Inconsistencies in Settlement Analysis Textbook and FORTRAN Code

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During review of the legacy FORTRAN code for the VDispl software, we referenced the Settlements Analysis book linked in the README file to correlate each calculation with its corresponding theories and formulas. This process revealed many potential errors in the code and the formulas presented in the textbook, along with some inconsistencies between calculations made in the code and calculations shown in the textbook. This document is a compilation of all such occurrences.

Notes

All references to FORTRAN code are relative to line numbers in the *most recent* version of the code, found under **Resources/fortran_src/vdisp.for** while all references to the pages in the Settlements Analysis textbook refer to a page number of the PDF linked in the README.md file.

Potential Errors in Textbook

Having examined the many formulas in the book during the research and analysis of the FORTRAN code, we have come across some potential errors in the textbook, ranging from variable names to questionable units.

Units for unit weight of water, γ_w:

On page 12 of the Settlements Analysis PDF, under heading (3), there is a reference to a constant γ_w, which represents the unit weight of water. This constant is known to be 9.807 kN/m^3 in SI units, however the textbook lists it as 0.031tsf. The unit tsf — tonnes per square foot — seems to be a unit of pressure which can be converted to N/m^2. We have no current explanation for this discrepancy.

Leonard's and Frost Model:

On page 169 of the Settlements Analysis PDF, the equation (F-1) has a variable c_i which represents the correction to account for strain relief from embedment, but in subsequent explanations and in the FORTRAN code it is labelled as c_1.

Furthermore, the equation (F-4) on the same page is as follows:

$$\phi_{ax} = \phi_{ps} + [\tfrac{\phi_{ps}-32}{3}]$$

However, in the 1994 publication of the textbook, the equation is slightly altered to:

$$\phi_{ax} = \phi_{px} + [\tfrac{\phi_{ps}-32}{3}]$$

The variable ϕ_{px} is not defined nor mentioned in the textbook. The FORTRAN code uses the 1990 version of this formula. It is not clear whether the 1994 version introduced a typo or a meaningful change.

Finally, equation (F-5) on page 170 of the Settlements Analysis PDF has a

variable called K_p. The textbook never describes nor mentions this variable. It does however mention a variable K_d, and also provides a formula for it. It seems equation (F-5) has a typo in the subscript.

Output File Explanation:

In Appendix F, Table F-3 (p. 167) of the Settlements Analysis Textbook, there is a typo in the explanation of the logic for deciding to output "Equilibrium saturated above water table" or "Equilibrium hydrostatic profile above water table". On line 13, the conditional statement checks for NOPT= 0 instead of NOPT= 1. The truth table should match the following, where $f = 1$ means the program outputs "Equilibrium saturated above water table", else program outputs "Equilibrium hydrostatic profile above water table":

IOPTION	NOPT	f
0	0	1
0	1	1
1	0	0
1	1	1

Note: $f \equiv$ IOPTION$\Rightarrow$NOPT.

Input File Examples:

In Appendix F of the Settlements Analysis Textbook, there are multiple example input files, and their corresponding output. Table F-6 on p.176, titled *Settlment of Granular Soil, Schmertmann Model*, has a typo. In the last line of Table F-6a, there are two entries: "3 10.00". This line should only have one entry which represents *time in years after construction*. By examining the output file, Table F-6b, it is clear that the value of *time in years after construction* should be 10, thus the *3* at the beginning of the line should be removed. Upon removal the output of the *vdisp.for* program matches Table F-6b.