UniCone Method, Eslami & Fellenius (1997)

Pile capacity by direct CPT and CPTu methods applied to 102 case histories

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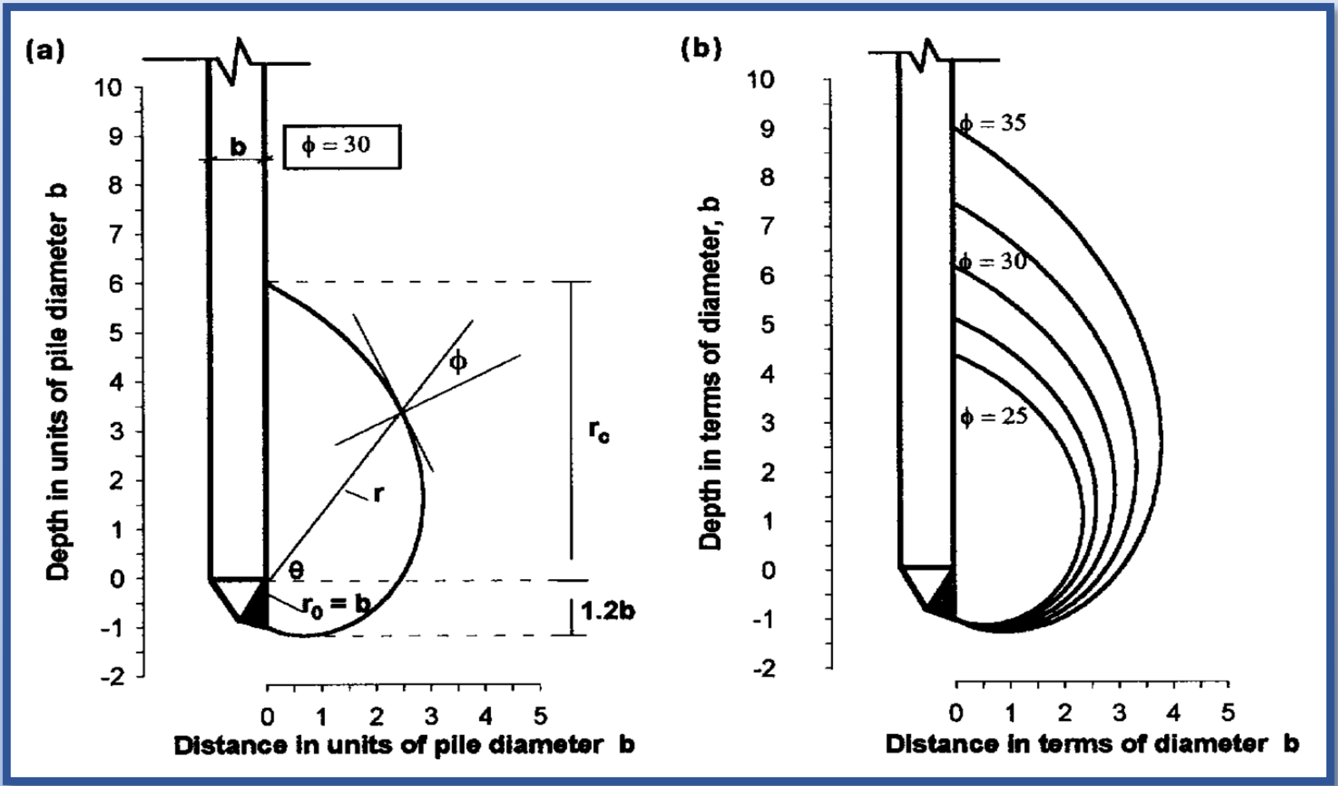
Abstract: Six methods to determine axial pile capacity directly from cone penetration test (CPT) data are presented, discussed, and compared. Five of the methods are CPT methods that apply total stress and a filtered arithmetic average of cone resistance. One is a recently developed method, CPTu, that considers pore-water pressure and applies an unfiltered geometric average of cone resistance. To determine unit shaft resistance, the new method uses a new soil profiling chart based on CPTu data. The six methods are applied to 102 case histories combining CPTu data and capacities obtained in static loading tests in compression and tension. The pile capacities range from 80 to 8000 kN. The soil profiles range from soft to stiff clay, medium to dense sand, and mixtures of clay, silt, and sand. The pile embedment lengths range from 5 to 67 m and the pile diameters range from 200 to 900 mm. The new CPTu method for determining pile capacity demonstrates better agreement with the capacity determined in a static loading test and less scatter than by CPT methods.

Key words: cone penetration test, pile capacity, toe resistance, shaft resistance, soil classification.

UniCone Method, Eslami & Fellenius (1997)

Toe Failure Zone



a) Principle of a logarithmic spiral rupture, b) rupture surfaces around pile toe for different soils (Eslami & Fellenius, 1997)

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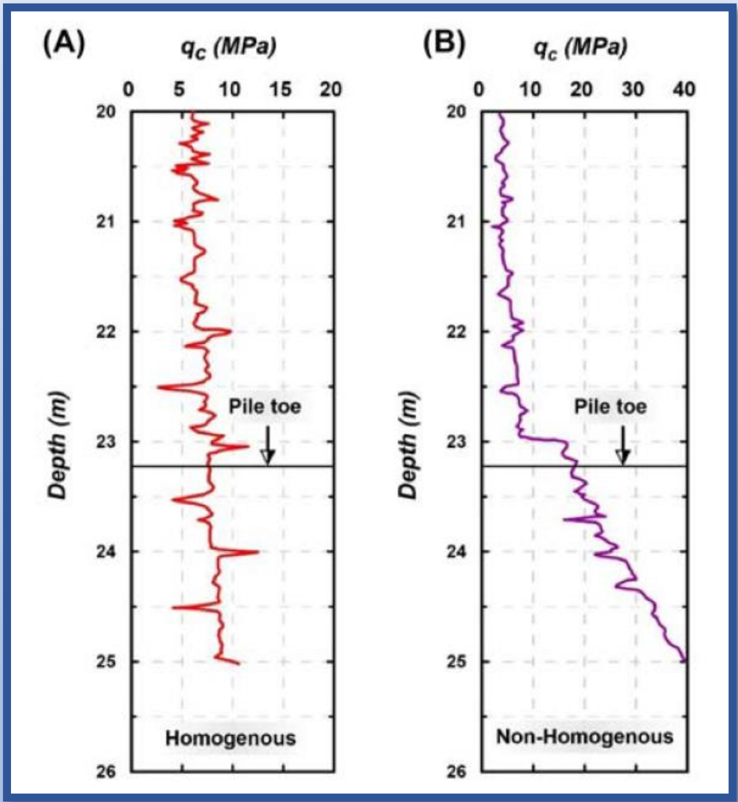
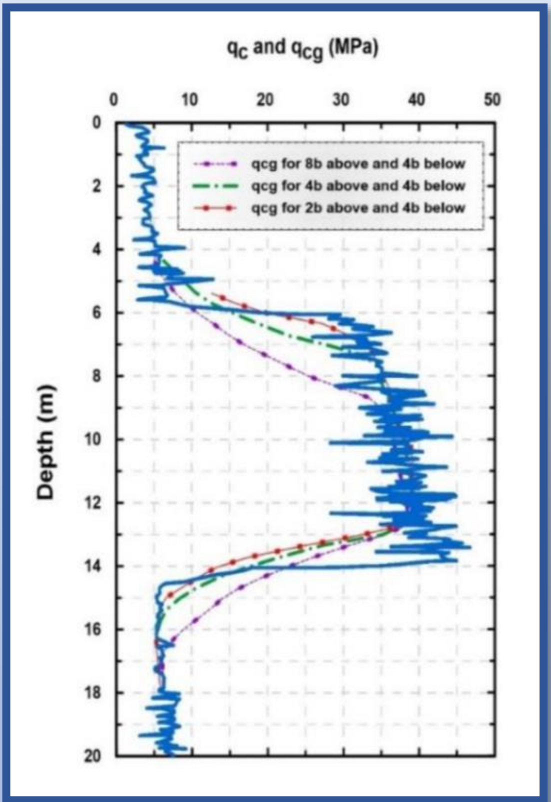
Homogeneous and Nonhomogeneous Deposits



Comparison of pile unit toe resistance for different zones: (A) Homogeneous and (B) Nonhomogeneous



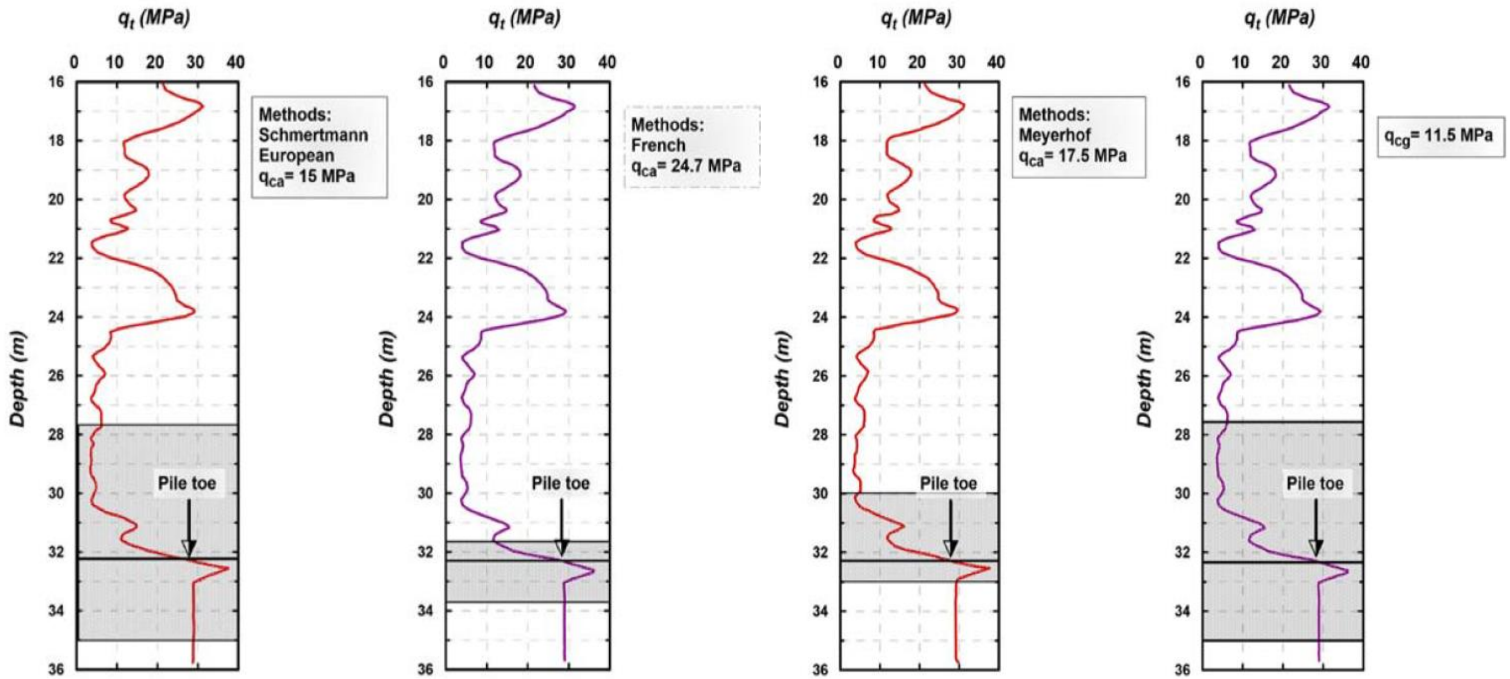
Comparison of cone resistance and calculated geometric average for a dense soil layer laid between loose layers

UniCone Method, Eslami & Fellenius (1997)

Averaging

$$q_{ca} = \frac{q_{c1} + q_{c2} + \cdots + q_{cn}}{n}$$

$$q_{cg} = \sqrt{q_{c1} \times q_{c2} \times \cdots \times q_{cn}}$$



Example of comparison of average cone resistance for different CPT methods (Eslami & Fellenius, 1997)

UniCone Method, Eslami & Fellenius (1997)

- **Toe Capacity**

$$r_t = c_t \times q_{Eg}$$

$$q_E = q_t - u$$

$$q_t = q_c + (1 - a)u_2$$

- **Shaft Capacity**

$$r_s = c_s \times q_{Eg}$$

$$q_{Eg} = \sqrt[n]{q_{E1} \times q_{E2} \times \cdots \times q_{En}}$$

Shaft coefficient correlation

Soil type	Cs
Soft sensitive soils	8.0%
Clay	5.0%
Stiff clay and mixture of clay and silt	2.5%
Mixture of silt and sand	1.0%
Sand	0.4%

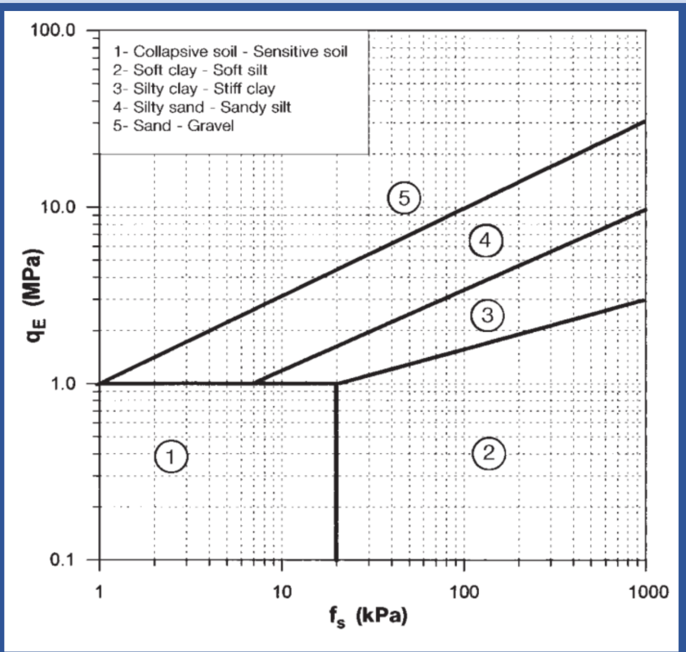
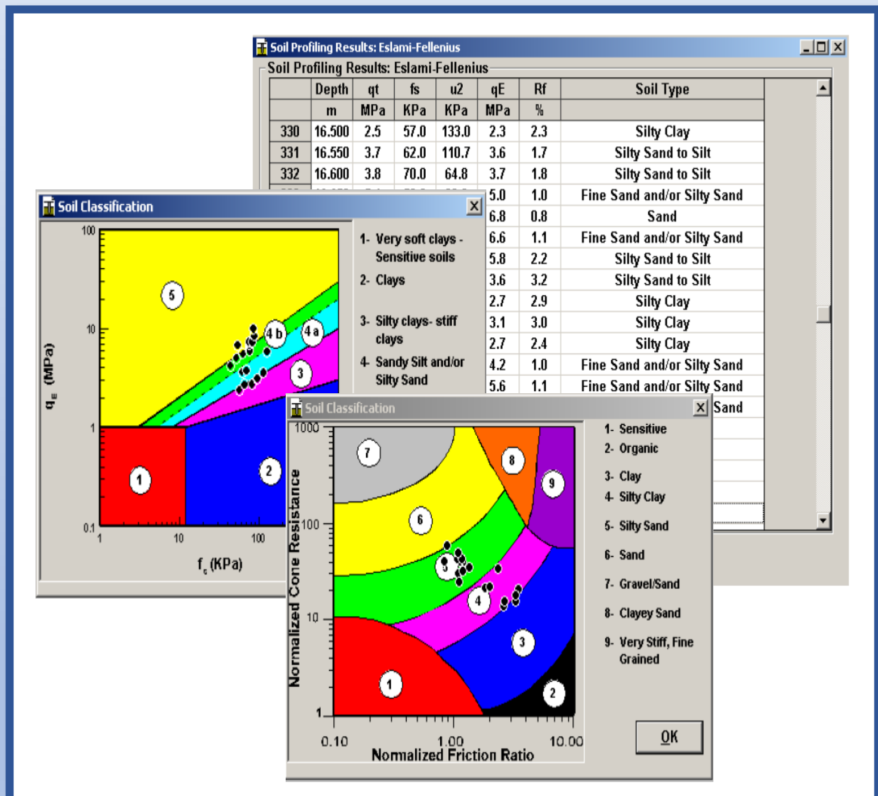


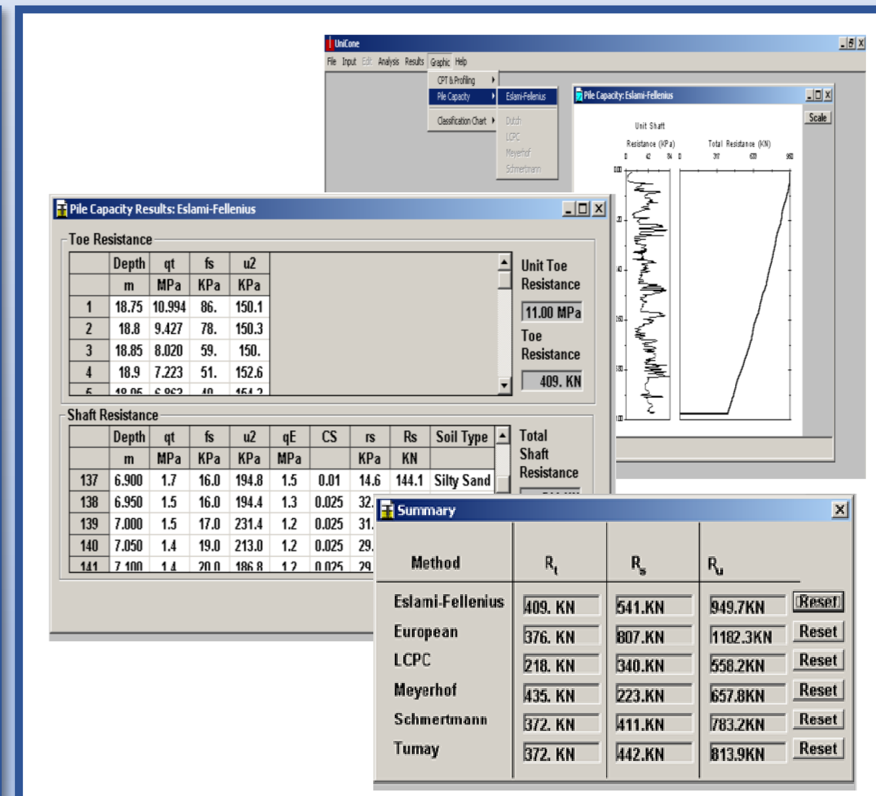
Chart for soil classification (Eslami & Fellenius, 1997)

UniCone Inputs & Outputs

Pile Capacity Calculation

Soil Profiling





New Enhancements

- Incorporating other in-situ tests, such as SPT & VST
- Appraisal of Settlement, Resistance Distribution & Load-Displacement
- Determining Relevant Geotechnical Parameters
- More Insightful and Meticulous Capacity Calculation