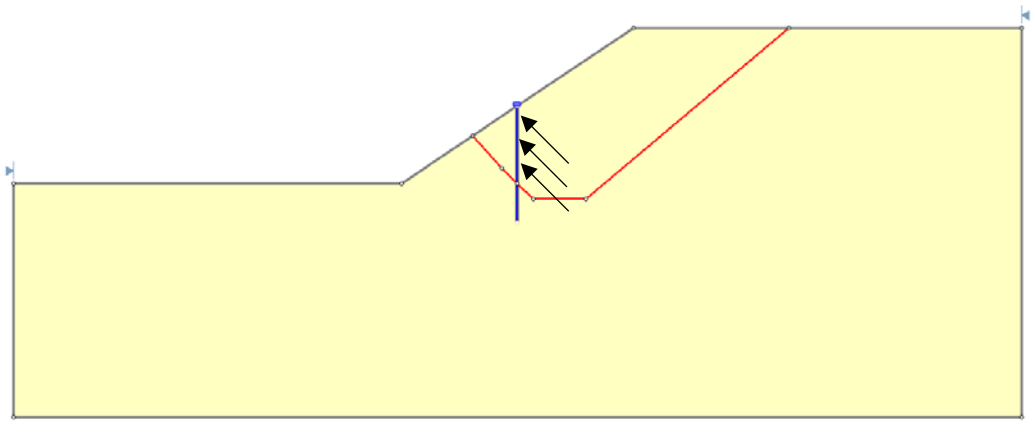
RSPile

Axial and Lateral Pile Analysis



Verification 2 Steel Pile for Slope Stabilization in Cohesionless Soil

Keywords: Steel pipe pile, Sliding analysis, Axially Loaded Pile in Uplift, Laterally Loaded Pile, API Sand, Sand

2 Steel Pile for Slope Stabilization in Cohesionless Soil

2.1 Problem Description

This problem examines a steel pipe pile embedded into cohesionless soil for slope stabilization. The assumed slip surface intersects the pile at 45 degrees to the horizontal. The problem will analyze the axial and shear forces in the pile when subjected to a uniform soil displacement of 25 mm from the ground to the slip surface intersection as shown in Figure 2-1. The solutions from *RSPile* are compared to commercial pile analysis software *TZPile* [1] and *LPile* [2].

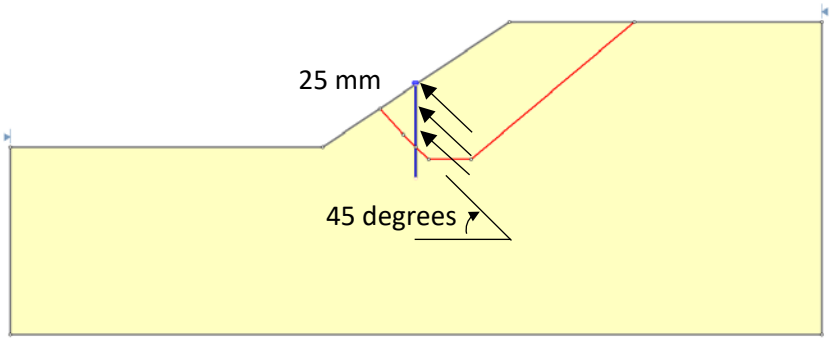


Figure 2-1: Steel pipe pile subjected to a uniform soil displacement of 25 mm

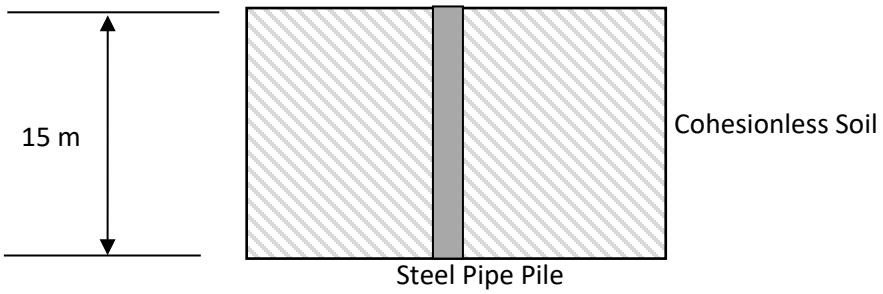


Figure 2-2: 15 m embedded steel pipe pile in cohesionless soil

The pile properties are presented in the following Table 2-1.

Table 2-1: Pile Properties

Parameter	Value
Young's modulus (*E*)	200 GPa
Pile Outer Diameter	0.61 m
Pipe Wall Thickness	0.02 m
Embedment Length	15 m

Conventional soil models are different for axially and laterally loaded piles although they may share similar properties. The soil properties are presented in Table 2-2.

Table 2-2: Cohesionless Soil Properties

Parameter	Value
General Properties	
Unit Weight	18 kN/m^3
Friction Angle	30 degrees
Axially Loaded Piles	
Soil Type	API Sand
Coefficient of Lateral Earth Pressure	0.8
Bearing Capacity Factor	35
Laterally Loaded Piles	
Soil Type	Sand
Coefficient of soil reaction (k_{py}) (elastic portion of p-y curve)	16300 kN/m^3

2.2 Numerical Solution

To compute the pile resistance, the axial and lateral components are computed separately. For a slip surface intersection at 45 degrees above the horizontal, the axial and lateral components of the applied displacement are 17.68 mm respectively, as shown in Figure 2-3. The resultant force from the axial and lateral resistance is the pile resistance.

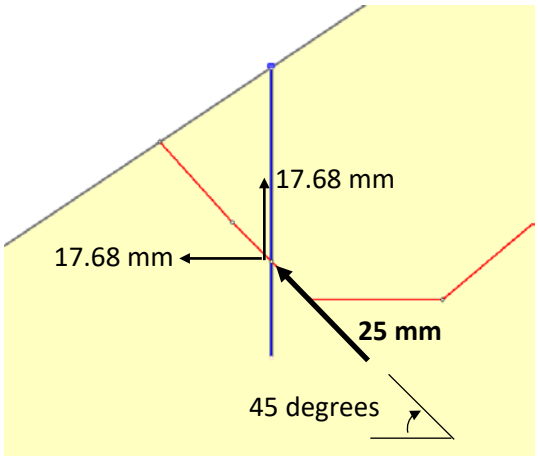


Figure 2-3: Components of the applied displacement to compute axial and lateral resistance

2.3 Results

Figure 2-4 shows the load distribution throughout the pile subjected to an applied displacement of 25 mm at 5 degrees to the horizontal. The results from RSPile compare well with TZPile [1] and LPile [2].

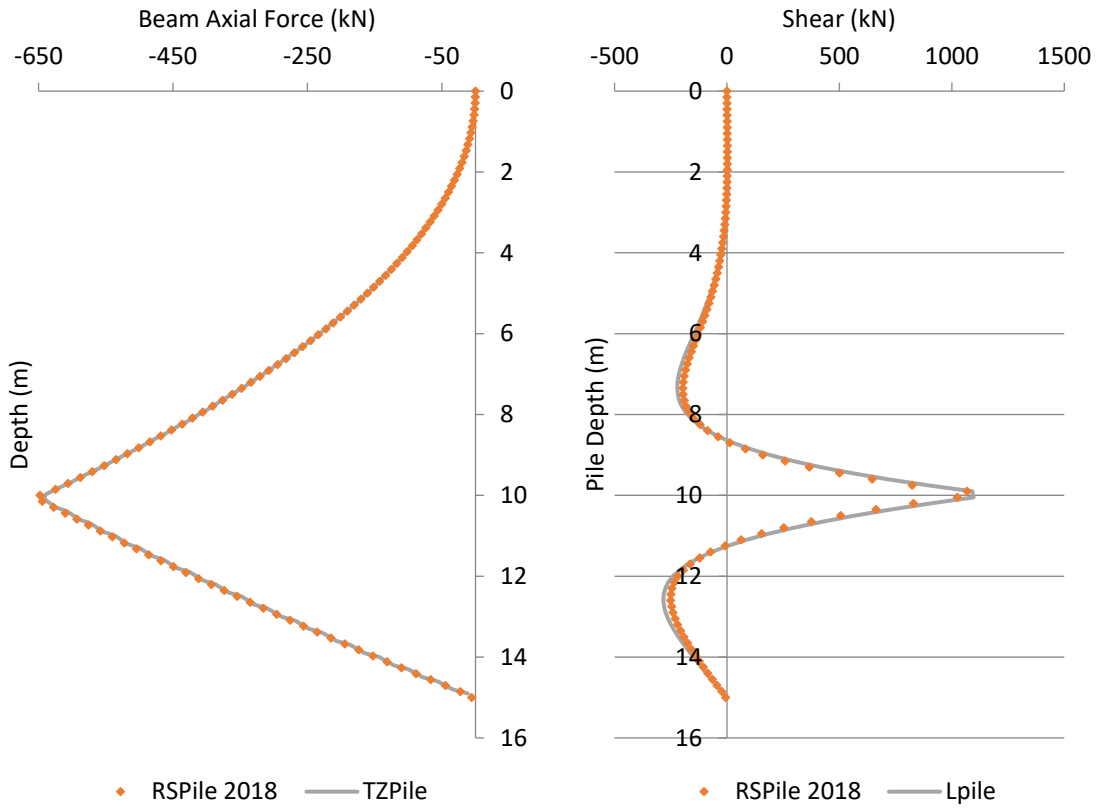


Figure 2-4: Pile load distribution for a sliding depth of 10 m

The axial and lateral resistance at a sliding depth of 10 m are 648 kN and 1068 kN respectively. The resultant pile resistance is 1249 kN.

2.4 References

1. Ensoft, Inc. *TZPile*. Computer software. Vers. 2014.3.2. Ensoft, Inc., 21 Jan. 2015.

2. Ensoft, Inc. *LPile*. Computer software. Vers. 2013-7.007. Ensoft, Inc., 24 Oct. 2013.

2.5 Data Files

The input data file **Verification 002 (Steel Pile for Slope Stabilization in Cohesionless Soil).rspile** can be found in the installation folder.