U N I P I L E Version 4

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Analysis of Piles and Pile Groups for Capacity and Settlement

including Dragload due to Negative Skin Friction, and Downdrag due to Settlement

Piles are not installed in elastic half spheres of uniform material. Piles are installed in soils consisting of a variety of materials deposited or formed in layers and bands of different density and strength. Moreover, the groundwater table lies not always at the ground surface and, frequently, a pore pressure gradient—upward or downward—exists in the soil. In the real world, piles are usually installed in excavations and through old fills, and an embankment may be placed around a pile group. In the real world, piles have variable capacities, experience varying amounts of settlement, and are subjected to downdrag.

UniPile is developed to determine pile **capacity**, pile group **settlement**, and **dragload** due to negative skin friction in the real world, where the soils consist of interchanging layers, where the pore pressures are artesian or the gradients are downward and differ from layer to layer, and where there are excavations and fills. UniPile also produces a simulation of the load-movement behavior to expect in a **static loading test**.

UniPile options and advantages are many. For example:

- Learning the program takes only a few minutes. Pile and soil data describing the conditions at a site are quickly entered and the calculation is **instantaneous**. All calculations and file handling follow the Windows format.
- Analysis can be by the **beta** (effective stress) or **alpha** (total stress) methods, even the **lambda** method, and the methods can be combined in up to 20 soil layers with the soil strength parameters, soil compressibility, as well as pore pressures varying within each layer.
- Perform calculations in either **English or SI-units** and convert from one to the other and back again with one simple keystroke.
- Analyze piles of all sizes: **driven piles** and **drilled-shafts**, single or in group, of any cross section: square, rectangular, hexagonal, octagonal, round, or H-section.
- Analyze **tapered piles:** step-tapered, uniform tapered, Mono-Tubes, and underreamed piles.
- Analyze the **settlement** of a pile group and, simultaneously, that of the surrounding area, choose for each soil layer conventional c_c-e_0 approach, an E-modulus, or the tangent modulus method.
- UniPile has a very strong "what if" capability and will in seconds determine the effect on capacity, dragload, and settlement of a **change** in pile length, pile size, soil density, etc.
- Determine the distribution of **residual load** and how it would affect, say, measured loads.
- Simulate a **static loading test** with input of t-z curves for each separate soil layer. The simulation uses the calculated shaft and toe capacities and is useful when calibrating the analysis to the results of a static loading test and when designing for deformations under the pile loads.
- Produce the capacity and distribution of shaft and toe resistances a table in the format required for **GRLWEAP** input at both initial driving and at restriking—at initial installation and after set-up.
- Print the results in tables (hard copy or to files) that are easy to understand and ready for insertion in an engineering report.
- Plot the results in easily edited diagrams to the plotter/printer of your choice or to files for access by a graphics program. Send data to file for special plotting and editing in other programs, e.g., Excel.
- Determine the effect of capacity variation between piles in a group.
- Import a soil file from UniSettle or export a soil file to UniSettle (Version 2.3 and later).
- Of course, Version 4 will read files produced using earlier versions of the program.

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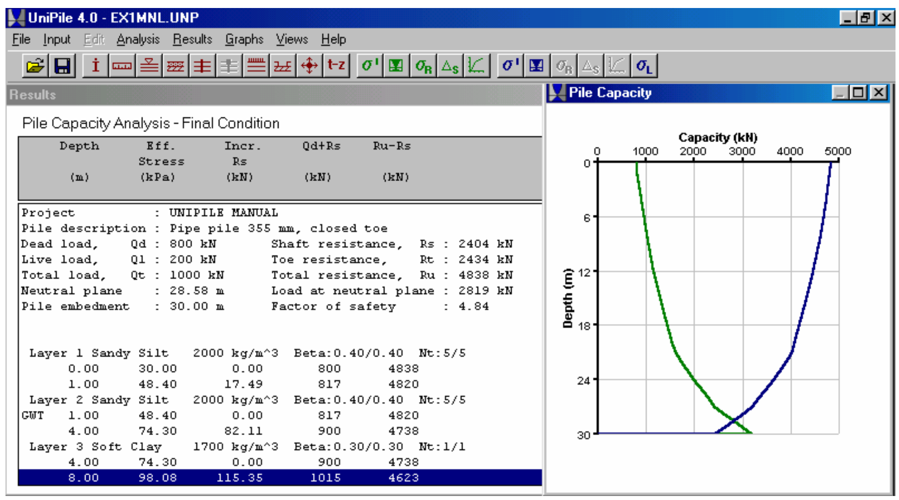
The table to the right shows UniPile's soil data input window. Four layers are visible. The cursor is on the Layer 4 soil density input (kg/m3). The figure below presents the results of a calculation of capacity. The results are given in a tables (print to hard copy oft to file) and as a load and resistance distribution diagram with the construction of the neutral plane included. Units are SI (metric) but the input and results can be converted to English units by a toggle command.

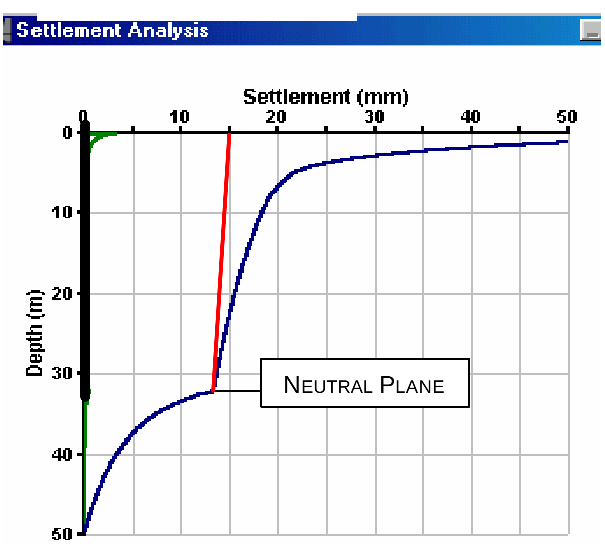
Soil Data

Units : (kg/m^3)

Layers :	1	2	3	4
Type :	Silt Sand	Silt Sand	Silty Clay	Sandy Silt
Thickness :	0.5	1.5	8.	5.
Depth :	0.5	2.	10.	15.
Density :	2150.	2150.	1950.	2100.
Exp, j :	0.5	0.5	0.	0.5
m (t/b) :	100/100	100/100	40/40	180/180
mr (t/b) :	0/0	0/0	350/350	900/900
dp (t/b) :	0./0.	0./0.	0./0.	0./0.
OCR (t/b) :	1./1.	1./1.	1.4/1.4	2./2.
Beta, B :	0.6/0.6	0.6/0.6	0.35/0.35	0.4/0.4
C' (t/b) :	0./0.	0./0.	0./0.	0./0.
Nt' (t/b) :	10./10.	10./10.	12./12.	20./20.
Step :	2.	2.	2.	5.
t-z shaft :	1	3	3	3
t-z toe :	21	21	21	21

Additional analysis options are deter-mining capacity versus depth, input of soil resistance to a GRLWEAP analysis (previous as well as current WEAP versions), simulation of a static loading test, residual load distribution, and, not least, pile group settlement.





The diagram to the left presents the results of a settlement analysis. The calculation includes the effect of the load on the pile group, of course, but also the effect of an excavation and fill plus a lowering of the groundwater table.

The example shows the neutral plane at the pile toe. The "Neutral Plane" is where negative skin friction goes over into positive shaft resistance. This location is not just the point of equilibrium between forces, it is also where the pile and the soil move equally (no relative movement between pile and soil). The red line indicates the settlement of the pile head, which is the soil settlement plus the 'elastic' shortening of the pile.

The technical articles available for downloading at our web site include several examples of analysis performed with UniPile. Please visit at: www.unisoftLtd.com.

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