EXAMINATION – HELICAL PILE DESIGN

REFRENCES PDF

Name *

1. What are the four methods used to determine the soil axial capacity of a helical pile? Explain how each method differs from the others. *

2. The capacity-torque correlation method usually results in a more accurate prediction of the pile capacity in tension rather than in compression. Why? *

3. One of the most significant attributes of helical piles is the relationship between pile capacity and installation torque. What does the correlation factor, Kt, depend on?How is it determined? *

4. Given the soil profile shown in the table below.

Soil Boring			
Depth (ft)	**Description of Materials**	**Density (lb/ft3)**	**Blow count N**
0.0	Fill: Silty sand, fine-to- medium grained, black & brown, moist, very loose	70	2
5.0	Poorly graded sand with silt, fine-to-medium grained, gray, loose	90	5
10.0			6
15.0			6
20.0	Poorly graded sand, fine-to-coarse grained, medium, dense	115	9
25.0			11
30.0			15
35.0			18
35.5	End of boring. No GW encountered		

A helical pile, comprised of a 2-7 /8" O.D. shaft with a single 14" helix, was installed to a final depth of 30 ft. What is the allowable axial compression capacity of this pile using a safety factor of 2.5? *

5. A helical pile comprised of a 3.5" O.D. shaft with 1 0", 12" & 14" helices was installed to a final termination torque of 10,000 ft-lb. The pile was then tested in tension. The test was stopped when the total pile deflection reached 1.0". The measured ultimate capacity at 1.0" total deflection was 63,000 Lbs. The owner complained that he thought the traditional Kt value for the 3.5" O.D. shaft was 7.0, but he got only 6.3. Which answer is correct? Explain. *

6. Given the soil profile below.

Depth Below Ground Surface (ft)	Soil Description
0.0	**Loose Sand** C = 0 Φ = 28° γ_{moist} = 105 lb/ft^3
6.0	**Stiff Clay** C = 1,000 lb/ft^2 Φ = 0 γ = 115 lb/ft^3
15.0	**Very Stiff Clay** C = 3,000 lb/ft^2 Φ = 0 γ = 120 lb/ft^3
25.0	
No ground water table was encountered	

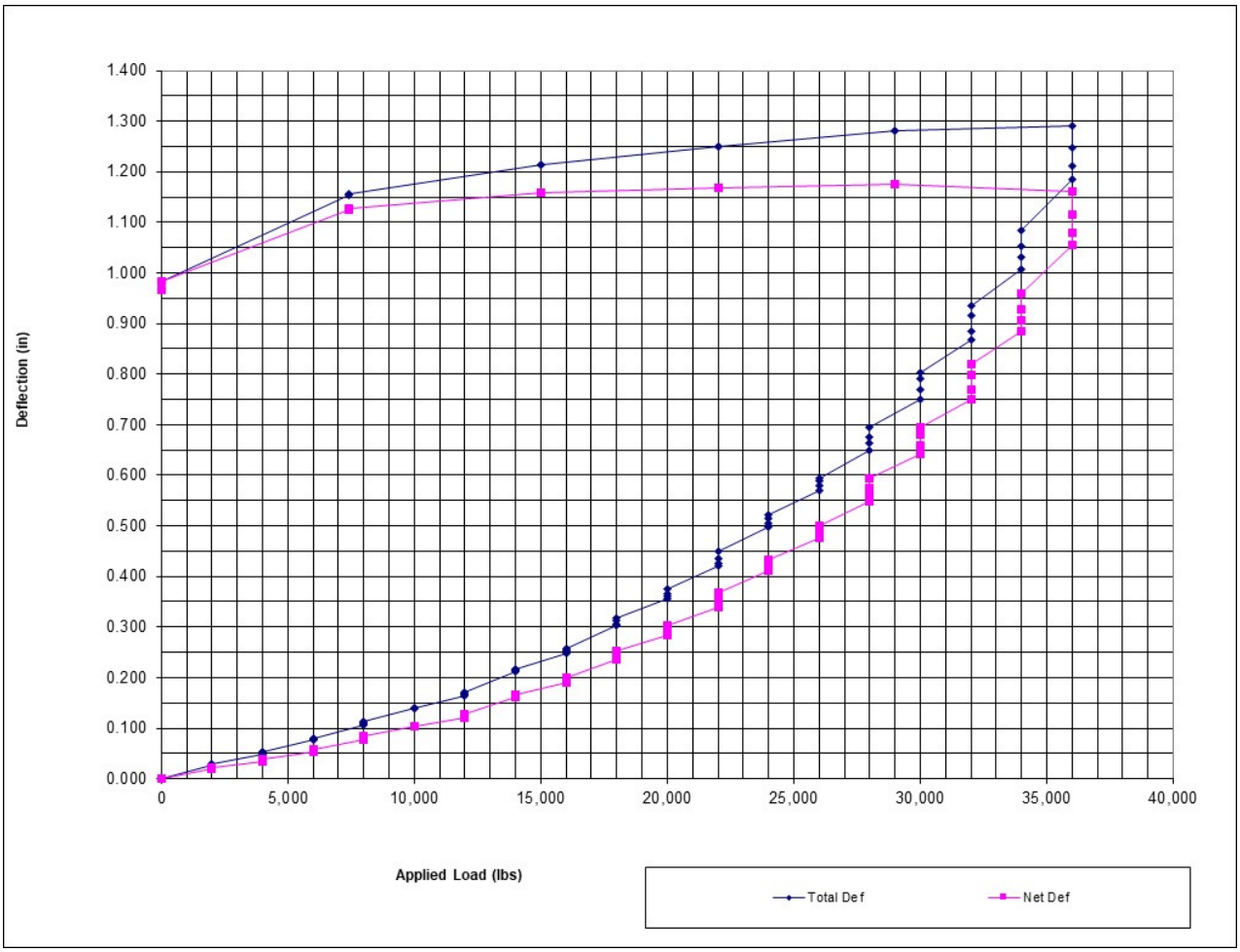
The design working load is given as 27 Kips in compression and the safety factor is 2. The pile consists of a 2-7 /8" O.D. shaft. The helices available are 8", 1 O", 12" and 14". The helical pile final installation depth will be in the very stiff clay layer. What is the helix configuration needed to support the working design load? Assume spacing between helices is 3D. *

7. Given the soil profile below.

Depth Below Ground Surface (ft)	Soil Description
0.0	**Loose Sand** C = 0 Φ = 30° γ_{moist} = 110 lb/ft^3
5.0	**Medium Dense Sand** C = 0 Φ = 34° γ_{moist} = 115 lb/ft^3 γ_{sat} = 125 lb/ft^3
13.0	**Dense Sand** C = 0 Φ = 38° γ_{moist} = 120 lb/ft^3 γ_{sat} = 130 lb/ft^3
25.0	
Water table was encountered at 10' below ground surface	

The design working load is 40 Kips in compression and the safety factor is 2. The pile consists of a 3.5" O.D. shaft. The helices available are 8", 1 0", 12" and 14". The helical pile final installation depth will be in the dense sand. What is the helix configuration needed to support the working design load? Assume spacing between helices is 3D. *

8. The load deflection curve below, obtained from a tension load test, is for a 2-7 /8" O.D. shaft, with 8", 1 O" and 12" helix configuration. The final installation torque was 3,300 ft-lb.



What is the measured capacity-to-torque ratio, Kt? What is the deflection at the working load assuming a safety factor of 2? *

9. Using the modified Kt by Moncef (2019), what is the ultimate capacity of the installed pile in question 8? *

10. A helical pile consisting of a 3.5" O.D. shaft, with an 8", 10" and 12" helix configuration, was installed to a depth of 20'. The soil characteristics between 15' and 22' are as follows:

Sand with γ_{moist} = 120 lb/ft^3; Φ = 36°; C = 0

Assuming a spacing of 3D between the helices, what is the ultimate tension capacity of this pile using the Individual Bearing Method? Assuming a spacing of 1.5D between the helices, what is the ultimate tension capacity of the pile using the Cylindrical Shear Method? Assume Ko = 1- sinΦ. *

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