IIS UNIVERSITY OF TOKYO
GDM

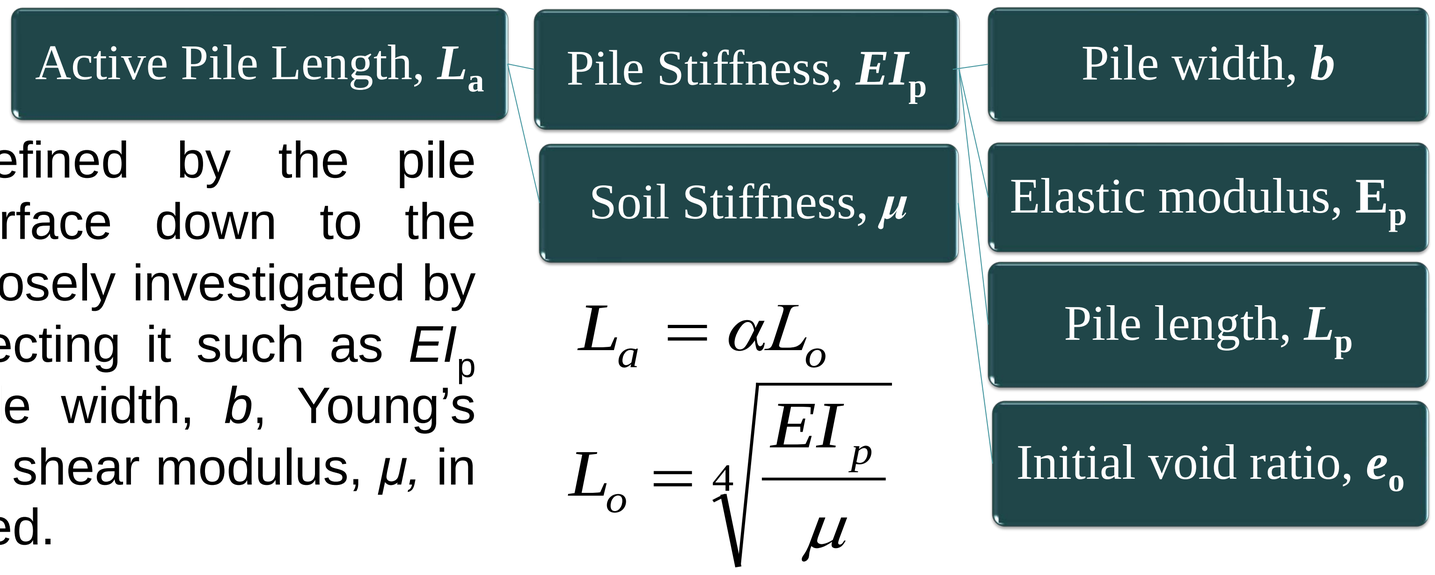
Parametric Analysis of Active Pile Length and Application to Ultimate Lateral Pile Resistance in Sand

Geo-disaster Mitigation Engineering

R. AGLIPAY

Active Pile Length

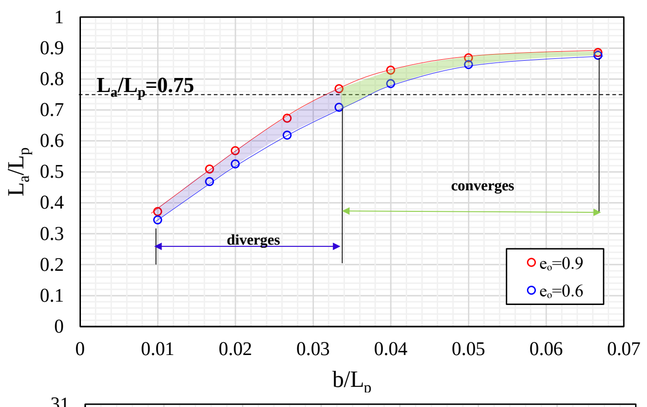
The **active pile length, L_a,** defined by the pile deformation near the ground surface down to the negligible point along the depth is closely investigated by varying the parameters directly affecting it such as EI_p and μ. Particularly, the factors: pile width, b, Young's modulus, E_p, pile length, L_p, and soil shear modulus, μ, in terms of initial void ratio, e_0, are varied.



$$L_a = \alpha L_o$$

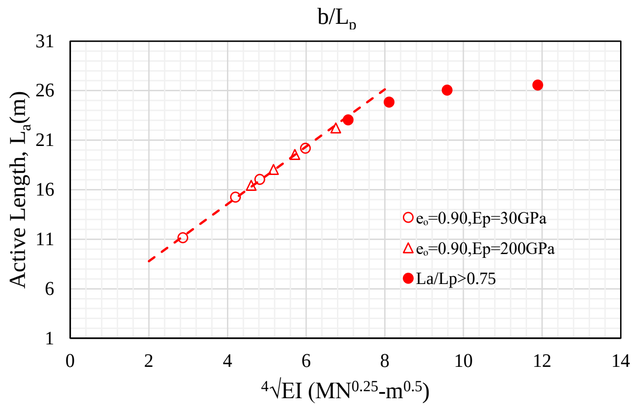
$$L_o = \sqrt[4]{\frac{EI_p}{\mu}}$$

Effects on the Active Pile Length by the Following Factors:



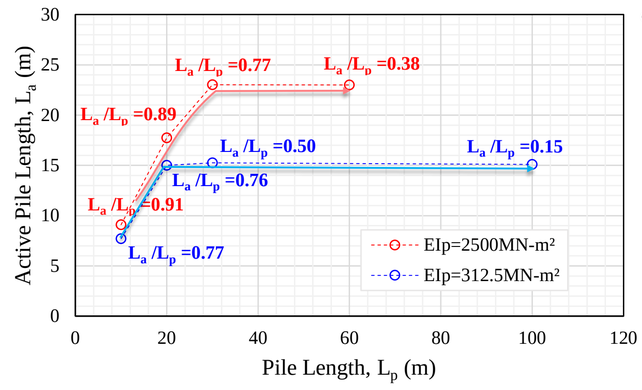
(1) Pile Stiffness, EI_p

- Generally, the L_a increases with increase in the b.
- For L_a/L_p <0.75, the L_a/L_p for loose and dense sands **diverges**.
- For L_a/L_p >0.75, the L_a/L_p for loose and dense sands **converges.**
- Consider L_a/L_p<0.75 to avoid an effect of bottom restraint.



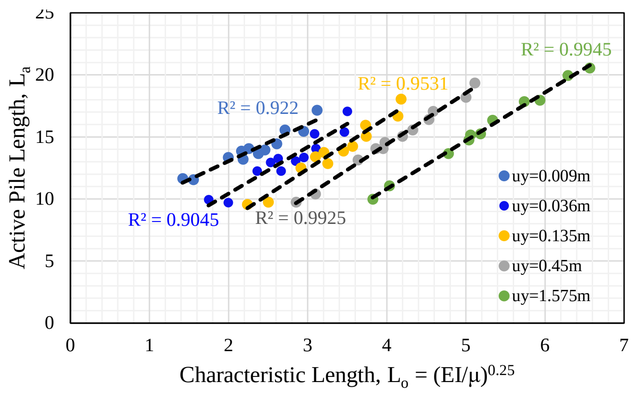
- With increase in EI_p, the L_a increases
- For L_a/L_p<0.75, all the data points lie on a line defined by y=2.891x+3.
- $\sqrt[4]{EI_p}$ is linearly proportional to L_a

(2) Pile Length, L_p

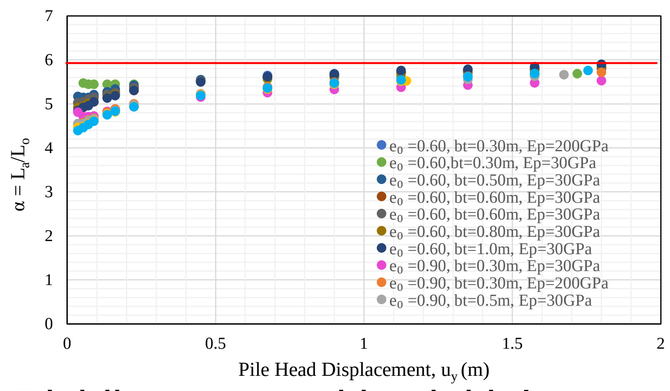


- L_a continues to increase with increasing actual pile length, L_p, until the ratio L_a/L_p becomes less than 0.75.
- L_a, starts to become constant despite increasing L_p, if L_a/L_p reaches 0.75.

(3) Shear Modulus, μ

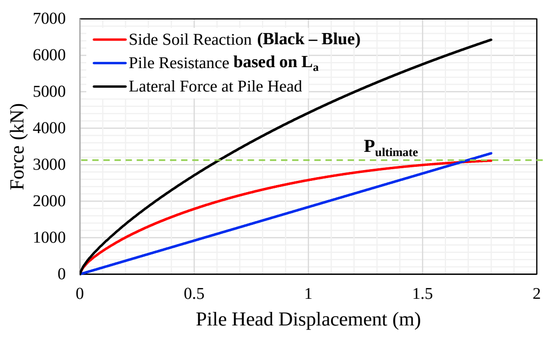


- The active pile length with respect to the characteristic length, $L_o = (EI_p/\mu)^{0.25}$ for **all cases of piles** embedded in **loose** and **dense** sand with various pile head displacement is **linearly proportional**.

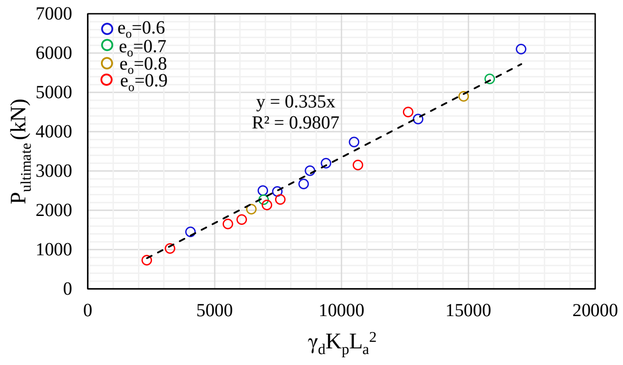


- Dividing L_a with initial L_o, α converges to a constant line with respect to the progression of u_y

Application of Active Pile Length



$P_{ultimate}$ for all cases is defined by the constant line in the **side soil reaction.**



$$P_{ultimate} = 0.335 K_p \gamma_d L_a^2$$

L_a, K_p and **γ** can be key parameters to define **$P_{ultimate}$** evidenced by high correlation

➡ The active pile length, a function of pile stiffness and shear modulus is a key parameter to describe the ultimate side soil resistance for simplified approach