IIS UNIVERSITY OF TOKYO
GDM

Ultimate lateral resistance of piles embedded in soils based on active pile length

R. AGLIPAY

Geo-disaster Mitigation Engineering

Active pile length

The lateral resistance of the piles is governed by the soil-pile interaction since the piles and the soil are mutually dependent from each other. When the pile is induced with a lateral load, it deforms relative to the surrounding soil's deformation. For flexible piles commonly used in practice, when a vertical beam is loaded at the head by a lateral force, the lateral deformation is observed to be significantly prominent at the upper portion and the lateral deformation decreases with increasing depth. Within this region of deformation, the pile can be described as a cantilever beam, assuming fixity at negligible deformation. This region is called the **active pile length , L_a** (see Figure 1).

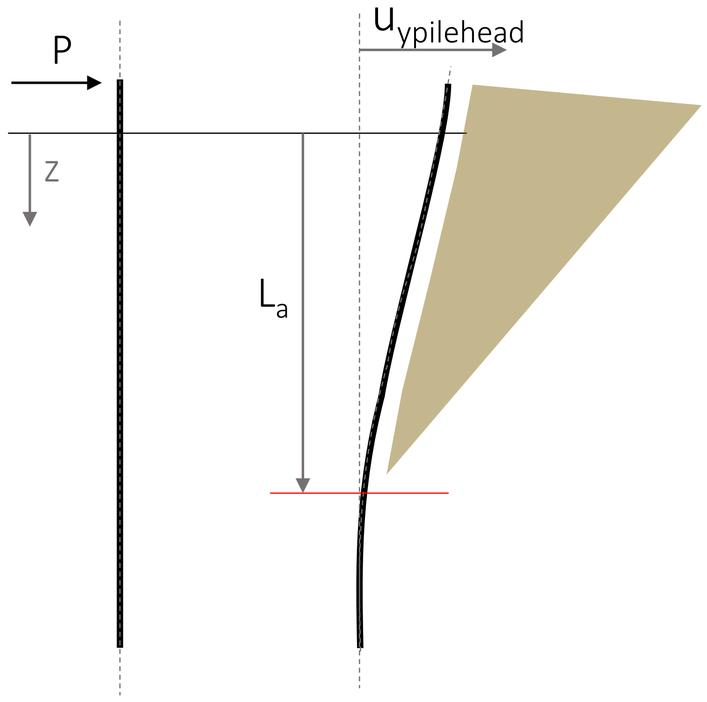

FIGURE 1. Formation of soil wedge along the active pile length

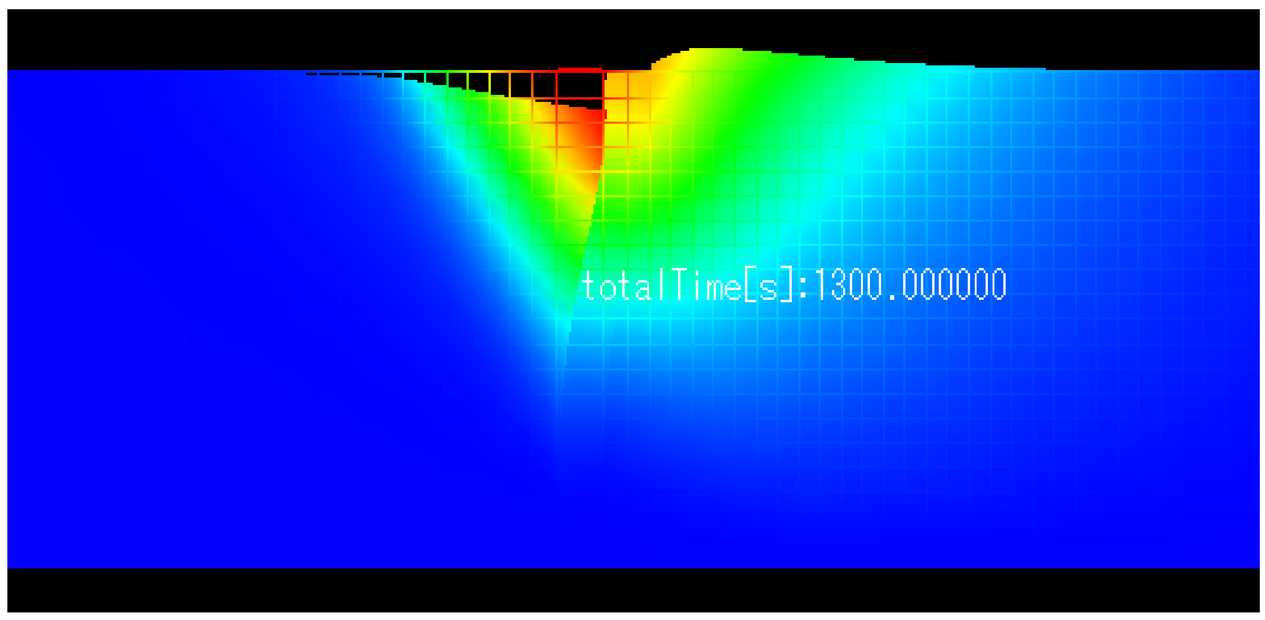

FIGURE 2. Numerically simulated soil deformation of laterally loaded pile

Under large excitation, soil nonlinearity happens. When piles reached its ultimate lateral load, a soil wedge is pushed up along this active pile length. This soil wedge is deemed to define the ultimate lateral resistance of pile as a function of the active pile length. The soil deformation due to a lateral load is numerically simulated (see Figure 2).

Load-deformation curves of laterally loaded pile

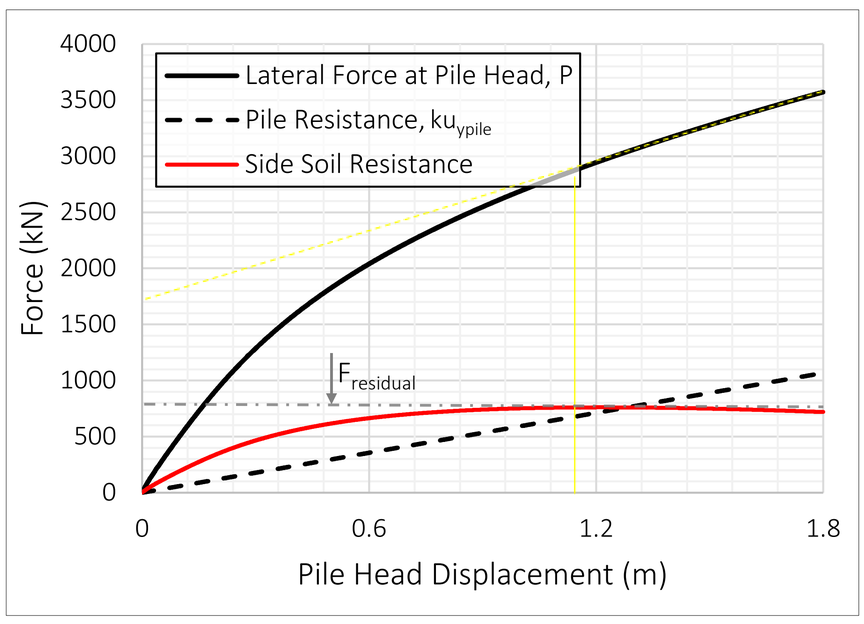

FIGURE 3. Load-Deformation (P-Y) Curves of the Laterally Loaded Pile

The active lengths are derived at the fixity point defined as 5% of the maximum pile head deflection (Velez, 1983). In Figure 3,

- **Pile resistance curve** is derived assuming a cantilever beam of length same as the **active pile length**.
- Then the **side soil reaction curve** is derived from the difference between the P-Y curve of the lateral force at the pile head and the pile resistance.

The side soil reaction becomes constant despite increasing pile head deformation, this constant value is the **residual force** or the ultimate side soil resistance.

Thus, the active pile length is a key parameter to describe the ultimate lateral resistance of piles and has the potential to evaluate the soil wedge together with other important soil parameters

Active pile length can be a key parameter to evaluate the ultimate lateral resistance of piles.