On the Preparation of a Piling Paper

A Guide prepared for
the Deep Foundations Institute Annual Meeting
October 14 – 16, 1999, Dearborn, Michigan

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INTRODUCTION

Other than conferences arranged by the ASCE ASTM and other well established organizations, conference proceedings are often very lacking in standard of style and demonstrate that quite a variable level of effort went into the preparations of the manuscripts. Moreover, an abominable proliferation of terms, definitions, symbols, and units are used in papers and engineering reports written by the piling community. Too often, a manuscript or report is prepared with little concern for style and proper use of English grammar. Such texts simply do not get read; not to the end, anyway. In the following, a few suggestions are made for unifying the terminology and style of geotechnical engineering papers and, notably, piling papers. The suggestions do not cover all aspects. However, authors of engineering papers and reports may take the lead from the principles of the suggestions when considering aspects that are not addressed. The suggestions are generic and do not address the format (margins–font size–line spacing–etc.) of a manuscript. Most conferences as well as journals have their own preferred style.

TERMINOLOGY

There is an abominable proliferation of terms, definitions, symbols, and units used in papers and engineering reports written by the piling community. Not only do the terms vary between authors, many authors use several different words for the same thing in the same paper, which makes the papers difficult to read and conveys an impression of poor professional quality. Fig. 1 gives a few examples of definitions and preferred piling terms to use.

Upper End of a Pile

One of the most abused terms is the name for the upper and lower ends of a pile. Terms in common use are, for the upper end, “top”, “butt”, and “head”, and for the lower end, “end”, “tip”, “base”, “point”, “bottom”, and “toe”.

The term “top” is not good, because, in case of wood piles, the top of the tree is not normally the 'top' of the pile, which can and has caused confusion. Also, what is meant by the word “top force”? Is it the force at the 'top of the pile' or the maximum (peak) force measured somewhere in the pile? “Butt” is essentially a wood-pile term. “**Head**” is the preferred term. For instance, “the forces were measured at the pile head”.

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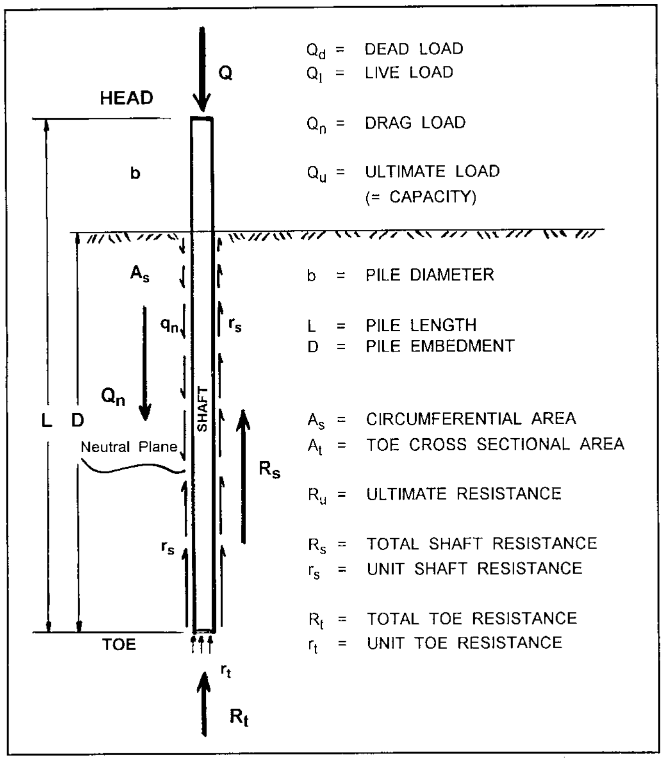

Fig. 1. Example of Definitions and Preferred Terms

Lower End of a Pile

With regard to the term for the lower end of a pile, the word "tip" is easily confused with "top", should the latter term be used—the terms are but a typo apart. A case-in-point is provided by the 3rd edition (1993) of the Canadian Foundation Engineering Manual, Page 289, 2nd paragraph. More important, "tip" implies a uttermost end, usually a pointed end, and piles are usually blunt-ended.

The term "end" is not good for two reasons**:** the pile has two ends, not just one, and, more important, "end" has a connotation of time. Thus, "end resistance" implies a "final resistance".

"Base" is not a bad term. However, it is used mainly for shallow footings, piers, and drilled-shafts. "Point" is often used for a separate rock-point, that is, a pile shoe with a hardened tip (see!) or point. Then, before driving, there is the point of the pile and on the ground next to the pile lies the separate rock-point, making a sum of two points. After driving, only one, the pile point remains. Where did the other one go? And what is meant by "at a point in the pile"? Any point or just the one at the lower end?

The preferred term is "**toe**", as it cannot be confused with any other term and it can, and is, easily be combined with other terms, such as "toe resistance", "toe damping", "toe quake", etc.

The word "bottom", when used in the context of piles, should be limited to refer to lower end of a pile when inspecting down a pipe pile inside the pile.

The Pile Shaft

Commonly used for the part of the pile in between the head and toe of the pile are the terms “side”, “skin”, “surface”, and “shaft”. The terms “skin” and “shaft” are about as frequent. “Side” is mostly reserved for stubby piers, and “surface”, although the term is used, it is not in frequent use. The preferred term is “**shaft**” because “skin” is restricted to indicate an outer surface and, therefore, if using “skin”, a second term would be necessary when referring to the actual shaft of the pile.

Other Preferred Piling Terms

A word often causing confusion is “capacity”, especially when it is combined with other words. “Capacity” of a unit, as in “lateral capacity”, “axial capacity”, “bearing capacity”, “uplift capacity”, “shaft capacity” and “toe capacity”, is the **ultimate resistance** of the unit. The term “ultimate capacity” is a tautology to avoid, although it cannot be misunderstood. However, the meaningless and utterly confusing combination terms, such as “load capacity”, “design capacity”, “carrying capacity”, “load carrying capacity”, even “failure capacity”, which can be found in many papers, should not be used. (I have experienced a court case where the main cause of the dispute turned out to originate from the designer’s use of the term “load capacity” to mean capacity while the field people believed the designer’s term to mean “allowable load”. As a factor of safety of 2 was applied, the piles were driven to twice the capacity necessary with predictable results). Use “**capacity**” as a stand-alone term and as a synonym to “**ultimate resistance**”. Never use an adjective with “capacity”.

Incidentally, the term “ultimate load” can be used as a substitute for “capacity” or “ultimate resistance”, but it should be reserved for the capacity evaluated from the results of a static loading test.

As to the term “resistance”, it can stand alone, or be modified to “ultimate resistance”, “mobilized resistance”, “shaft resistance”, “toe resistance”, “static resistance”, “initial shaft resistance”, “unit toe resistance”, etc.

Obviously, combinations such as “skin friction and toe resistance” and “bearing of the pile toe” constitute poor language. They can be replaced with, for instance, “shaft and toe resistances”, and “toe resistance” or “toe load”, respectively. “Shaft bearing” as well as “toe bearing” are acceptable terms.

Resistance develops when the pile forces the soil**:** “positive shaft resistance”, when loading the pile in compression, and “negative shaft resistance”, when loading in tension. The term “skin friction” by itself should not be used, but it may be combined with the ‘directional’ words “negative” and “positive”**:** “Negative skin friction” is caused by settling soil and “positive skin friction” by swelling soil. A compilation of the preferred terms is given in Fig. 1, above.

The terms “load test” and “loading test” are often thought to mean the same thing. However, the situation referred to is a test performed by loading a pile, not a test for finding out what load that is applied to a pile. Therefore, “**loading test**” is the semantically correct and the preferred term.

Arguing for the term "loading test" as opposed to "load test" may suggest that I am a bit of a fusspot. After all, the semantically correct term for one of my favorite desserts is "iced cream", not "ice cream" (but compare "iced tea"). By any name, though, the calories are as many and a rose would smell as sweet. On the other hand, the laymen, call them lawyers, judges, or first year students, do subconsciously pick up on the true meaning of "load" as opposed to "loading" and are unnecessarily confused.

While the terms "static loading test" "static testing" are good terms, do not use the term "dynamic load testing" or worse**:** "dynamic load test". Often a capacity determination is not even meant by these terms. Use "**dynamic testing**", or, for instance, "capacity determined by dynamic testing".

When presenting the results of a loading test, many authors write "load-settlement curve" and "settlement" of the pile. The terms should be "**load-movemen**t curve" and "**movement**". The term "settlement" must be reserved to refer to what occurs over long time under a more or less constant load smaller than the ultimate resistance of the pile. The term "deflection" instead of "movement" is normally used for lateral deflection. "Compression", of course, is not a term to use instead of "movement" as it means "shortening".

In fact, not just in relation to piling terminology, but as a general rule, the terms "movement", "settlement", and "creep" mean deformation. However, they are not identical synonyms and it is important not to confuse them.

Movement occurs as a result of an increase of stress, but, strictly, the term should be reserved to mean as a response to an increase of total stress, that is, as the result of stress transfer (the movement necessary to build up the resistance to the load), such as, for example, when adding load increments to a pile or to a plate in a static loading test. Use the term "movement" when the involved, or influenced, soil volume successively increases as the stress increases.

Settlement is volume reduction of the subsoil as a result of a increase in effective stress. It consists of the sum of "elastic" compression of the soil grains (soil skeleton) and of any free gas present in the voids—called "immediate settlement—and of consolidation settlement. The immediate settlement occurs quickly and is normally small (the "elastic" compression is not associated with expulsion of water). The consolidation settlement, on the other hand, is volume change due to the compression of the soil structure associated with an expulsion of water—consolidation. The consolidation occurs quickly in coarse-grained soils, but slowly in fine-grained soils, when the imposed stress, initially carried by the pore water, is transferred to the soil structure. The soil structure compresses in the process until all the imposed stress is carried by effective stress. Use the term "settlement" when the involved, or affected or influenced, soil volume (amount, rather) stays constant as the effective stress increases.

Creep is compression occurring without an increase of effective stress. Creep is usually small, but, in some soils, it may add significantly to the compression of the soil skeleton and, thus, to the total deformation of the soil. It is then acceptable to talk in terms of creep settlement.

In cases other than a static loading test, the term "settlement" is used to refer to deformation resulting from the combined effect of load transfer, increase of effective stress, and creep.

When there is a perfectly good common term understandable by a layman, one should not use professional jargon. For example, for an inclined pile, the terms "raker pile" and "batter pile" are often used. But "a raker" is not normally a pile, but an inclined support of a retaining wall. As to the term "batter", I have experienced the difficulty of explaining a situation to a judge whose prior contact with the word "batter" was with regard to "battered wives" and who thought, no, was convinced, that "to batter a pile" was to drive it abusively! The preferred term is "**inclined**".

The word "set" means penetration for one blow, sometimes penetration for a series of blows. Sometimes, "set" is erroneously thought to mean "termination criterion" and applied as blows/inch! Please, recognize that the term "set" even when used in its proper sense is avoidable jargon and should not be used at all.

The word "refusal" is another example of confusing jargon. It is really an absolute word. It is often used in combinations, such as "practical refusal" meaning the penetration resistance for when the pile cannot reasonable be driven deeper. However, "refusal" used in a combination such as "refusal criterion" means "the criterion for (practical) refusal", whereas the author might have meant "**termination criterion**", that is, the criterion for when to terminate the driving of the pile. Avoid the term "refusal" and use "penetration resistance" and "termination criterion", instead.

Terms such as "penetration resistance", "blow-count", and "driving resistance", are usually taken to mean the same thing, but they do not. "**Penetration resistance**" is the preferred term for the effort required to advance a pile and, when quantified, it is either the number of blows required for the pile to penetrate a certain distance, or the distance penetrated for a certain number of blows.

"Blow-count" is a casual term and should be used only when an actual count of blows is considered. For instance, if blows are counted by the foot, one cannot state that "the blow-count is so and so many inches per blow", not even say that it is in blows/inch, unless words are inserted such as, "which corresponds to a penetration resistance of. . ." Obviously, the term "equivalent blow-count" is a no-good term.

"Driving resistance" is an ambiguous term, as it can be used to also refer to the resistance in terms of force and, therefore, it should be avoided.

Often, the terms "allowable load" and "service load" are taken to be equal. However, "allowable load" is the load obtained by dividing the capacity with a factor of safety. "Service load" is the load actually applied to the pile. In most designs, it is smaller than the "allowable load". The term "design load" is undefined and should be avoided.

The term for describing the effect of resistance increase with time after driving is “**set-up”** (soil set-up). Do not use the term “**freeze**” (soil freeze), as this term has a different meaning for persons working in cold regions of the world.

Avoid the term “timber pile”, use “wood pile” in conformity with the terms “steel pile” and “concrete pile”.

Do not use the term “reliability” unless presenting an analysis based on probabilistic principles.

COMPILATION OF SOME DEFINITIONS AND TERMS RELATED TO PILING

Caisson - A large, deep foundation unit other than a driven or bored pile. A caisson is sunk into the ground to carry a structural unit.

Capacity - The maximum or ultimate soil resistance mobilized by a foundation unit.

Capacity, **bearing -** The maximum or ultimate soil resistance mobilized by a foundation unit subjected to downward loading.

Capacity, **geotechnical -** See **capacity, bearing.**

Capacity, **lateral -** The maximum or ultimate soil resistance mobilized by a foundation unit subjected to horizontal loading.

Capacity, structural - The maximum or ultimate strength of the foundation unit.

Capacity, **tension -** The maximum or ultimate soil resistance mobilized by a foundation unit subjected to tension (upward) loading.

Cushion, hammer - The material placed in a pile driving helmet to cushion the impact (formerly called “capblock”).

Cushion, pile - The material placed on a **pile head**, usually inside a helmet, to cushion the impact.

Downdrag - The downward <u>movement</u> on a deep foundation unit due to **negative skin friction** and expressed in terms of **settlement**.

Dragload - The <u>load</u> transferred to a deep foundation unit from **negative skin friction**.

Dynamic method of analysis - The determination of **capacity**, **impact force**, **transferred energy**, etc. of a driven **pile** using analysis of measured **strain-waves** induced by the driving of the pile.

Dynamic monitoring - The recording of strain and acceleration induced in a pile during driving and presentation of the data in terms of stress and **transferred energy** in the pile as well as of estimates of **capacity**.

Factor of safety - The ratio of maximum available resistance or of the **capacity** to the allowable stress or load.

Foundation unit, **deep -** A unit that provides support for a structure by transferring load or stress to the soil at depth considerably larger than the width of the unit. A **pile** is the most common type of deep foundation.

Foundations - A system or arrangement of structural members through which the loads are transferred to supporting soil or rock.

Groundwater table - The upper surface of the zone of saturation in the ground.

Impact force - The peak force delivered by a pile driving hammer to the **pile head** as measured by means of **dynamic monitoring** (the measured impact force must not be influenced by soil resistance reflections).

Load, **allowable -** The maximum load that may be safely applied to a **foundation unit** under expected loading and soil conditions and determined as the **capacity** divided by the **factor of safety**.

Load, **applied** or **load, service -** The load actually applied to a foundation unit.

Neutral plane - The location where equilibrium exists between the sum of downward acting permanent load applied to the pile and **dragload** due to **negative skin friction** and the sum of upward acting **positive shaft resistance** and mobilized **toe resistance**. The neutral plane is also where the relative movement between the pile and the soil is zero.

Pile - A slender **deep foundation unit**, made of wood, steel, or concrete, or combinations thereof, which is either premanufactured and placed by driving, jacking, jetting, or screwing, or cast-in-situ in a hole formed by driving, excavating, or boring. A pile can be a non-displacement, a low-displacement, or displacement type.

Pile head - The uppermost end of a **pile**.

Pile impedance - $Z = EA/c$, a material property of a pile cross section determined as the product of the Young's modulus (E) and area (A) of the cross section divided by the **wave speed** (c).

Pile point - A special type of **pile shoe**.

Pile shaft - The portion of the pile between the **pile head** and the **pile toe**.

Pile shoe - A separate reinforcement attached to the **pile toe** of a pile to facilitate driving, to protect the lower end of the pile, and/or to improve the toe resistance of the pile.

Pile toe - The lowermost end of a **pile**. (Use of terms such as pile tip, **pile point**, or pile end in the same sense as pile toe is discouraged).

Pore pressure - Pressure in the water and gas present in the voids between the soil grains minus the atmospheric pressure.

Pore pressure, **artesian - Pore pressure** in a confined body of water having a level of **hydrostatic pressure** higher than the ground surface.

Pore pressure, **hydrostatic - Pore pressure** varying directly with a free-standing column of water.

Pore pressure elevation, **phreatic -** The elevation of a **groundwater table** corresponding to a **hydrostatic pore pressure** equal to the actual **pore pressure**.

Pressure - Omnidirectional force per unit area. (Compare **stress**).

Settlement - The downward movement of a foundation unit or soil layer due to rapidly or slowly occurring compression of the soils located below the foundation unit or soil layer, when the compression is caused by an increase of effective stress.

Shaft resistance, **negative -** Soil resistance acting downward along the pile shaft because of an applied uplift load.

Shaft resistance, **positive -** Soil resistance acting upward along the pile shaft because of an applied compressive load.

Skin friction, **negative -** Soil resistance acting downward along the pile shaft as a result of the soil moving down in relation to the pile.

Skin friction, **positive -** Soil resistance acting upward along the pile shaft caused by swelling of the soil.

Stress - Unidirectional force per unit area. (Compare **pressure**).

Stress, **effective -** The total stress in a particular direction minus the **pore pressure**.

Toe resistance - soil resistance acting on the **pile toe**.

Transferred energy - The energy transferred to the pile head and determined as the integral over time of the product of force, velocity**,** and **pile impedance**.

Wave speed - The speed of strain propagation in a **pile**.

Wave trace - A graphic representation against time of a force or velocity measurement.

LITERATURE REFERENCES

Literature references in the text are cited by the last name of the author(s) followed by the year of publication in parentheses. If more than two authors exist for a paper, use the first author's name followed by et al., which words stand for "et alii" (means "and others"). Do not forget to include the period in "al.". When the reference is not a noun or an object in a sentence, both the name(s) and year(s) are placed in parentheses and separated by a comma.

If more than one paper are cited within the parentheses, place the references in chronological order and separate them by semicolons.

When reference is made to more than one paper by the same author(s) published during the same year, denote the references by 1984a, 1984b, etc. with "a", "b", etc. determined by alphabetical order from the first word in the title.

The following are examples of format references given in the text**:**

> Jones (1982) found the coefficient, C, to be equal to 1.403.
>
> The results presented by Plankare (1984) were in agreement with the findings of Herremann (1983), Gragossen et al. (1974), and Laurel and Hardy (1981).
>
> A number of researchers (Lillflickanovitz, 1932; Sellers, 1957, 1962; Raringen and Gosingen, 1974; Churchill et al., 1981; and Zorrocz, 1981) have reported similar phenomena.
>
> The findings reported by Wroom (1977, 1981) and Zolacion (1976a, 1976b) enabled Phiitz and Ztarts (1983) to formulate the general theory of mudcake activated communal swirls.
>
> Subsequently, the continued testing had to be significantly expanded to eliminate the consequence of elated shaft escitassion on the dynamically sensitive rackare and busar (Fint and Fult, 1982; Samt and Synnerligt, 1983).

REFERENCE LIST

In the References list at the end of the paper, the referenced paper must include the names of all the authors and the full title of the paper followed by the publication place and the publishers' name. Placed last are the specific page numbers**;** Not just to facilitate finding the paper, but also to enable the reader to judge the costs of ordering copies. Do not use abbreviations in the References list**;** abbreviations do not save space, but they often create confusion. Give the page numbers for the first and last page, or, if the reference is a full book, give the total number of pages in the book. The following is an example of a reference list attempting to cover several of the various types of texts encountered: journals, conference proceedings, and other texts.

Altaee, A., Evgin, E., and Fellenius, B. H., 1992. Axial load transfer for piles in sand. I: Tests on an instrumented precast pile. Canadian Geotechnical Journal, Vol. 29, No. 1, pp. 11 - 20.

Canadian Foundation Engineering Manual, CFEM, 1985. Second Edition. Canadian Geotechnical Society, BiTech Publishers, Vancouver, 456 p.

Goble, G. G., Rausche, F., and Likins, G., 1980. The analysis of pile driving—a state-of-the-art. Proceedings of the 1st International Seminar of the Application of Stress-wave Theory to Piles, Stockholm, Edited by H. Bredenberg, A. A. Balkema Publishers Rotterdam, pp. 131 - 161.

Holtz, R. D. and Kovacs, W. D., 1981. An introduction to geotechnical engineering. Prentice-Hall Inc., New York, 780 p.

Hunter A. H. and Davisson M. T., 1969. Measurements of pile load transfer. Proceedings of Symposium on performance of Deep Foundations, San Francisco, June 1968, American Society for Testing and Materials, ASTM, Special Technical Publication, STP 444, pp. 106 - 117.

Rausche, F., Moses, F., and Goble. G. G., 1972. Soil resistance predictions from pile dynamics. American Society of Civil Engineers, ASCE, Journal of Soil Mechanics and Foundation Engineering, Vol. 8, SM9, pp. 17 - 937.

Rausche, F., Goble, G. G., and Likins, G. E., 1985. Dynamic determination of pile capacity. American Society of Civil Engineers, ASCE Journal of the Geotechnical Engineering Division, Vol. 111, No. 3, pp. 367 - 383.

Schmertmann, J. H., 1978. Guidelines for cone penetration test, performance, and design. U.S. Federal Highway Administration, Washington, Report FHWA-TS-78-209, 145 p.

Shen Bao-Han and Niu Dong-Sheng, 1991. A new method for determining the yield load of piles. Proceedings of the Fourth International Conference on Piling and Deep Foundations, Deep Foundation Institute, Stresa April 7 - 12, Balkema Publishers, Vol. 1, pp. 531 - 534.

Skrivare, L. A. T., 1979. The saturated limit weight of blue bull feathers. Lecture Notes. University of Old City, Faculty of Engineering, Department of Civil Engineering, 13 p.

Terzaghi, K., 1954. Anchored bulkheads. American Society of Civil Engineers, ASCE, Transactions, Vol. 119, pp. 1243 - 1324.

Terzaghi, K., 1955. Evaluation of coefficients of subgrade reaction. Geotechnique, Vol. 5, No. 4, pp. 297 - 326.

Vesic, A. S., 1973. Analysis of ultimate loads of shallow foundations. American Society of Civil Engineers, ASCE, Journal of Soil Mechanics and Foundation Engineering, Vol. 99, SM1, pp. 45 - 73.

Vesic, A. S., 1975. Bearing capacity of shallow foundations. Chapter 3 in Foundation Engineering Handbook, edited by H. F. Winterkorn and H-Y Fang, VanNostrand Reinhold Co., New York, pp. 121 - 147.

FIGURES

In the text, when referring to specific figures, always write "Fig. 2.5" or Figs. 3.6 and 3.8". When referring to a figure without giving its number, write "figure". Example**:** "The preceding figures and Fig. 1.4 verify the assumption".

Draw figures in black ink. Make all lines thick (heavy; wide) and the lines in the graph about twice as thick as the width used for the axes in the diagram.

Use a non-serif font for the figure texts, such as Arial or Helvetica, not serif fonts such as Time Roman.

The figure texts are often too small to be read. For optimum clarity, determine the proper height of a letter by imagining a rectangle around the figure and do not use any main lettering smaller than 3 percent of the diagonal of that rectangle. For secondary texts, subscripts, and symbols, do not use a size smaller than 2 percent.

EQUATIONS

When referring to specific equation(s), write "Eq. 2.5" or "Eqs. 3.6 and 3.8". When referring to an equation without giving its number, write out the entire word "equation".

To improve the appearance of equations, close the distance between the numerator and denominator by reducing the line spacing.

When an equation is cited from a reference using symbols and notations deviating from those of the thesis, the equation should be rewritten into the convention of the manuscript.

CONCLUSIONS

With the possible exception of some case history papers, a professional paper should finish with a section called "Conclusions" that reiterates the results and conclusions developed in the paper.

SUMMARY

All papers should have a summary placed at the beginning of the main body of the text immediately below the title. The Summary presents, but only very briefly, the background, objective, and scope of the paper. Do not write "This paper present the results comparing polymorganic piles with monogamic piles and comments on the economics of the new piles". Such a sentence is only descriptive and provides very little useful information. Instead, concentrate on the factual information and write: "Results from full-scale static loading tests to failure loads of about 5,000 KN showed that the stiffness of polymorganic piles was four times smaller than that of monogamic piles. Compilation of construction costs from three projects showed that neither pile type was competitive with conventional wood piles".

UNITS

In the SI-system, all parameters such as length, volume, mass, force, etc. are to be inserted in a formula with the value given in its base unit. If a parameter value is given in a unit using a multiple of the base unit, e.g., 50 MN — 50 meganewton, the multiple is considered as an abbreviated number and inserted with the value, i. e., “mega” means million and the value is inserted into the formula as $50 \cdot 10^6$. Notice that the base units of hydraulic conductivity (permeability), k, and consolidation coefficient, c_v, are m/s and m^2/s, not cm/s or cm^2/s, and not m/year or m^2/hour, respectively.

When indicating length and distance in the SI-system, use the unit metre and multiples millimetre (mm) or kilometre (Km). Avoid using the unit centimetre (cm).

For area, square centimeter (cm^2) can be used when it is alone. However, never in combined terms (for example, when indicating stress). The unit for stress is multiple of newton/square metre or pascal (N/m^2 or Pa). Combination units, such as N/mm^2 and MN/cm^2 violate the principle of the international system (SI) and can be the cause of errors of calculation. That is, prefixes, such as “M” and “m”, must only be used in the numerator not in the denominator. Notice also that the unit “atmosphere” (**at** = 100 KPa) is an aberration to avoid.

Notice, the abbreviated unit for “second” is “s”, not “sec”! — a very common and unnecessary mistake. The units “newton”, “pascal”, “joule” etc. do not take plural ending. It is logical and acceptable to omit the plural ending for all other units in the SI-system.

The terms “specific weight” and “specific gravity” were canceled as technical terms long ago, but they are still found in current professional papers. “Specific weight” was used to signify the weight of material for a unit volume. However, the proper terms are “**solid density**” and “**unit weight**” (the units are mass/volume and force/volume, respectively). The term “specific gravity” was used to mean the ratio of the density of the material over the density of water (dimensionless). The internationally assigned term for this ratio is “relative density”, which term, unfortunately, conflicts with the geotechnical meaning of the term “relative density” as a classification of soil density with respect to its maximum and minimum density. For the latter, however, the internationally assigned term is “density index”.

Soils can be moist, but the measurements and term for the amount of water in a soils ample is “water content”, not “moisture content”.

When writing out SI-units, do not capitalize the unit. Write “67 newton, 15 pascal, 511 metre, and 96 kilogramme. Moreover, while the kilogramme is written kg—it is really a single unit (base unit) although this is belied by its symbol being composed of two letters. For true multiple units, such as kilonewton and kilometre, the “kilo” is a prefix meaning 1,000. When abbreviating the prefix of these, it is acceptable, indeed preferable, to capitalize the prefix letter**:** “KPa”, “KN”, etc., instead of writing “kPa”, “kN”, but be consistent. Notice, “kg” should be considered as one symbol; it always requires lower case “k”.

If your manuscript uses SI-units and the original work quoted from a paper used English, make sure to apply a soft conversion and avoid writing “30.48 metre”, when the original measure was “100 feet”, or maybe even “about 100 feet”. Similarly, “about one inch” is “about 20 mm” or “about 30 mm”, while the conversion of “2.27 inches” is “57.7 mm”.

SPELLING RULES AND SPECIAL ASPECTS

Use either English or U.S. spelling (but be consistent)**:** for example, English spelling includes the letter “u” in words such as “behaviour”, “colour”, “favour”, “harbour”, “labour”, “rumour”, “neighbouring”, “remould”, “gauge” and doubles the consonant in words such as “modelling”, “travelling”, “controlled”, “labelling”, “omitted”, “focussing”, “referring”, and “preferred”, (but “offered” and “offering”, because the stress is on the first syllable). American spelling omits the “u” and does not double the consonant in these words. (“occurring” and “occurred”, however, are written the same way by both conventions).

A simple and useful distinction of meanings can be made by writing “metre” for distance and “meter” when referring to a measuring device. Similarly, the spelling “programme” as in “testing programme” keeps the meaning apart from “program” as in a “computer program”.

When writing “centre” (English) and “center” (U.S.), use the correct tense forms**:** “centred” and “centered”, respectively.

Avoid the lose style displayed by contractions such as “don't” or “can't”. Write “do not” and “cannot”. Also, when meaning “it is”, do not write “it's” or “its”. (“its” is a possessive pronoun that must not be written “it's” in any style).

Do not overuse nouns as adjectives. Four nouns in a row is an abomination. For instance, “the concrete pile toe capacity”, which reads much better if changed to “the toe capacity of the concrete pile”.

Avoid “there are “ constructions; write “two critical points are shown ...”, not “there are two critical points shown...”.

Avoid “of the” phrases. Thus, write “the page length should be 100 mm” rather than “the length of the page should be 100 mm”.

Use plain English and common words rather than fancy ones, and be concise (on account of that sesquipedality does not result in perspicacity). Use short sentences and avoid lengthy or awkward constructions. If a sentence requires more than three lines, it is usually better to divide it into two sentences.

Think of the literal meaning of words and expressions and avoid 'ear-sores' such as “up to a depth of 4.5 metre”.

Do not abuse the word “predict” by using it as synonymous with “calculate”, “determine”, or “compute”. The word “prediction” is an absolute word that requires that the calculation truly was made before the test. True prediction is a rare flower!

Short paragraphs will make the paper more readable. Limit the text to one statement or message per paragraph.

Always make two space bar depressions after a period before starting a new sentence.

Take care never to leave a number alone at the end of a line and its units on the next line, e. g., “16 MPa”. Use a non-break space command between numerals and units for getting “16 MPa” to always be together.

When writing “Fig. 5”, “Author B. C.”, “i. e.”, “e. g.”, and abbreviated words, automatic justification of the lines may result in too wide a space after the period, e. g., Fig.   5”, “e.   g.,” and “Author B.   C.”. To avoid this, always follow such a period with a no-break-space command. This is particularly necessary in the Reference chapter.

Work on the interpunctuation. Commas are important for assisting the understanding of the text and must not be neglected. Notice that there is a difference of meaning between “Also, the experiments showed that ...” and “Also the experiments showed that ...”. Consider the life and death importance of whether Caesar's order about your impending execution or liberation reads “*Execute, not liberate*” or “*Execute not, liberate*”.

Use always the convention of the “serial comma”. Thus, write “red, white, and blue” with a comma separating each item in the series.

Notice that there is often a difference between similar words. For instance, “alternate” and “alternative”, where “alternate” refers to every second in a series, and “alternative” is one of two possibilities. “Alternate”, but not “alternative” can sometimes mean “substitute”. The word “substitute” is then to be preferred. Further, do not confuse the words “objective” and “object”, they are quite different. And “disinterested” and uninterested” have different meanings, as do “imply” and “infer” as well as “principle” and “principal”. Other examples of common mixed-up pairs are “continuous” and “continual”, “imminent” and “eminent”, and “consist of” and “consist in”. It is a good idea to keep a thesaurus handy for reference to the correct meaning of words.

Many times, the words “precision” and “accuracy” are confused. An example of “precision” is the reading precision of a gage, that is, the number of decimals given in the gage reading. “Accuracy” considers errors in the gage and in a combination of measurements and calculations. Some authors will write “the accuracy of the prediction of capacity was 3 percent”, but they actually mean to refer to an “agreement” between values. Accuracy in prediction of pile capacity can never be as good as 3 percent!

The word “anybody” means “anyone”. “Any body” means “any corpse”. Similarly, “any one” means “any single person”.

The word “data” is a plural word and takes plural verbs. So are and do the words “criteria”, “formulae”, “media”, “memoranda”, “phenomena”, as well as “strata”. Therefore, the appertained verb must be in plural form. The corresponding singular words are “datum”, “criterion”, “formula”, “medium”, “memorandum”, “phenomenon”, and “stratum”.

Notice that a verbal message can be spoken or written, heard or read. If you want to say that the message is spoken as opposed to written, say "oral".

To some, words such as "usage", "finalized", etc. may look refined. The truth is that they just disturb the reader. Use the simple versions: "use", "final or finished", etc.

The words "order of magnitude" imply a relation of ten! Usually, the intended meaning is better expressed by plain "magnitude" or "size".

Puristically, "in-situ" should be written in italics, but hyphenating it provides sufficient distinction. Do not write it as "insitu", or as "in situ".

The word "less" is overused. Whenever possible, replace it by its various equivalents, such as "fewer", "smaller", "lighter", "lower", "poorer", etc.

Do not use the ampersand symbol, "&" in a running text, write "and".

Prefixes such as "pre-" are often unnecessary. For example, the word "predominant" can often be written "dominant" (and preferably be replaced by words such as "governing", "principal", "leading", etc.).

PRESENTATION AT CONFERENCES AND SEMINARS

A presentation should make ample use of visual aids, such as slides and overheads. Do not read from a prepared text, but use cue cards, or better still, take your cue from your visuals. Speak only when facing the audience, that is, point and look at the visual projected on the screen, as necessary, but when doing so stop talking.

Speak slowly and make an effort to pronounce all words in full. Remember, if English is your own language, it may not be the most familiar tongue of your audience. If English is not your mother tongue, keep in mind that the audience may not be used to your accent. Give an considerate thought to that piling people tend to be hard of hearing.

It is impossible to present all the information contained in your paper, so do not even try. Choose one main result or message and concentrate on it. When the persons in the audience can understand and appreciate the message of the presentation, they will search out your written material to learn about the rest of your work. Cramming too much into the oral presentation will have the effect of alienating the audience.

Good visuals can rarely be made from the figures used in a paper, because most such figures have too much detail and too small lettering and letters and numbers should be as large as possible. The minimum text size for a figure used as a visual the recommended size (height) of a letter is 3 percent of the diagonal. If you intend to use a figure from the paper as a visual, therefore, you most likely will have to redraw it to do the audience and the paper—as well as yourself—full justice. When preparing the visual from the figure in the paper, eliminate all extraneous text, such as captions and literature references. For curves, use wide lines and use large symbols to indicate all plotted points.

As a rule, show only the graphic information you intend to address in the presentation and use no more information than can be assimilated in 30 seconds. Then, allow for 2 minutes of presentation time per visual and consider that additional time is needed for information not supported by a visual.

Typically, a presentation assigned, say, 15 minutes total time, barely contains 12 minutes of effective time. Then, if the entire presentation is supported by visuals, there is time for no more than about 6 visuals, and maximum 8. Trying to include more than this easily reduces the efficiency of the presentation and the audience will have difficulties catching the message. This is particularly the case when the speaker's home language is not English.

Do not use tables in a visual. Most material contained in a table is much more informative if shown in a diagram. When a table just has to be shown, limit the number of lines to 4 and the number of columns to 3.

For 35-mm slides, make sure that the copy fills the image rectangle so that the visual properly fills the screen. This is in contrast to overheads, which should not be larger than a square with 7 inches side. Outside this area, most overhead projectors give a faint or a blurred picture.

Unless your are addressing a very large audience, it is better to use overheads instead of 35-mm slides, because when the light is dimmed in the hall, the concentration powers of the audience diminishes too. Furthermore, your direct eye contact with the audience is lost. But remember, the preparation of the overhead 'flimsies' deserves as much care and respect as the slides.

When using computer graphics, e. g., Power Point, avoid the temptation to add too many colors and especially all fancy backgrounds, or the visual will be hard to read and to absorb quickly.

THE MANUSCRIPT

As everyone knows from own experience, the quality and value of the papers published by the profession in journals and conference proceedings vary. Reading a paper is often a frustrating experience and one that could have been much more gratifying had the author considered a few simple rules, as follows.

The paper that is short on soil information provides little of value to the reader, however detailed the rest of the paper. All geotechnical papers must contain a minimum of basic soil information, which should include soil descriptions based on grain size, geological origin of the deposit, and distribution of the bulk density of the soil as well as the solid density (the latter is not always 2,670 kg/m^3). In addition, the paper should inform how these data were obtained and give representative results of applicable in-situ tests (SPT, CPT, PMT, DMT, etc.) and laboratory tests. Naturally, information on

the location of the groundwater table and the distribution of the pore pressure must always be included. Notice, the pore pressure distribution is rarely hydrostatic. Without this minimum of background information, the reader will not be able to relate the site conditions to experience from other sites and papers and judge the applicability and contribution of the paper to the state-of-the-art.

Test data should be presented in diagrams with legible text (see the specific advice given above). In addition to the diagram, on occasions, it may be a good idea to include important data also in a table to enable the reader to numerically re-analyze the information or to combine the data with other data.

As to the technical content of a paper, empirical design rules are of course valuable and useful in practice and papers are well justified in presenting analyses based on such approaches. However, the empirical approaches rarely have general validity, but their relation to the basic parameters is always valuable. For example, when making use of empirical approaches to calculate capacity, say, basing the calculation on SPT N-values or on the CPT local friction and point stress, the calculation results, as well as the results of an analysis of a static loading test, should always be put in relation to basic principles of effective stress. Too many papers ignore this simple to follow, yet so important principle.

Similarly, when addressing settlement of foundations, the elastic modulus approach is of little general interest. Soil settlement should be presented with an understanding that soil compressibility is not linear with stress level. At the very least, the Janbu tangent modulus approach should be applied to the calculations in engineering papers dealing with analysis or prediction of settlement.

A large number of piling papers deal with load-transfer observed during a static loading test. For many years, it has been known that neglecting the effect of residual loads imposes gross errors in the load distribution estimation. Yet, many authors presenting load distribution results still do not include a discussion of the effect of residual loads on the results.

Residual loads are locked-in loads, compression as well as tension, produced in the pile by a variety of factors. They can be induced by the pile driving, by the displacement and soil movements from the driving of adjacent piles in a pile group, by the reconsolidation of the soil after the driving, and by the long-term transfer of stress and strain between the stiff pile and the not so stiff soil. The two latter effects dominate in both cohesive and non-cohesive soils. Normally, therefore, when performing a static pile loading test, the pile is in compression. Disregarding the residual load (compression load) results in a load-transfer curve that overestimates the shaft resistance and underestimates the toe resistance.

Many papers include a publications reference list that appear to have been selected by random association rather than by thoughtful selection. Thoroughly selected pertinent references are vital to any paper. Whenever possible, papers addressing an international audience should give preference to references of papers written in English and be limited to those available in major libraries. The exception is when indicating the source of the data used in the paper and when the reference is given for credit of priority.

Remember, the reference list is not for showing how well read the author is, but to be of service to the reader.

No statement or conclusion should be given without being supported by fact, publication reference, or analysis in the paper. All calculations using a formula must indicate the source of the formula by proper reference. If the reference is not the original source of the formula, this should be so indicated. For example, “Terzaghi and Peck (1948) as quoted by Snabb and Slarvig (1989)”. Some authors of papers offered to the international literature are very chauvinistic when selecting the references, not realizing that a paper and an author may well be justifiably “world famous in Sweden”, but still unknown abroad.

In making a publication reference, information necessary for retrieval must be included and be correct. Notice that the reader must be able to locate the reference. See the detailed comments above.

The above offered comments are not exhaustive. However, they originate from observed neglects in papers offered to conferences where peer-review is not pursued or is too benign. Addressing these comments does not add much time to the writing of a paper and authors who take this time will find that the profession's response to their paper will improve dramatically.