the specs: A design engineer, in an area where the piles would normally be installed to a 200-ton capacity, was faced with the problem of the piles potentially reaching into a boulder layer existing at depth at a site. To avoid potential pile damage, the engineer reduced capacity per pile to only 100 tons, so that the piles would be correspondingly shorter and not reach into the boulder zone. Someone — it was never determined who — thought that plain "capacity" sounded too casual and added the adjective "load" to the phrase "100-ton pile capacity" used in the designer's draft specs so it read "100-ton pile load capacity." At the outset of pile driving, the contractor asked what loads he was to drive to and was told that the specs indicated the pile loads were 100 tons. So, naturally, he drove to a capacity of twice the 100-ton load, which meant that the piles had to be longer and, as the designer had feared and wanted to avoid, the piles were driven into the boulder layers. The results were much breakage, problems, delays and cost overruns. The contractor's claim for extra length of piles and prolonged driving was $300,000, or $75,000 per letter of the misleading adjective.

Incidentally, of all terms, capacity is most often misused. A recent DOT specs text required the contractor to achieve an "intimate capacity," probably a misspelling of the phrase ultimate capacity. Capacity simply means ultimate resistance and adding the adjective ultimate is redundant, because the term does not require an adjective (other than axial as opposed to lateral, for example).

Similar to the usage of capacity, load is often combined with adjectives that can result in confusion. Combinations such

as allowable load, factored load, dead load, live load, permanent load, transient load, etc. are well defined and, therefore, unmistakable. Some people, however, find different meaning between design load and working load, and some believe the two to be synonymous. If both are used in the same specifications, a judge, at least, will take them to have different meaning if not so, then only one should have been used in the specs but, same or different, what do the terms mean? The phrase "design load" is usually taken to mean the maximum load acting on the foundation (the pile) from the structure. It could be equal to the allowable load, but it cannot be larger. The phrase "working load" does not work very well and is best not used. Adding the word "safe" to either phrase, or to any phrase, increases the potential for confusion.

On the topic of using jargon: the word "set" is not a synonym for blowcount (the blows counted for a certain penetration distance). Set is the net penetration for one blow or possibly for a series of blows. Its origin is an abbreviation of settlement, meaning the net penetration, usually for one blow. The following is an example of what the use of set can cause: Specifications for a project stated that piles were to be driven to depths indicated by the plans and drawings and added "the piles will be driven to a very small set and the contractor is cautioned not to overdrive the piles." Of course, the contractor took care not to damage the piles by driving them too hard, which is what overdriving means, and which can occur when the penetration per blow is very small. The driving turned out to be very easy and, in the contractor's search for the very-small-set termination criterion, he drove the piles much deeper than the plans and drawings indicated. Unfortunately, in writing the quoted sentence, the spec writer meant to warn the contractor that the penetration per blow was expected to be very large and that the piles, therefore, could easily drive deeper than desired. Talk about diametrically opposed interpretations! And predictable surprises. In this case, the engineers insisted that their intended interpretation was the right one and a costly claim and litigation ensued. Because the industry has a vague understanding of the proper meaning of the term "set," avoid using it in any context. Use "penetration resistance".

The word set is also frequently misconstrued to be a synonym for termination criterion, which incidentally, is not the same as "refusal," and the jargon confusion does not get any better by shifting from set to refusal. Although most people have a qualitative understanding of what is addressed, one person's refusal is another person's promise. Refusal is an absolute term; it implies that one just cannot drive the piles deeper after having exhausted all means to do so. Then, specifications suggesting a refusal of six blows per foot sounds not only silly, but implies a spec writer with a poor command of language. Instead, termination criterion should be used. It is a neutral term that states exactly what is meant. What about battered? It is a term that really separates the men from the boys, or people experienced in — or at least exposed to — piling from people who are not. The latter group includes lawyers, judges and jury members. A case in point is the true story, experienced by the first author, of a contractor appearing in court to argue a claim. And did he ever have an uphill battle once the judge realized that he had battered his piles. The judge had experience with battered spouses and children, but he had no knowledge and little appreciation of the term and its discrete meaning for piling people. When the matter was made clear to him, he was quite annoyed that a group of professionals would use a jargon term that had a perfectly suitable everyday English term available, i.e., inclined. Please, stop using batter. Alas, a cry in the wilderness. It is getting worse rather than better. Recently a paper used the "batter" term to characterize a leaning structure!

There is more to the matter than a poor choice of terms and definitions. You may enjoy the following direct quotes from real life contract specifications:

1. Piles shall be driven to reach the design bearing pressures.
2. The minimum allowable pile penetration under any circumstance shall be 17 feet.
3. The contracting officer will determine what procedure should be followed if driving refusal occurs.
4. The hammer shall have a capacity equal to the weight of the pile and the character of the subsurface material to be encountered.
5. The hammer energy in footpounds shall be three times the weight of the pile in pounds.
6. Inefficient diesel, air, or steam hammers shall not be used.
7. Each pile shall be driven until the bearing power is equal to the design piles pressure.
8. All piles incorrectly driven as to be unsuitable as determined by the contracting officer shall be pulled and no payment will be made for furnishing, driving, or pulling such piles.

9. All piles determined to be unsuitable by the contracting officer shall be replaced by and at the expense of the contractor.
10. The driving shall continue, using hammer falls of 150 mm to 200 mm in a series of 20 blows until penetration of the pile has stopped. The height of the fall shall then be doubled and the pile again driven to refusal. This procedure shall be continued until the design load of the pile has been achieved.
11. The pile design load is defined as one-and-a-half times the working load. The design load will be deemed to have been achieved when the pile exhibits zero residual (= net?) set under 10 successive blows of the hammer, where each blow has a sufficient energy to cause elastic deformation of the pile at the ground level equal to the static shortening of the pile at design load, as calculated by Hooke's Law.
12. Inclined head to be used for batter piles.
13. Cut off portions of pile, which are battered, split, warped, buckled, damaged, or imperfect.
14. Where unwatering is required, the contractor shall effect a dewatering scheme.
15. When the hammer performance is requested to be verified, all costs associated with this work will be included in the contract price when the energy delivered is less than 90 percent of the stated potential energy specified in the submission. When the energy is greater than 90 percent of the potential energy stated in the required submission, the costs will be paid as extra work.
16. Pile shall be accepted if . . . the pile reaches refusal at a load, which would give a working load equal to, or greater than, the design capacity.
17. The piles will be driven to a factored design load of 630 kN (71 tons) which is about three times the estimated required bearing capacity.

As a contractor, would you want to have these requirements imposed on you? As an inspector, would you want to be the one enforcing these specs? And, as an engineer, how do you feel about your professional association with such nonsense?

Surprises occur frequently during construction projects. The surprises take many forms, but one aspect is shared amongst them: they invariably result in difficulties at the site and, more often than not, in disputes between the parties involved. When the unexpected occurs at a site, costs escalate, and delays develop, the contractor feels justified to submit a claim that the owner may see little reason to accept. Well-written specifications can resolve disputes and avoid claims. However, when the parties turn to the technical specifications for the rules of the contract, these often fuel the dispute instead of mitigating it, because the specifications are vague, unclear, unbalanced, and containing ambiguous language and weasel clauses that help nobody in resolving the conflict.

The piling practice differs with geologic conditions and geographic locations. It would be difficult to come up with a set of master specifications that would fit all projects. We should, however, be able to agree on a common usage of the terms and definitions involved in our industry. Maybe a list of well-defined terms could be a task for the PDCA, in order to move toward a more uniform terminology. ▼