CPT Method

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1 CPT Correlation

This document presents the correlation implemented in the current code. ## Basic Engineering Properties

1.0.1 Unit Weight

@robertson2010soil, refer to say

$$\gamma/\gamma_w = 0.27[\log(R_f)] + 0.36[\log(q_t/p_a)] + 1.236 \tag{1}$$

- γ = unit weight of soil
- γ_w = unit weight of water
- R_f = friction ratio, the ratio of f_s over q_t, i.e, $\frac{f_s}{q_t} \times 100\%$
- q_t = corrected cone resistance
- P_a = atmospheric pressure

1.0.2 Relative Density

> Jamiolkowski (2003), Table 5 on Page 9.

The original form of relative density can be expressed as Eq.(2).

$$D_R = \frac{1}{C_2} \tag{2}$$

$$D_r = \frac{1}{3.10} \cdot \ln\left[\frac{q_t/P_a}{17.68 \cdot (\sigma'_{v0}/P_a))^{0.5}}\right] \tag{3}$$

1.0.3 Friction Angle

$$\varphi'_p = 17.6 + 11 \cdot \log_{10}\left[\frac{q_t/P_a}{(\sigma'_{v0}/P_a)^{0.5}}\right] \tag{4}$$

1.0.4 Small Strain Stiffness G_0

$$G_0 = 50 \cdot \sigma_{atm}\left[(q_t - \sigma_{v0}/\sigma_{atm}\right]^{m*} \tag{5}$$

where:

$$m^* = \begin{cases} 0.6 & \text{sand} \\ 0.8 & \text{silt} \\ 1.0 & \text{clay} \end{cases} \tag{6}$$

1.1 Liquefaction Assessment

1.2 Dissipation Tests

1.3 To-dos

2 Unified CPT Method

2.1

Skin friction within the sand can be determined using Eq.(7). The method implemented is presented in **Section 8.1.4, page 46** of ISO19901-4.

$$f(z) = f_L(\sigma'_{rc} + \Delta\sigma'_{rd}) \cdot \tan(29^0) \tag{7}$$

where σ'_{rc} refers to the radial confined stress, which can be correlated to the CPT cone tip resistance by Eq.(8).

$$\sigma'_{rc} = \frac{q_c}{44} \cdot A_{re}^{0.3} \cdot \left[\max(1, \frac{h}{D})\right]^{-0.4} \tag{8}$$

$$\Delta\sigma'_{rd} = \frac{q_c}{10} \cdot \left(\frac{q_c}{\sigma'_v}\right)^{-0.33} \cdot \frac{d_{ref}}{D} \tag{9}$$

$$A_{re} = 1 - PLR \cdot \left(\frac{D_i}{D}\right)^2 \tag{10}$$

where $PLR = 1.0$ for typical offshore piles.

3 Reference