

RSPile 2018

Pile Capacity and Loading Analysis

**Lateral Pile Analysis
Verification Manual**

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Introduction

This document contains a series of verification pile analysis problems that have been analyzed using *RSPile* version 2018 2.006. Verification test cases are derived from varying loading and soil parameters.

RSPile 2018 results are computed and checked against *LPile 2016* and the comparisons are graphed in the results section of each problem.

For all examples, a short statement of the problem is given first, followed by a presentation of the analysis results. Full references cited in any of the verification tests are found at the end of the document.

The sign convention for *RSPile 2018* is shown in the following diagram.

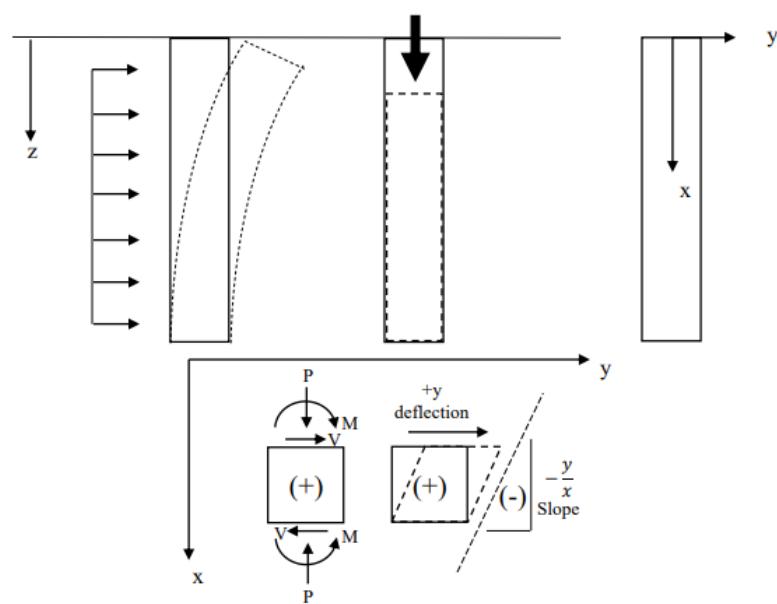


Figure 1-1: Stress and deformation conventions

Note from Figure 1-1 that the positive stress conventions produce positive deflection in the y -axis, but the calculated slope is negative based on the orientation of the y and x axis.

LPile uses opposite sign conventions for bending moment, rotations, and soil reaction force. Sign conventions in comparison graphs have been adjusted to fit *LPile*'s standards.

RSPile Verification Problem #1

API sand, static and cyclic loading, p-y multipliers, ground slope

Case 1:

a. Problem Description

Problem 1, case 1 is a laterally loaded pile located inside a single layer of API sand. Pile and soil properties are given in tables 1-1 and 1-2.

b. Material Properties

Table 1-1: API Sand Properties

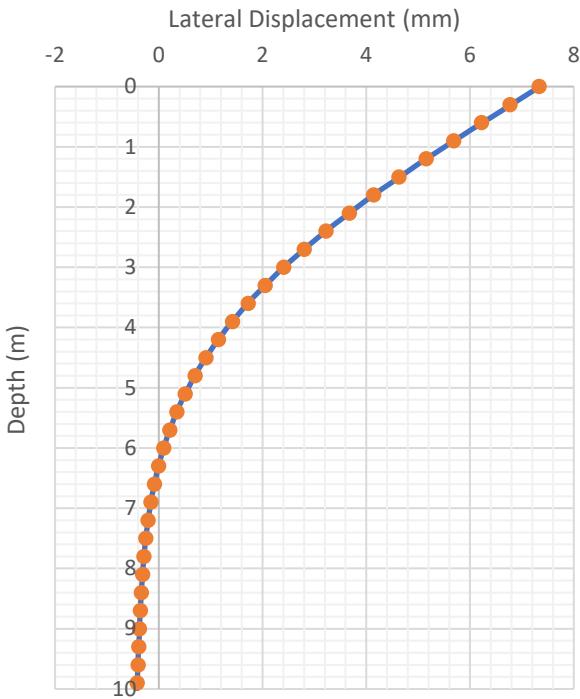
Parameter	Value
General Properties	
Unit Weight	8 kN/m ³
Laterally Loaded Piles	
Friction Angle	30 degrees
Soil Type	API method for sand
Modulus (Kpy)	5400 kN/m ³
Soil layer thickness	10 m

Table 1-2 Pile and Loading Properties

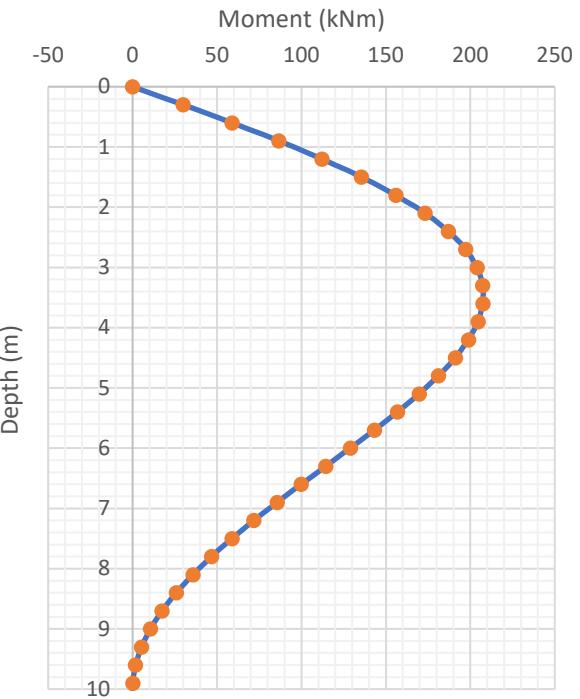
Parameter	Value
Young's Modulus (E)	200,000,000 kPa
Cross Section	Circle
Diameter	0.5 m
Embedment Length	10 m
Lateral/shear load	100 kN

c. Results

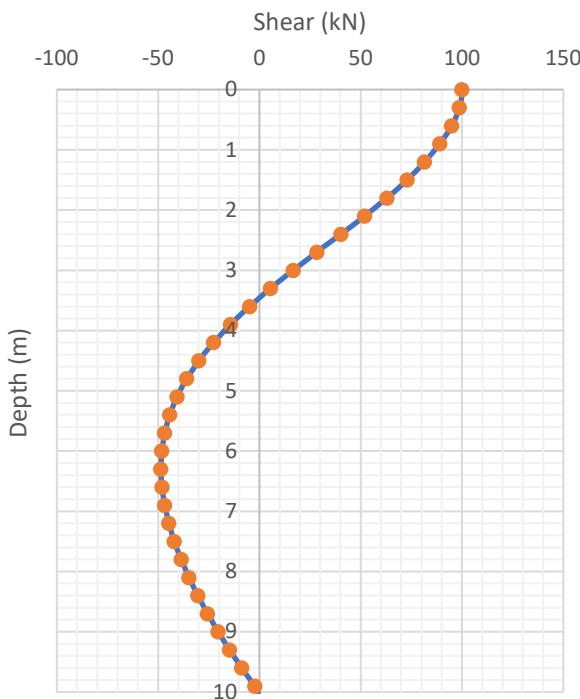
Lateral Displacement Vs. Depth



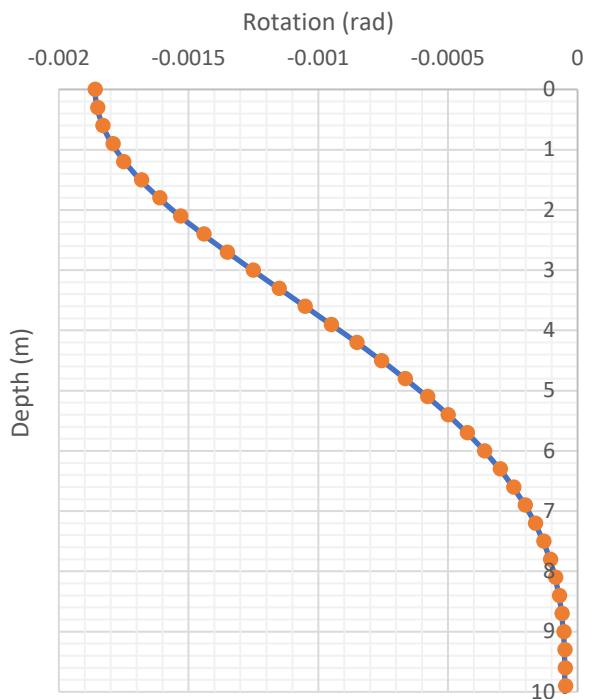
Moment Vs. Depth



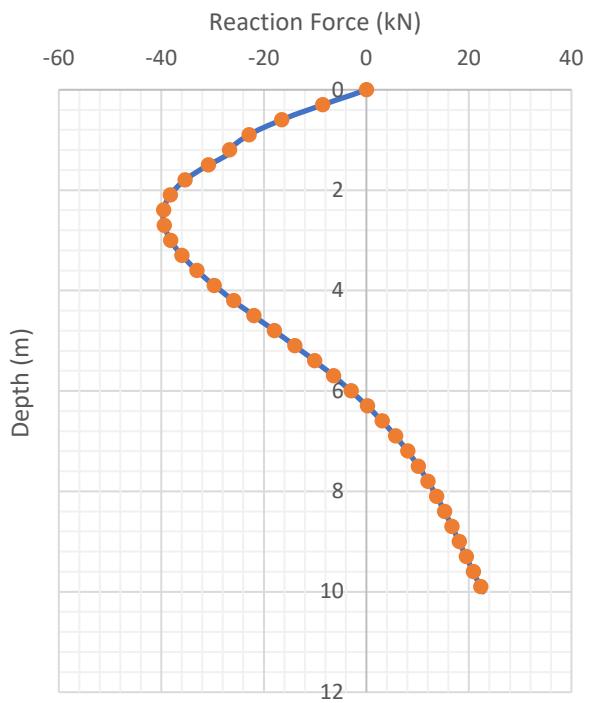
Shear Vs. Depth



Rotation Vs. Depth



Soil Reaction Force Vs. Depth



Case 2:**a. Problem Description**

Problem 1, case 2 is a statically loaded pile in sloped ground. P-Y multipliers are applied to the soil p-y curve. Soil and pile properties as well as the PY multipliers are given in tables 1-3, 1-4, and 1-5

b. Material Properties and Loading**Table 1-3: API Sand Properties**

Parameter	Value
General Properties	
Unit Weight	8 kN/m ³
Laterally Loaded Piles	
Friction Angle	30 degrees
Soil Type	API method for sand
Modulus (Kpy)	5400 kN/m ³
Soil layer thickness	10 m

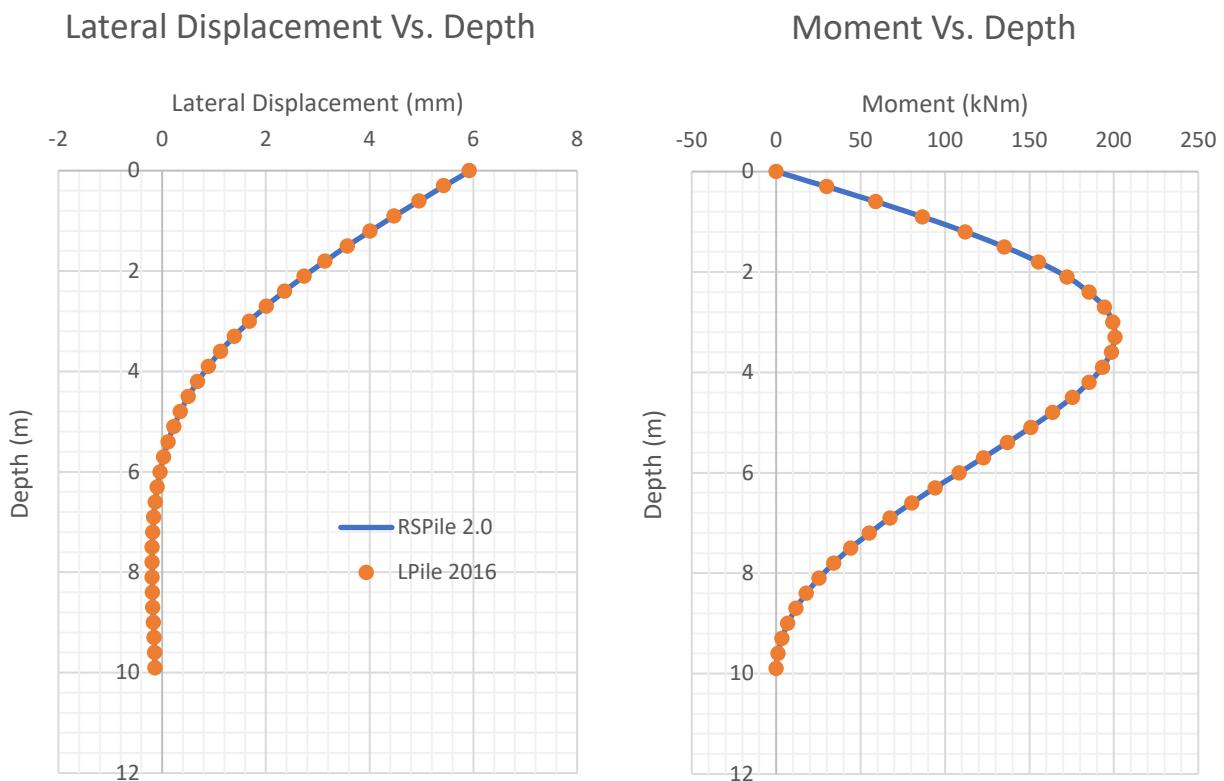
Table 1-4: PY Multipliers

Depth	Y-Multiplier	P-Multiplier
0	0.6	1.1
5	0.8	1.2
10	0.7	1.3

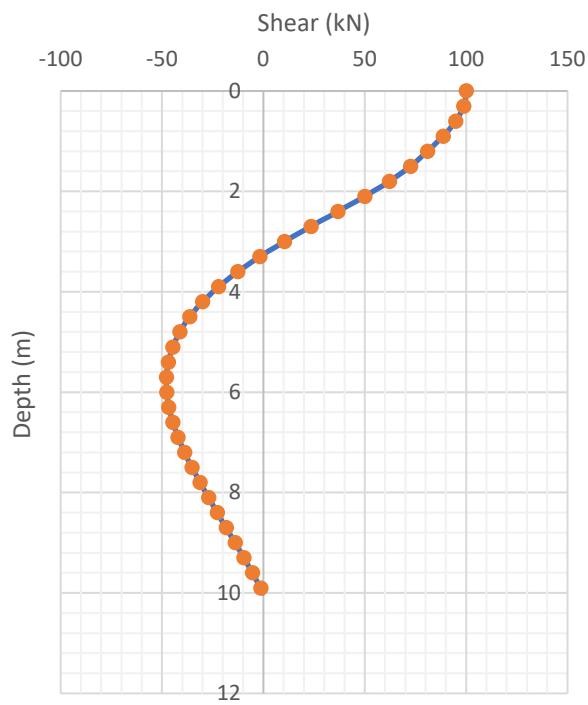
Table 1-5: Pile and Loading Properties

Parameter	Value
Cross Section	Circle
Diameter	0.5 m
Young's Modulus (E)	200,000,000 kPa
Embedment Length	10 m
Lateral/shear load	100 kN
Ground slope	10 degrees

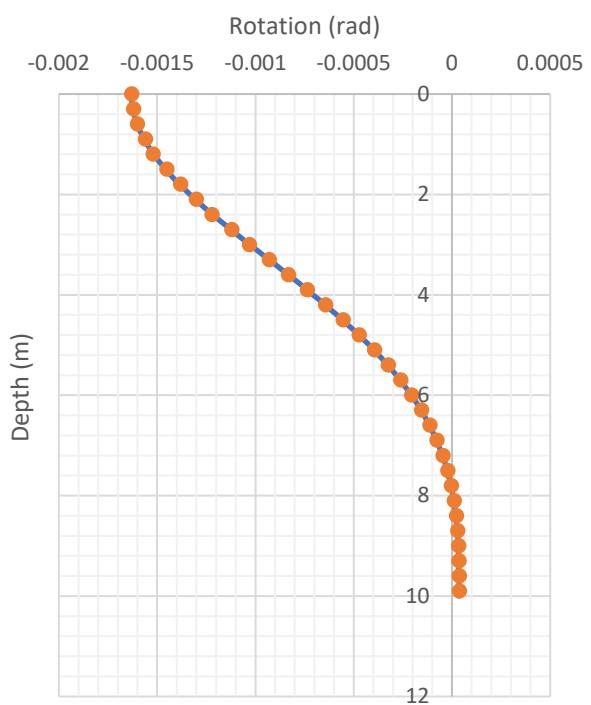
c. Results



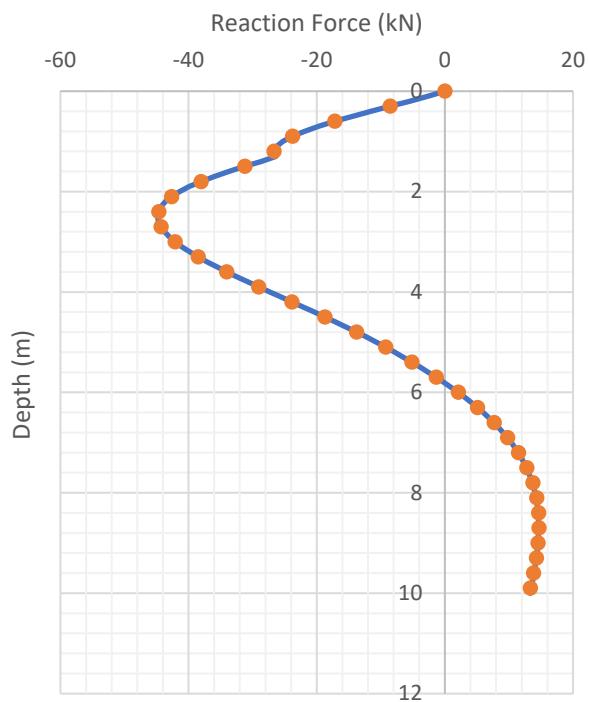
Shear Vs. Depth



Rotation Vs. Depth



Soil Reaction Force Vs. Depth



Case 3:**a. Problem Description**

Problem 1, case 3 is a uniform pile subjected to 2 cycles of a cyclic lateral load. Pile and soil properties are given in tables 1-6 and 1-7.

b. Material Properties and Loading**Table 1-6: API Sand Properties**

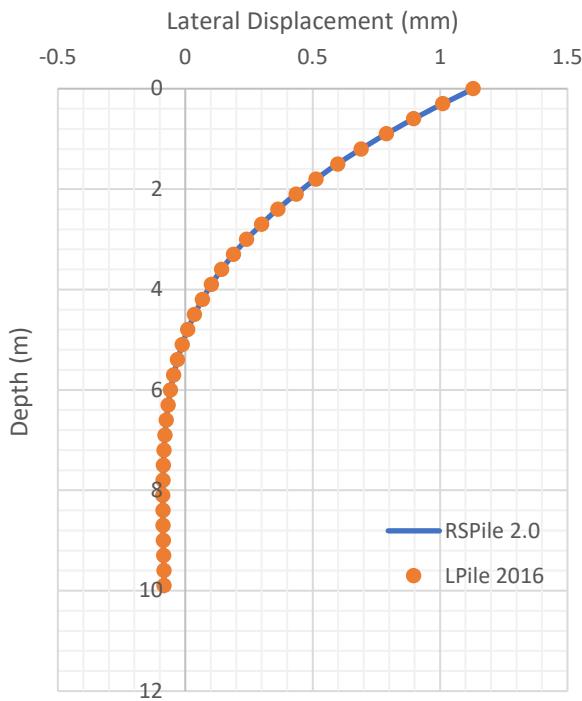
Parameter	Value
General Properties	
Unit Weight	15 kN/m ³
Laterally Loaded Piles	
Soil Type	API method for sand
Friction Angle	20 degrees
Modulus (Kpy)	3000 kN/m ³
Soil layer thickness	10 m

Table 1-7: Pile and Loading Properties

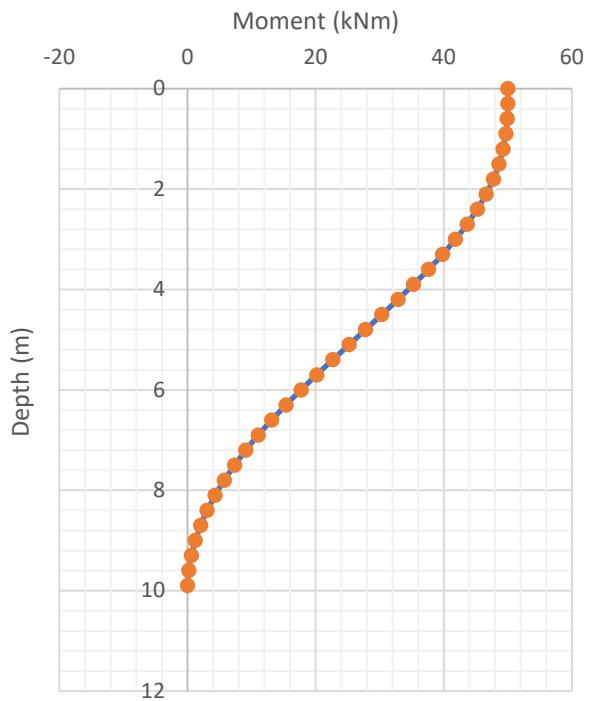
Parameter	Value
Cross Section	Circle
Diameter	0.5 m
Young's Modulus (E)	200,000,000 kPa
Embedment Length	10 m
Moment	50 kN-m
Number of load cycles	2
Ground Slope	15 degrees

c. Results

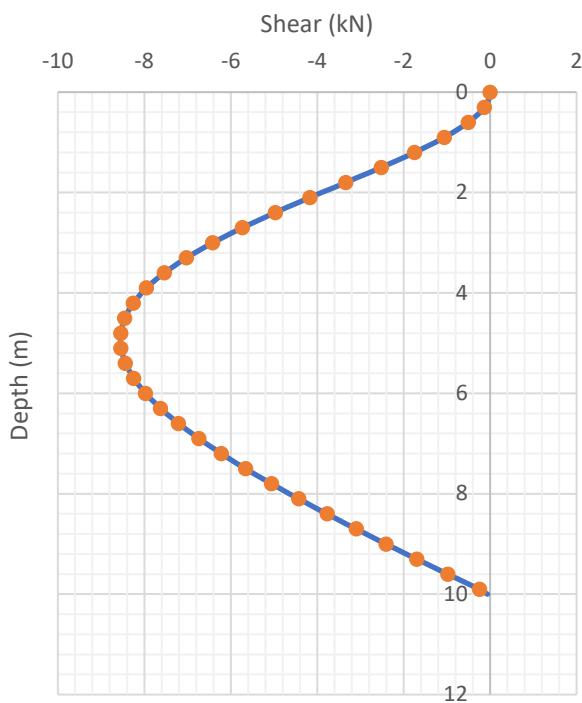
Lateral Displacement Vs. Depth



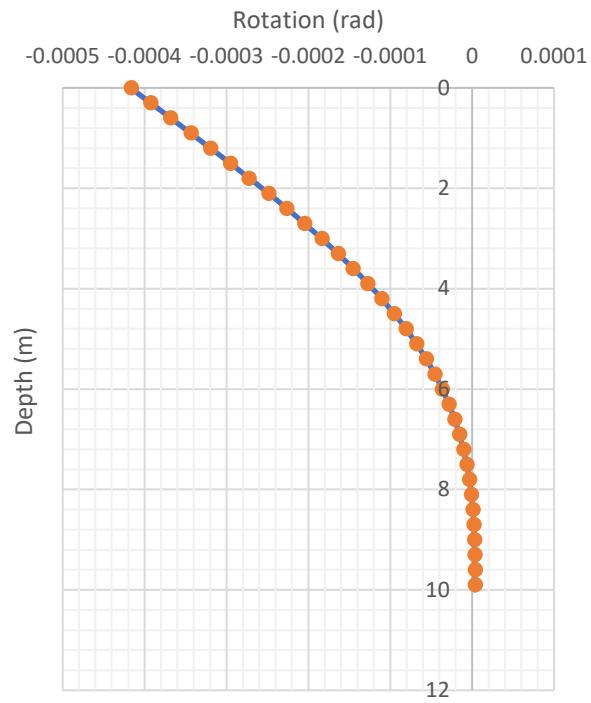
Moment Vs. Depth



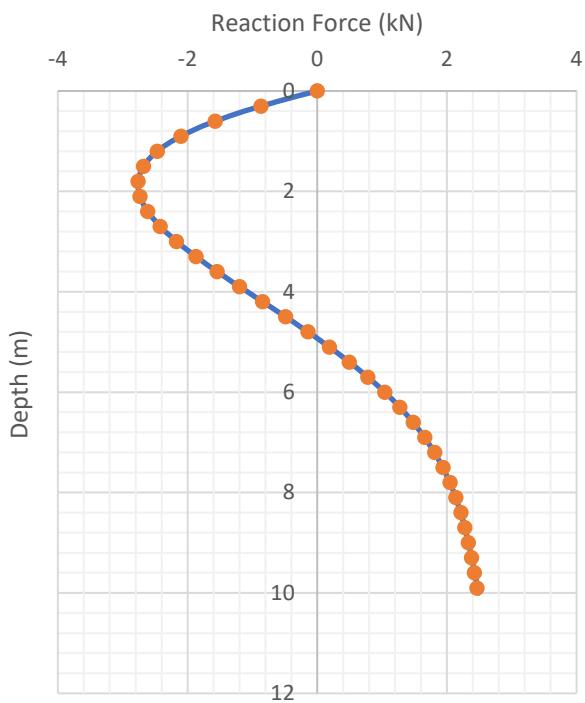
Shear Vs. Depth



Rotation Vs. Depth



Soil Reaction Force Vs. Depth



Case 4:**a. Problem Description**

Problem 1, case 4 is a statically loaded pile in API sand with soil and pile properties given in imperial units. Pile and soil properties are given in tables 1-8 and 1-9.

b. Material Properties**Table 1-8: API Sand Properties**

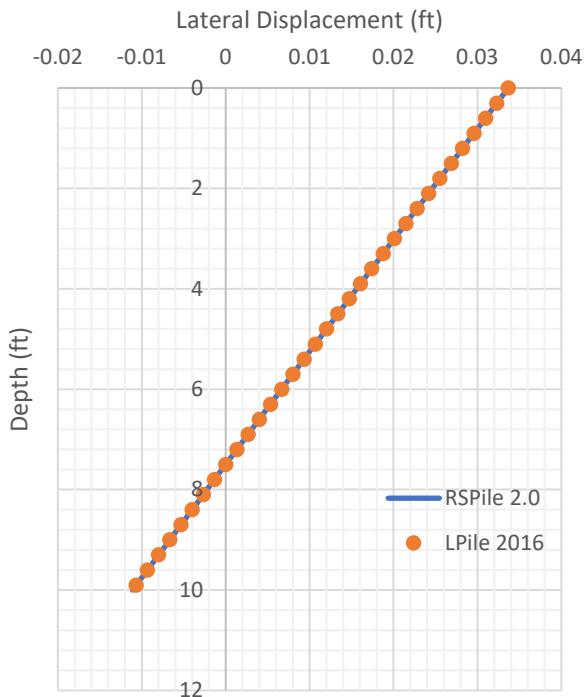
Parameter	Value
General Properties	
Unit Weight	50 lb/ft ³
Laterally Loaded Piles	
Soil Type	API method for sand
Friction Angle	30 degrees
Modulus (Kpy)	5400 lb/ft ³
Soil layer thickness	10 ft

Table 1-9: Pile and Loading Properties

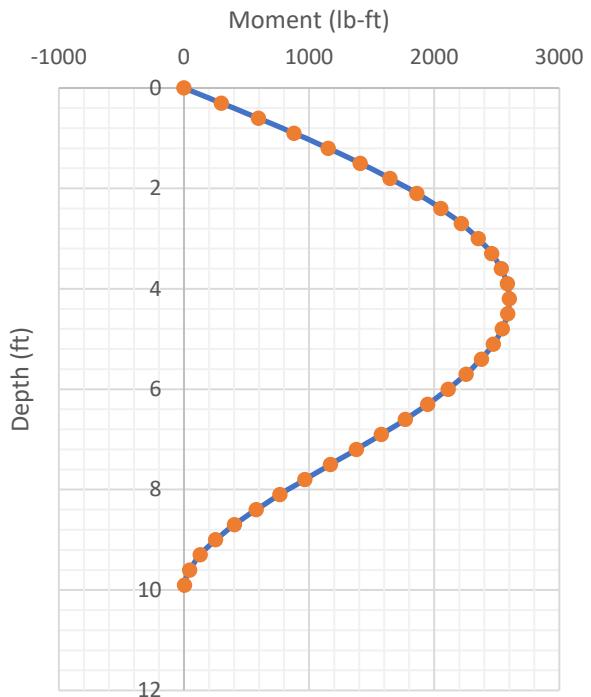
Parameter	Value
Cross Section	Circle
Diameter	2 ft
Young's Modulus (E)	200,000,000 psf
Embedment Length	10 ft
Lateral / Shear Load	1000 lb

c. Results

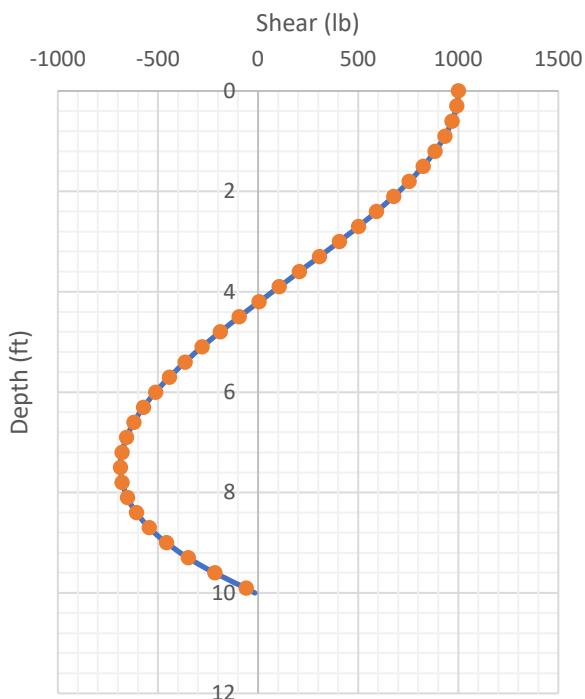
Lateral Displacement Vs. Depth



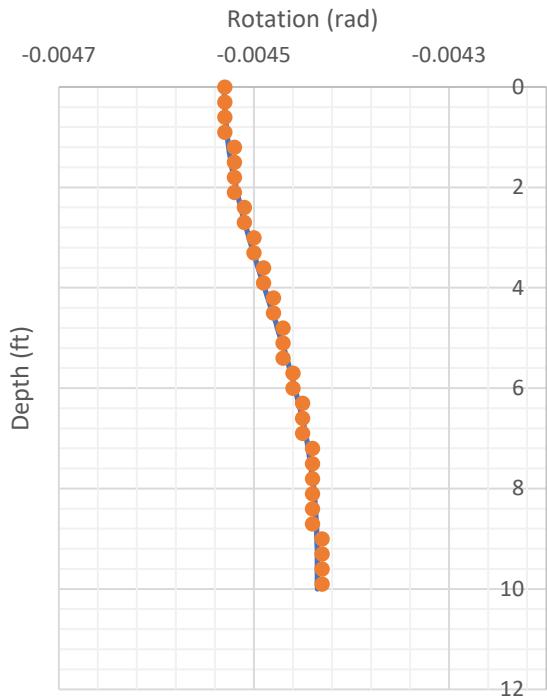
Moment Vs. Depth



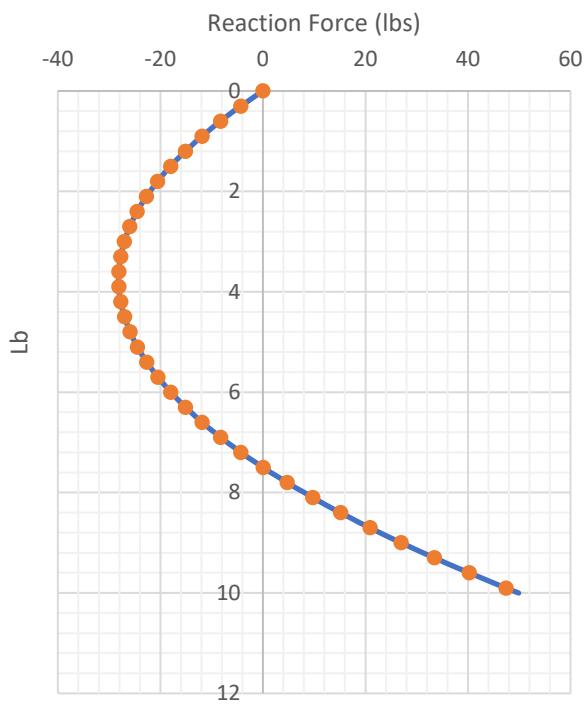
Shear Vs. Depth



Rotation Vs. Depth



Soil Reaction Force Vs. Depth



RSPile Verification Problem #2

Dry stiff clay, static loading

Case 1:

a. Problem Description

Problem 2, Case 1 is a laterally loaded pile located within a single layer of dry stiff clay. The pile has uniform properties with depth.

b. Material Properties

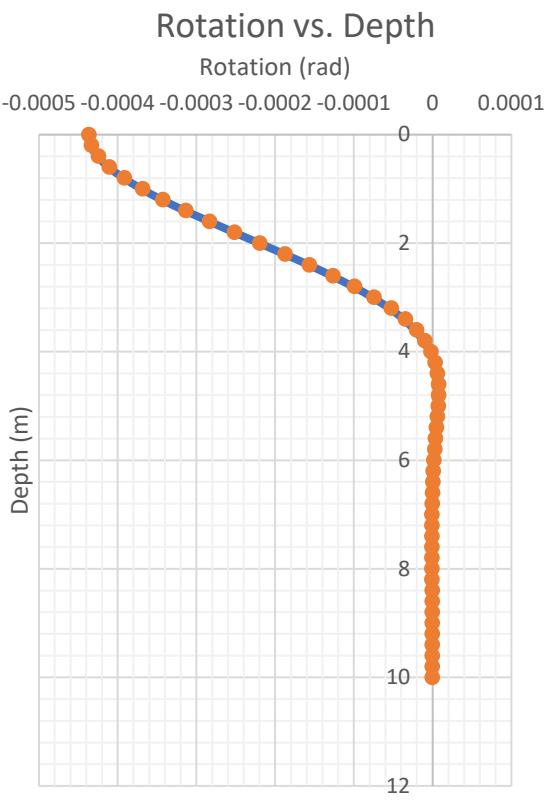
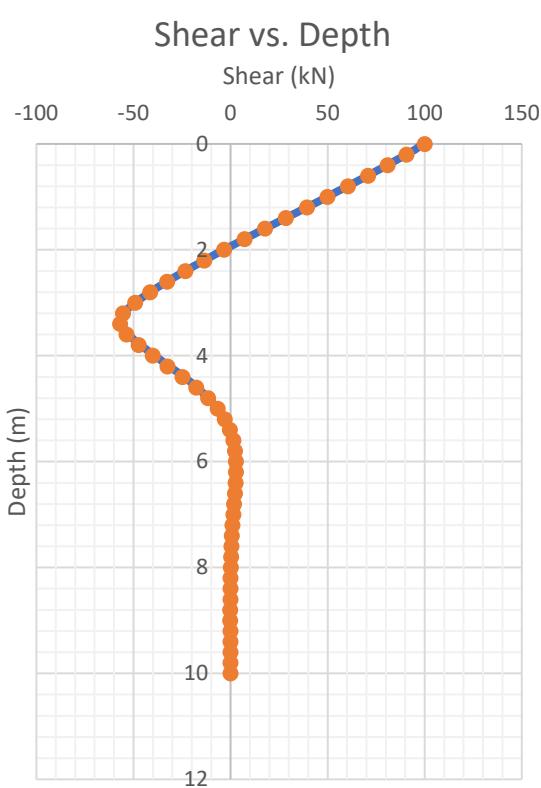
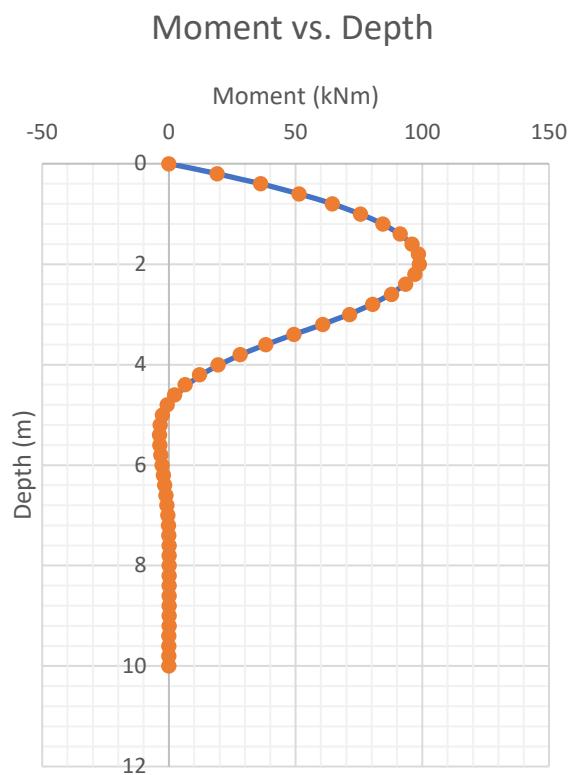
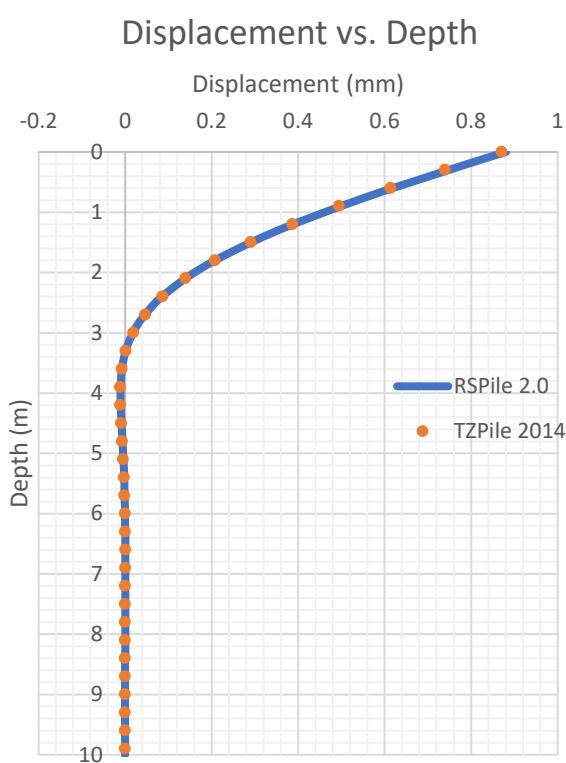
Table 2-1: Dry Stiff Clay Properties

Parameter	Value
General Properties	
Unit Weight	8 kN/m ³
Strain Factor, E50	0.005
Laterally Loaded Piles	
Soil Type	Dry Stiff Clay
Undrained Shear Strength	100 kPa
Soil layer thickness	10 m

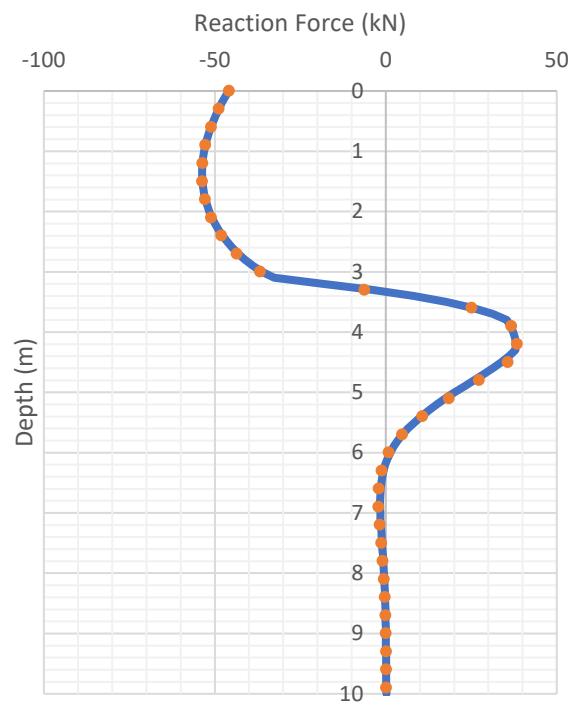
Table 2-2: Pile and Loading Properties

Parameter	Value
Cross Section	Circle
Diameter	0.5 m
Young's Modulus (E)	200,000,000 kPa
Embedment Length	10 m
Lateral / Shear Load	100 kN

c. Results



Soil Reaction Force vs. Depth



Case 2:**a. Problem Description**

Problem 2, case 2 is a laterally loaded pile located within a single layer of dry stiff clay. The pile has uniform properties with depth and the ground has a constant slope angle defined below.

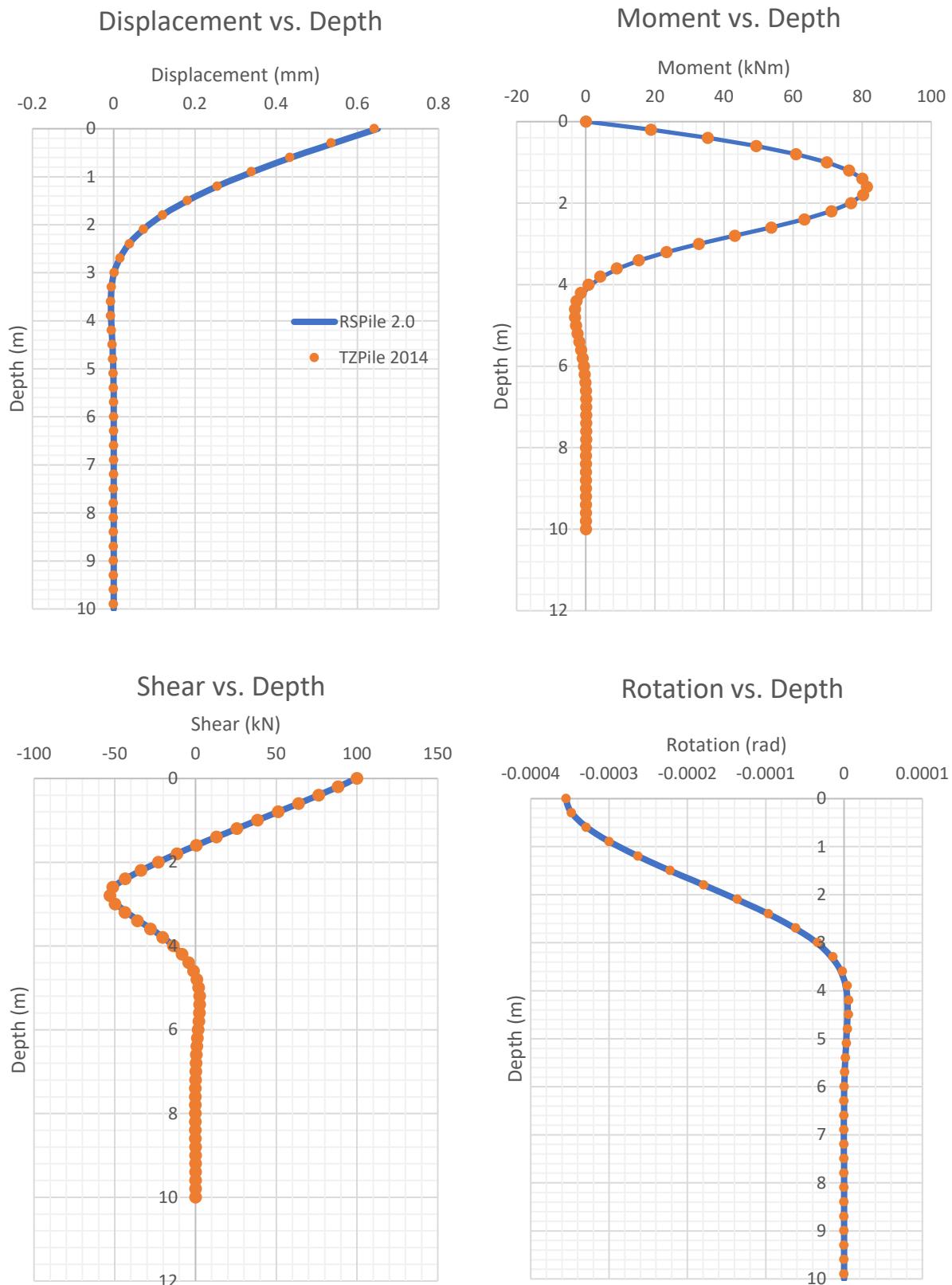
b. Material Properties**Table 2-3: Dry Stiff Clay Properties**

Parameter	Value
General Properties	
Unit Weight	15 kN/m ³
Laterally Loaded Piles	
Soil Type	Dry Stiff Clay
Strain Factor, E50	0.006
Undrained Shear Strength	150 kPa
Soil layer thickness	10 m

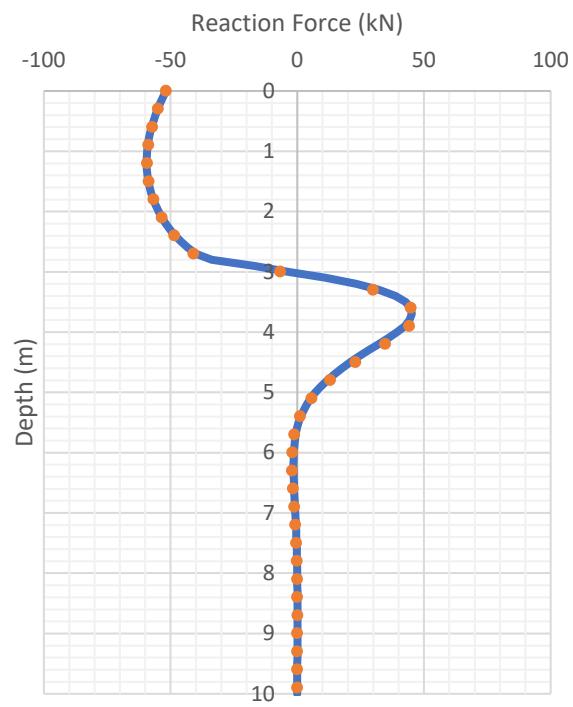
Table 2-4: Pile and Loading Properties

Parameter	Value
Cross Section	Circle
Diameter	0.5 m
Young's Modulus (E)	200,000,000 kPa
Embedment Length	10 m
Lateral / Shear Load	100 kN
Ground Slope	10 degrees

c. Results



Soil Reaction Force vs. Depth



Case 3:

a. **Problem Description**

Problem 2, case 3 is a laterally loaded pile located within a single layer of dry stiff clay. The pile has uniform properties with depth. This case tests soil with depth varying properties.

b. **Material Properties**

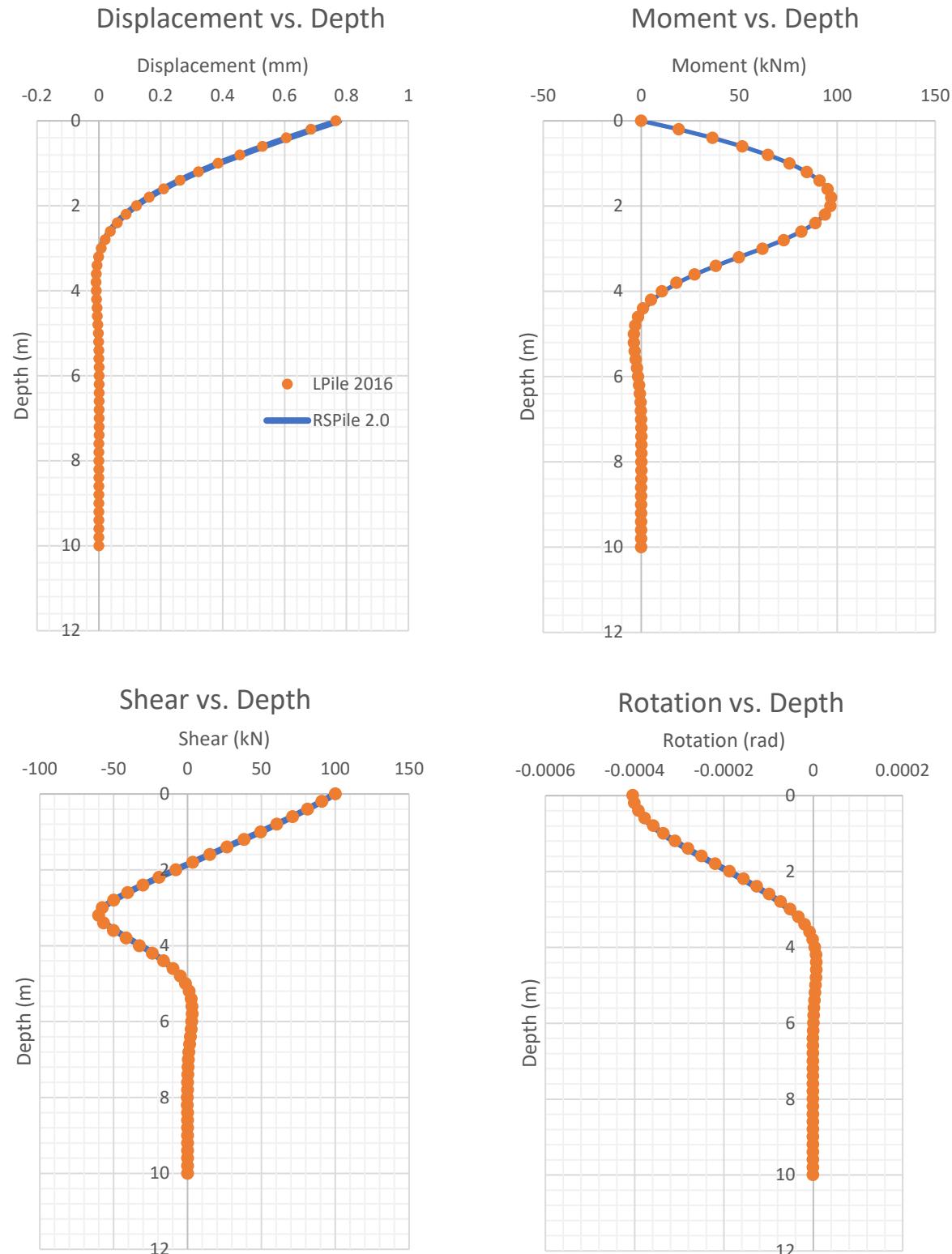
Table 2-5: Dry Stiff Clay Properties

Parameter	Top Value
General Properties	
Unit Weight	Top: 8 kN/m ³ Bottom: 16 kN/m ³
Strain Factor, E50	Top: 0.005 Bottom: 0.006
Laterally Loaded Piles	
Soil Type	Dry Stiff Clay
Undrained Shear Strength	Top: 100 kPa Bottom: 200 kPa
Soil layer thickness	10 m

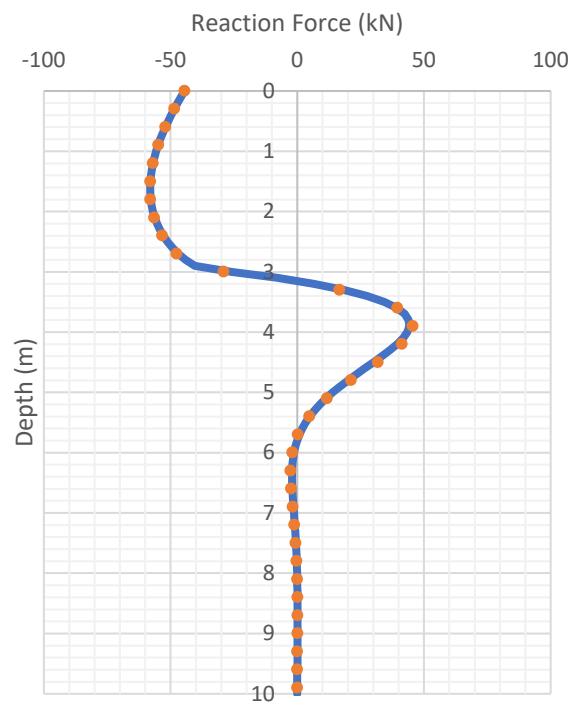
Table 2-6: Pile and Loading Properties

Parameter	Value
Cross Section	Circle
Diameter	0.5 m
Young's Modulus (E)	200,000,000 kPa
Embedment Length	10 m
Lateral / Shear Load	100 kN

c. Results



Soil Reaction Force vs. Depth



Case 4:**a. Problem Description**

Problem 2, case 4 is a laterally loaded pile located within a single layer of dry stiff clay. The pile has uniform properties with depth. This case will test Imperial units.

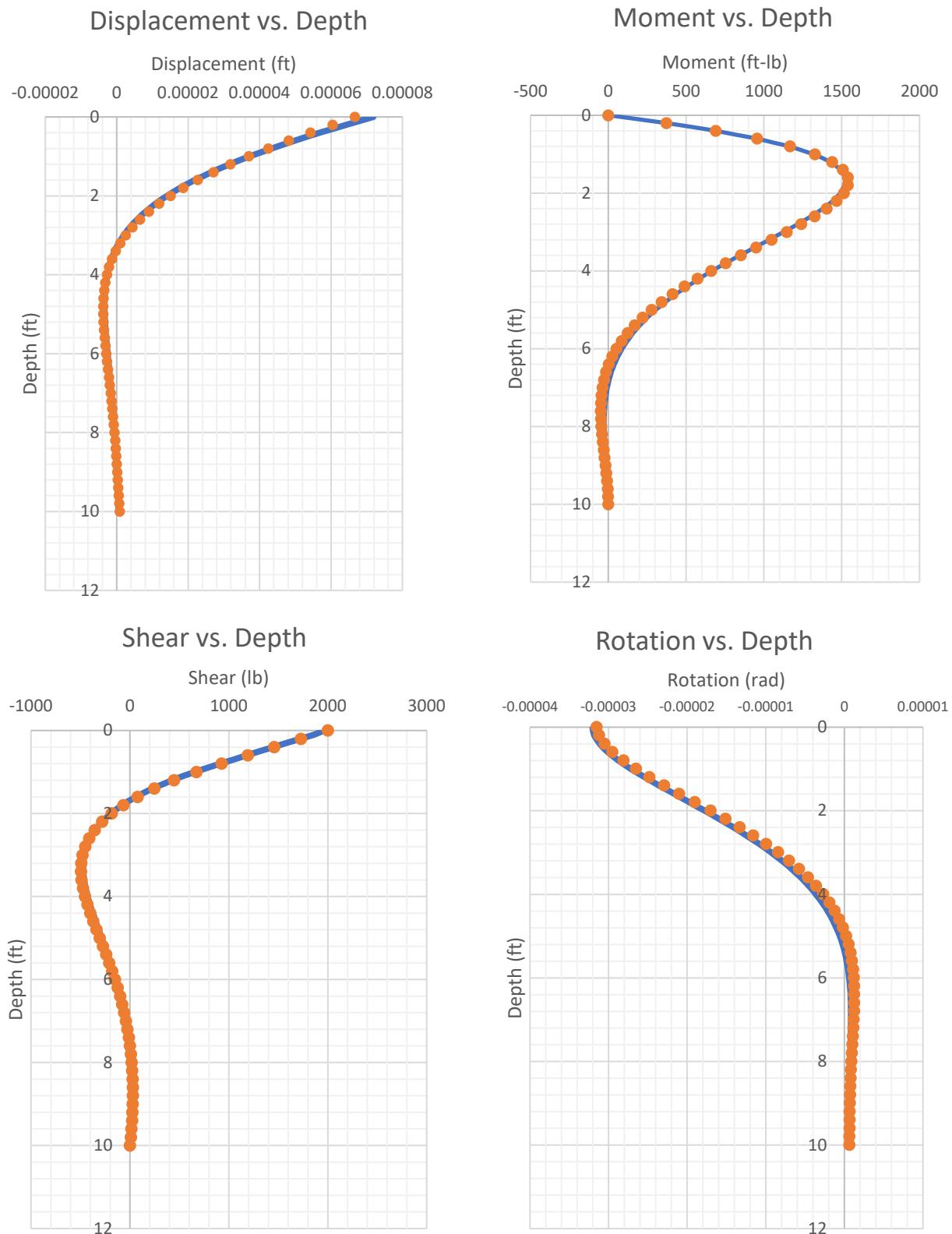
b. Material Properties**Table 2-7: Dry Stiff Clay Properties**

Parameter	Value
General Properties	
Unit Weight	50 lb/ft ³
Strain Factor, E50	0.005
Laterally Loaded Piles	
Soil Type	Dry Stiff Clay
Undrained Shear Strength	2000 psf
Soil layer thickness	10 ft

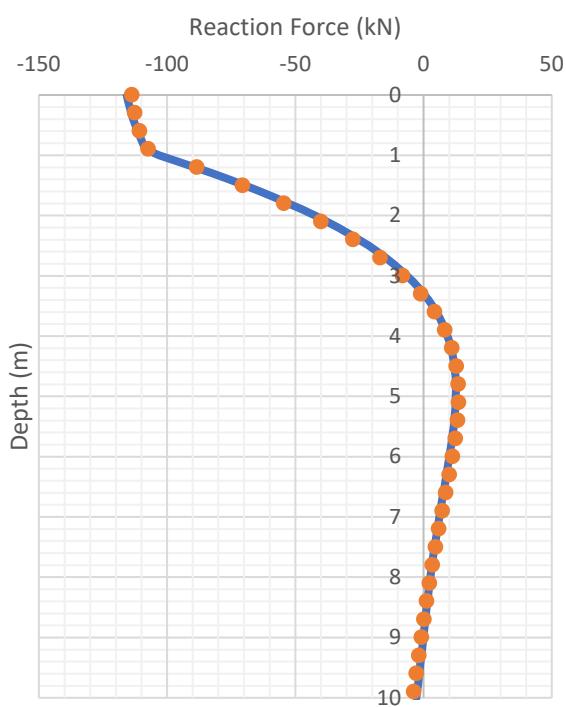
Table 2-8: Pile and Loading Properties

Parameter	Value
Cross Section	Circle
Diameter	2 ft
Young's Modulus	200,000,000 psf
Embedment Length	10 ft
Lateral / Shear Load	2000 lb

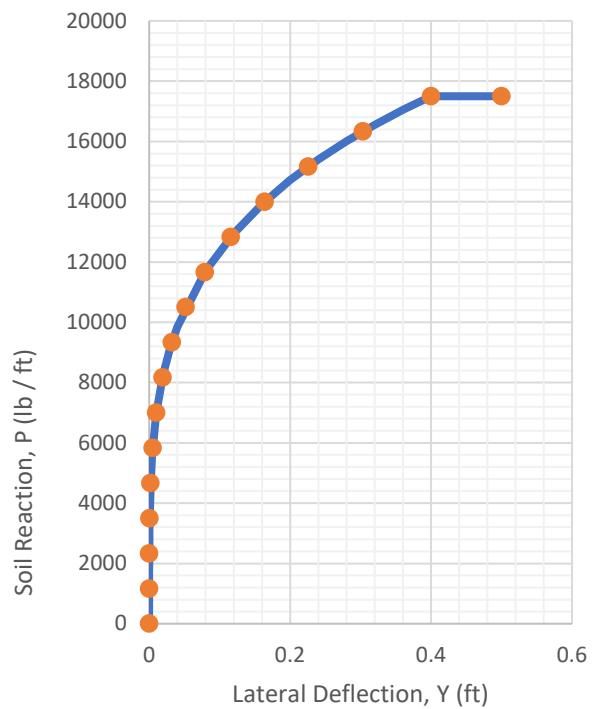
c. Results



Soil Reaction Force vs. Depth



PY Curve at 5 ft Depth



RSPile Verification Problem #3

Elastic soil, static slope and shear loads

Case 1:

a. Problem Description

Problem 3, case 1 is a statically loaded pile in elastic soil. Soil and pile properties are listed in tables 3.1 and 3.2.

b. Material Properties

Table 3-1: Elastic Soil Properties

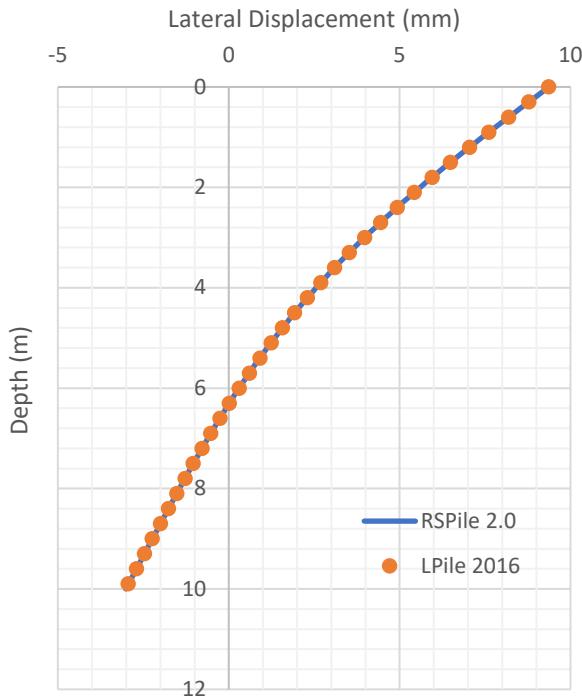
Parameter	Value
General Properties	
Unit Weight	8 kN/m ³
Laterally Loaded Piles	
Soil Type	Elastic Soil
Elastic Subgrade Reaction	10,000 kN/m ³
Soil layer thickness	10 m

Table 3-2: Pile and Loading Properties

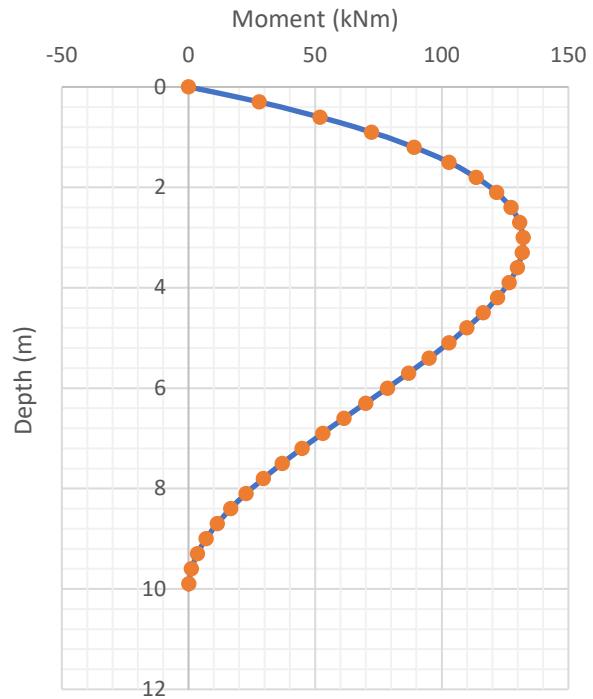
Parameter	Value
Cross Section	Circle
Diameter	0.5 m
Young's Modulus	200,000,000 kPa
Embedment Length	10 m
Lateral / Shear Load	100 kN

c. Results

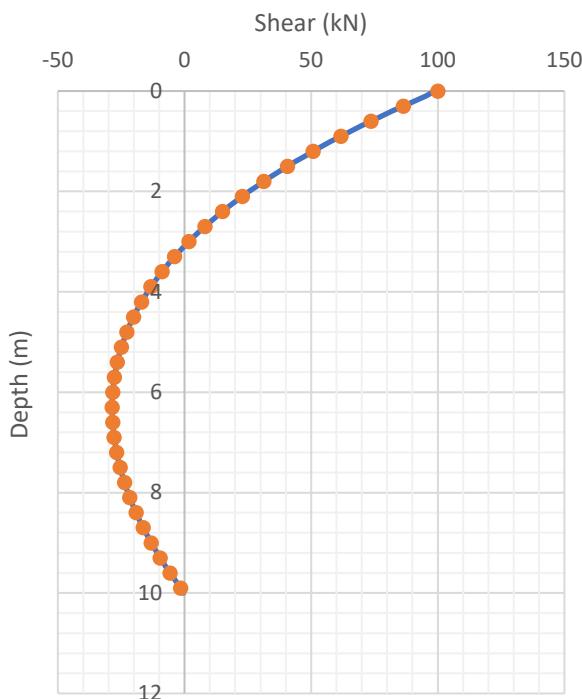
Lateral Displacement Vs. Depth



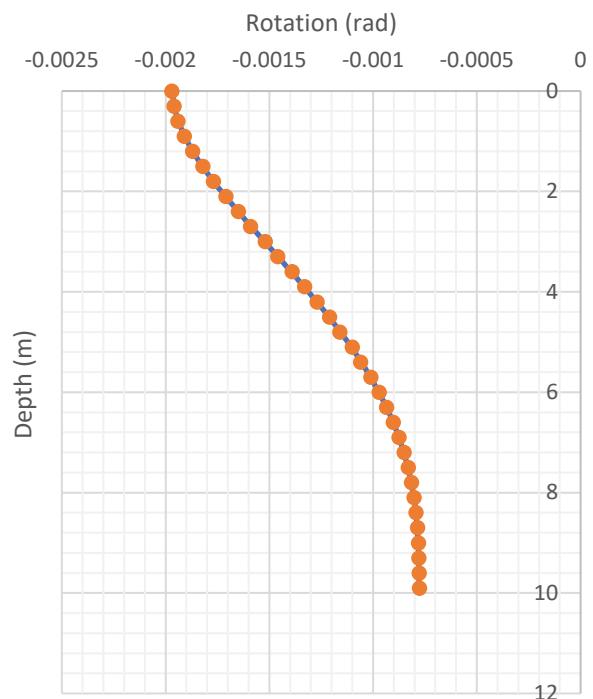
Moment Vs. Depth



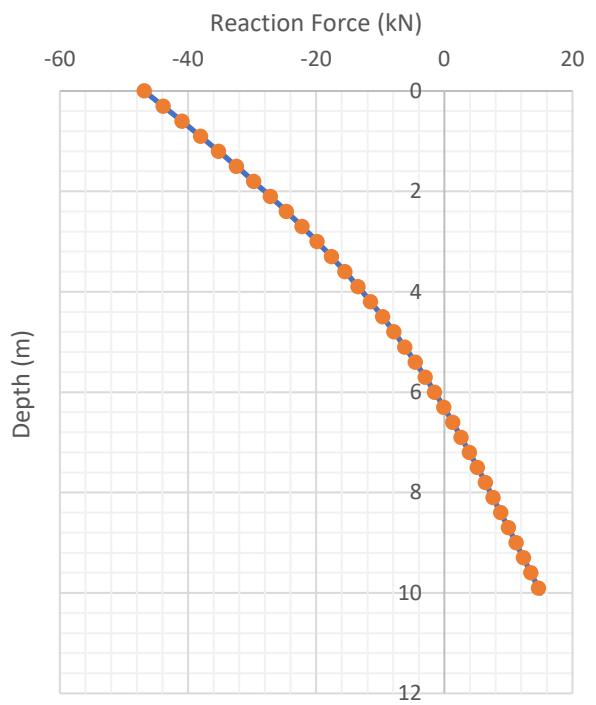
Shear Vs. Depth



Rotation Vs. Depth



Soil Reaction Force Vs. Depth



Case 2:**a. Problem Description**

Problem 3, case 2 is a statically loaded pile in elastic soil. Soil and pile properties are listed in tables 3.3 and 3.4 below and are given in imperial units.

b. Material Properties**Table 3-3: Elastic Soil Properties**

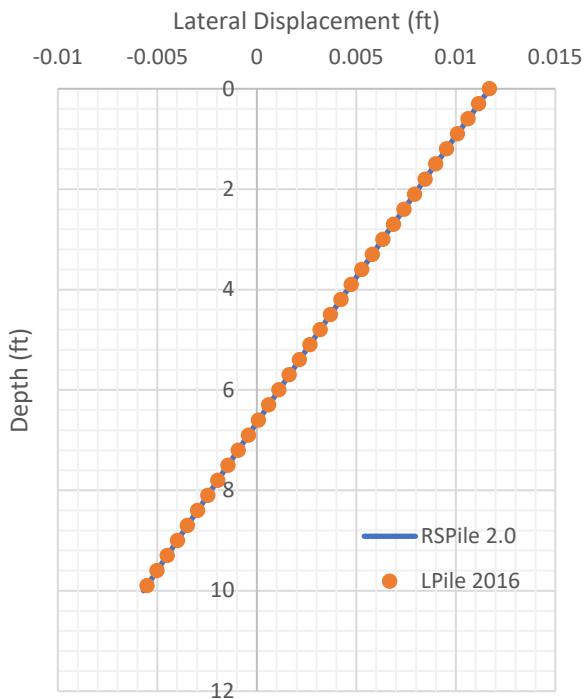
Parameter	Value
General Properties	
Unit Weight	50 lb/ft ³
Laterally Loaded Piles	
Soil Type	Elastic subgrade
Elastic Subgrade Reaction	34,560 lb/ft ³
Soil layer thickness	10 ft

Table 3-4: Pile and Loading Properties

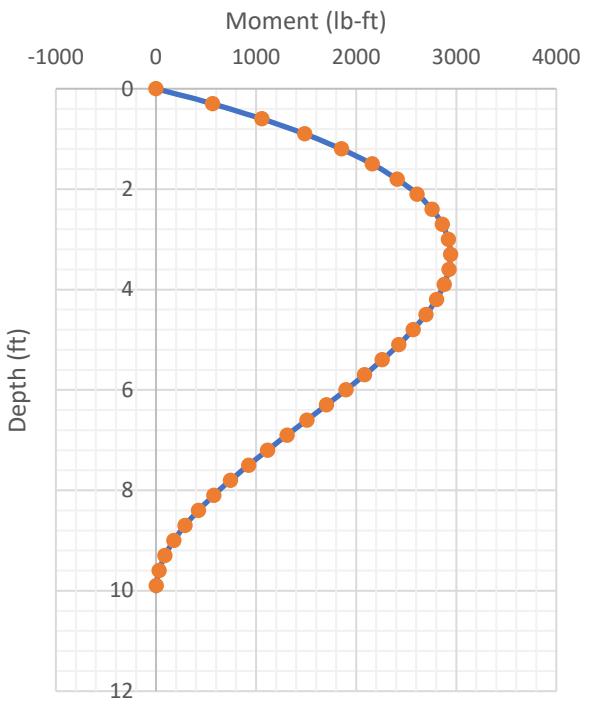
Parameter	Value
Cross Section	Circle
Diameter	2 ft
Young's Modulus	200,000,000 psf
Embedment Length	10 ft
Lateral / Shear Load	2,000 lb

c. Results

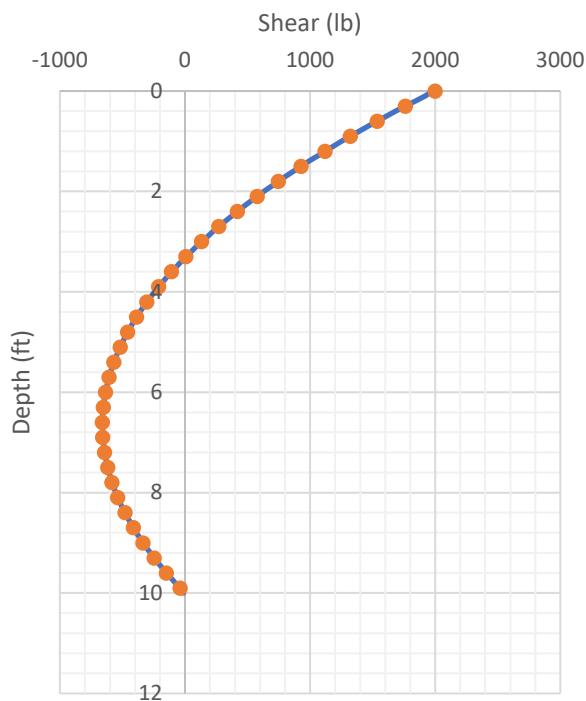
Lateral Displacement Vs. Depth



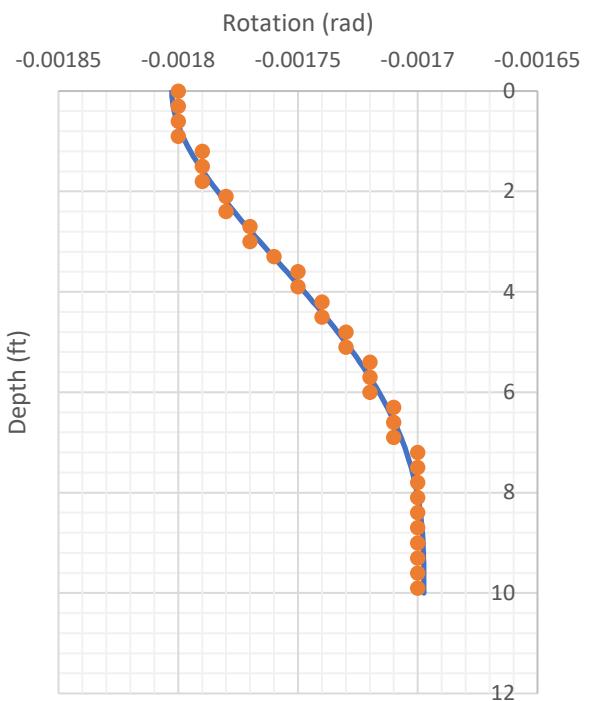
Moment Vs. Depth



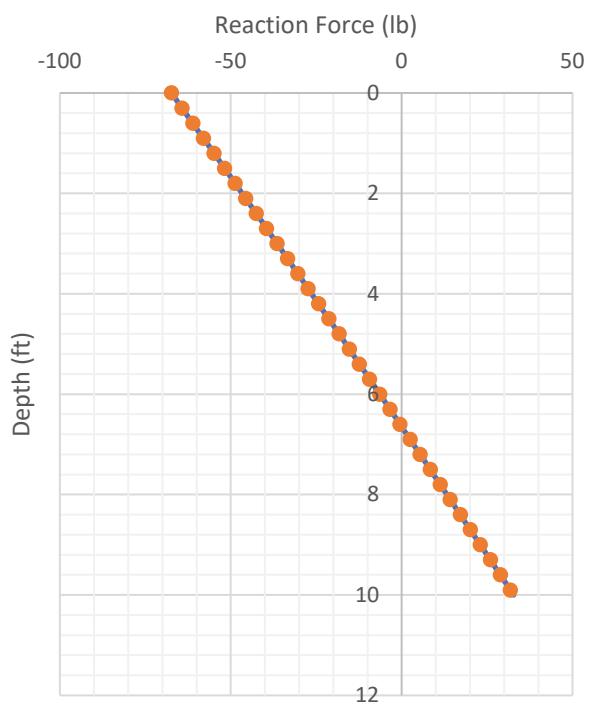
Shear Vs. Depth



Rotation Vs. Depth



Soil Reaction Force Vs. Depth



Case 3:**a. Problem Description**

Problem 3, case 3 is a statically loaded pile in elastic soil with an initial slope applied at the pile head. Soil and pile properties are indicated in tables 3.5 and 3.6.

b. Material Properties**Table 3-5: Elastic Soil Properties**

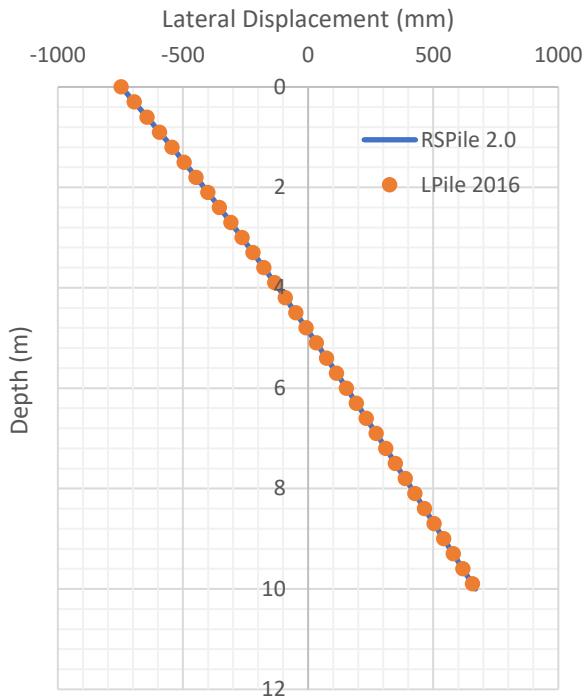
Parameter	Value
General Properties	
Unit Weight	8 kN/m ³
Laterally Loaded Piles	
Soil Type	Elastic soil
Elastic Subgrade Reaction	10,000 kN/m ³
Soil layer thickness	10 m

Table 3-6: Pile and Loading Properties

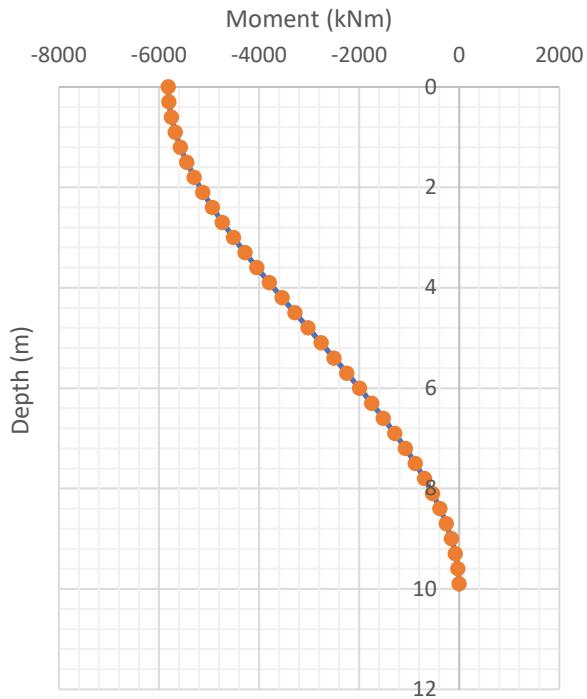
Parameter	Value
Cross Section	Circle
Diameter	0.5 m
Young's Modulus	200,000,000 kPa
Embedment Length	10 m
Slope	10 Degrees

c. Results

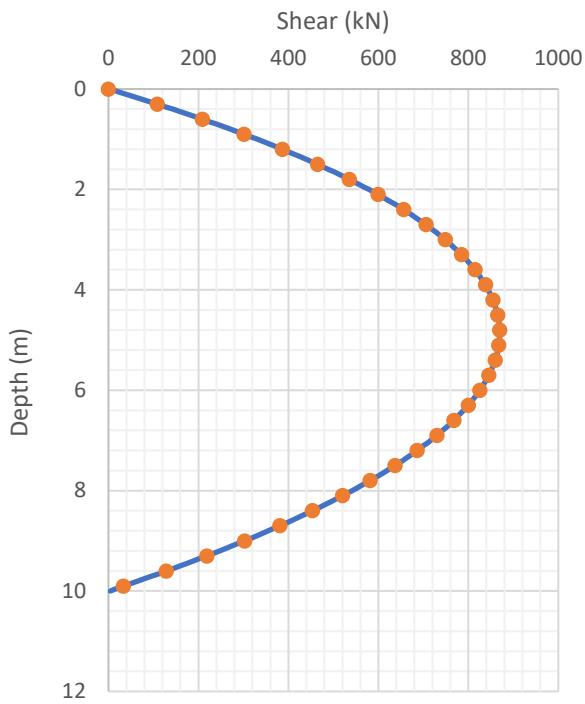
Lateral Displacement Vs. Depth



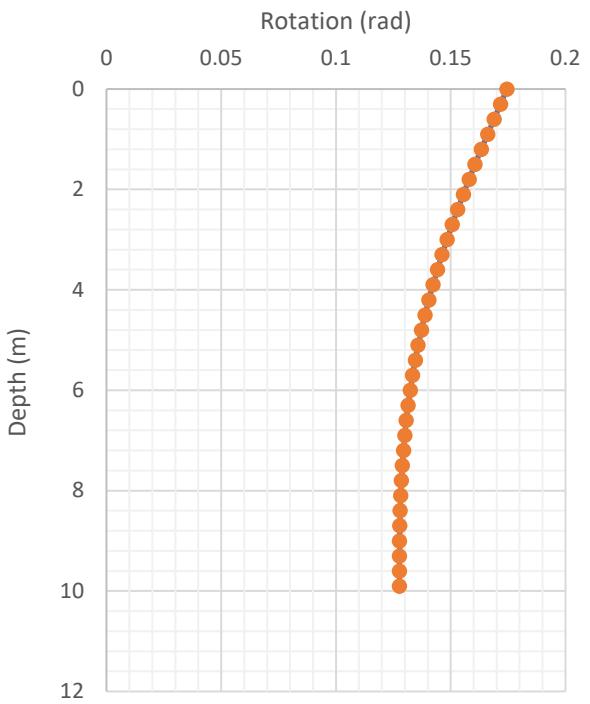
Moment Vs. Depth



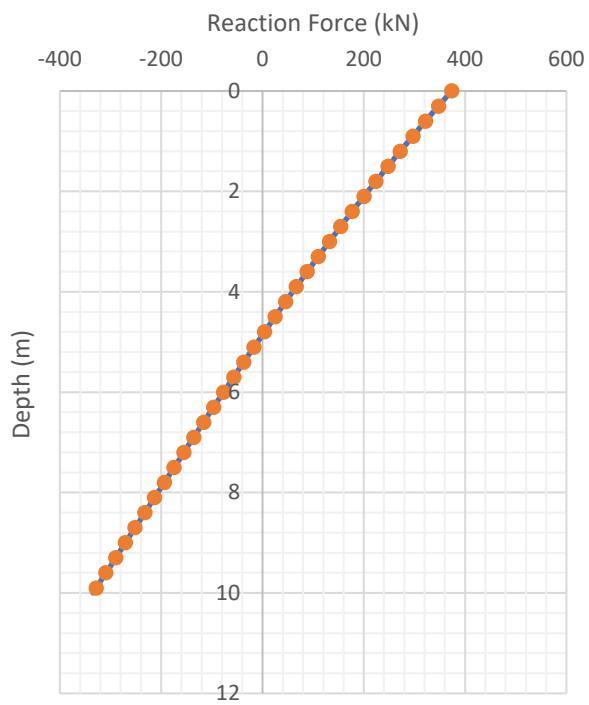
Shear Vs. Depth



Rotation Vs. Depth



Soil Reaction Force Vs. Depth



RSPile Verification Problem #4

Liquefied sand, static shear and axial loading

Case 1:

a. Problem Description

Problem 4, case 1 is a laterally loaded pile located within a single layer of liquefied sand. The pile has uniform properties with depth.

b. Material Properties

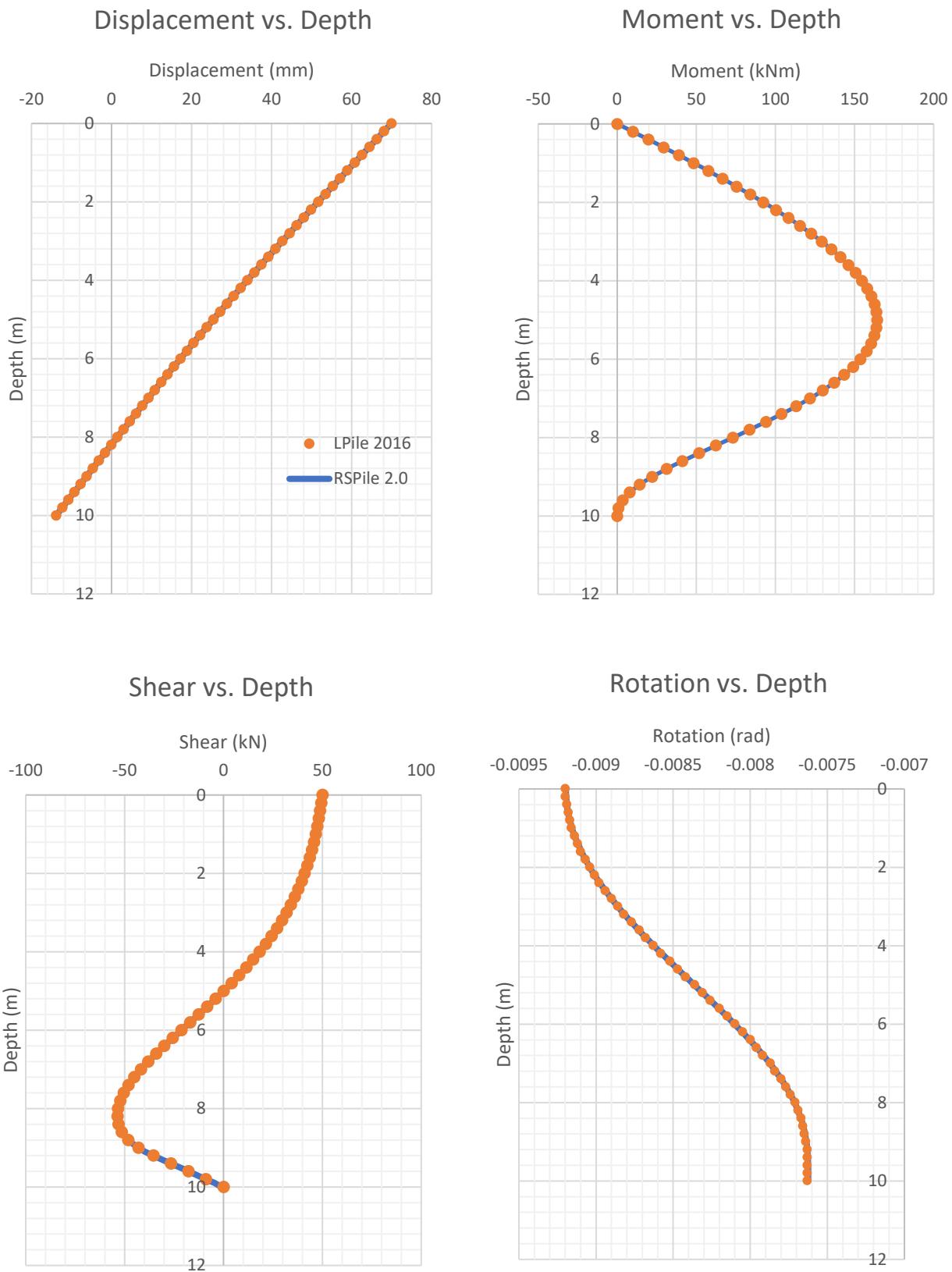
Table 4-1: Liquefied Sand Properties

Parameter	Value
General Properties	
Unit Weight	8 kN/m ³
Laterally Loaded Piles	
Soil Type	Liquefied Sand
Soil layer thickness	10 m

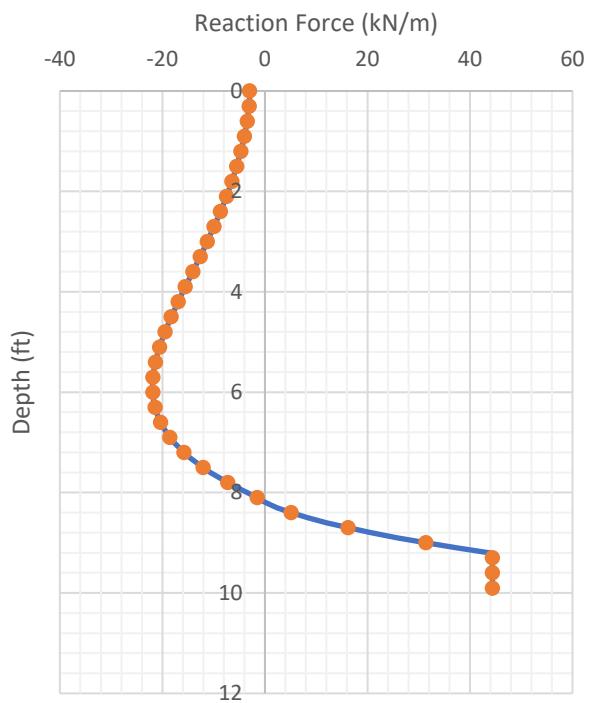
Table 4-2: Pile and Loading Properties

Parameter	Value
Cross Section	Circle
Diameter	0.5 m
Young's Modulus	200,000,000 kPa
Embedment Length	10 m
Lateral / Shear Load	50 kN
Axial Load	1 kN

c. Results



Soil Reaction Force Vs. Depth



Case 2:**a. Problem Description**

Problem 4, case 2 is a laterally loaded pile located within a single layer of liquefied sand. The pile has uniform properties with depth.

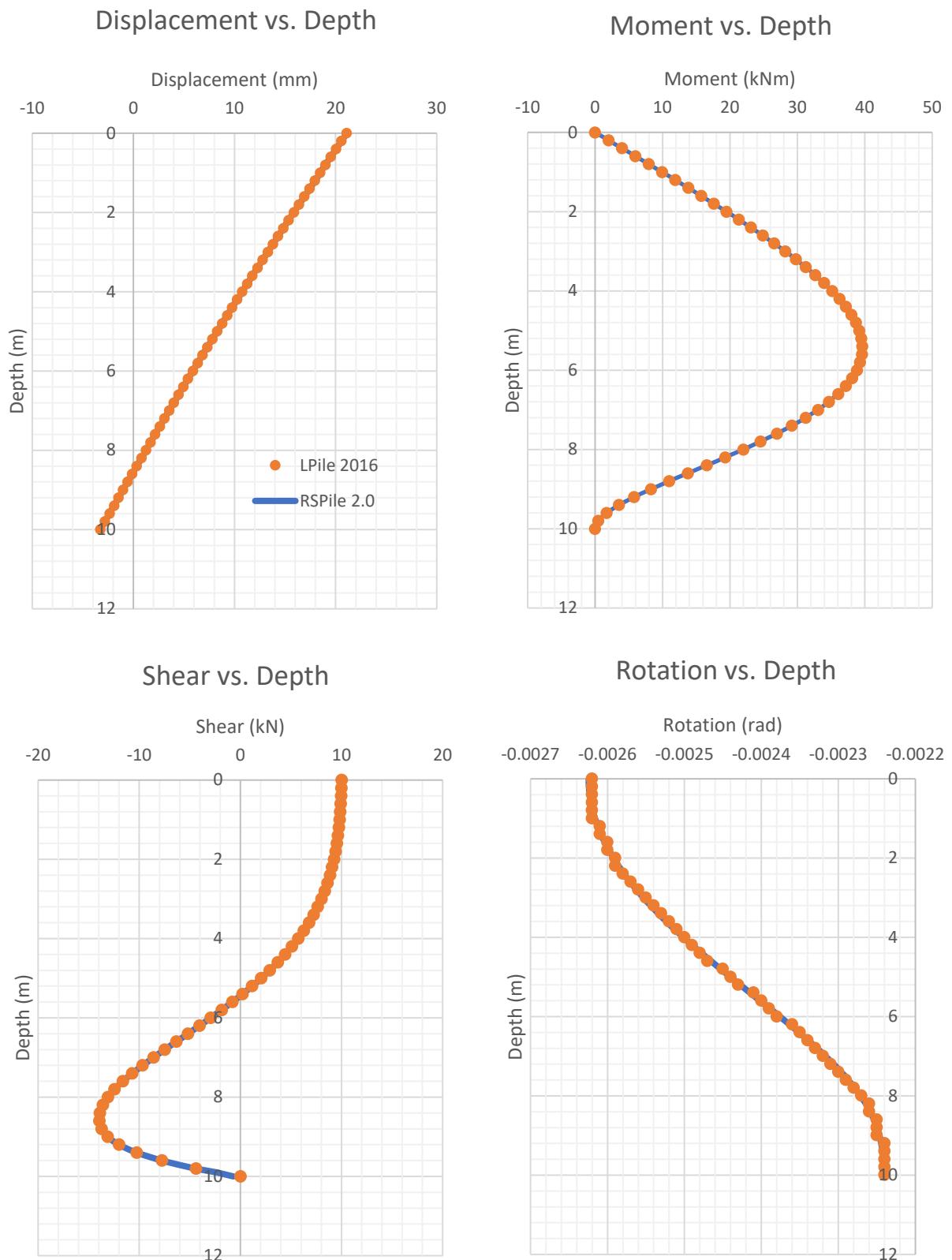
b. Material Properties**Table 4-3: Liquefied Sand Properties**

Parameter	Value
General Properties	
Unit Weight	8 kN/m ³
Laterally Loaded Piles	
Soil Type	Liquefied Sand
Soil layer thickness	10 m

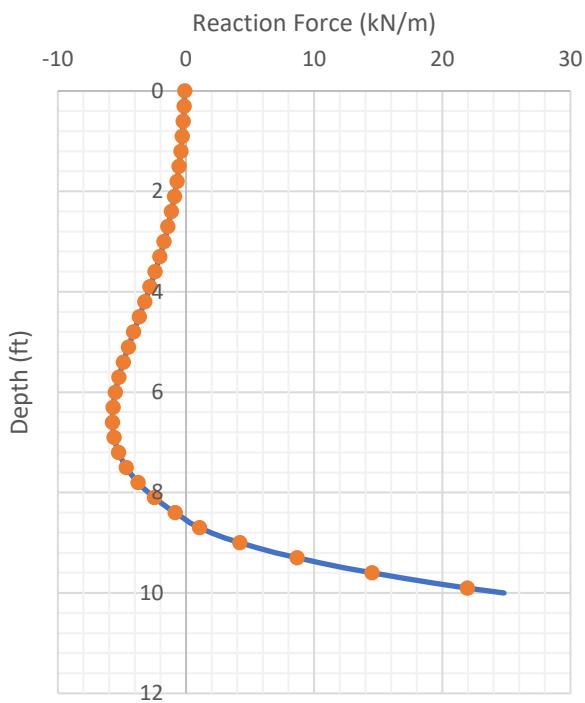
Table 4-4: Pile and Loading Properties

Parameter	Value
Cross Section	Circle
Diameter	0.5 m
Young's Modulus	200,000,000 kPa
Embedment Length	10 m
Lateral / Shear Load	10 kN
Axial Load	1 kN

c. Results



Soil Reaction Force Vs. Depth



Case 3:**a. Problem Description**

Problem 4, case 3 is a laterally loaded pile located within a single layer of liquefied sand. The pile has uniform properties with depth. This case will test Imperial units.

b. Material Properties**Table 4-5: Liquefied Sand Properties**

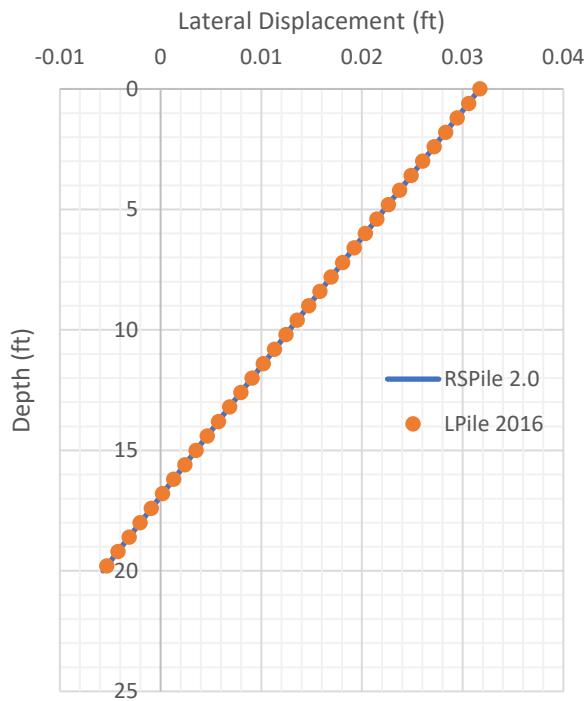
Parameter	Value
General Properties	
Unit Weight	100 lb/ft ³
Laterally Loaded Piles	
Soil Type	Liquefied Sand
Soil layer thickness	20 ft

Table 4-6: Pile and Loading Properties

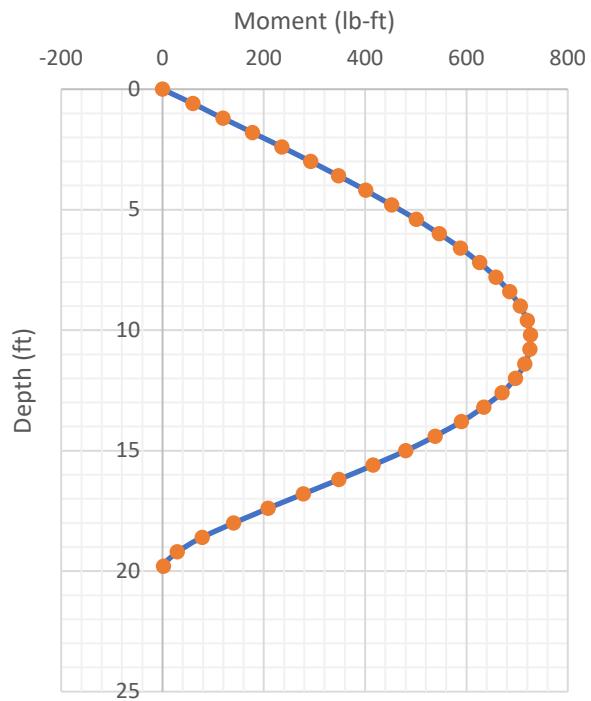
Parameter	Value
Cross Section	Circle
Diameter	2 ft
Young's Modulus	200,000,000 psf
Embedment Length	20 ft
Lateral / Shear Load	100 lb
Axial Load	2 lb

c. Results

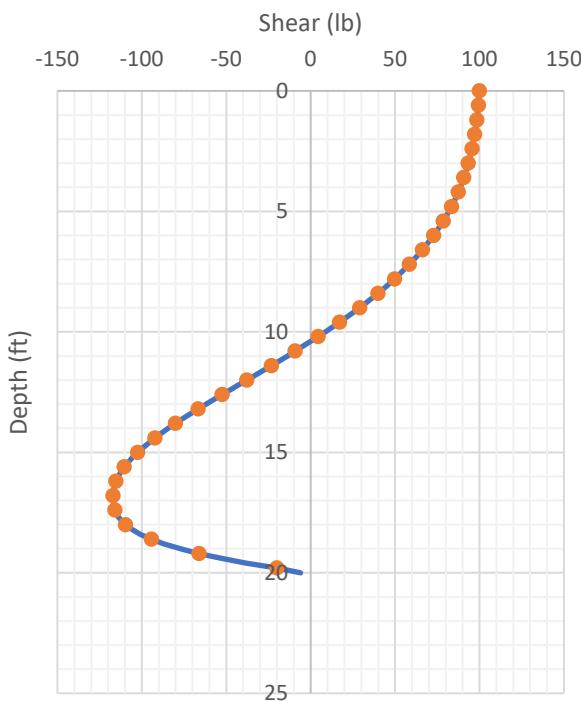
Lateral Displacement Vs. Depth



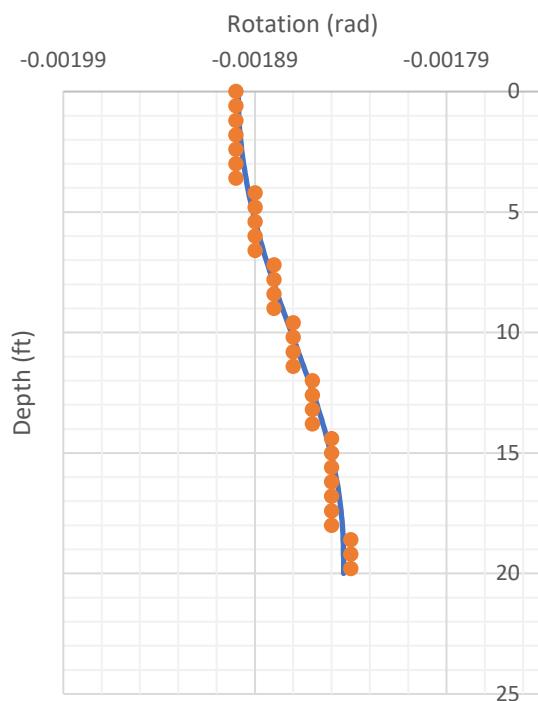
Moment Vs. Depth



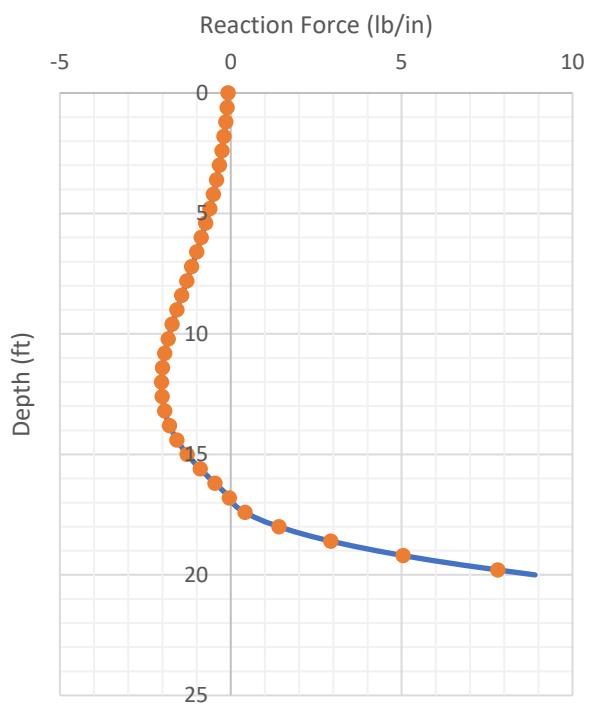
Shear Vs. Depth



Rotation Vs. Depth



Soil Reaction Force Vs. Depth



RSPile Verification Problem #5

Piedmont residual soils, static shear loading

Case 1:

a. Problem Description

Problem 5, case 1 is a laterally loaded pile located within a single layer of piedmont residual soil. The pile has uniform properties with depth.

b. Material Properties

Table 5-1: Piedmont Residual Soil Properties

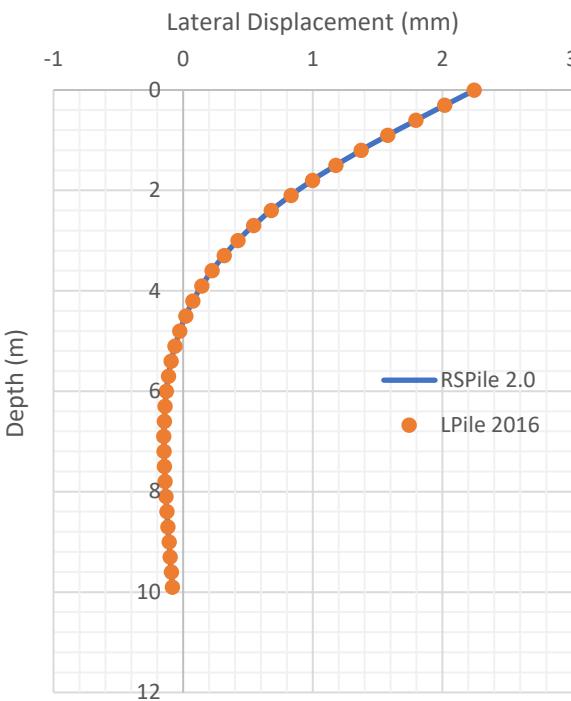
Parameter	Value
General Properties	
Unit Weight	8 kN/m ³
Laterally Loaded Piles	
Soil Type	Piedmont Residual
Standard Penetration Blow Count	13 blows / 30 cm
Soil layer thickness	10 m

Table 5-2: Pile and Loading Properties

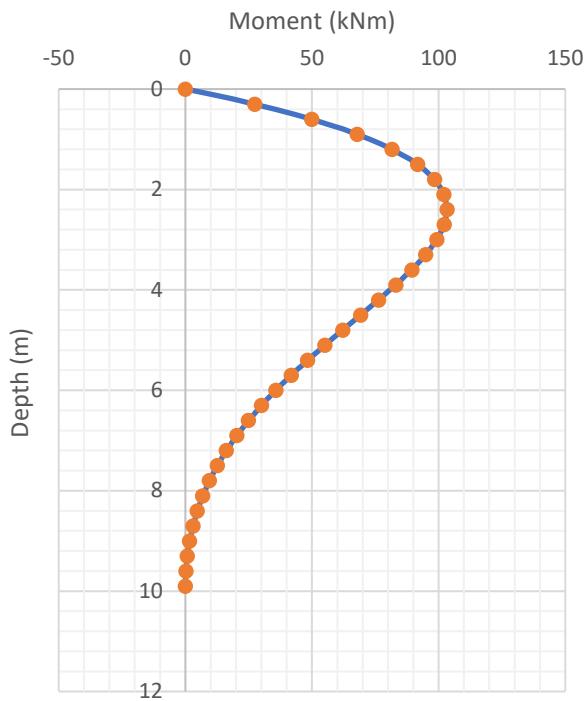
Parameter	Value
Cross Section	Circle
Diameter	0.5 m
Young's Modulus	200,000,000 kPa
Embedment Length	10 m
Lateral / Shear Load	100 kN

c. Results

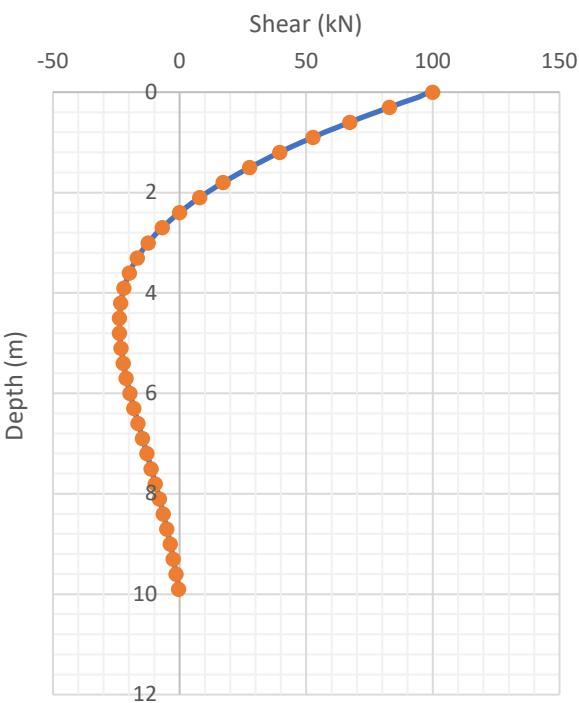
Lateral Displacement Vs. Depth



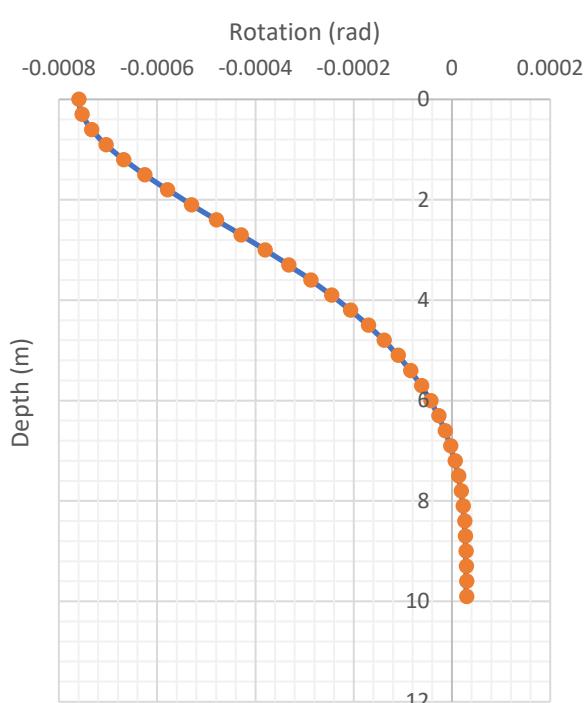
Moment Vs. Depth



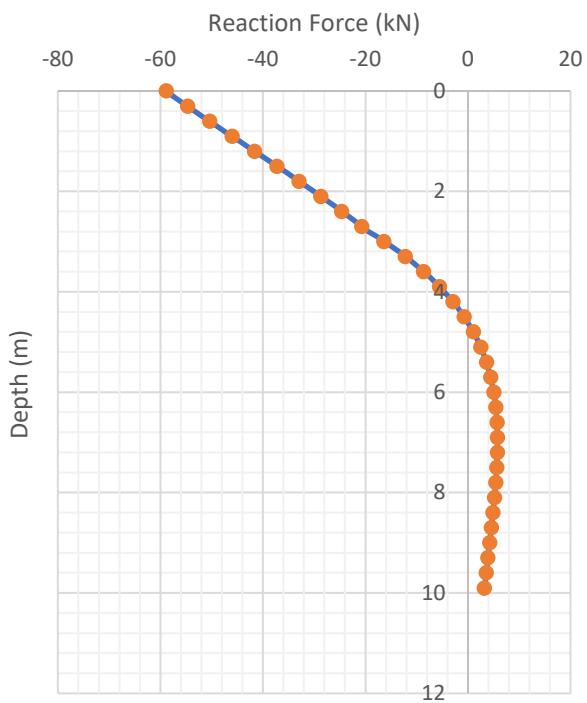
Shear Vs. Depth



Rotation Vs. Depth



Soil Reaction Force Vs. Depth



Case 2:

a. Problem Description

Problem 5, case 2 is a laterally loaded pile located within a single layer of piedmont residual soil. The pile has uniform properties with depth.

b. Material Properties

Table 5-3: Piedmont Residual Soil Properties

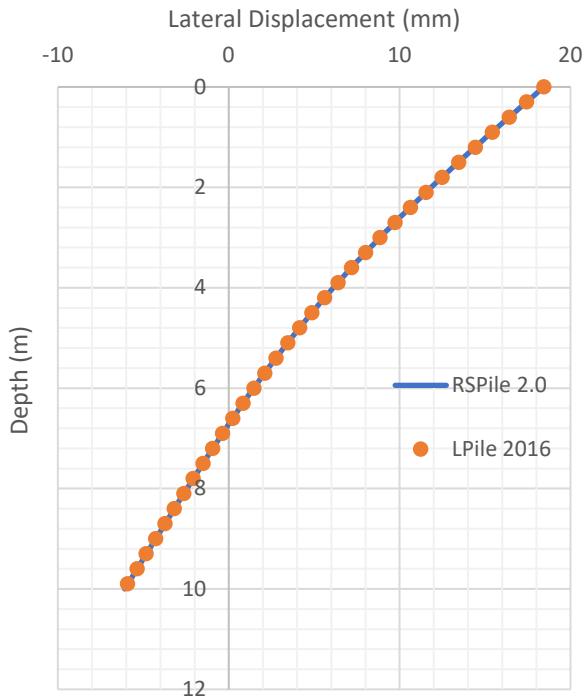
Parameter	Value
General Properties	
Unit Weight	8 kN/m ³
Laterally Loaded Piles	
Soil Type	Piedmont Residual
Dilatometer modulus	5000 kPa
Soil layer thickness	10 m

Table 5-4: Pile and Loading Properties

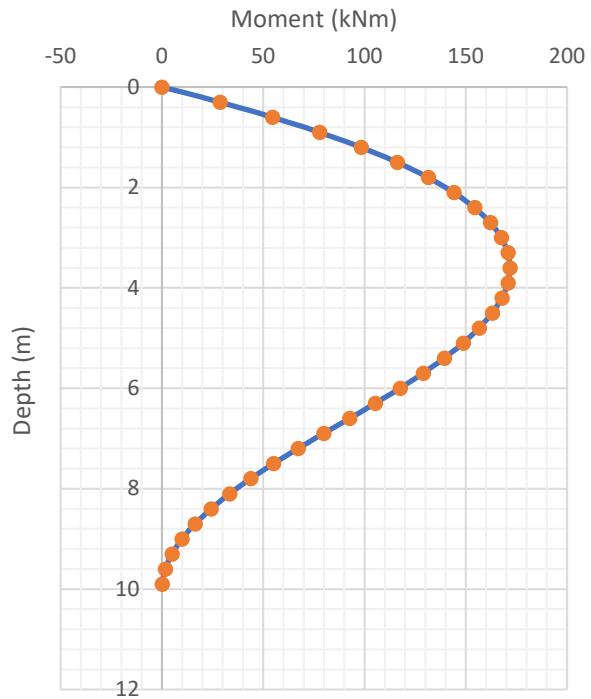
Parameter	Value
Cross Section	Circle
Diameter	0.5 m
Young's Modulus	200,000,000 kPa
Embedment Length	10 m
Lateral / Shear Load	100 kN

c. Results

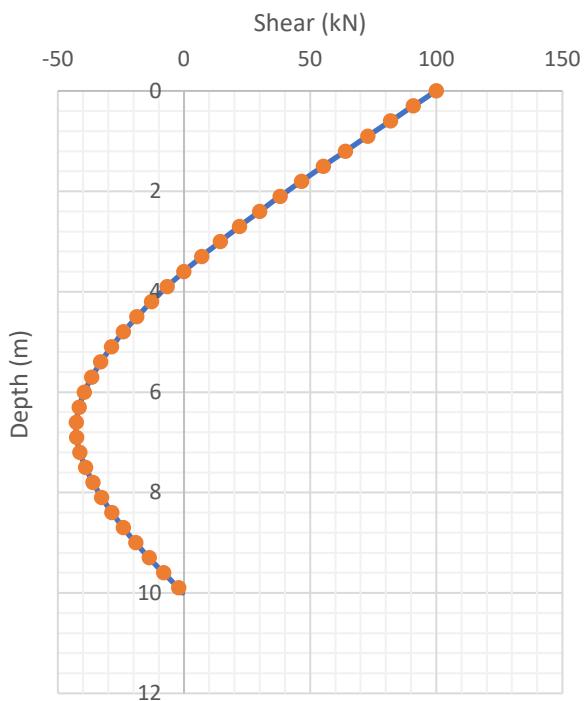
Lateral Displacement Vs. Depth



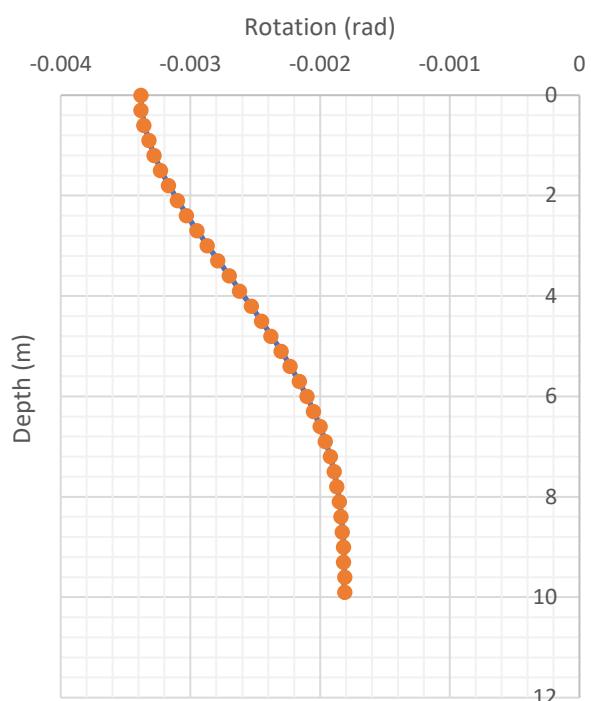
Moment Vs. Depth



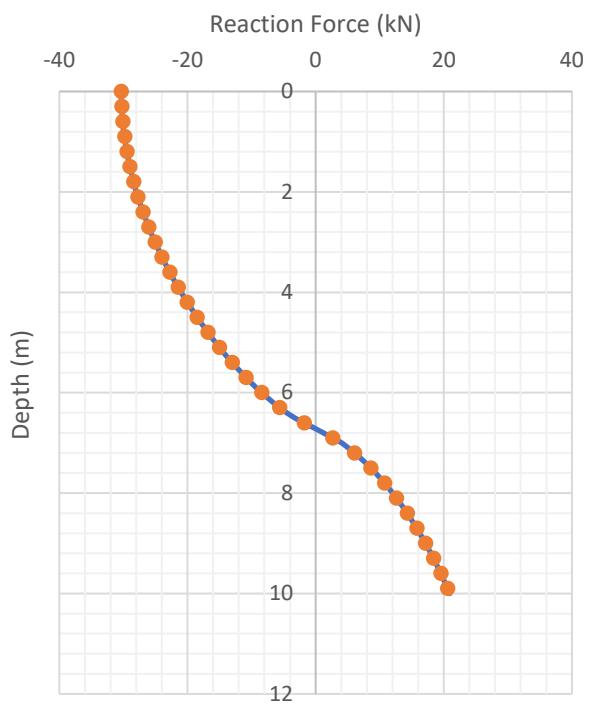
Shear Vs. Depth



Rotation Vs. Depth



Soil Reaction Force Vs. Depth



Case 3:**a. Problem Description**

Problem 5, case 3 is a laterally loaded pile located within a single layer of piedmont residual soil. The pile has uniform properties with depth.

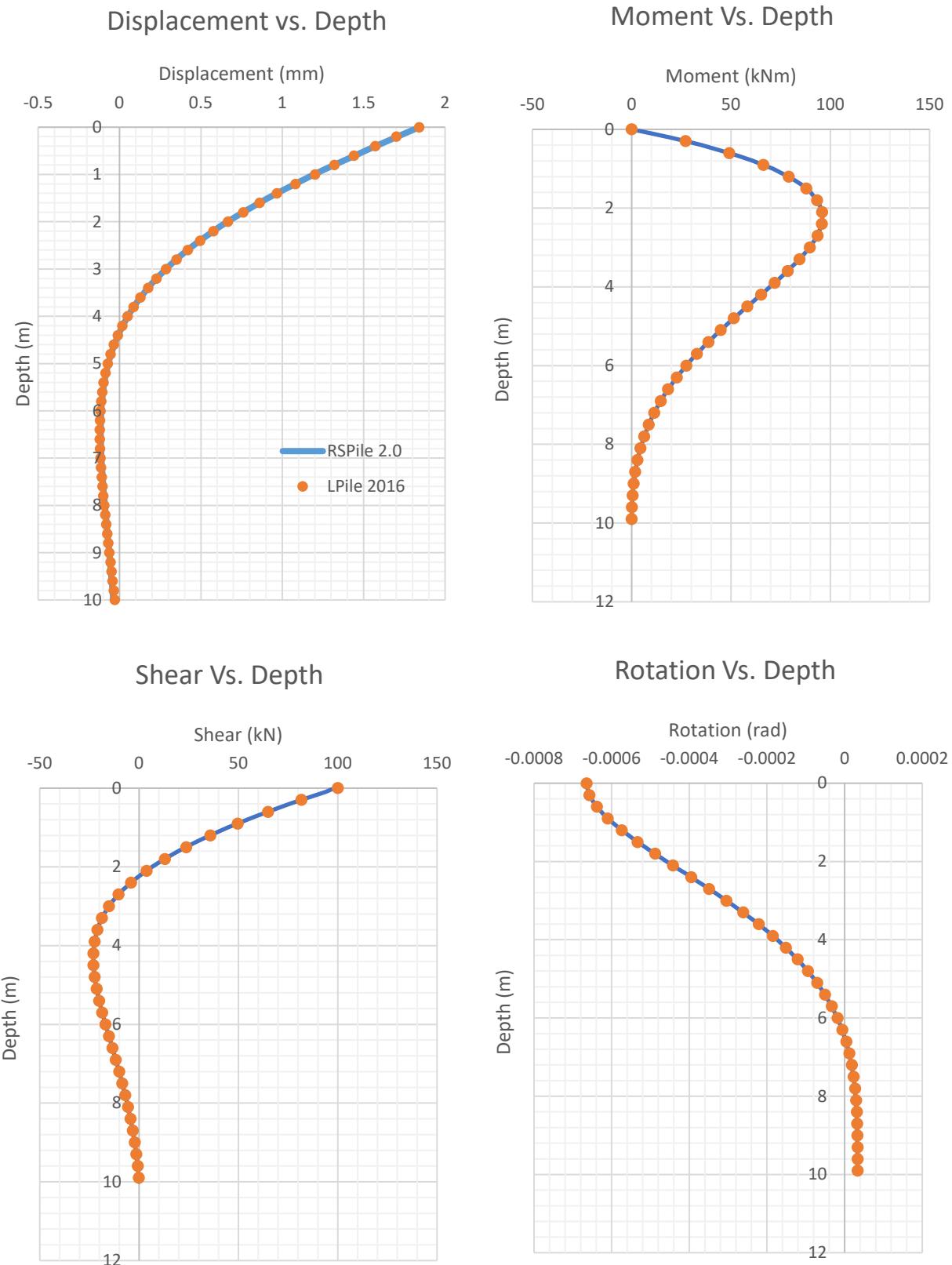
b. Material Properties**Table 5-5: Piedmont Residual Soil Properties**

Parameter	Value
General Properties	
Unit Weight	8 kN/m ³
Laterally Loaded Piles	
Soil Type	Piedmont Residual
Cone Penetration Test	3000 kPa
Soil layer thickness	10 m

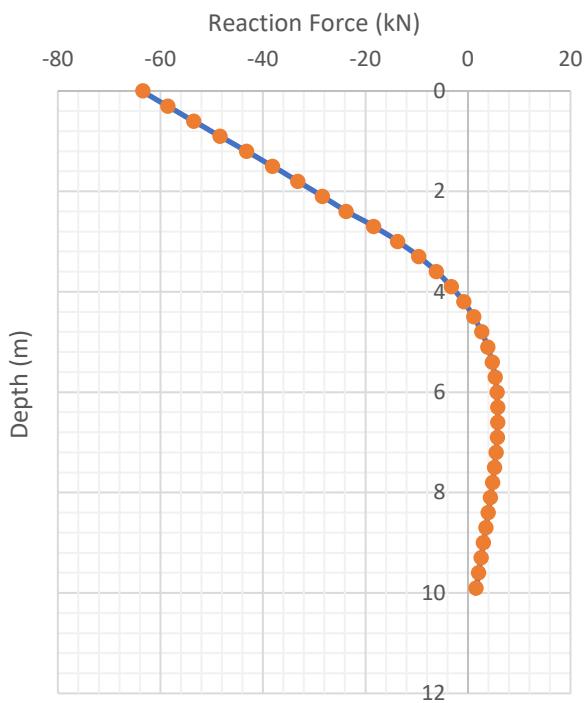
Table 5-6: Pile and Loading Properties

Parameter	Value
Cross Section	Circle
Diameter	0.5 m
Young's Modulus	200,000,000 kPa
Embedment Length	10 m
Lateral / Shear Load	100 kN

c. Results



Soil Reaction Force Vs. Depth



Case 4:**a. Problem Description**

Problem 5, case 4 is a laterally loaded pile located within a single layer of piedmont residual soil. The pile has uniform properties with depth.

b. Material Properties**Table 5-7: Piedmont Residual Soil Properties**

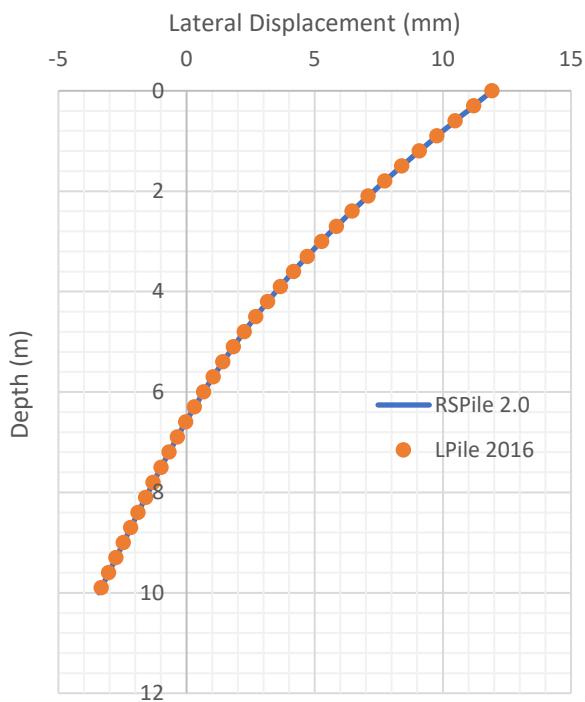
Parameter	Value
General Properties	
Unit Weight	8 kN/m ³
Laterally Loaded Piles	
Soil Type	Piedmont Residual
Menard Pressuremeter Modulus	2000 kPa
Soil layer thickness	10 m

Table 5-8: Pile and Loading Properties

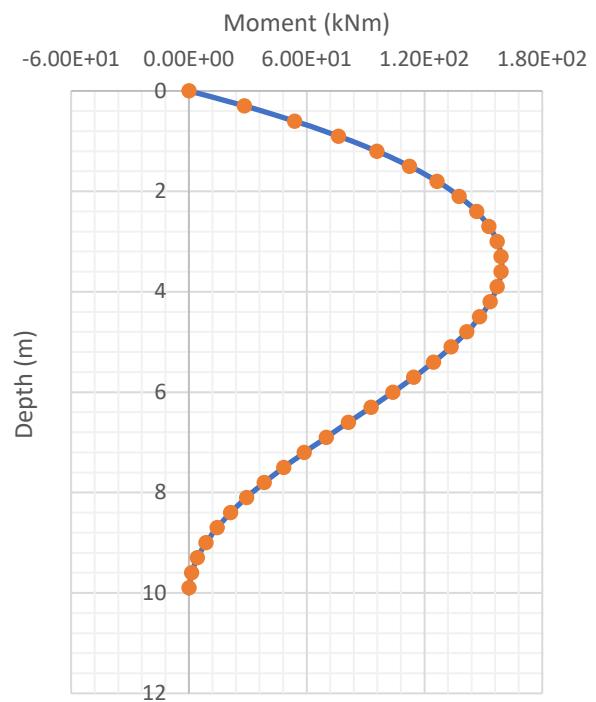
Parameter	Value
Cross Section	Circle
Diameter	0.5 m
Young's Modulus	200,000,000 kPa
Embedment Length	10 m
Lateral / Shear Load	100 kN

c. Results

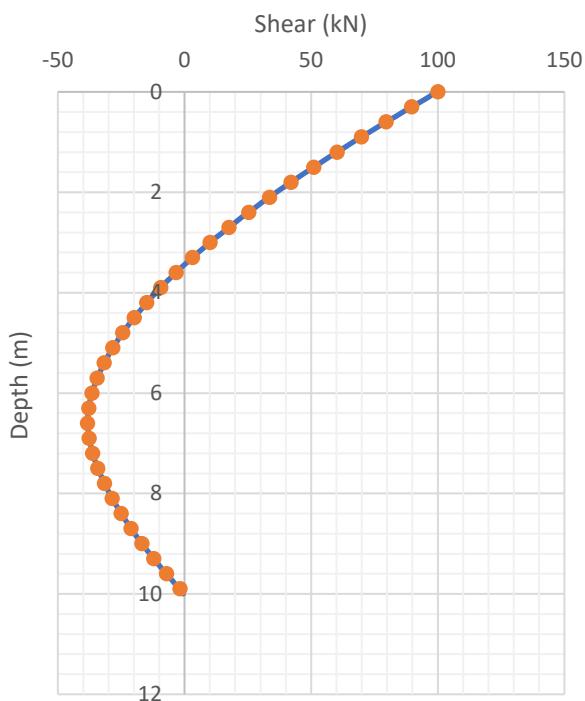
Lateral Displacement Vs. Depth



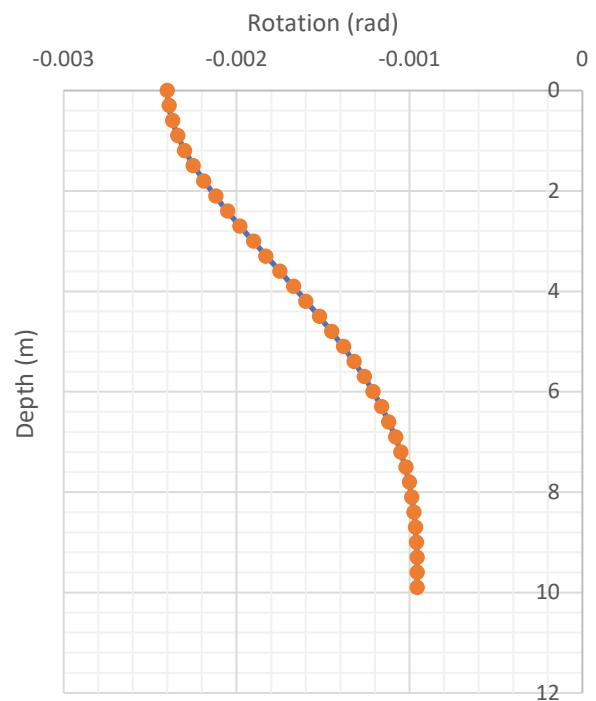
Moment Vs. Depth



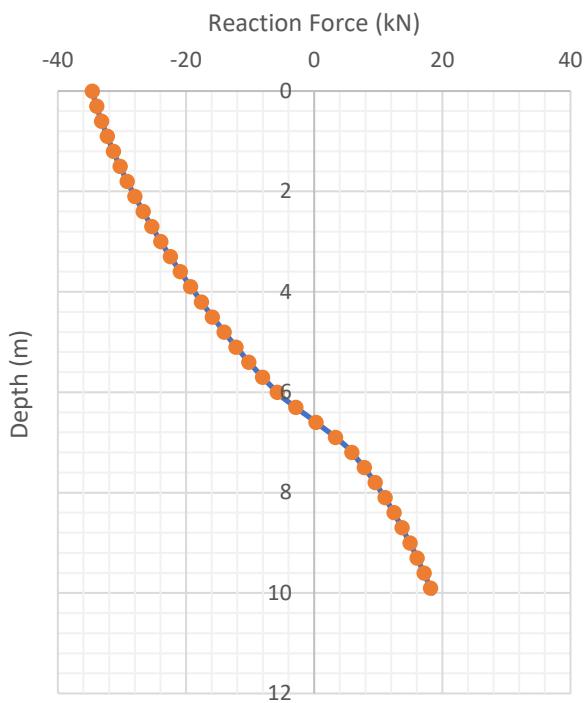
Shear Vs. Depth



Rotation Vs. Depth



Soil Reaction Force Vs. Depth



Case 5:**a. Problem Description**

Problem 5, case 5 is a laterally loaded pile located within a single layer of piedmont residual soil. The pile has uniform properties with depth.

b. Material Properties**Table 5-9: Piedmont Residual Soil Properties**

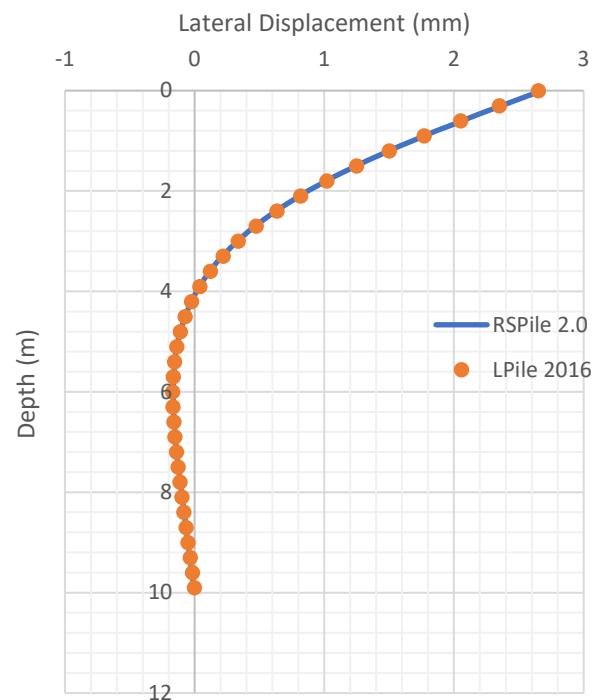
Parameter	Value
General Properties	
Unit Weight	8 kN/m ³
Laterally Loaded Piles	
Soil Type	Piedmont Residual
Standard Penetration Blow Count	13 blows / 30 cm
Soil layer thickness	10 m

Table 5-10: Pile and Loading Properties

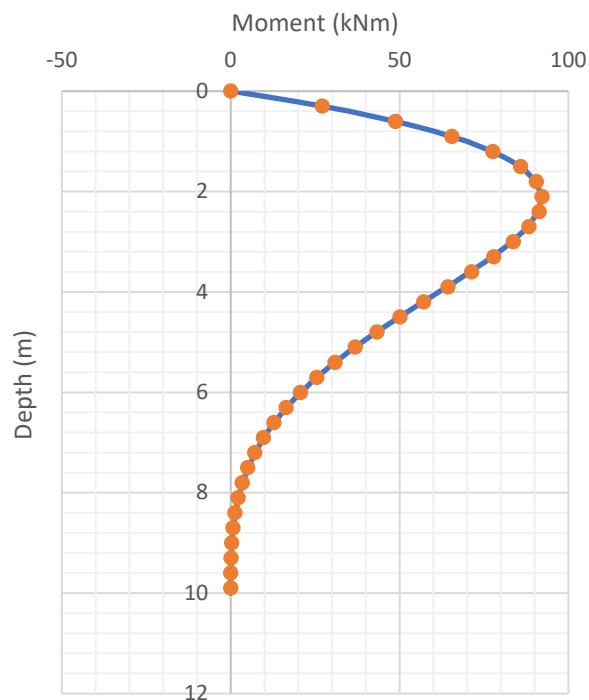
Parameter	Value
Cross Section	Pipe
Diameter	0.5 m
Wall Thickness	50 mm
Young's Modulus	200,000,000 kPa
Embedment Length	10 m
Lateral / Shear Load	100 kN

c. Results

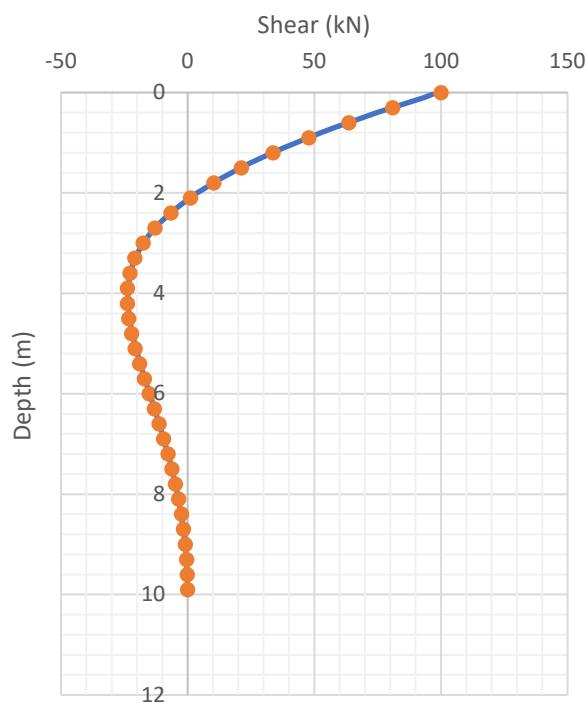
Lateral Displacement Vs. Depth



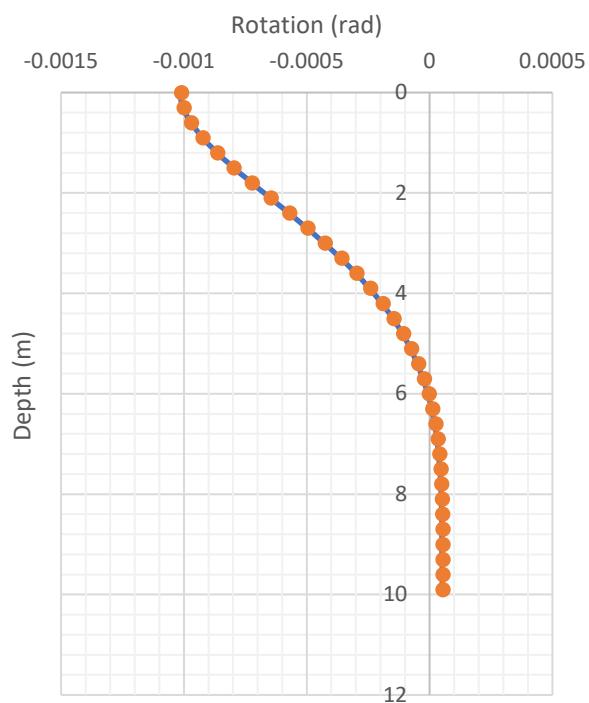
Moment Vs. Depth



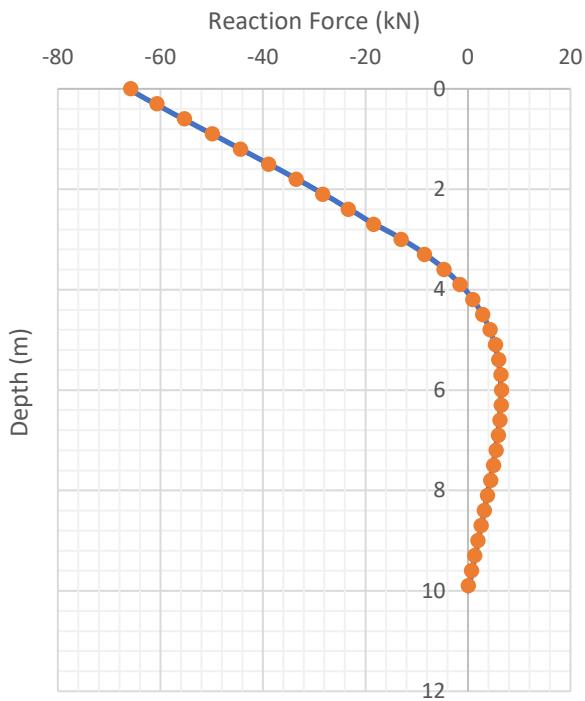
Shear Vs. Depth



Rotation Vs. Depth



Soil Reaction Force Vs. Depth



Case 6:**a. Problem Description**

Problem 5, case 6 is a laterally loaded pile located within a single layer of piedmont residual soil. The pile has uniform properties with depth. This case will test Imperial units.

b. Material Properties**Table 5-11: Piedmont Residual Soil Properties**

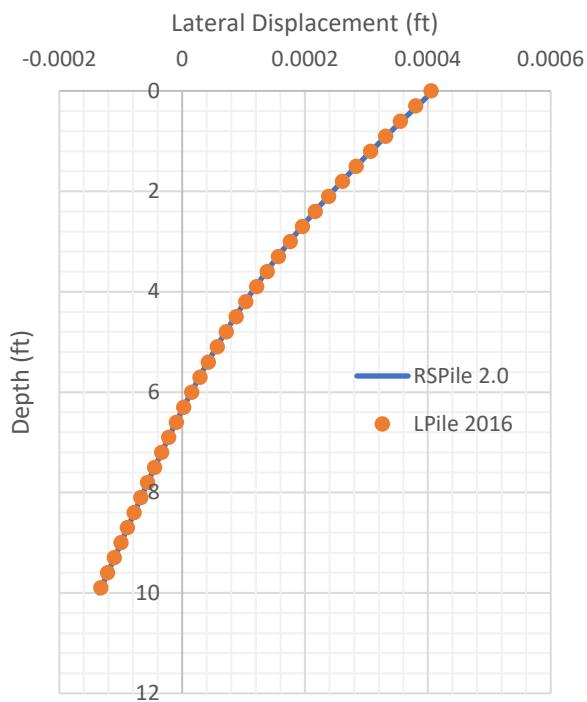
Parameter	Value
General Properties	
Unit Weight	50 lb/ft ³
Laterally Loaded Piles	
Soil Type	Piedmont Residual
Standard Penetration Test	15
Soil layer thickness	10 ft

Table 5-12: Pile and Loading Properties

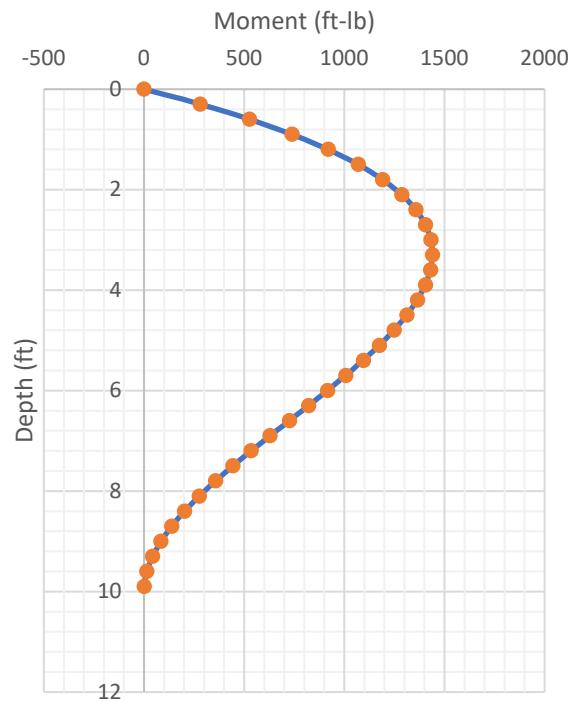
Parameter	Value
Cross Section	Circle
Diameter	2 ft
Young's Modulus	200,000,000 psf
Embedment Length	10 ft
Lateral / Shear Load	1000 lb

c. Results

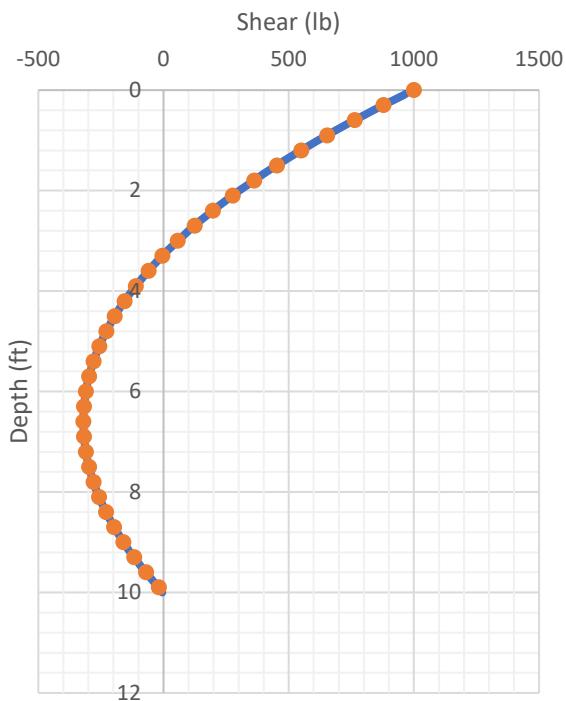
Lateral Displacement Vs. Depth



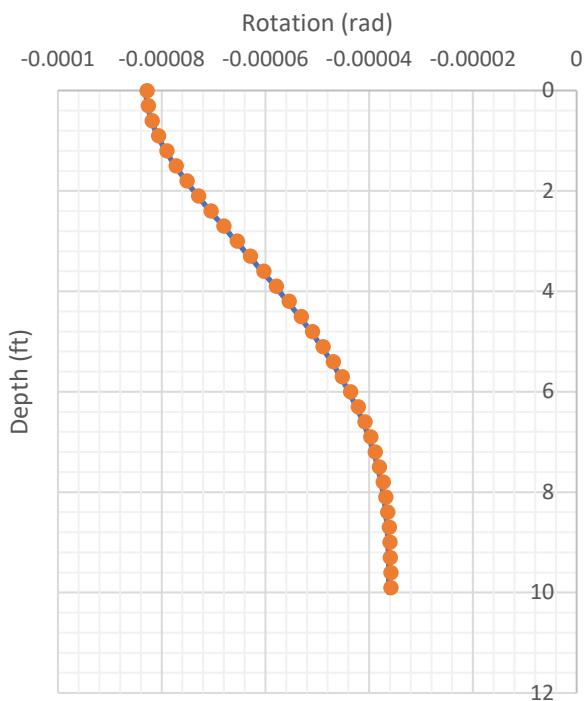
Moment vs. Depth



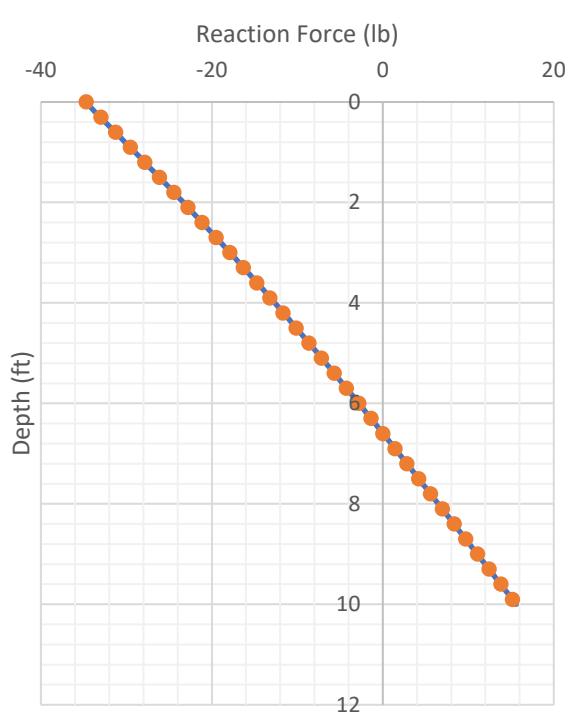
Shear vs. Depth



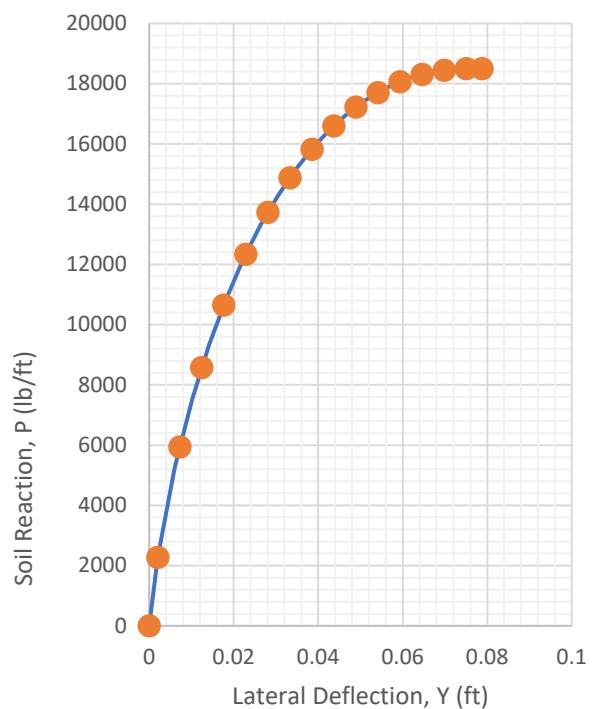
Rotation Vs. Depth



Soil Reaction Force vs. Depth



PY Curve at 5 ft Depth



Case 7:**a. Problem Description**

Problem 5, case 7 is a laterally loaded pile located within a single layer of piedmont residual soil. The pile has uniform properties with depth. This case will test Imperial units.

b. Material Properties**Table 5-13: Piedmont Residual Soil Properties**

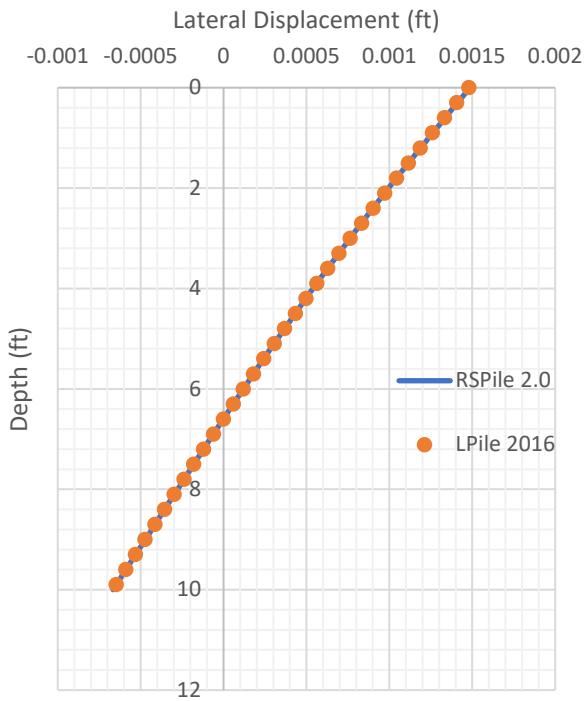
Parameter	Value
General Properties	
Unit Weight	50 lb/ft ³
Laterally Loaded Piles	
Soil Type	Piedmont Residual
Cone Tip Resistance	14,400 psf
Soil layer thickness	10 ft

Table 5-14: Pile and Loading Properties

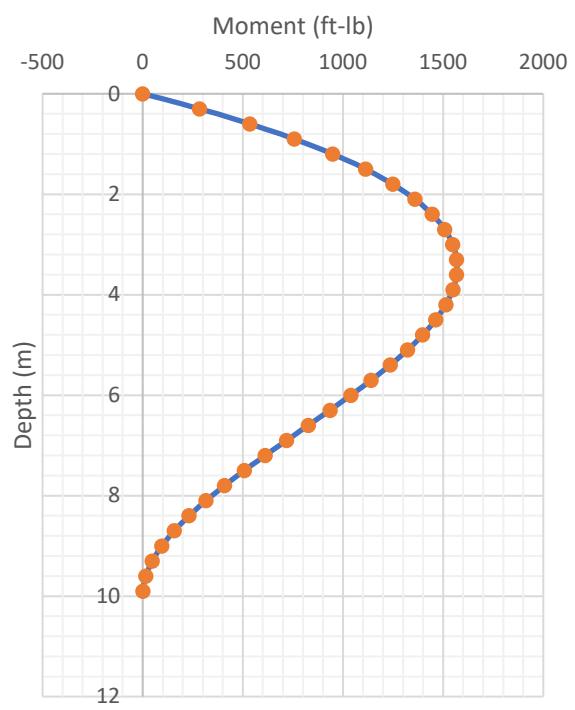
Parameter	Value
Cross Section	Circle
Diameter	2 ft
Young's Modulus	200,000,000 psf
Embedment Length	10 ft
Lateral / Shear Load	1000 lb

c. Results

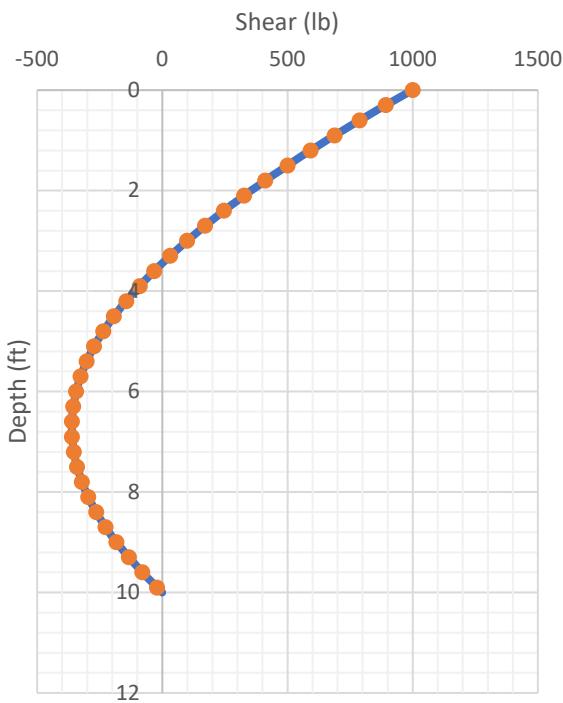
Lateral Displacement Vs. Depth



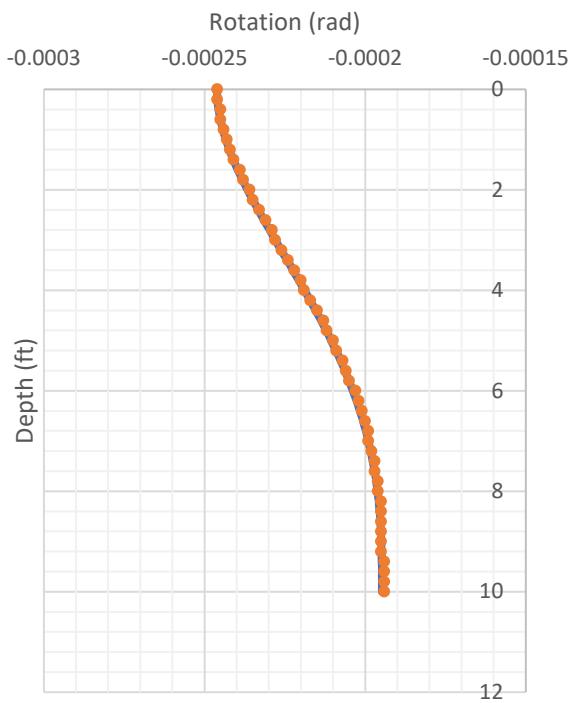
Moment vs. Depth



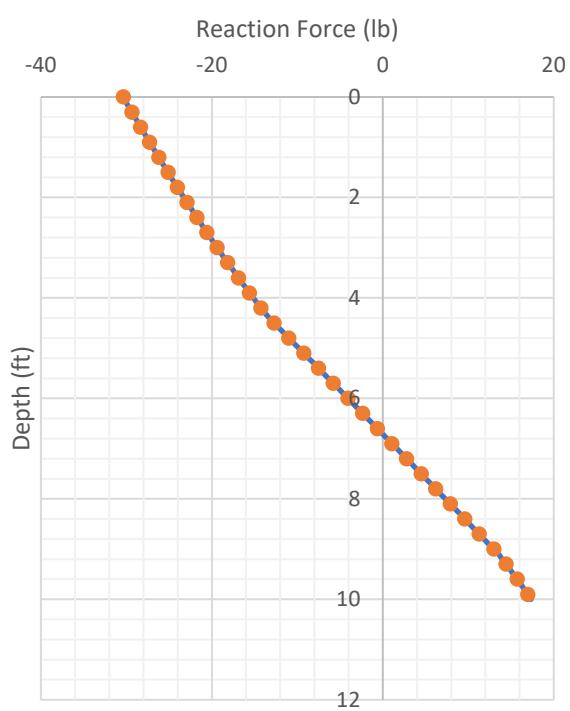
Shear vs. Depth



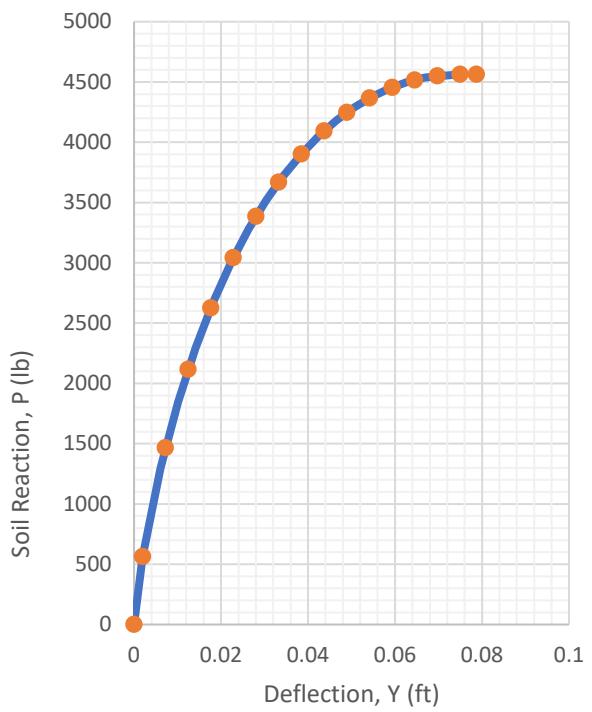
Rotation vs. Depth



Soil Reaction Force vs. Depth



PY Curve at 5 ft Depth



Case 8:

a. Problem Description

Problem 5, case 8 is a laterally loaded pile located within a single layer of piedmont residual soil. The pile has uniform properties with depth. This case will test Imperial units.

b. Material Properties

Table 5-15: Piedmont Residual Soil Properties

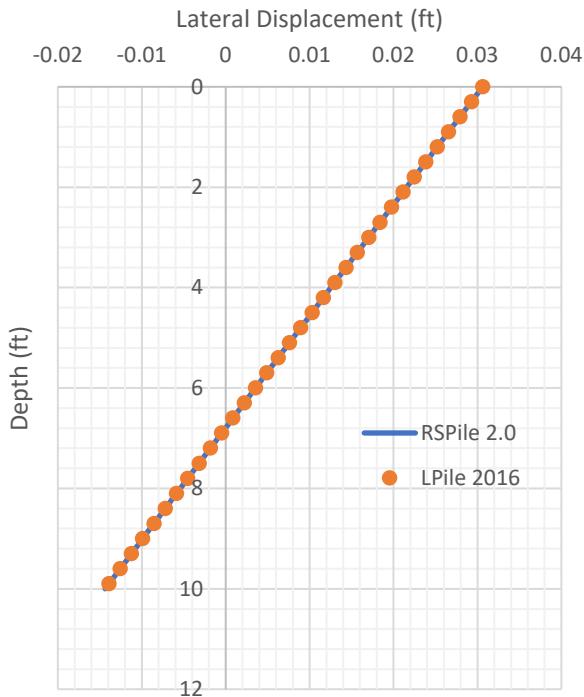
Parameter	Value
General Properties	
Unit Weight	50 lb/ft ³
Laterally Loaded Piles	
Soil Type	Dilatometer test
Dilatometer Test	14,400 psf
Soil layer thickness	10 ft

Table 5-16: Pile and Loading Properties

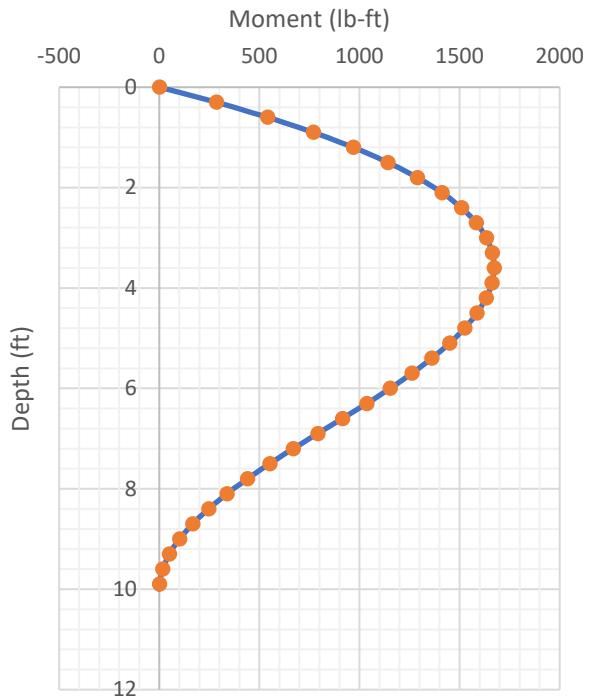
Parameter	Value
Cross Section	Circle
Diameter	2 ft
Young's Modulus	200,000,000 psf
Embedment Length	10 ft
Lateral / Shear Load	1000 lb

c. Results

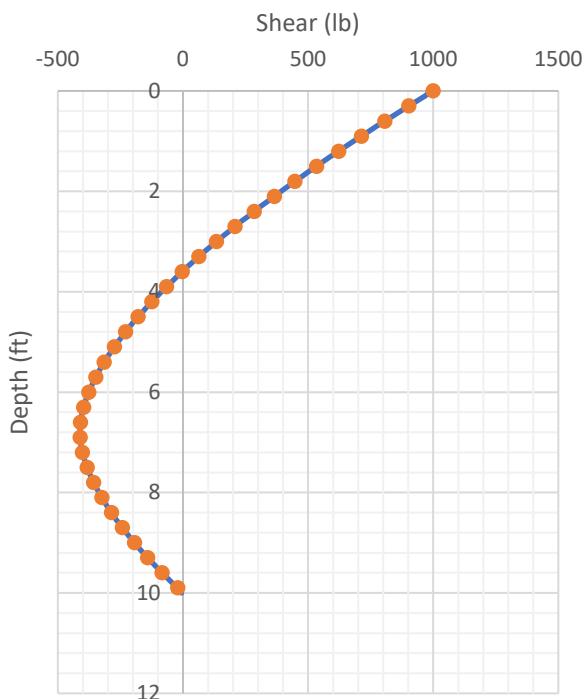
Lateral Displacement Vs. Depth



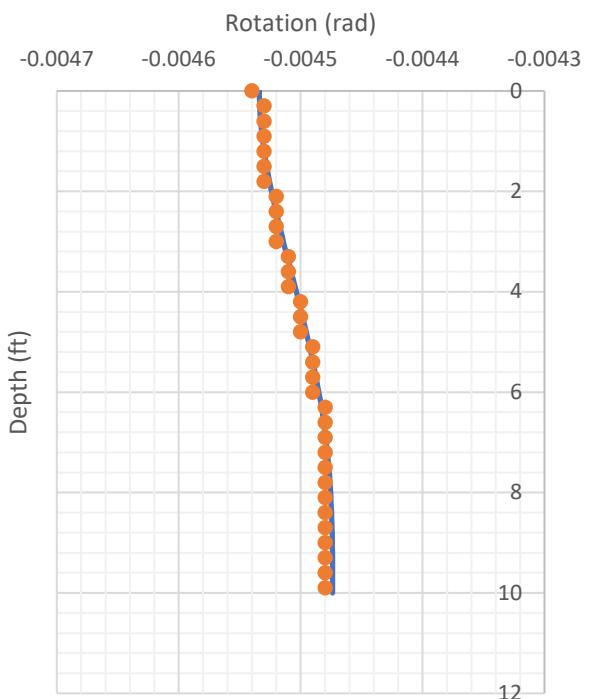
Moment Vs. Depth



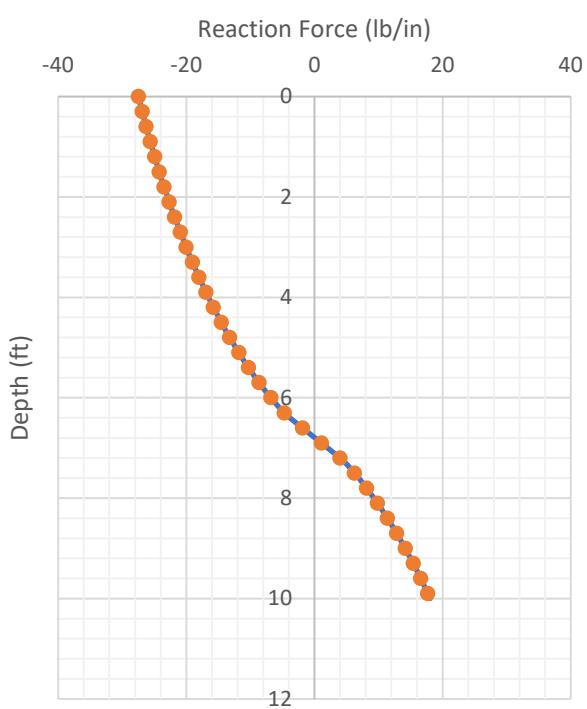
Shear Vs. Depth



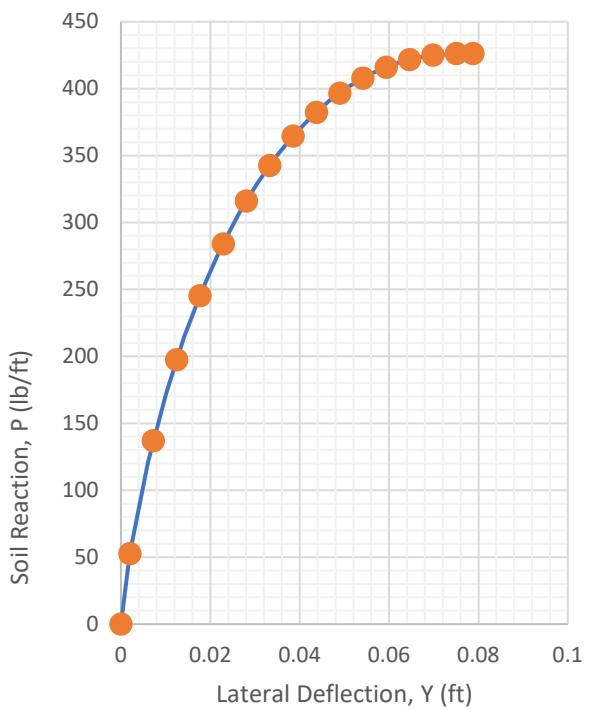
Rotation Vs. Depth



Soil Reaction Force Vs. Depth



PY Curve at 5 ft Depth



Case 9:**a. Problem Description**

Problem 5, case 9 is a laterally loaded pile located within a single layer of piedmont residual soil. The pile has uniform properties with depth. This case will test Imperial units.

b. Material Properties**Table 5-17: Piedmont Residual Soil Properties**

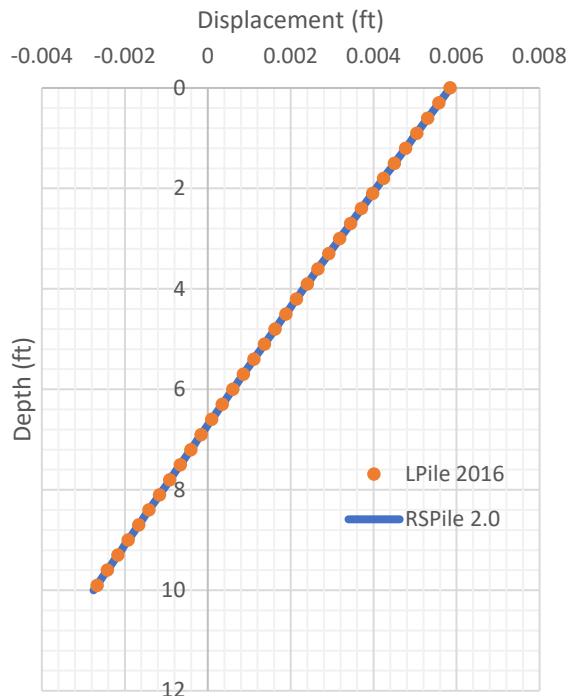
Parameter	Value
General Properties	
Unit Weight	50 lb/ft ³
Laterally Loaded Piles	
Soil Type	Piedmont Residual
Menard Pressuremeter Modulus	14,400 psf
Soil layer thickness	10 ft

Table 5-18: Pile and Loading Properties

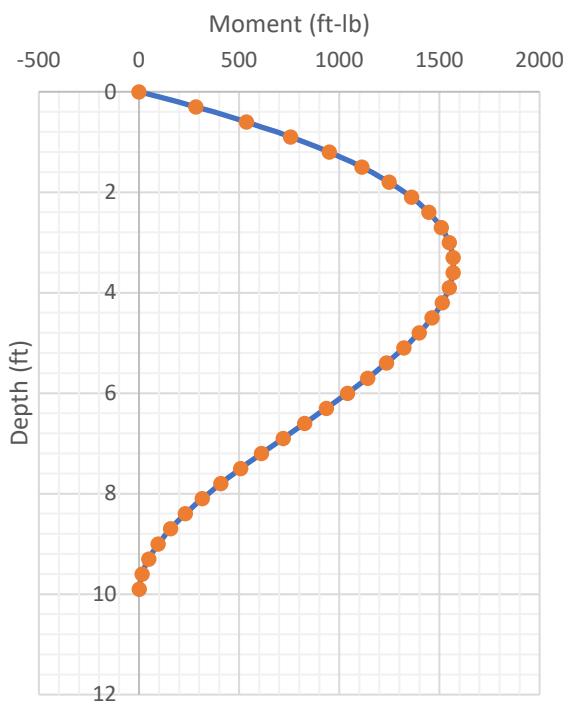
Parameter	Value
Cross Section	Circle
Diameter	2 ft
Young's Modulus	200,000,000 psf
Embedment Length	10 ft
Lateral / Shear Load	1000 lb

c. Results

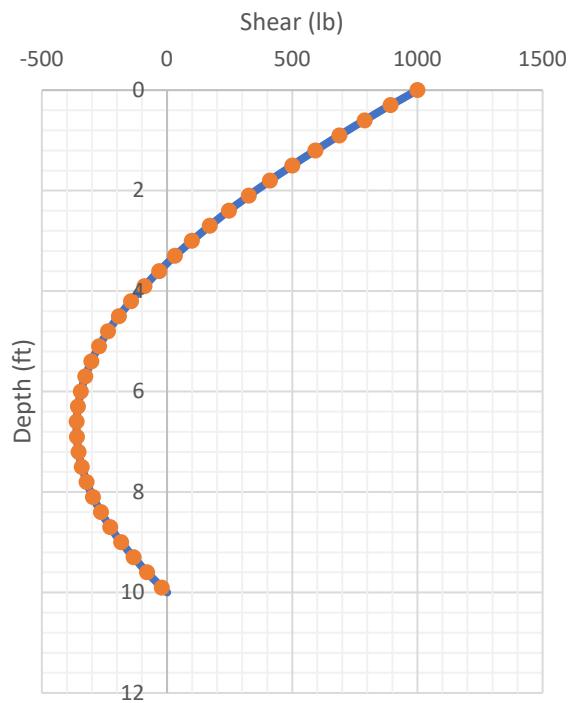
Displacement vs. Depth



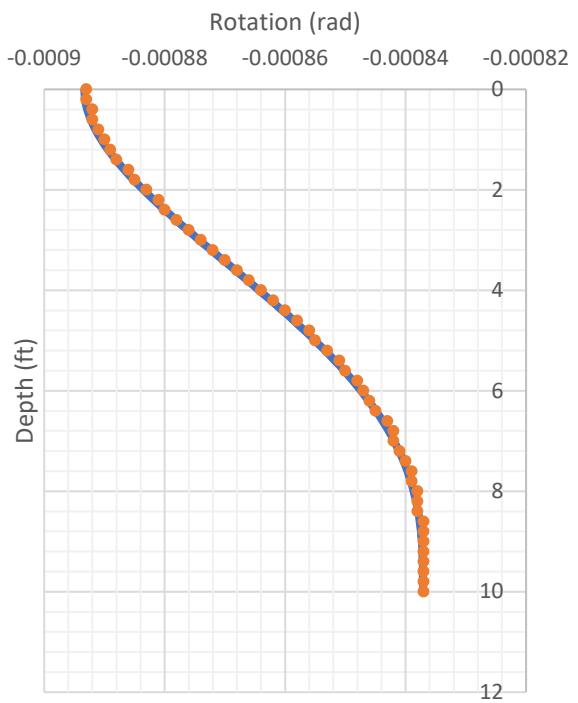
Moment vs. Depth



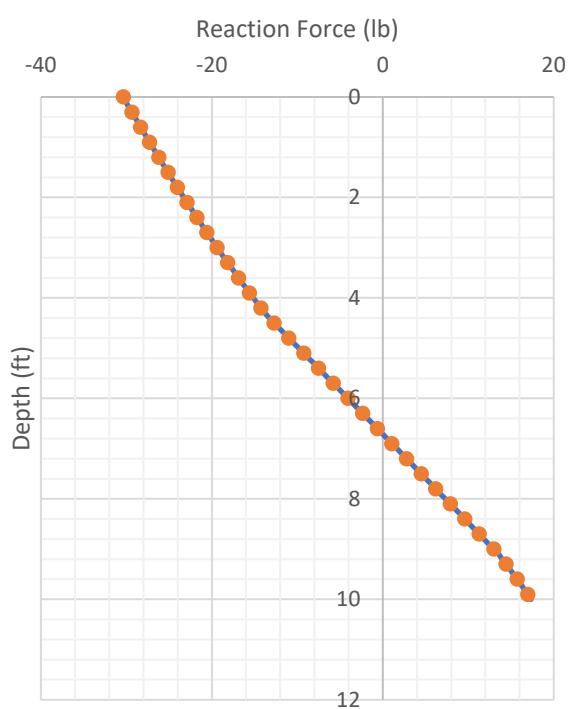
Shear vs. Depth



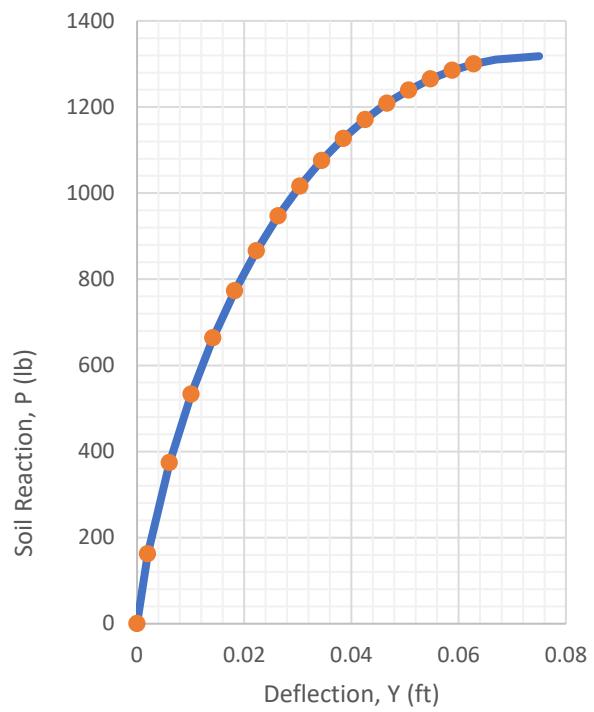
Rotation vs. Depth



Soil Reaction Force vs. Depth



PY Curve at 5 ft Depth



RSPile Verification Problem #6

User-defined soil, statically loaded pile

Case 1:

a. **Problem Description**

Problem 6, case 1 is a statically loaded pile in a soil with a user-defined p-y curve. The soil and pile properties are listed in tables 6-1, 6-2, and 6-3 below.

b. **Material Properties**

Table 6-1: User Defined Soil Properties

Parameter	Value
General Properties	
Unit Weight	8 kN/m ³
Laterally Loaded Piles	
Soil Type	User Defined
Soil layer thickness	10 m

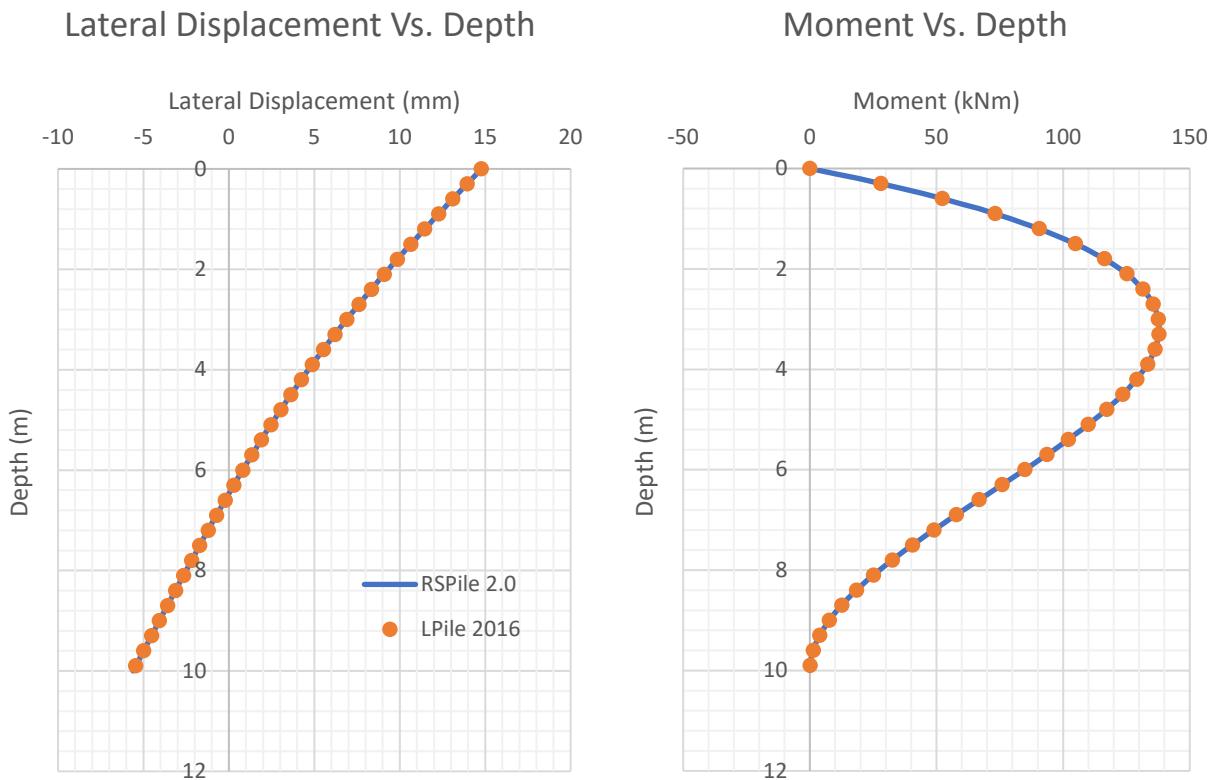
Table 6-2: PY Curves for User Defined Soil

Y (m)	P (kN/m)
0	0
0.1	300
0.5	500

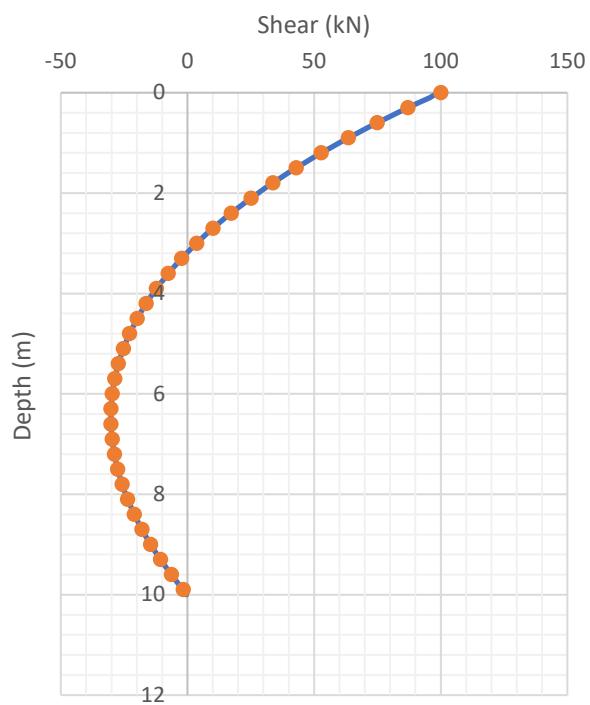
Table 6-3: Pile and Loading Properties

Parameter	Value
Cross Section	Circle
Diameter	0.5 m
Young's Modulus	200,000,000 kPa
Embedment Length	10 m
Lateral / Shear Load	100 kN

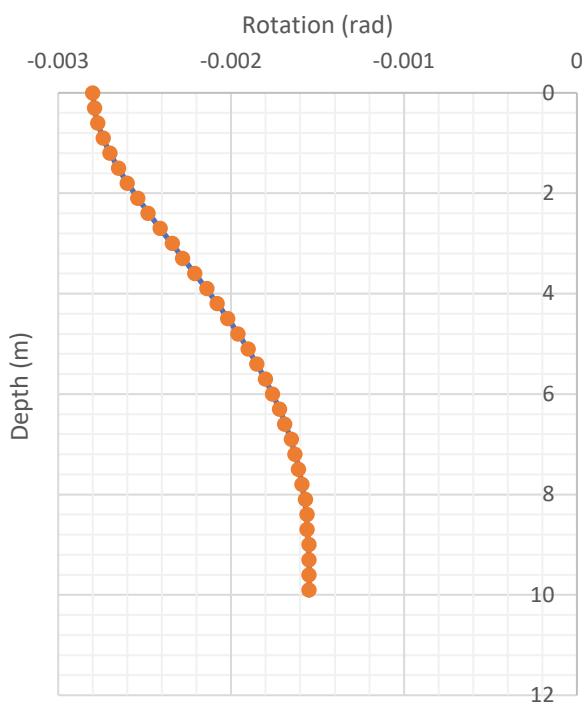
c. Results



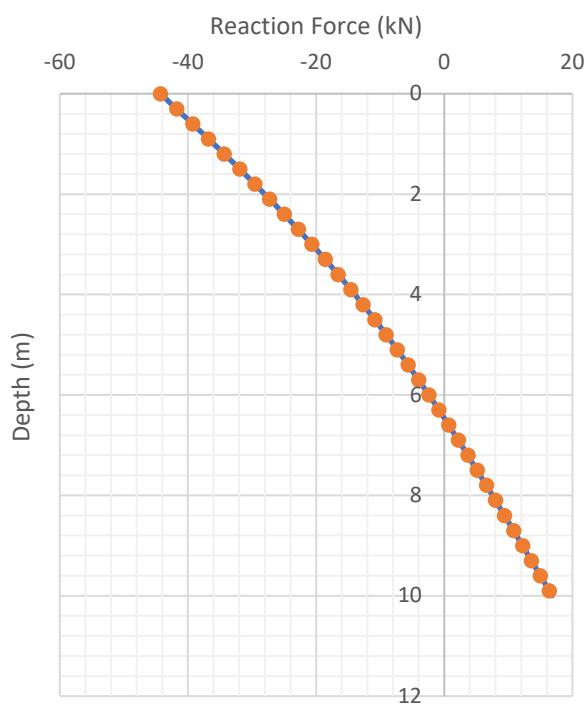
Shear Vs. Depth



Rotation Vs. Depth



Soil Reaction Force Vs. Depth



Case 2

a. Problem Description

Problem 6, case 2 is a statically loaded pile in soil with a user-defined p-y curve. The p-y curve is defined by the user at the top and the bottom of the soil layer. Soil and pile properties are listed in tables 6.4, 6.5, and 6.6 below.

b. Material Properties

Table 6-3: User Defined Soil Properties

Parameter	Value
General Properties	
Unit Weight	8 kN/m ³
Laterally Loaded Piles	
Soil Type	User Defined
Soil layer thickness	10 m

Table 6-4: PY Curves for User Defined Soil

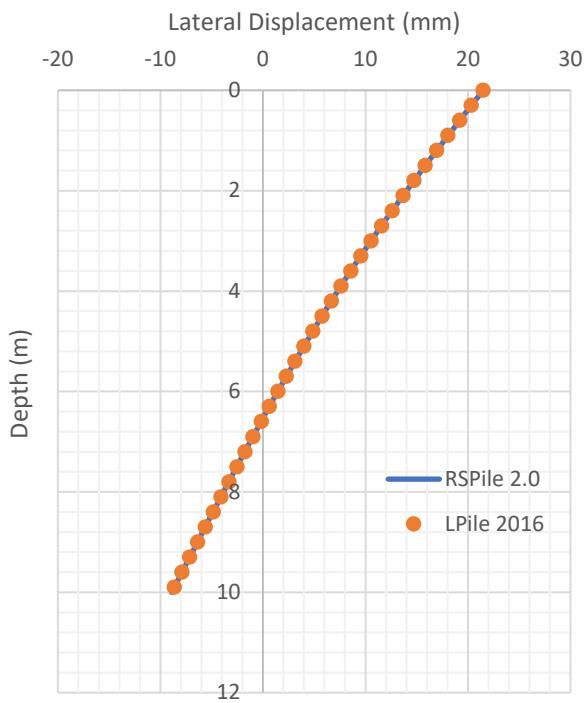
Top		Bottom	
Y (m)	P (kN/m)	Y (m)	P (kN/m)
0	0	0	0
0.1	200	0.2	400
0.5	300	0.3	500
		0.6	600

Table 6-4: Pile and Loading Properties

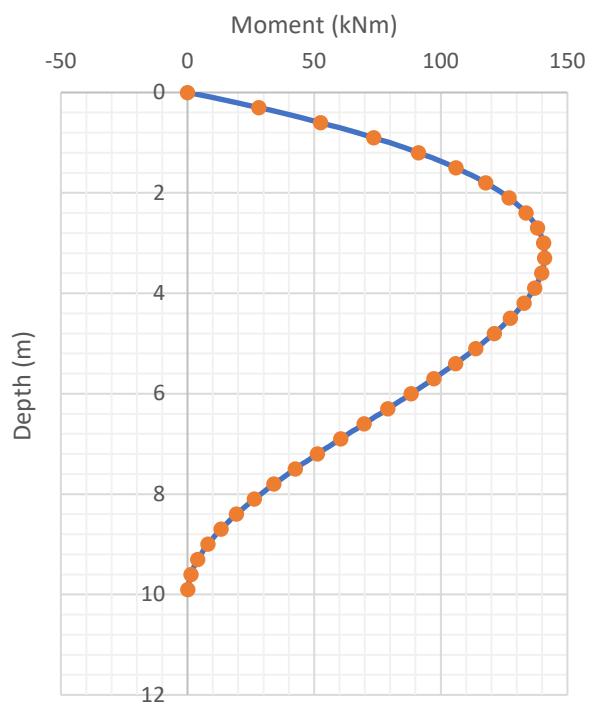
Parameter	Value
Cross Section	Circle
Diameter	0.5 m
Young's Modulus	200,000,000 kPa
Embedment Length	10 m
Lateral / Shear Load	100 kN

c. Results

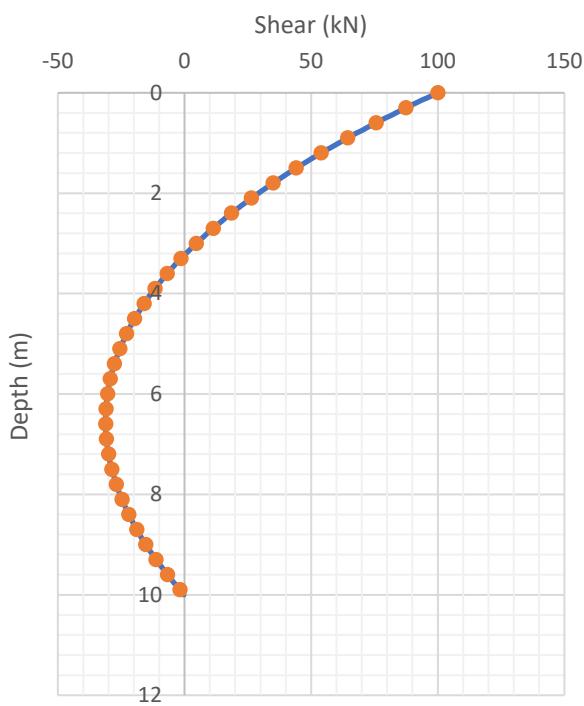
Lateral Displacement Vs. Depth



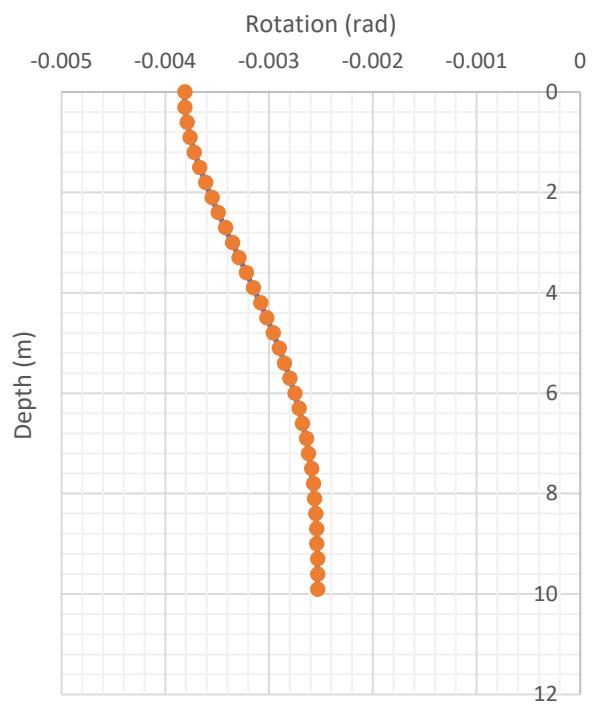
Moment Vs. Depth



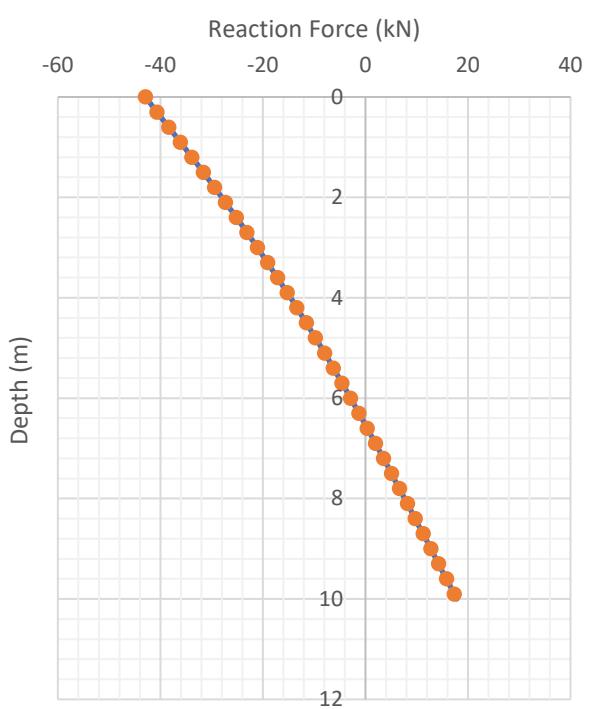
Shear Vs. Depth



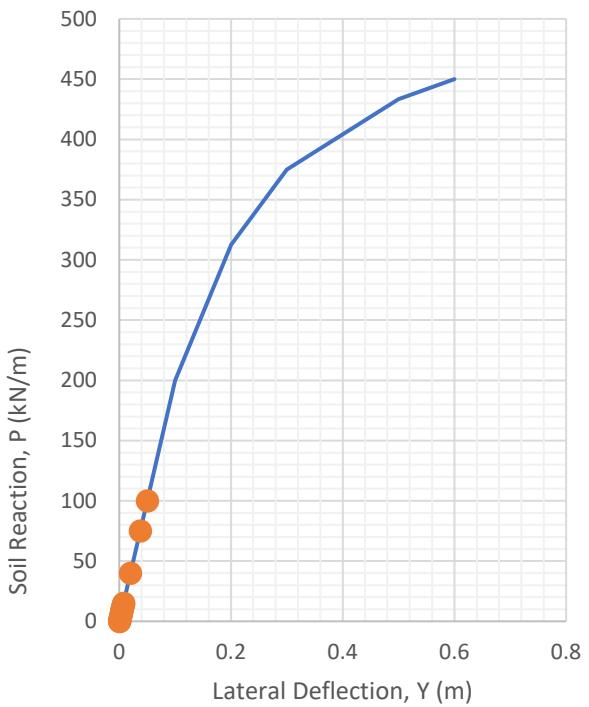
Rotation Vs. Depth



Soil Reaction Force Vs. Depth



PY Curve at 5 m Depth



Case 3

a. Problem Description

Problem 6, case 3 is a statically loaded pile in a soil with a user-defined p-y curve. The soil and pile properties are listed in tables 6-5, 6-6, and 6-7 below.

b. Material Properties

Table 6-5: User Defined Soil Properties

Parameter	Value
General Properties	
Unit Weight	8 kN/m ³
Laterally Loaded Piles	
Soil Type	User Defined
Soil layer thickness	10 m

Table 6-6: User Defined PY Curve

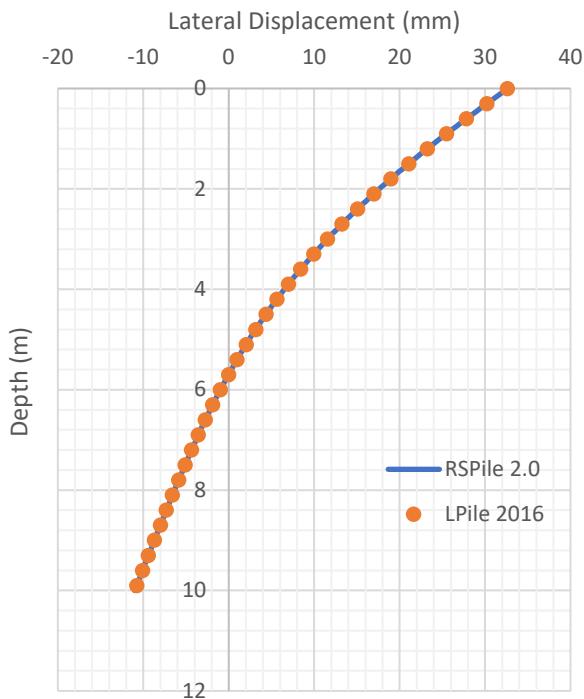
Y(m)	P (kN/m)
0	0
0.01	50
0.02	200
0.03	450

Table 6-7: Pile and Loading Properties

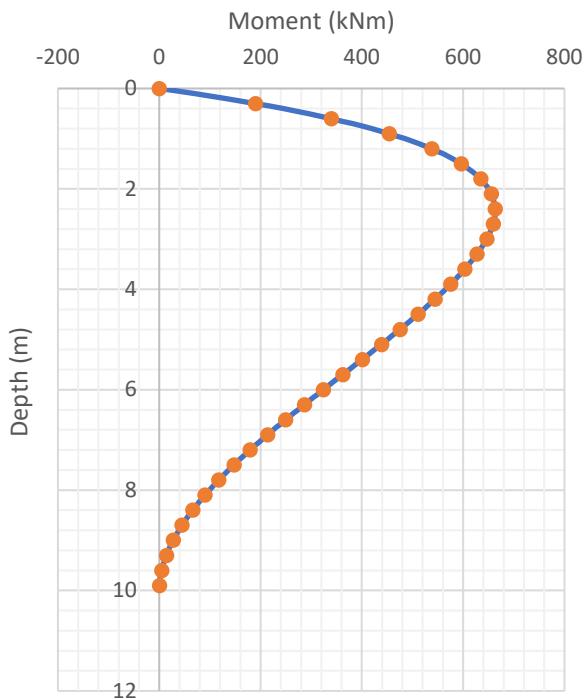
Parameter	Value
Cross Section	Circle
Diameter	0.5 m
Young's Modulus	200,000,000 kPa
Embedment Length	10 m
Lateral / Shear Load	700 kN

c. Results

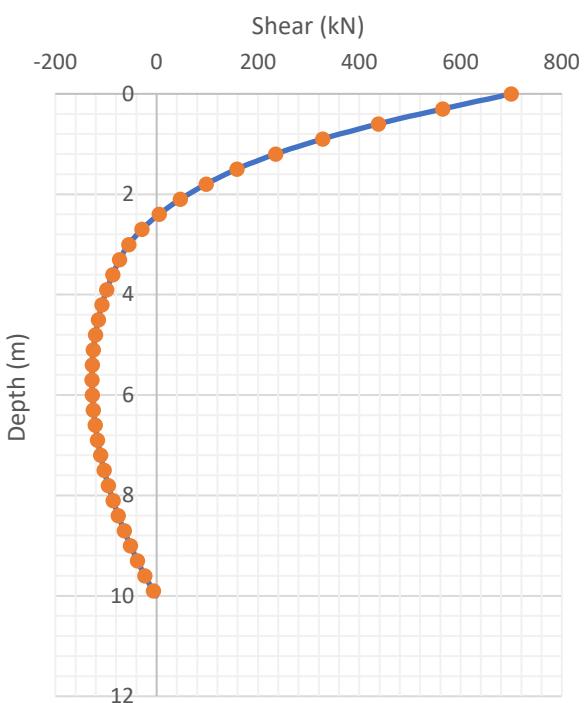
Lateral Displacement Vs. Depth



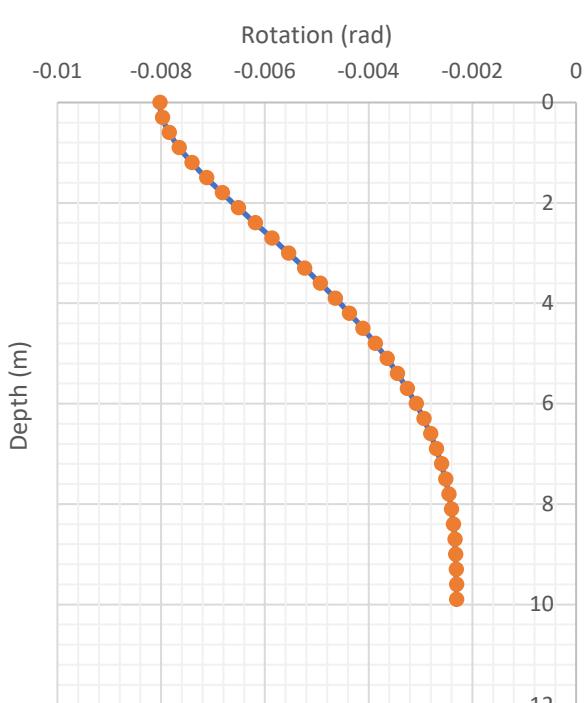
Moment Vs. Depth



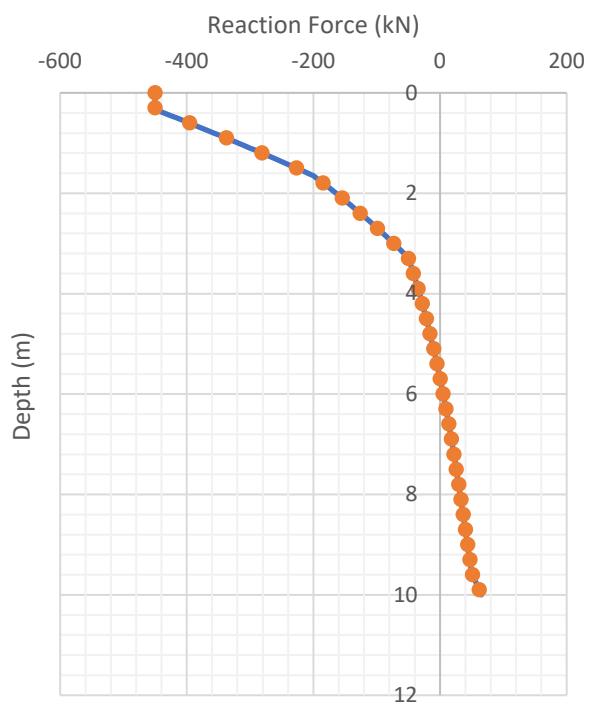
Shear Vs. Depth



Rotation Vs. Depth



Soil Reaction Force Vs. Depth



Case 4:**a. Problem Description**

Problem 6, case 4 is a statically loaded pile in a soil with a user-defined p-y curve. The soil and pile properties are listed in tables 6-8, 6-9, and 6-10 below. The properties are given in imperial units.

b. Material Properties**Table 6-8: User Defined Soil Properties**

Parameter	Value
General Properties	
Unit Weight	50 lb/ft ³
Laterally Loaded Piles	
Soil Type	User Defined
Soil layer thickness	10 ft

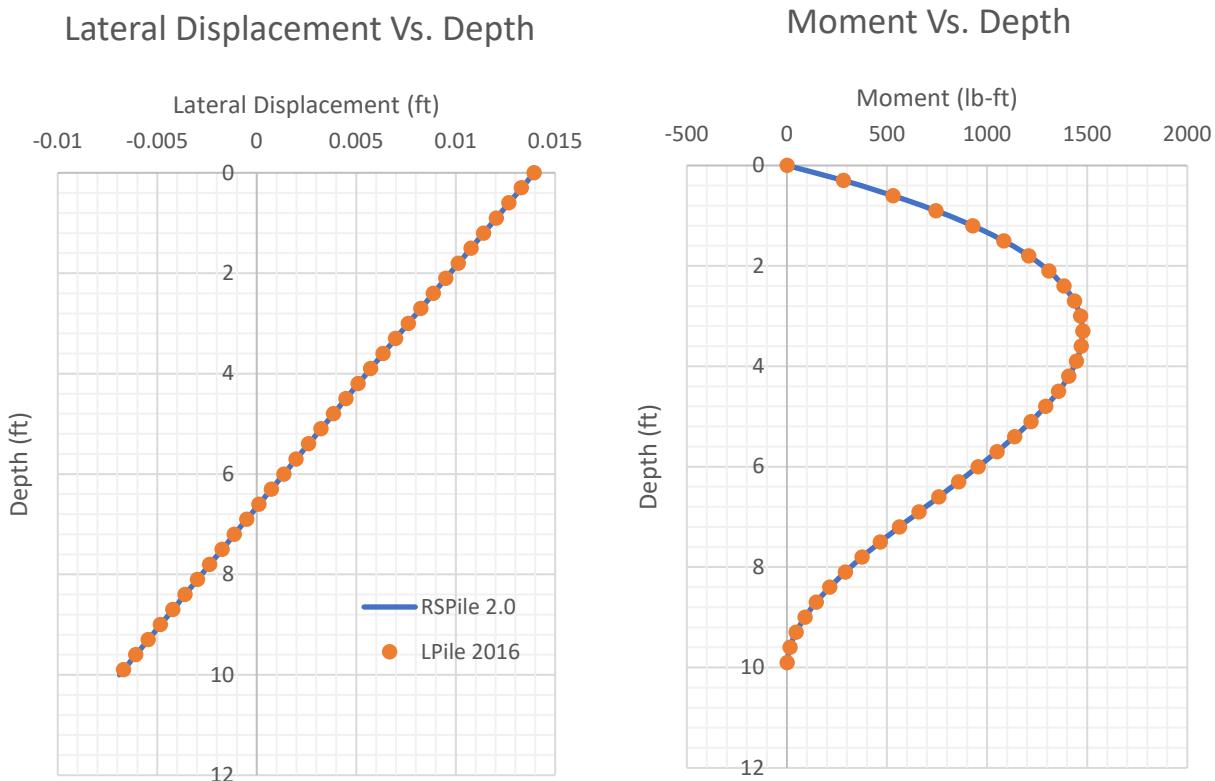
Table 6-9: User Defined PY Curve

Y(in)	P (lb/in)
0	0
1	200
2	500
5	600

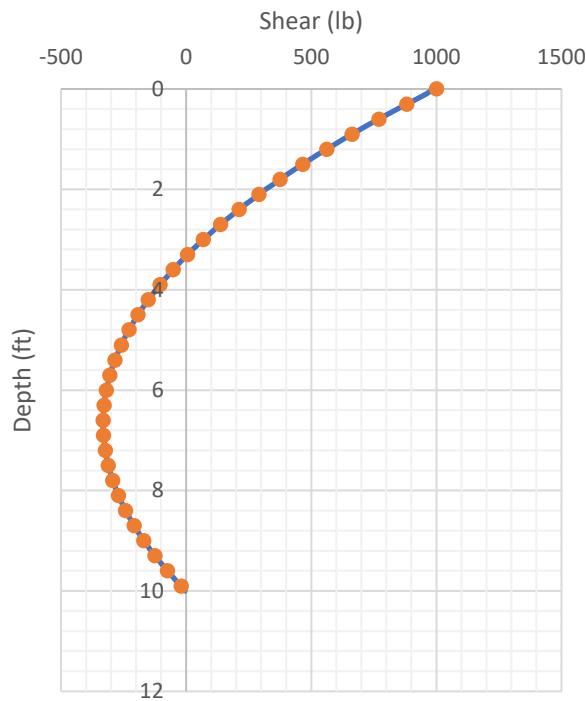
Table 6-10: Pile and Loading Properties

Parameter	Value
Cross Section	Circle
Diameter	2 ft
Young's Modulus	200,000,000 psf
Embedment Length	10 ft
Lateral / Shear Load	1000 lb

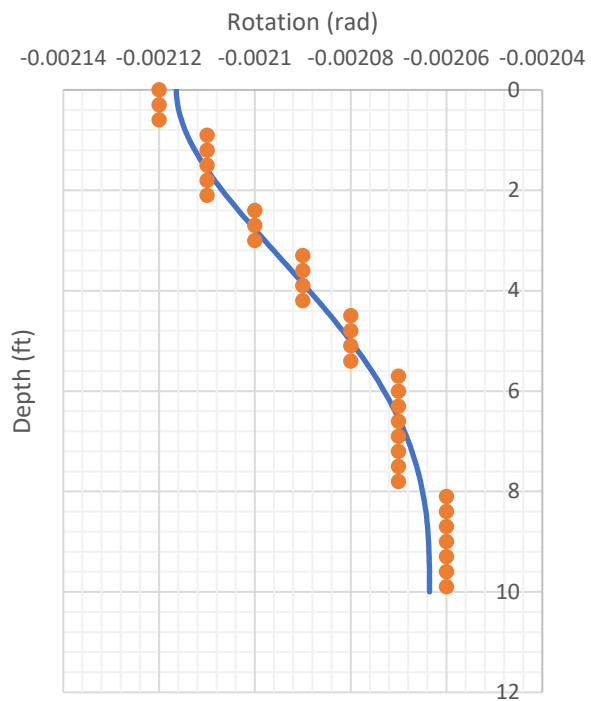
c. Results



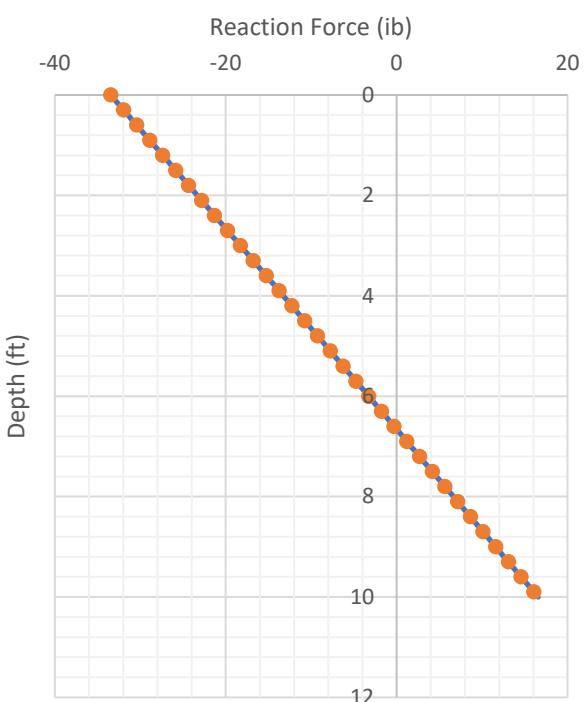
Shear Vs. Depth



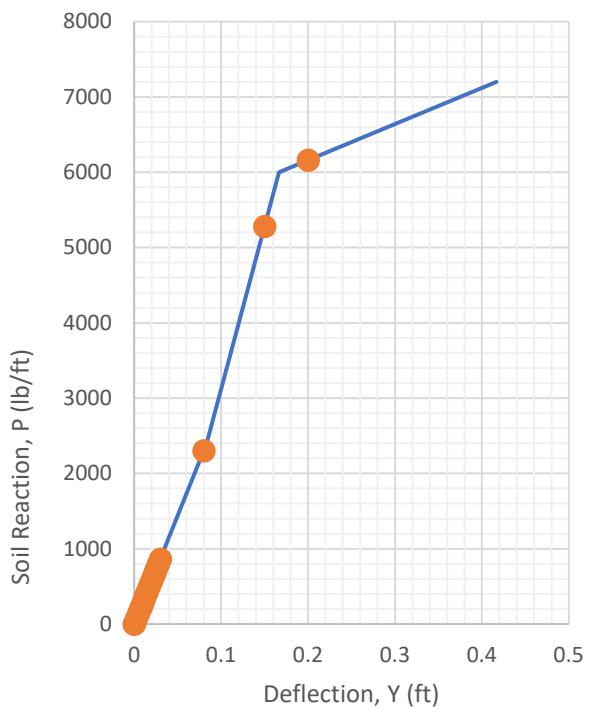
Rotation Vs. Depth



Soil Reaction Force Vs. Depth



PY Curve at 5 ft Depth



RSPile Verification Problem #7

Silt (cemented c- ϕ soils), static and cyclic loads

Case 1

a. Problem description

Problem 7, case 1 is a statically loaded pile in silt soil. Soil and pile properties are listed in tables 7-1 and 7-2 below.

b. Material Properties

Table 7-1: Silt Soil Properties

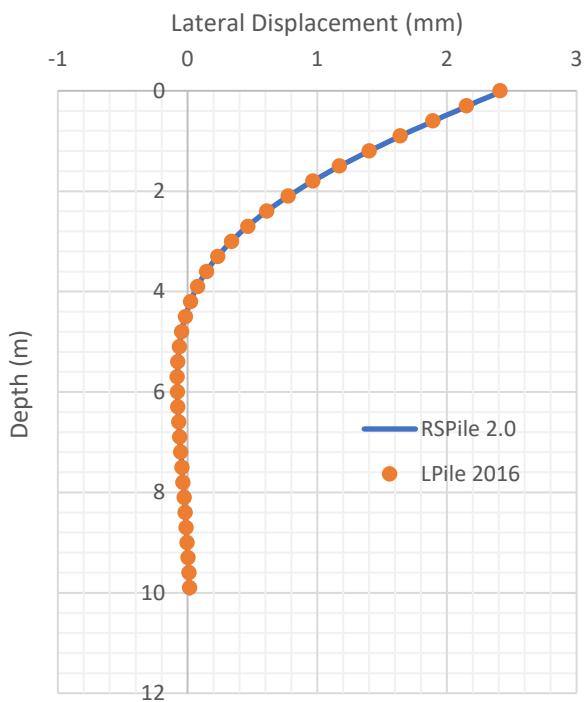
Parameter	Value
General Properties	
Unit Weight	8 kN/m ³
Laterally Loaded Piles	
Soil Type	Silt
Friction Angle	30 degrees
Cohesion	25 kPa
Strain Factor	0.01
Initial Stiffness	32,500 kN/m ³
Soil Layer Thickness	10 m

Table 7-2: Pile and Loading Properties

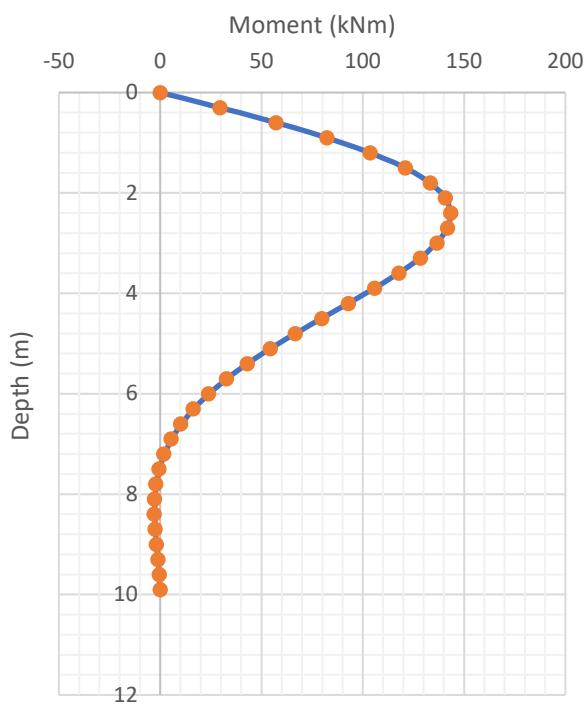
Parameter	Value
Cross Section	Circle
Diameter	0.5 m
Young's Modulus	200,000,000 kPa
Length	10 m
Lateral / Shear Load	100 kN

c. Results

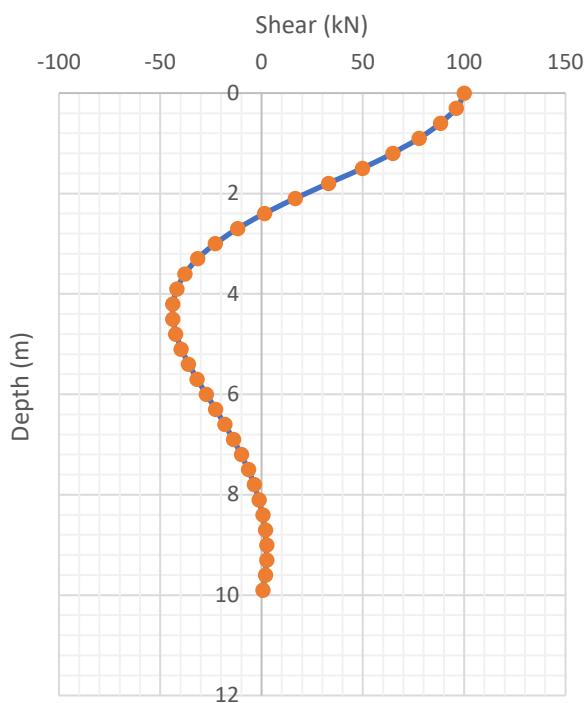
Lateral Displacement Vs. Depth



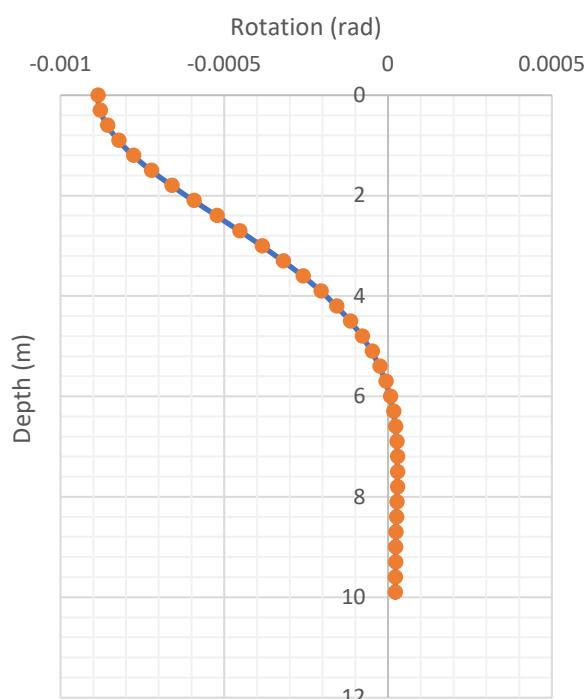
Moment Vs. Depth



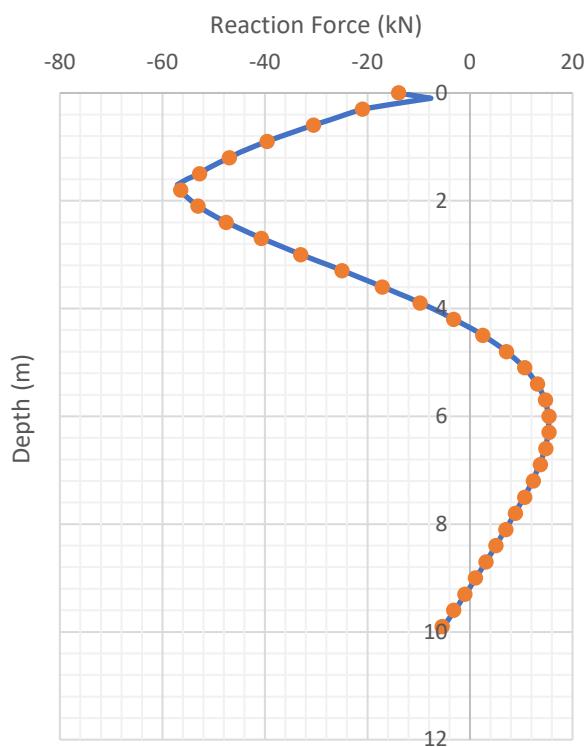
Shear Vs. Depth



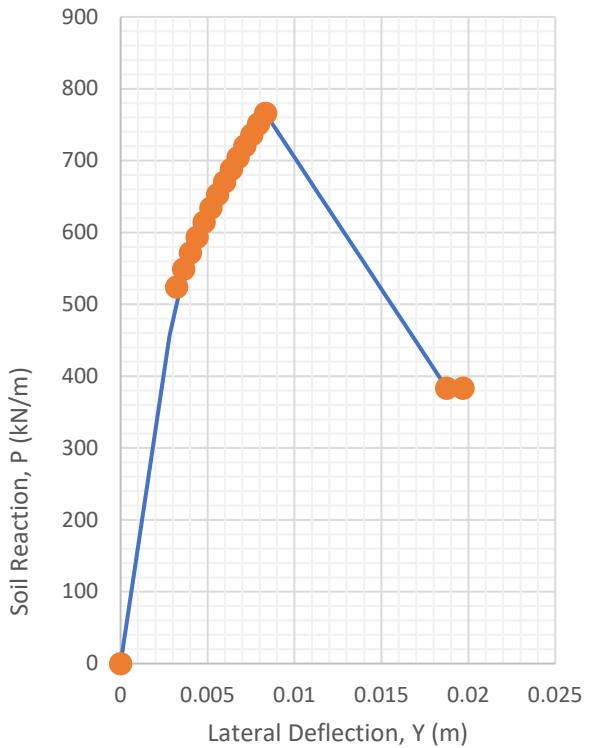
Rotation Vs. Depth



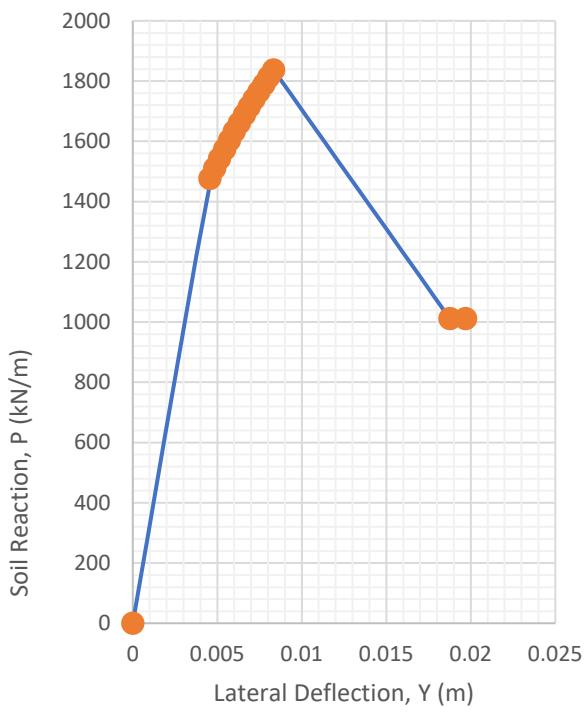
Soil Reaction Force Vs. Depth



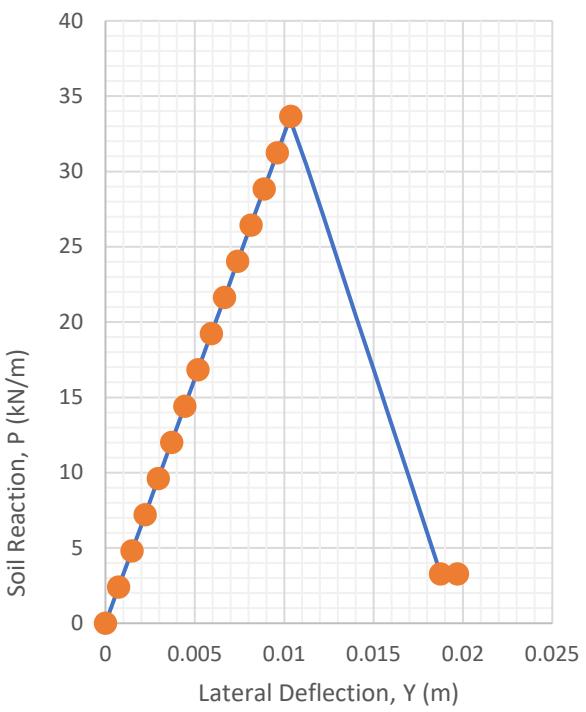
PY Curve at 5 m Depth



PY Curve at 10 m Depth



PY Curve at 0.1 m Depth



Case 2

a. Problem Description

Problem 7, case 2 is a statically loaded pile in silt soil. The ground is sloped. Soil and pile properties are listed in tables 7-3 and 7-4 below.

b. Material Properties

Table 7-3: Silt Soil Properties

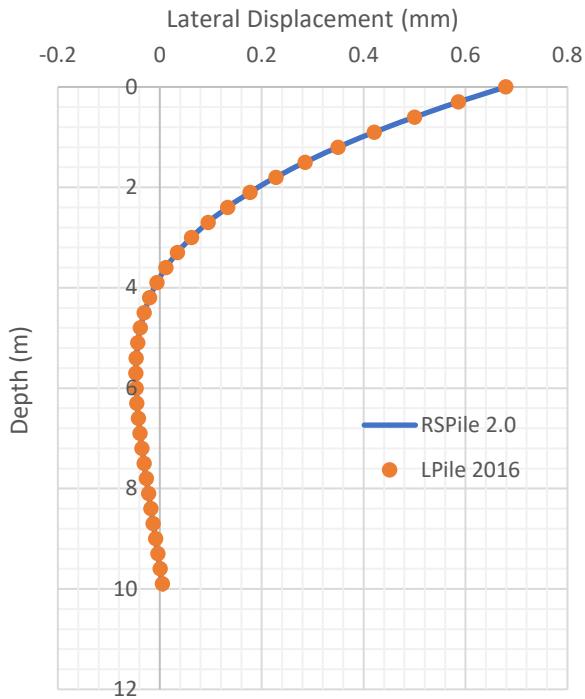
Parameter	Value
General Properties	
Unit Weight	16 kN/m ³
Laterally Loaded Piles	
Soil Type	Silt
Friction Angle	40 degrees
Cohesion	20 kPa
Strain Factor	0.01
Initial Stiffness	10,000 kN/m ³
Soil Layer Thickness	10 m

Table 7-4: Pile and Loading Properties

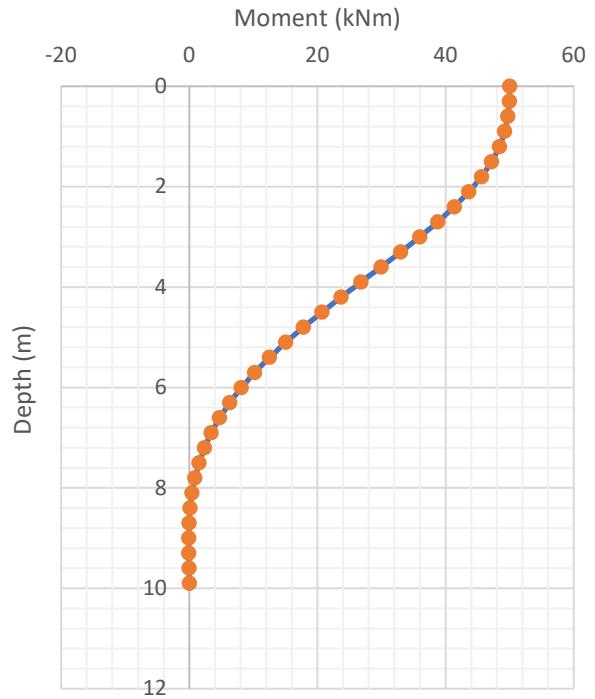
Parameter	Value
Cross Section	Circle
Diameter	0.5 m
Young's Modulus	200,000,000 kPa
Length	10 m
Moment	50 kNm
Ground Slope	20 degrees

c. Results

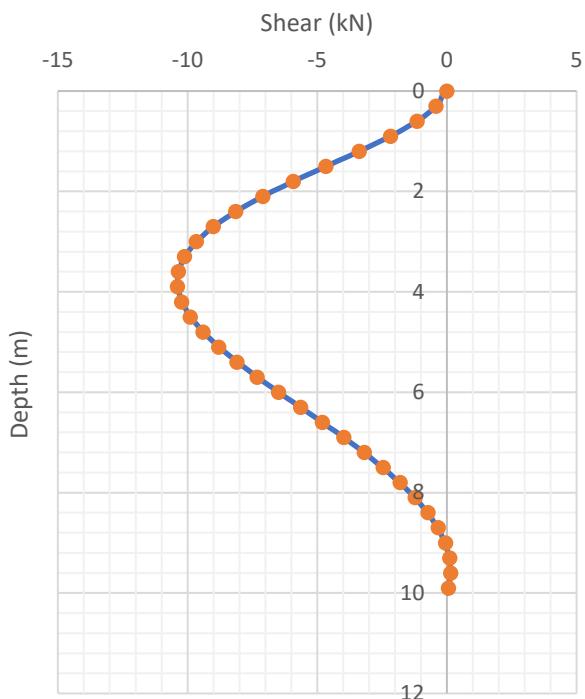
Lateral Displacement Vs. Depth



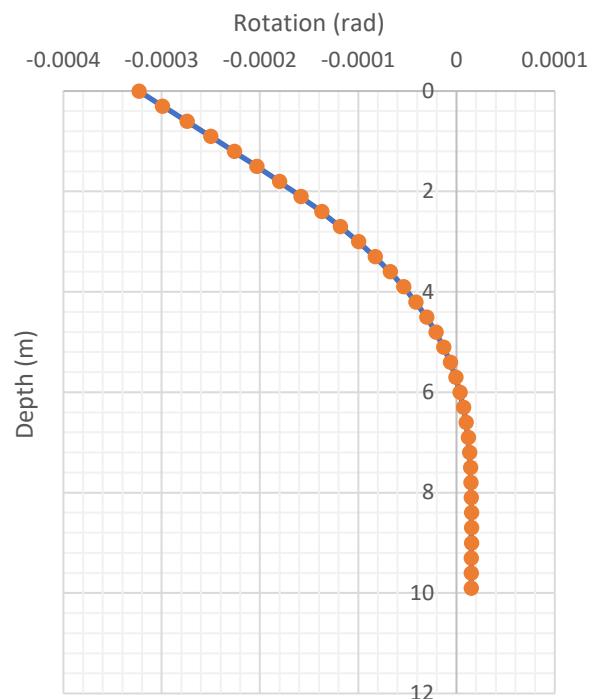
Moment Vs. Depth



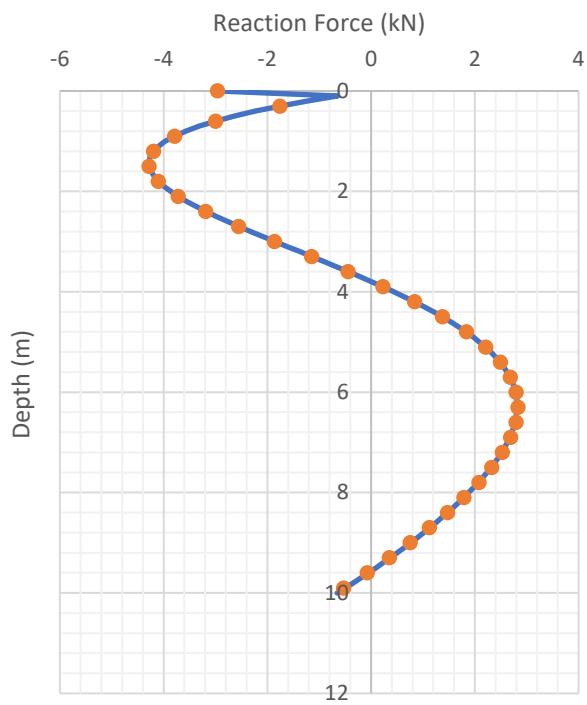
Shear Vs. Depth



Rotation Vs. Depth



Soil Reaction Force Vs. Depth



Case 3

a. Problem Description

Problem 7, case 3 is a statically loaded pile in silt soil. The ground is sloped, and the soil properties are different at the top and the bottom of the soil layer. Soil and pile properties are listed in tables 7.5 and 7.6 below.

b. Material Properties

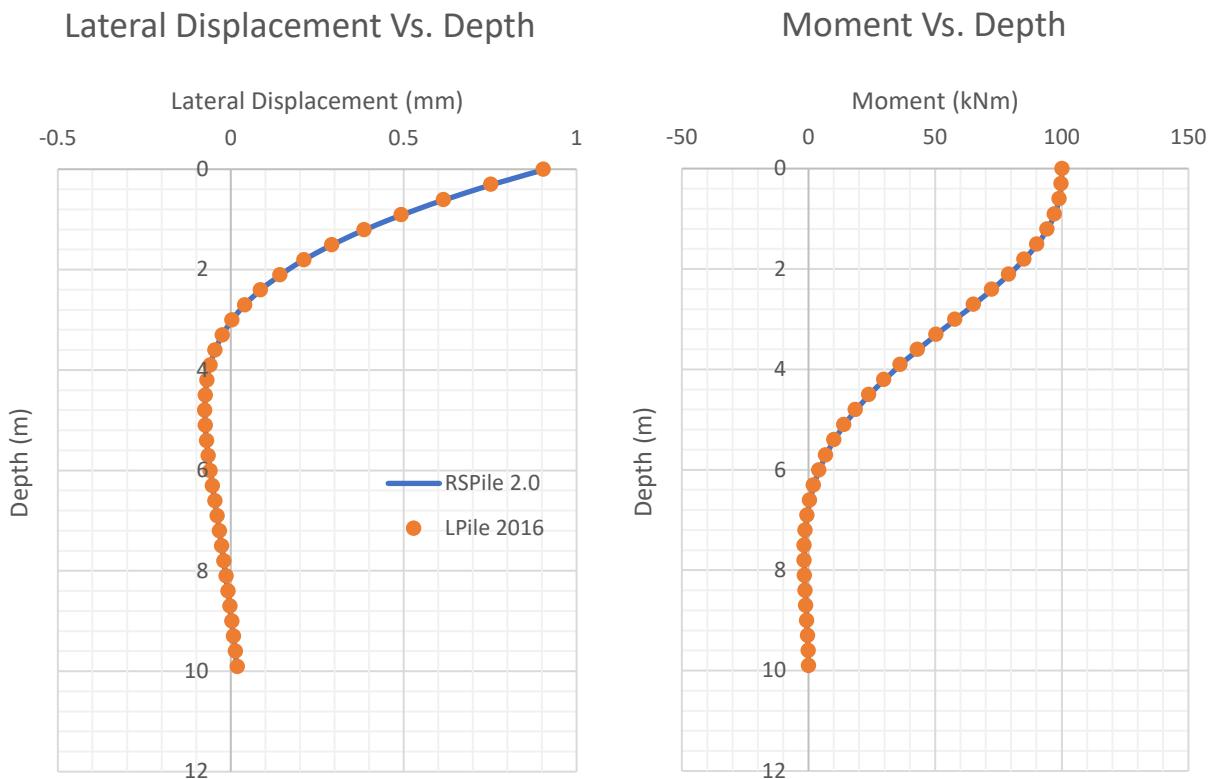
Table 7-5: Silt Soil Properties

Parameter	Value
General Properties	
Unit Weight	Top: 16 kN/m ³ Bottom: 10kN/m ³
Laterally Loaded Piles	
Soil Type	Silt
Friction Angle	Top: 40 degrees Bottom: 30 degrees
Cohesion	Top: 30 kPa Bottom: 20 kPa
Strain Factor	0.01
Initial Stiffness	Top: 30,000 kN/m ³ Bottom: 10,000 kN/m ³
Soil Layer Thickness	10 m

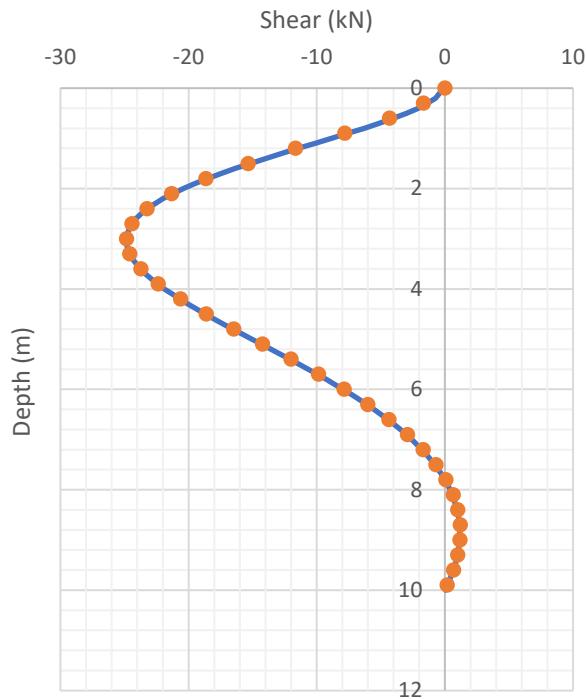
Table 7-6: Pile and Loading Properties

Parameter	Value
Cross Section	Circle
Diameter	0.5 m
Young's Modulus	200,000,000 kPa
Length	10 m
Moment	100 kNm
Ground Slope	20 degrees

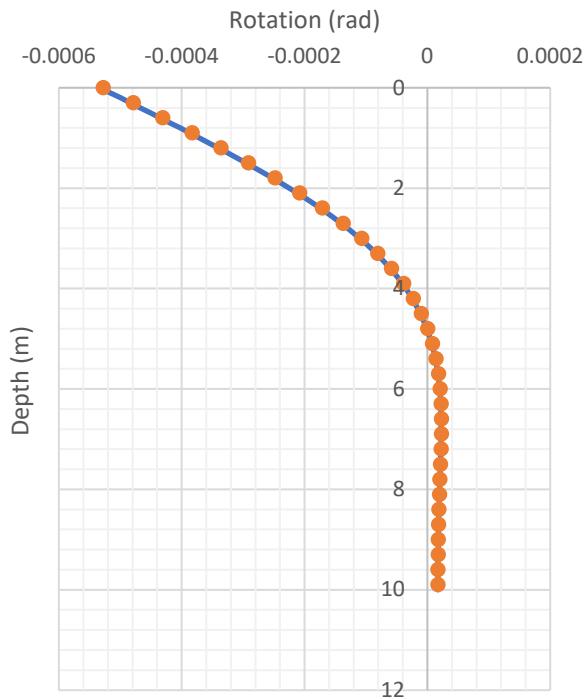
c. Results



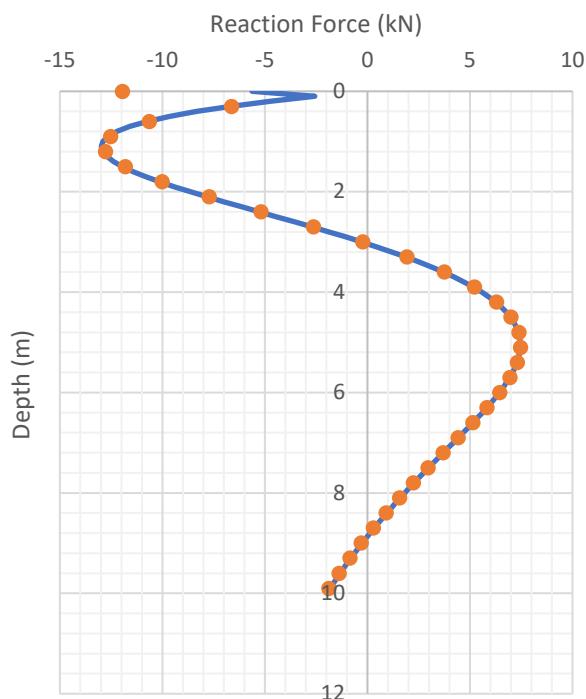
Shear Vs. Depth



Rotation Vs. Depth



Soil Reaction Force Vs. Depth



Case 4

a. Problem Description

Problem 7, case 4 is a pile in silt soil subjected to a cyclic lateral load. Soil and pile properties are listed in tables 7-7 and 7-8 below.

b. Materials Properties

Table 7-7: Silt Soil Properties

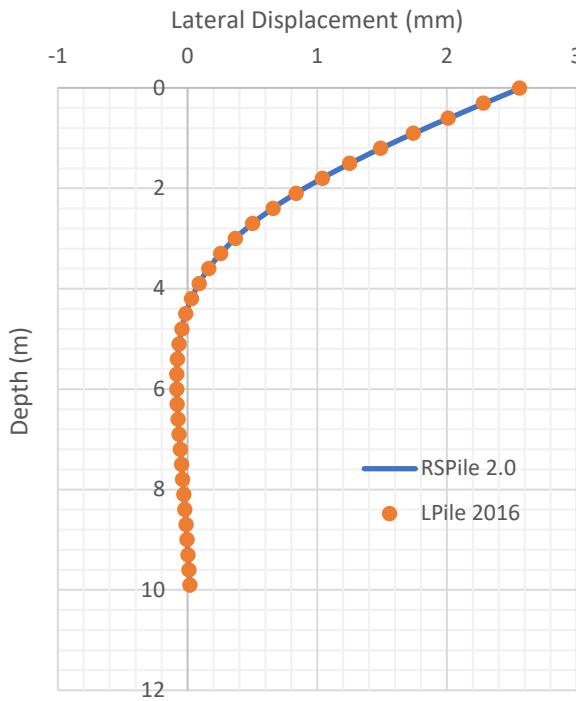
Parameter	Value
General Properties	
Unit Weight	8 kN/m ³
Laterally Loaded Piles	
Soil Type	Silt
Friction Angle	30 degrees
Cohesion	25 kPa
Strain Factor	0.01
Initial Stiffness	32,500 kN/m ³
Soil Layer Thickness	10 m

Table 7-8: Pile and Loading Properties

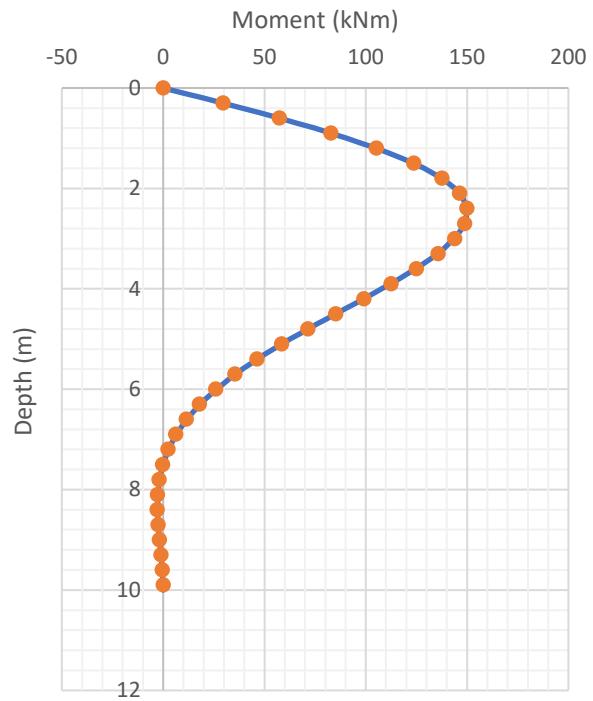
Parameter	Value
Cross Section	Circle
Diameter	0.5 m
Young's Modulus	200,000,000 kPa
Length	10 m
Lateral / Shear Load	100 kN
Number of Load Cycles	100

c. Results

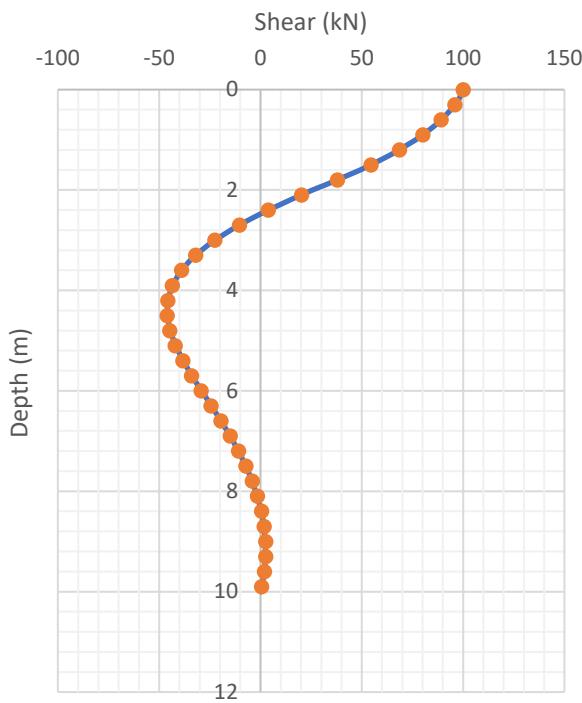
Lateral Displacement Vs. Depth



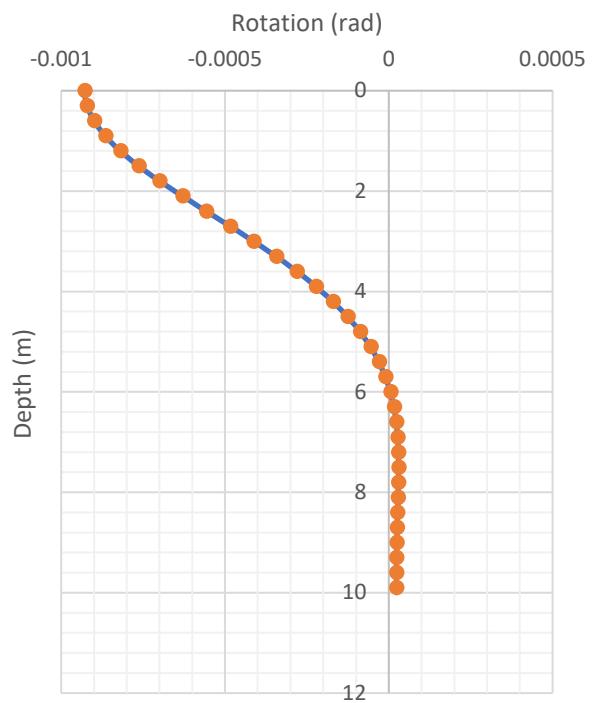
Moment Vs. Depth



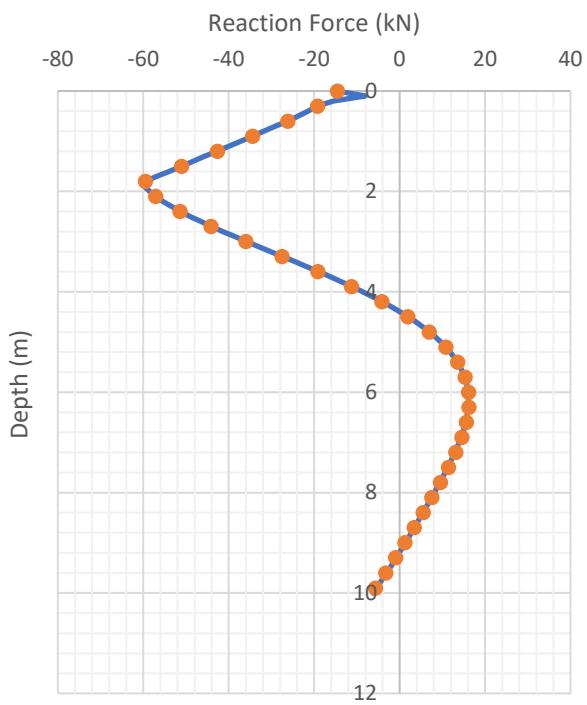
Shear Vs. Depth



Rotation Vs. Depth



Soil Reaction Force Vs. Depth



Case 5

a. Problem Description

Problem 7, case 5 is a statically loaded pile in silt soil. The soil and pile properties are listed in tables 7.9 and 7.10 below. The properties are given in imperial units.

b. Material Properties

Table 7-9: Silt Soil Properties

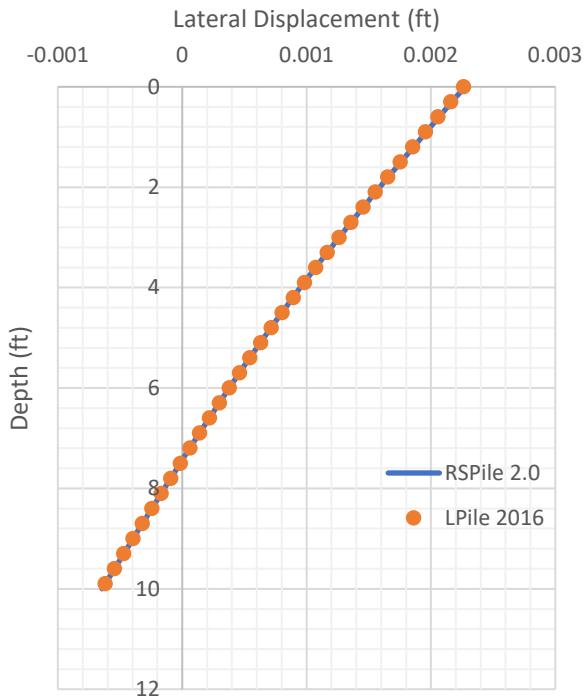
Parameter	Value
General Properties	
Unit Weight	50 lb/ft ³
Friction Angle	20 degrees
Cohesion	100 psf
Strain Factor	0.01
Initial Stiffness	86,400 lb/ft ³
Laterally Loaded Piles	
Soil Type	Silt
Soil Layer Thickness	10 ft

Table 7-10: Pile and Loading Properties

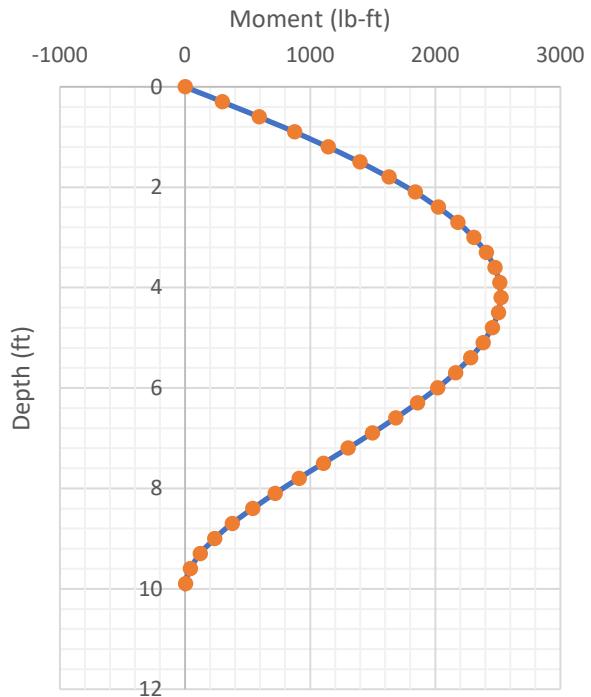
Parameter	Value
Cross Section	Circle
Diameter	2 ft
Young's Modulus	200,000,000 psf
Length	10 ft
Lateral / Shear Load	1000 lb

c. Results

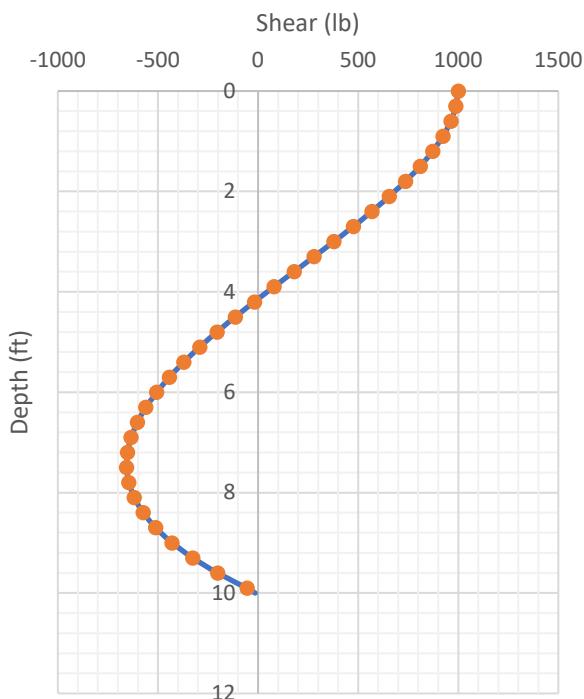
Lateral Displacement Vs. Depth



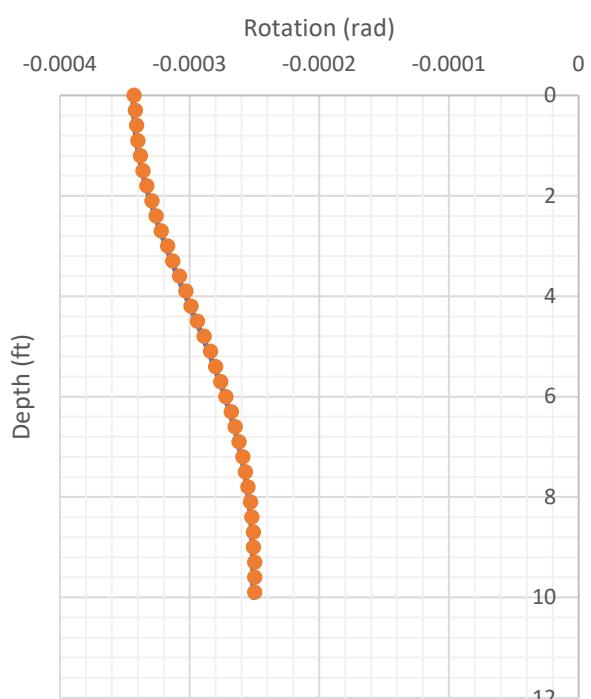
Moment Vs. Depth



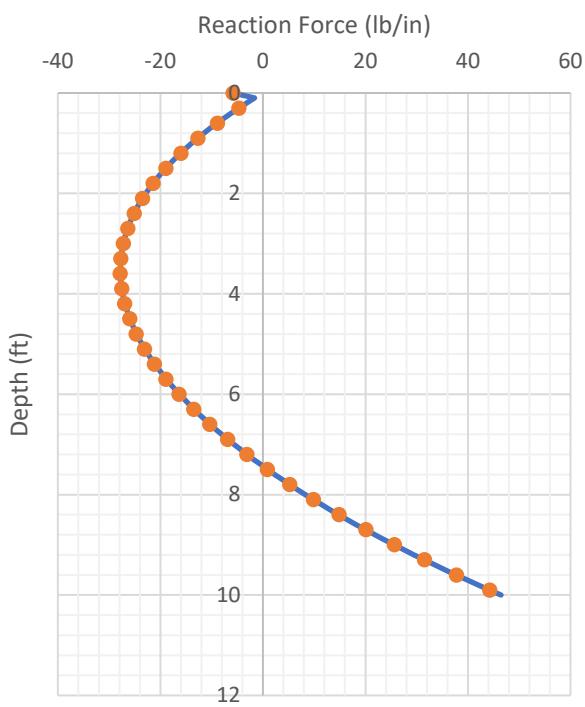
Shear Vs. Depth



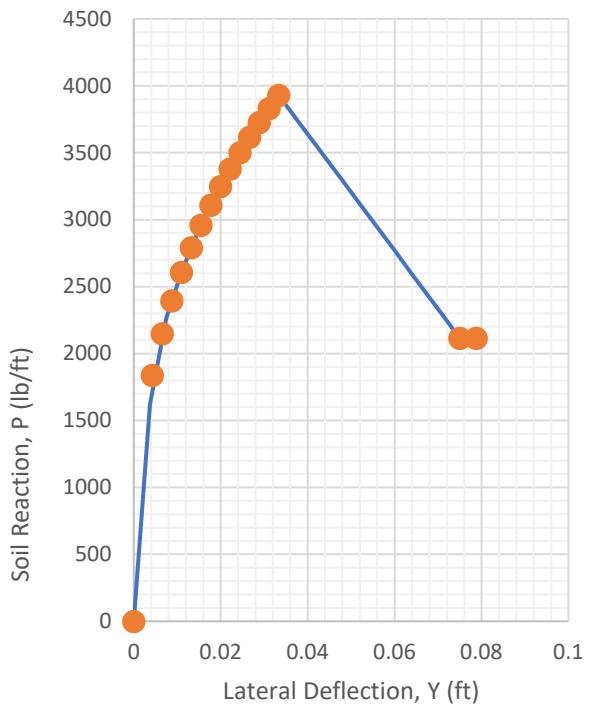
Rotation Vs. Depth



Soil Reaction Force Vs. Depth



PY Curve at 5 ft Depth



RSPile Verification Problem #8

Soft Clay with user defined J value, static lateral loading

Case 1

a. Problem description

Problem 8, case 1 is a statically loaded pile in soft clay. Soil and pile properties are listed in the tables below. This test uses an inputted value for stiffness coefficient J .

b. Material Properties

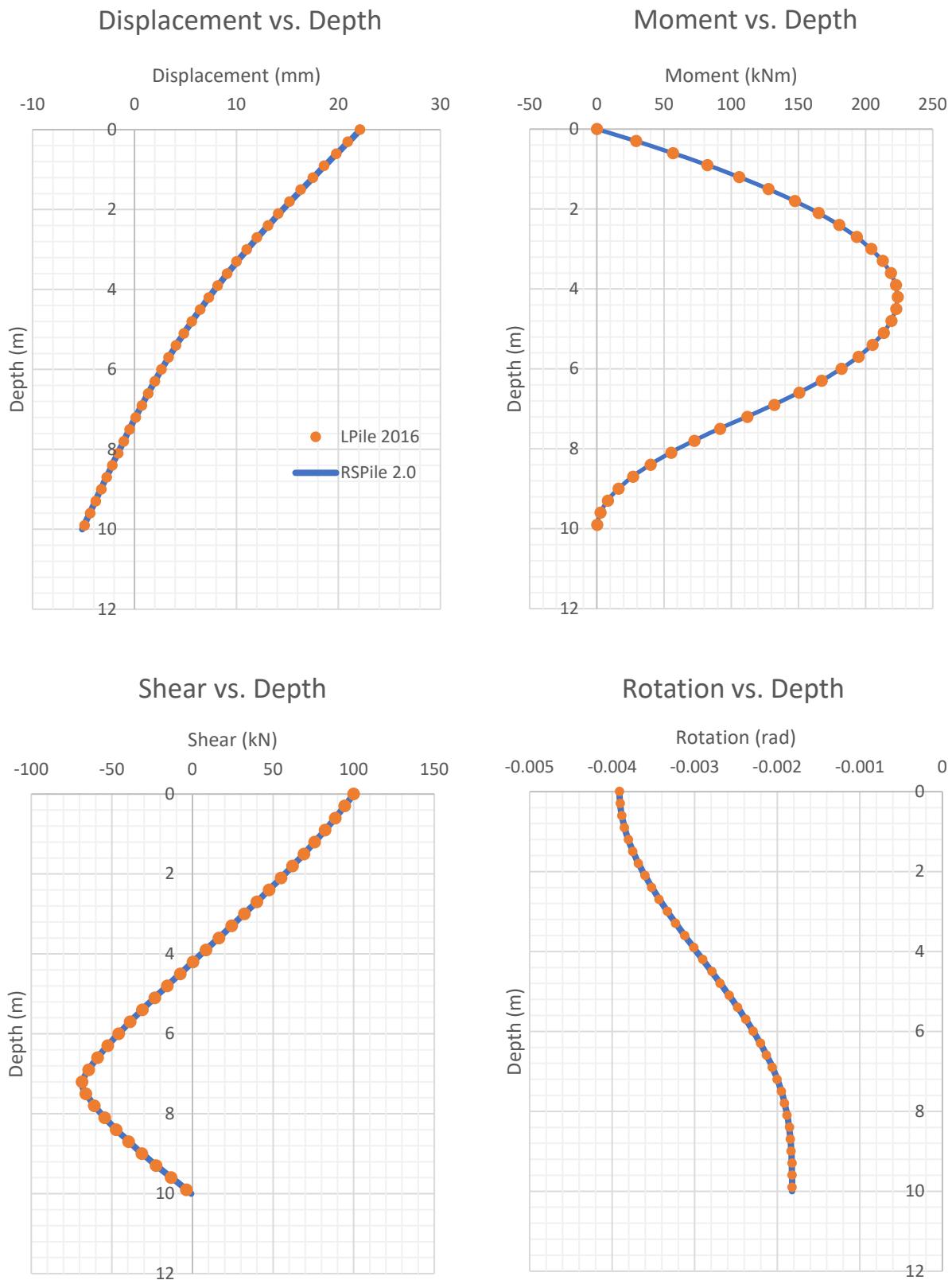
Table 8-1: Soft Clay Soil Properties

Parameter	Value
General Properties	
Unit Weight	8 kN / m ³
Strain Factor	0.02
Laterally Loaded Piles	
Soil Type	Soft Clay w/ User Defined J Value
Cohesion	25 kPa
Stiffness J	0.25
Soil Layer Thickness	10 m

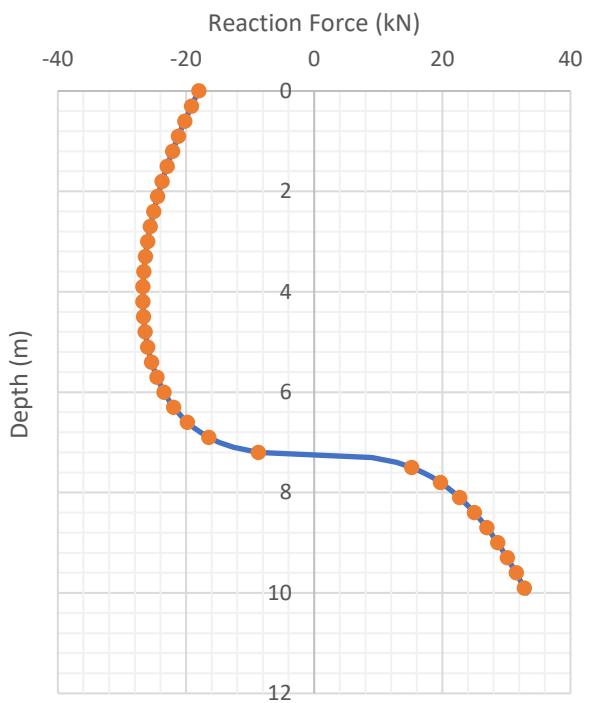
Table 8-2: Pile and Loading Properties

Parameter	Value
Cross Section	Circle
Diameter	0.5 m
Young's Modulus	200,000,000 kPa
Length	10 m
Lateral / Shear Load	100 kN

c. Results



Soil Reaction Force Vs. Depth



RSPile Verification Problem #9

Loess, static lateral, axial, and moment loading.

Case 1

a. Problem description

Problem 9, case 1 is a statically loaded pile in a single layer of loess. Soil and pile properties are listed in the tables below.

b. Material Properties

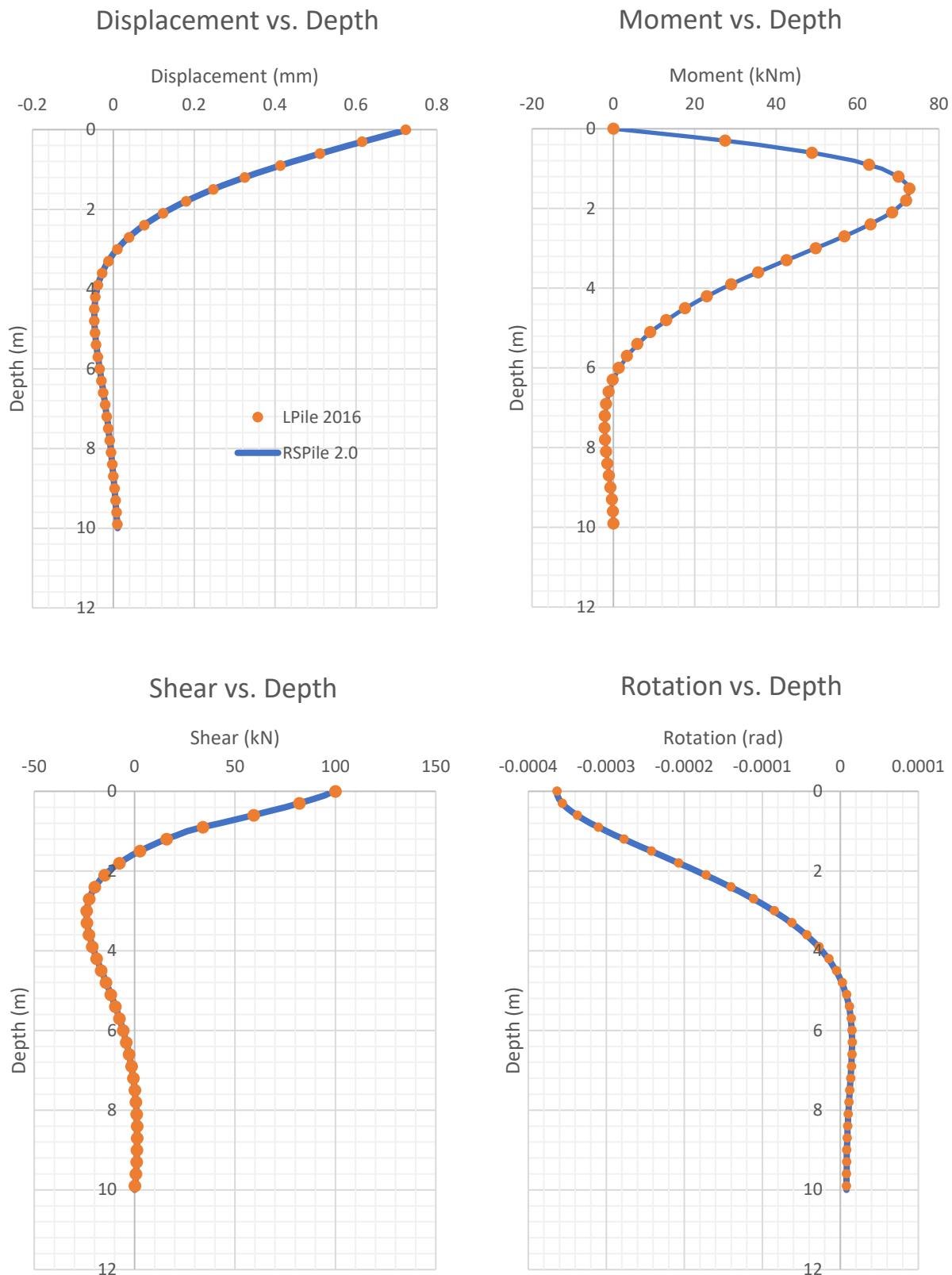
Table 9-1: Loess Soil Properties

Parameter	Value
General Properties	
Unit Weight	8 kN / m ³
Laterally Loaded Piles	
Soil Type	Loess Soil
Cone Penetration Tip Resistance	2,500 kPa
Soil Layer Thickness	10 m

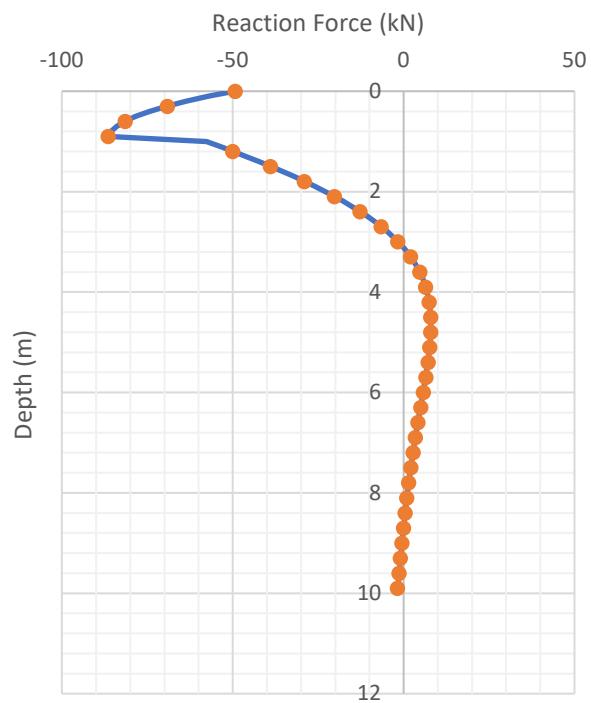
Table 9-2: Pile and Loading Properties

Parameter	Value
Cross Section	Circle
Diameter	0.5 m
Young's Modulus	200,000,000 kPa
Length	10 m
Lateral / Shear Load	100 kN
Axial Load	1 kN

c. Results



Soil Reaction Force Vs. Depth



Case 2

a. Problem description

Problem 9, case 2 is a statically loaded pile in a single layer of loess. Soil and pile properties are listed in the tables below.

b. Material Properties

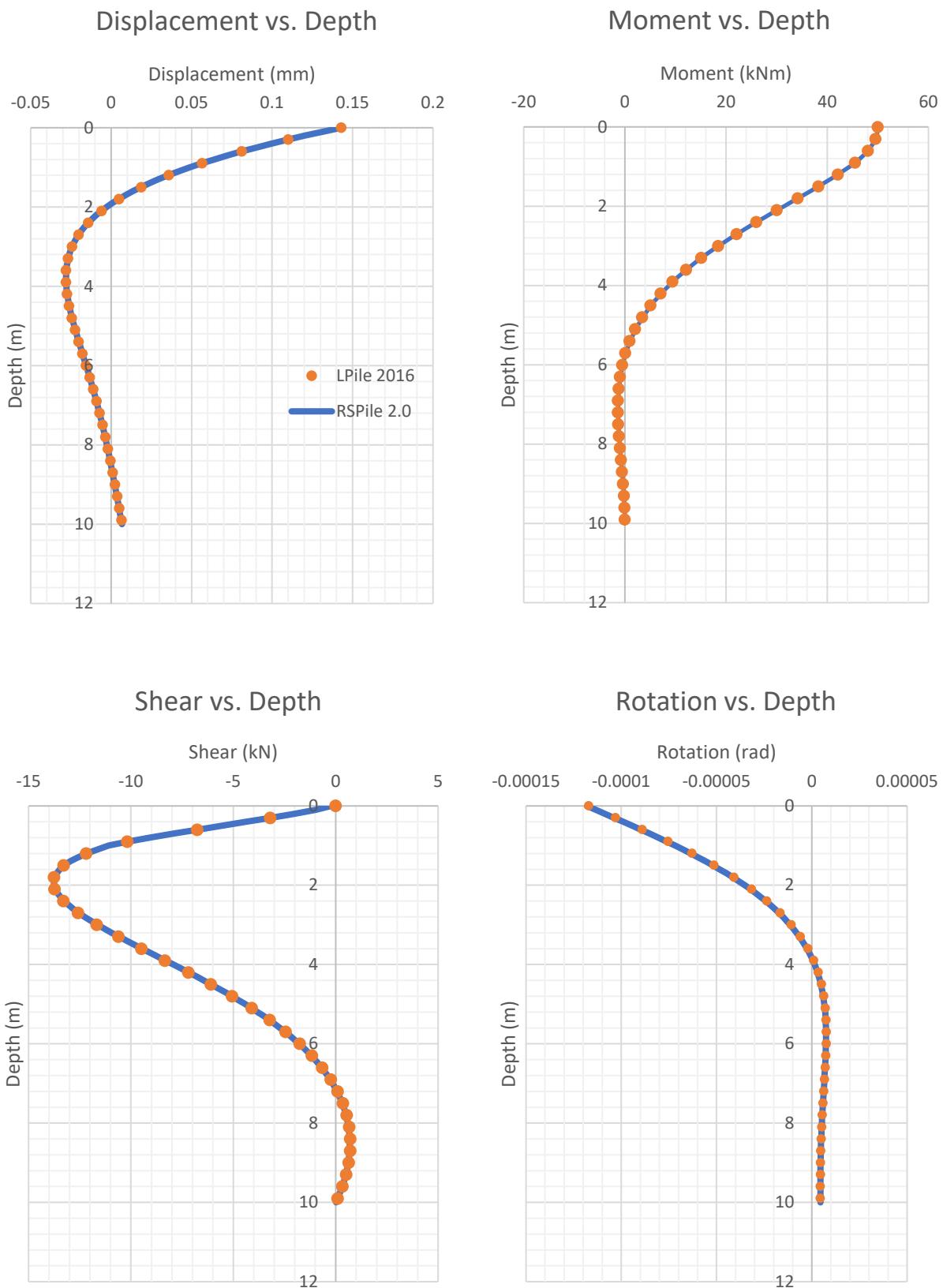
Table 9-3: Loess Soil Properties

Parameter	Value
General Properties	
Unit Weight	15 kN / m ³
Laterally Loaded Piles	
Soil Type	Loess Soil
Cone Penetration Tip Resistance	2000 kPa
Soil Layer Thickness	10 m

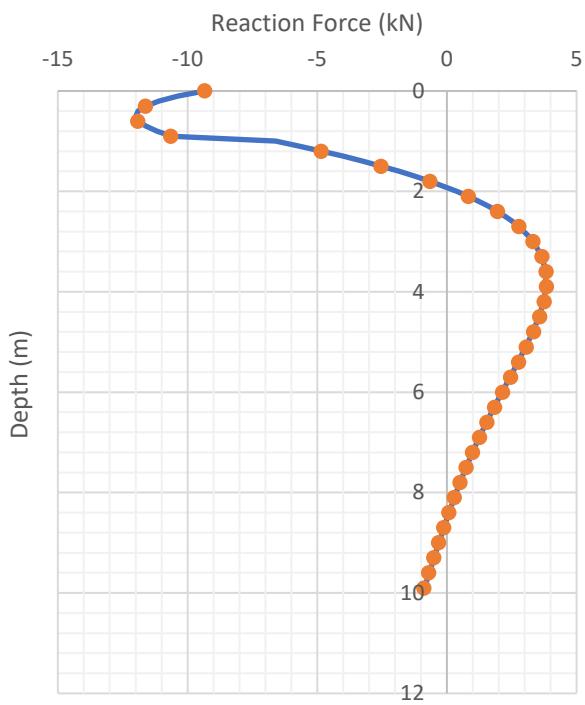
Table 9-4: Pile and Loading Properties

Parameter	Value
Cross Section	Square
Width	0.5 m
Young's Modulus	200,000,000 kPa
Length	10 m
Axial Load	1 kN
Moment Y	50 kN-m

c. Results



Soil Reaction Force Vs. Depth



Case 3

a. Problem description

Problem 9, case 3 is a statically loaded pile in a single layer of loess. Soil and pile properties are listed in the tables below. This case will test Imperial units.

b. Material Properties

Table 9-5: Loess Soil Properties

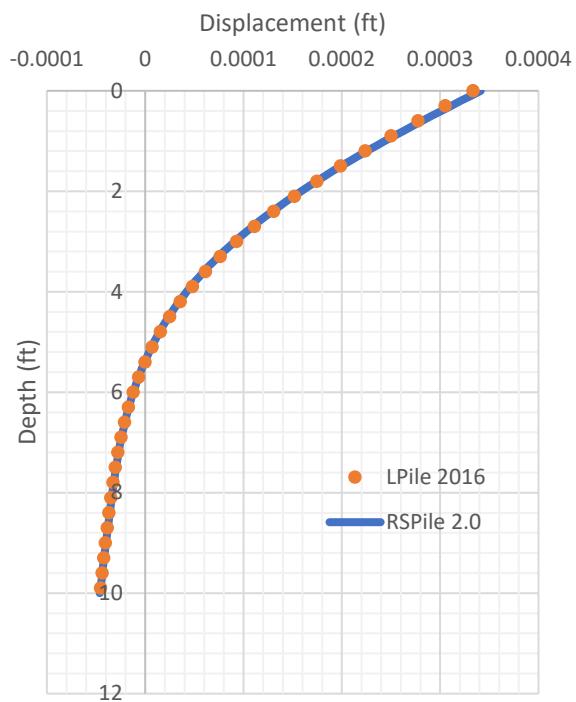
Parameter	Value
General Properties	
Unit Weight	50 lb/ft ³
Laterally Loaded Piles	
Soil Type	Loess Soil
Cone Penetration Tip Resistance	51,840 psf
Soil Layer Thickness	10 ft

Table 9-6: Pile and Loading Properties

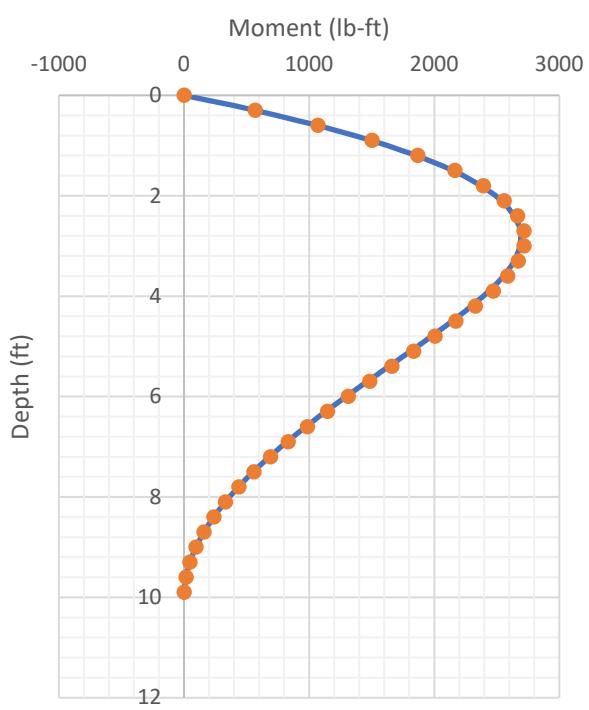
Parameter	Value
Cross Section	Circle
Diameter	2 ft
Young's Modulus	200,000,000 psf
Length	10 ft
Axial Load	2000 lb

c. Results

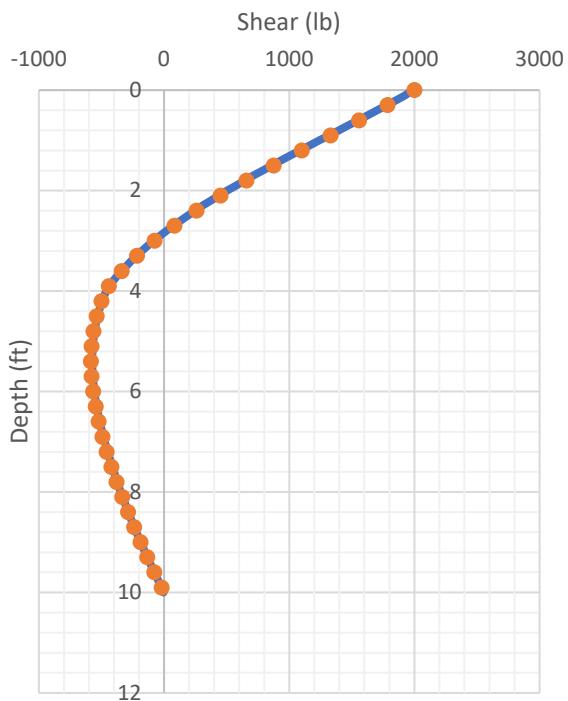
Displacement vs. Depth



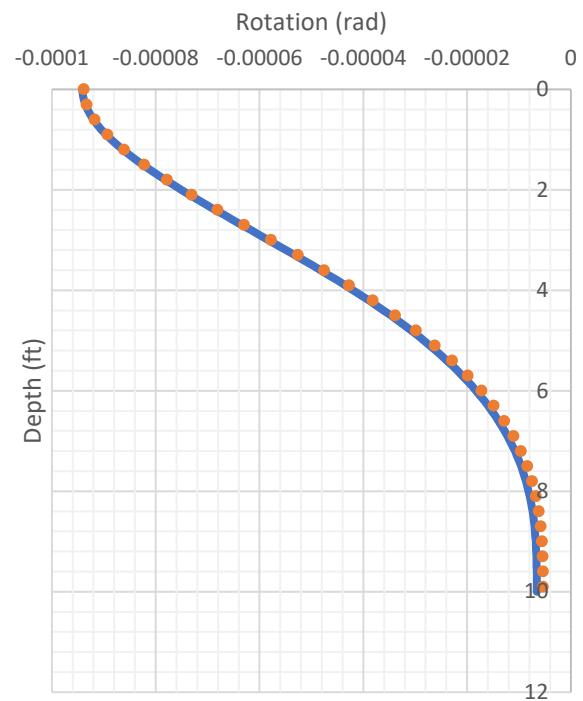
Moment Vs. Depth



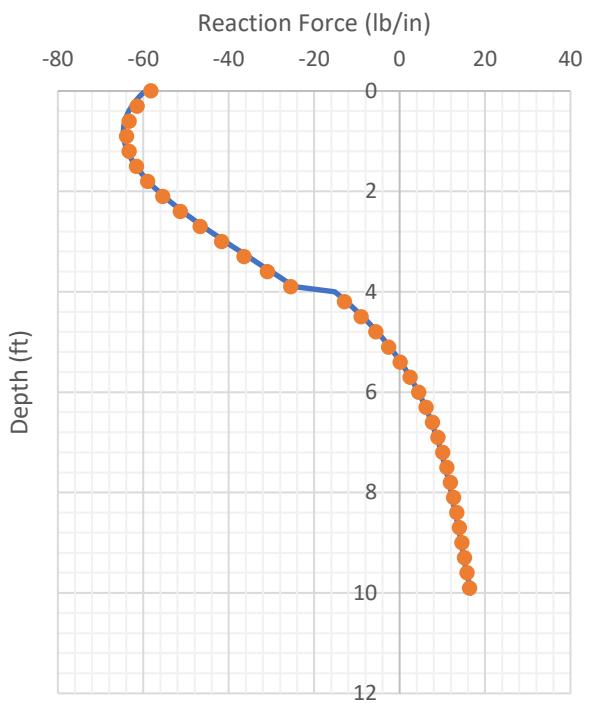
Shear vs. Depth



Rotation vs. Depth



Soil Reaction Force Vs. Depth



RSPile Verification Problem #10

Sand, lateral, axial, displacement, rotational stiffness, slope and moment loadings with PY multipliers

Case 1

a. Problem description

Problem 10, case 1 is a statically loaded pile in a single layer of sand. Soil and pile properties are listed in the tables below.

b. Material Properties

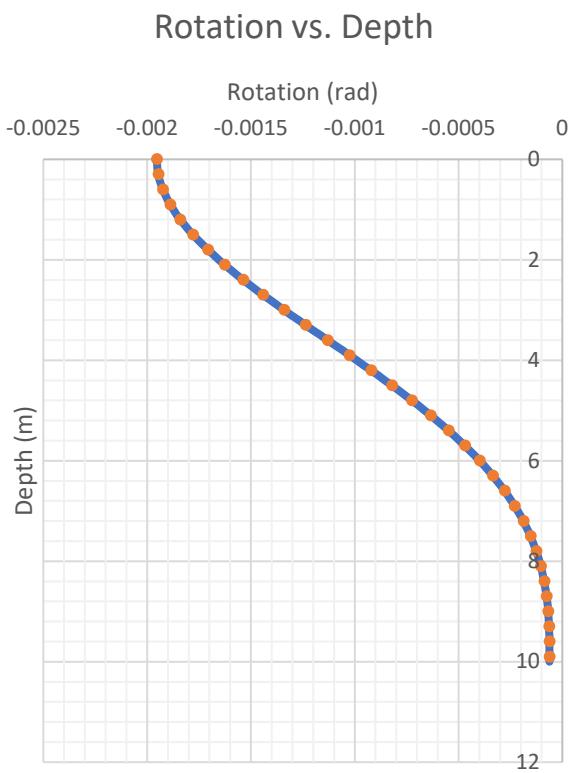
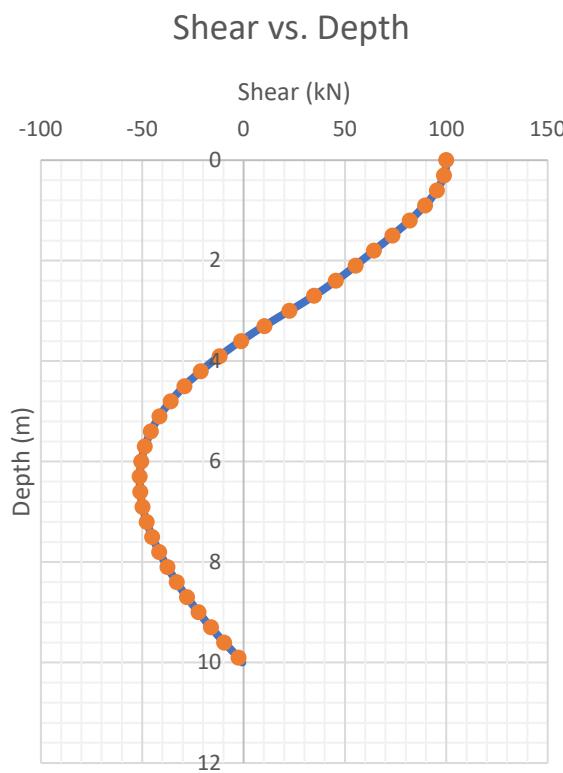
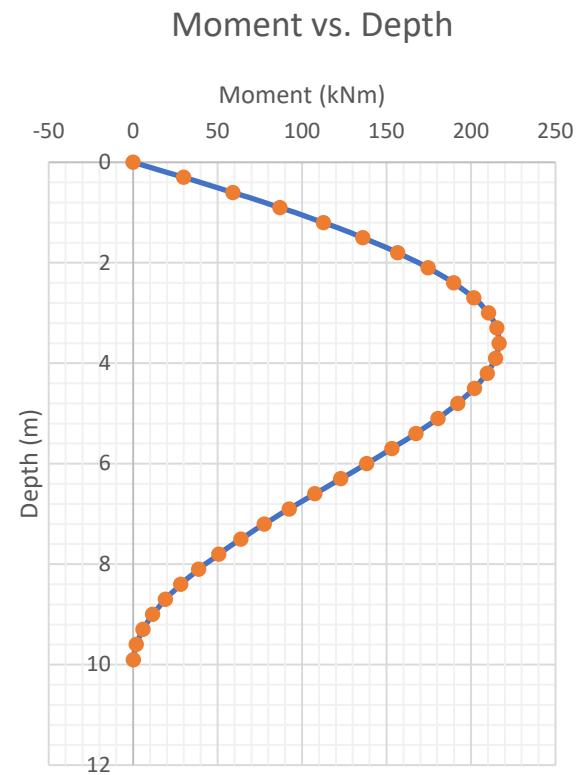
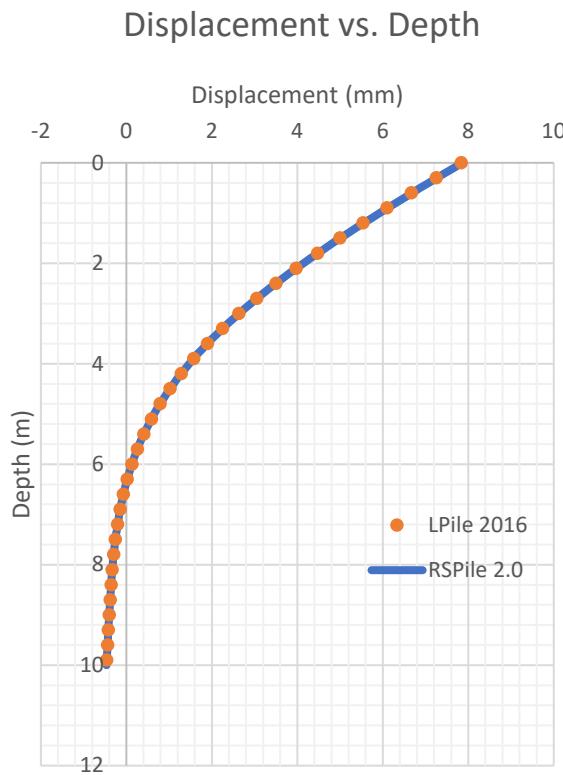
Table 10-1: Sand Properties

Parameter	Value
General Properties	
Unit Weight	8 kN / m ³
Friction Angle	30 degrees
Modulus (Kpy)	5400 kN /m ³
Laterally Loaded Piles	
Soil type	Sand
Soil Layer	10 m

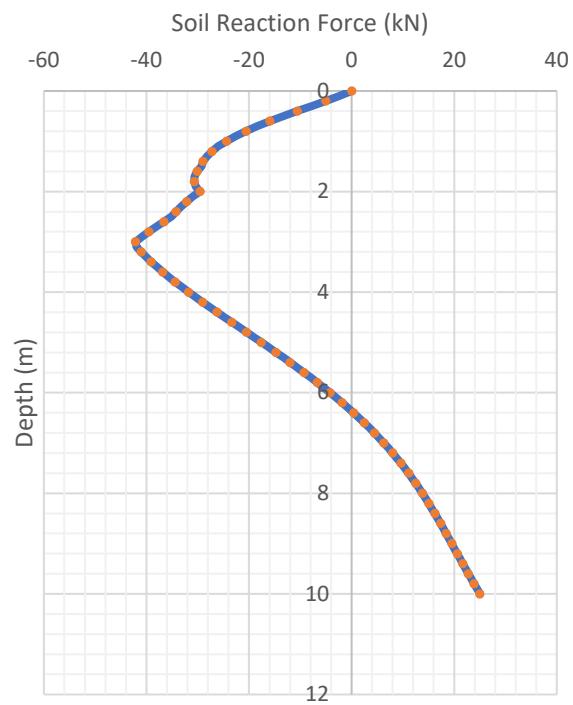
Table 10-2: Pile and Loading Properties

Parameter	Value
Cross Section	Circle
Diameter	0.5 m
Young's Modulus	200,000,000 kPa
Length	10 m
Lateral / Shear Load	100 kN

c. Results



Soil Reaction Force vs. Depth



Case 2

a. Problem description

Problem 10, case 2 is a statically loaded pile in a single layer of sand. Soil and pile properties are listed in the tables below.

b. Material Properties

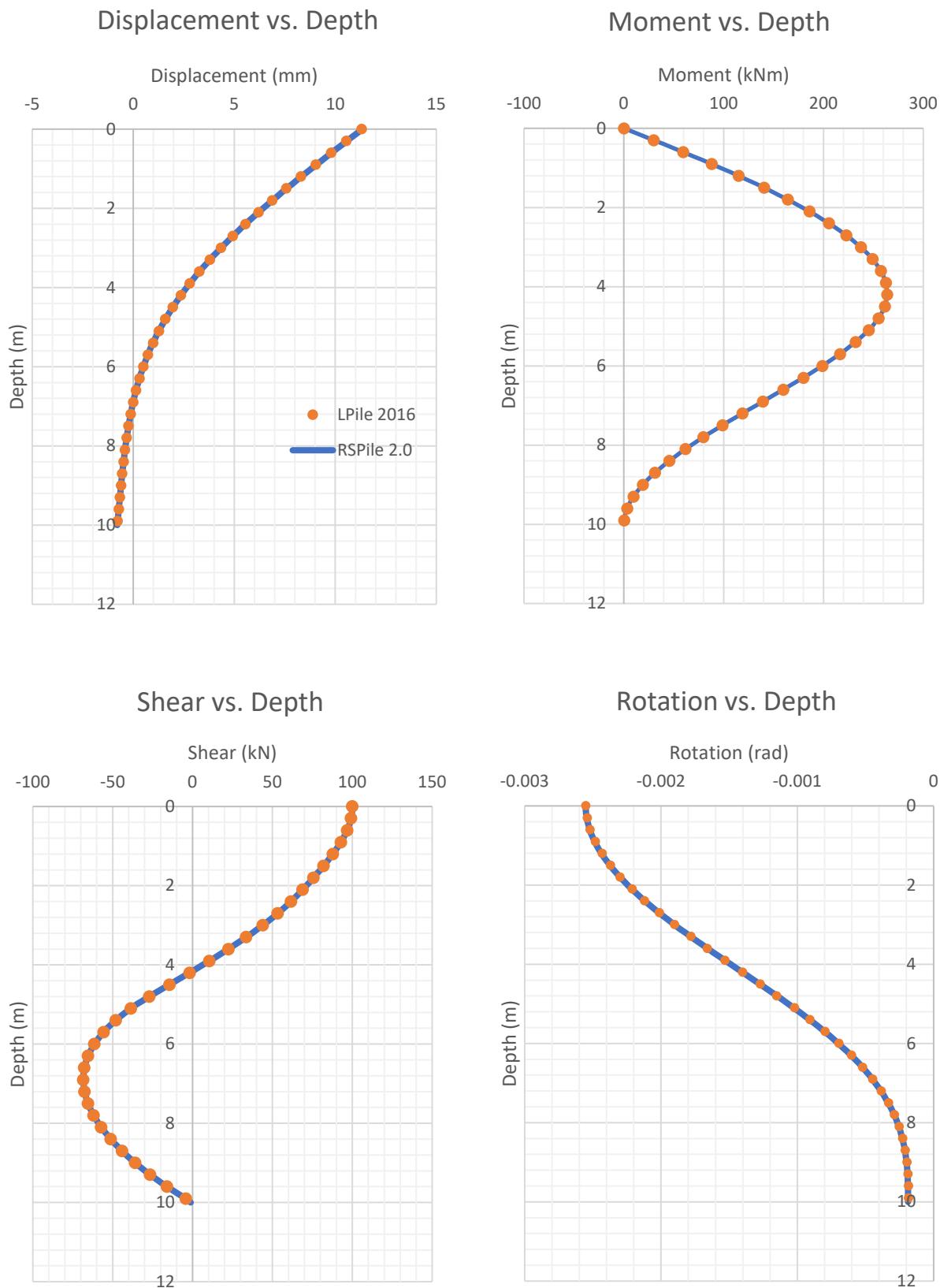
Table 10-3: Sand Properties

Parameter	Value
General Properties	
Unit Weight	8 kN / m ³
Friction Angle	30 degrees
Modulus (Kpy)	5400 kN /m ³
Laterally Loaded Piles	
Soil type	Sand
Soil Layer Thickness	10 m

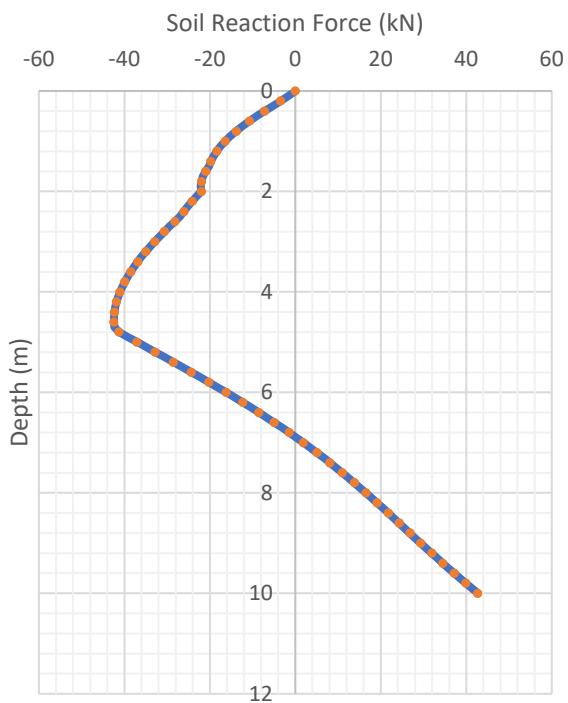
Table 10-4: Pile and Loading Properties

Parameter	Value
Cross Section	Circle
Diameter	0.5 m
Young's Modulus	200,000,000 kPa
Length	10 m
Lateral / Shear Load	100 kN
Ground Slope	15 degrees

c. Results



Soil Reaction Force vs. Depth



Case 3

a. Problem description

Problem 10, case 3 is a statically loaded pile in a single layer of sand. Soil and pile properties are listed in the tables below. In this case the pile is aligned at a batter angle listed below.

b. Material Properties

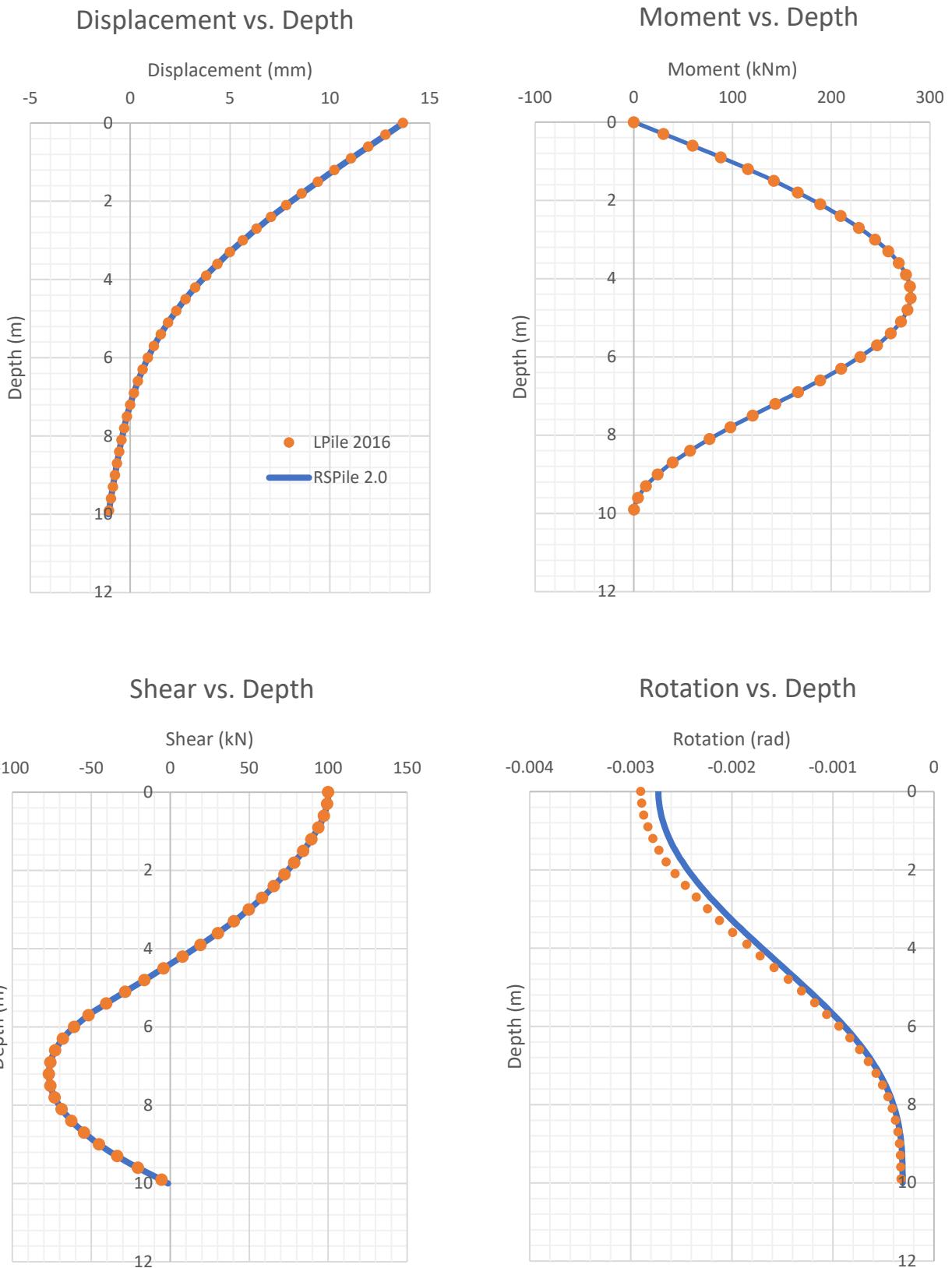
Table 10-5: Sand Properties

Parameter	Value
General Properties	
Unit Weight	8 kN / m ³
Friction Angle	30 degrees
Modulus (Kpy)	5400 kN /m ³
Laterally Loaded Piles	
Soil type	Sand
Soil Layer Thickness	10 m

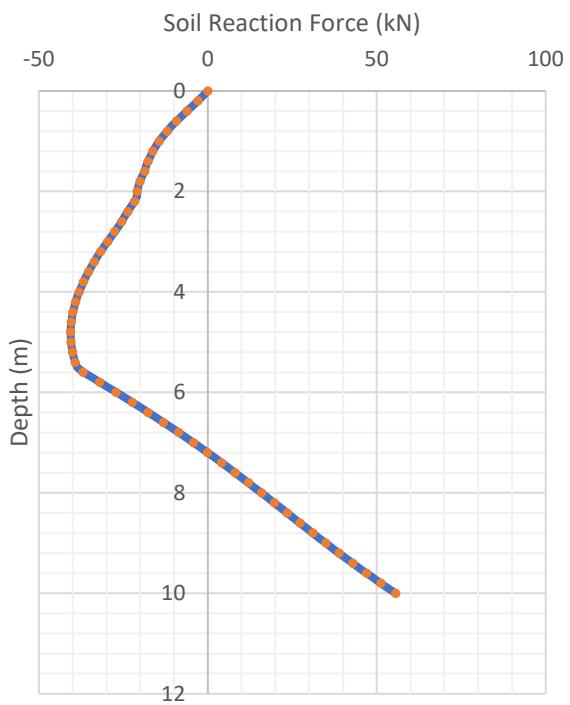
Table 10-6: Pile and Loading Properties

Parameter	Value
Cross Section	Circle
Diameter	0.5 m
Young's Modulus	200,000,000 kPa
Length	10 m
Lateral / Shear Load	100 kN
Batter angle (β)	20 degrees

c. Results



Soil Reaction Force vs. Depth



Case 4

a. Problem description

Problem 10, case 4 is a statically loaded pile in a single layer of sand. Soil and pile properties are listed in the tables below.

b. Material Properties

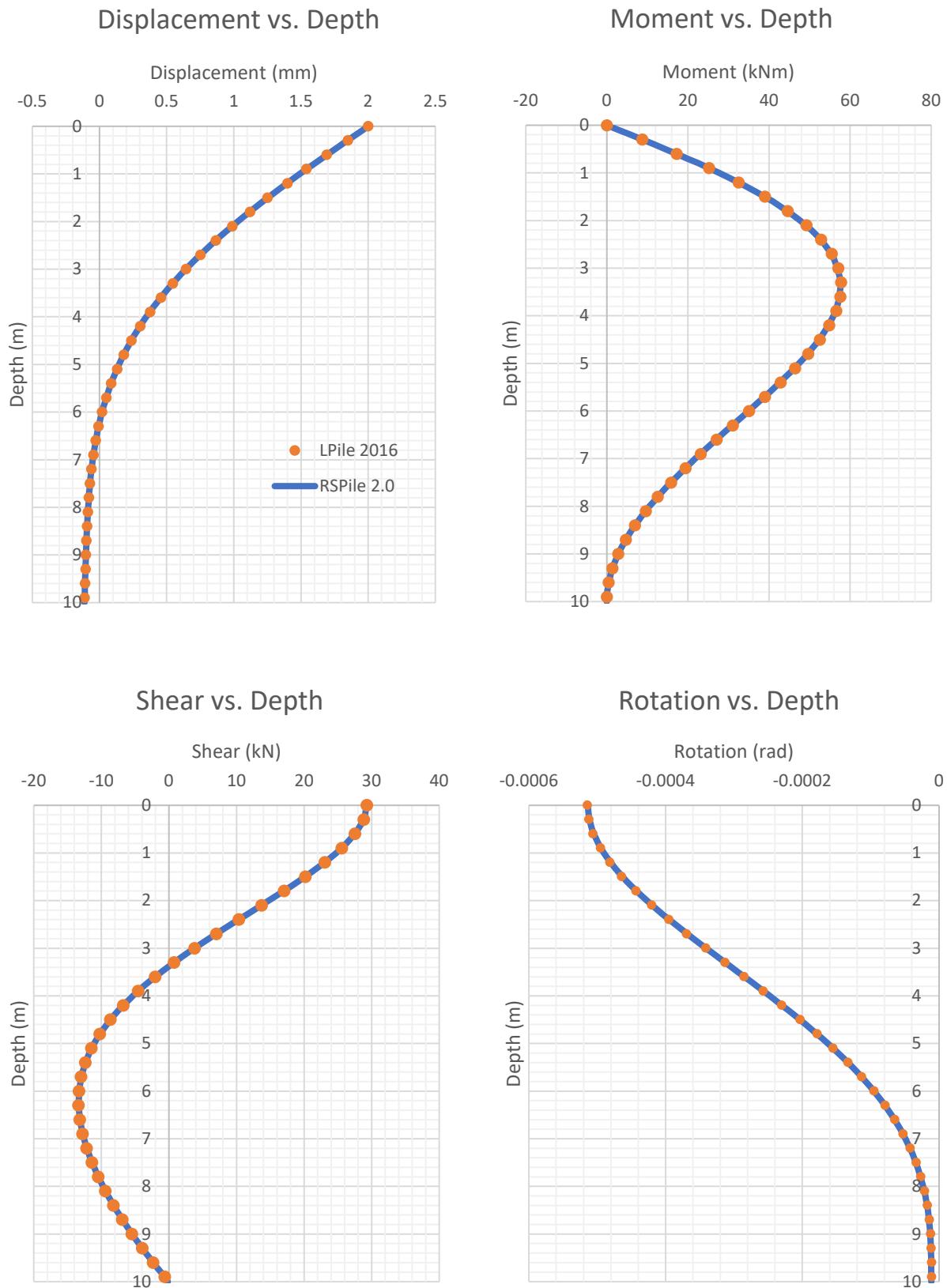
Table 10-7: Sand Properties

Parameter	Value
General Properties	
Unit Weight	8 kN / m ³
Friction Angle	30 degrees
Modulus (Kpy)	5400 kN /m ³
Laterally Loaded Piles	
Soil type	Sand
Soil Layer Thickness	10 m

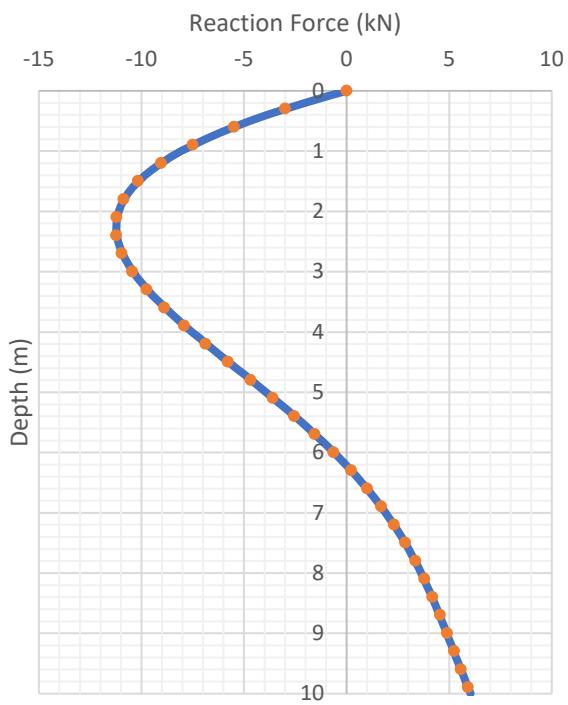
Table 10-8: Pile and Loading Properties

Parameter	Value
Cross Section	Circle
Diameter	0.5 m
Young's Modulus	200,000,000 kPa
Length	10 m
Deflection X	0.002 m (2mm)

c. Results



Soil Reaction Force vs. Depth



Case 5

a. Problem description

Problem 10, case 5 is a statically loaded pile in a single layer of sand. Soil and pile properties are listed in the tables below. This case will test Imperial units.

b. Material Properties

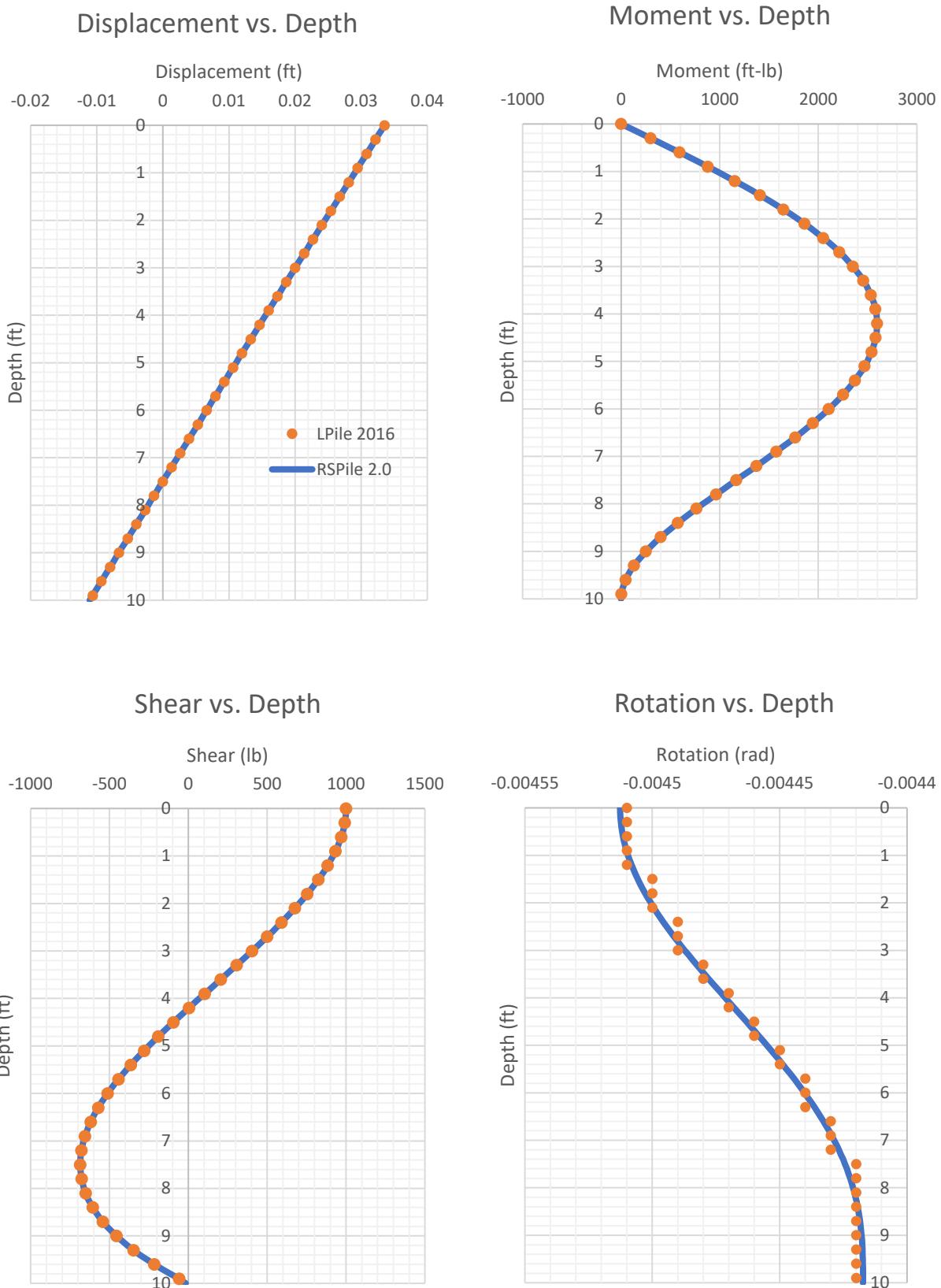
Table 10-9: Sand Properties

Parameter	Value
General Properties	
Unit Weight	50 lb/ft ³
Friction Angle	30 degrees
Modulus (Kpy)	5400 lb/ft ³
Laterally Loaded Piles	
Soil type	Sand
Soil Layer Thickness	10 ft

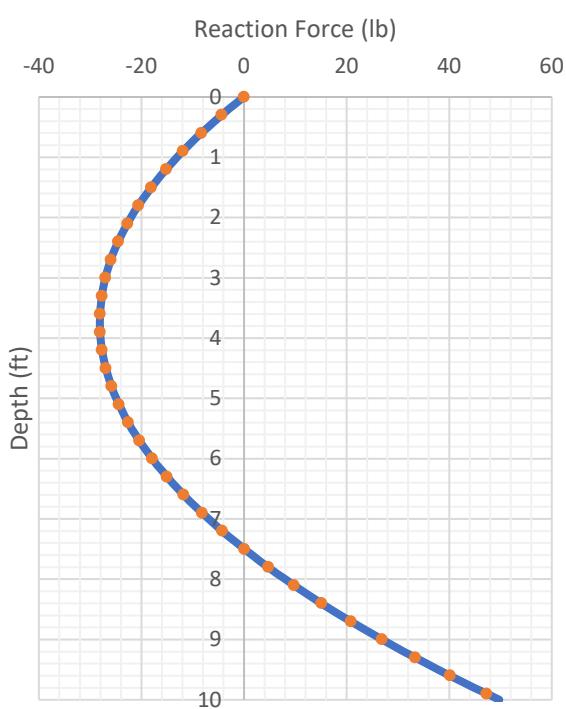
Table 10-10: Pile and Loading Properties

Parameter	Value
Cross Section	Circle
Diameter	2 ft
Young's Modulus	200,000,000 psf
Length	10 ft
Lateral / Shear Load	1000 lb

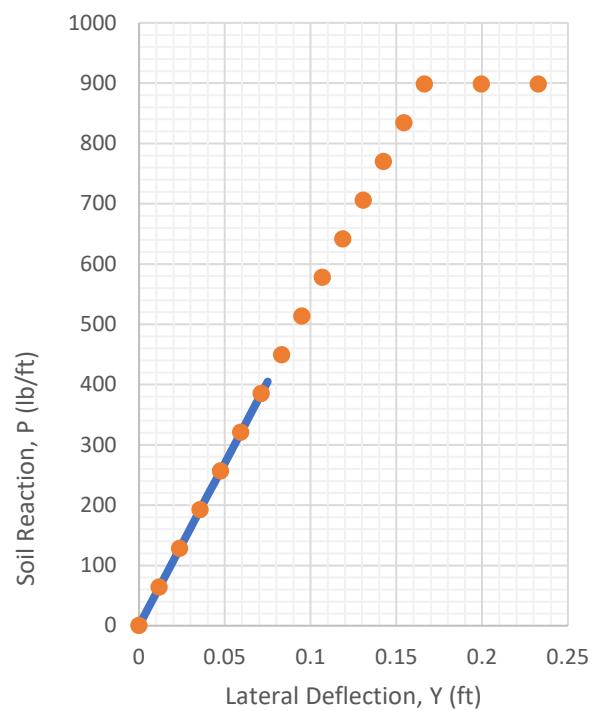
c. Results



Soil Reaction Force vs. Depth



PY Curve at 5 ft Depth



Case 6

a. Problem description

Problem 10, case 6 is a statically loaded pile in a single layer of sand. Soil and pile properties are listed in the tables below.

b. Material Properties

Table 10-11: Sand Properties

Parameter	Value
General Properties	
Unit Weight	8 kN/m ³
Friction Angle	30 degrees
Modulus (Kpy)	5400 kN/m ³
Laterally Loaded Piles	
Soil type	Sand
Soil Layer Thickness	10 m

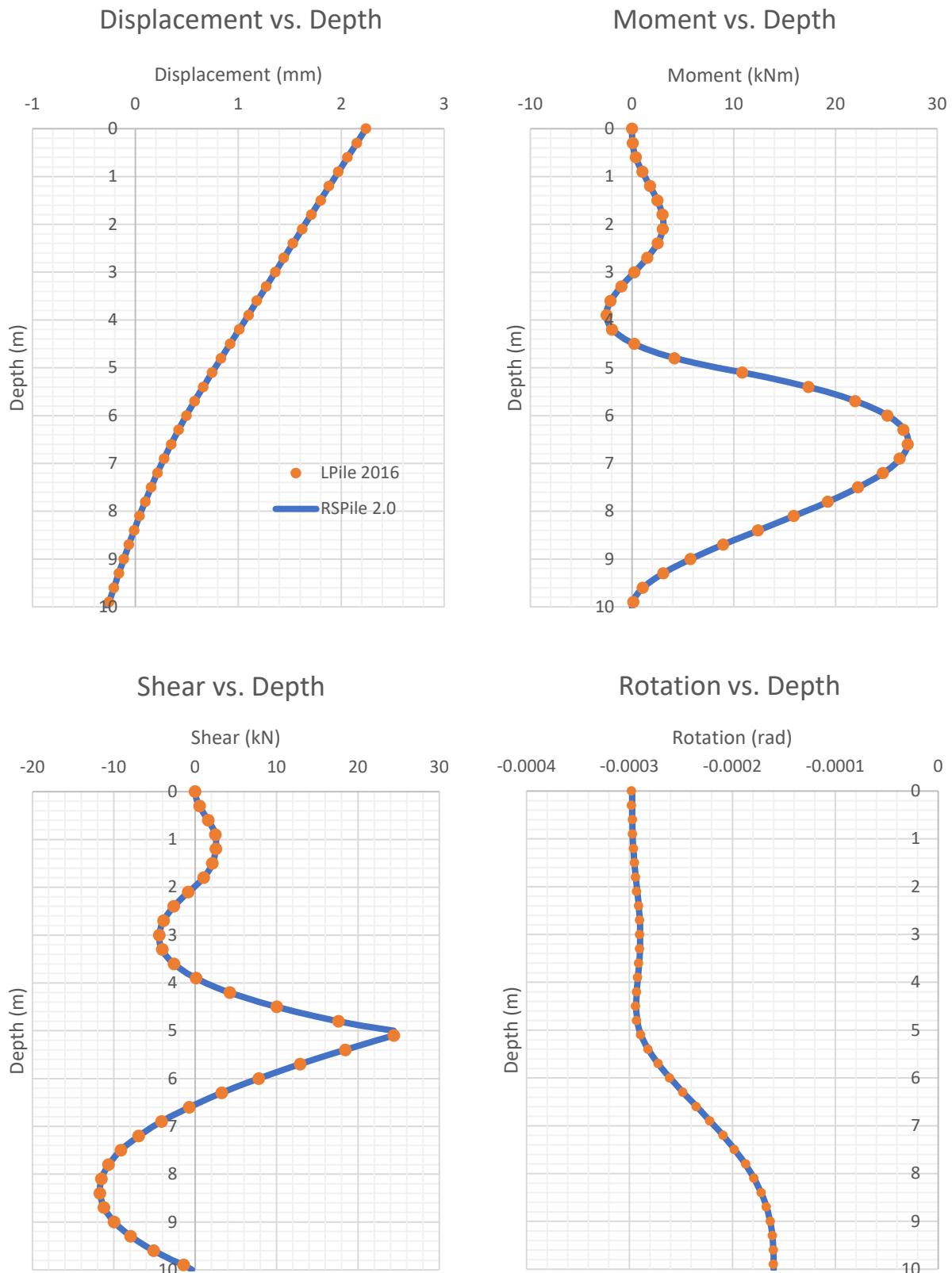
Table 10-12: Soil Displacement Profile

Depth (m)	Displacement (mm)
0	5
1	2
2	1
5	2

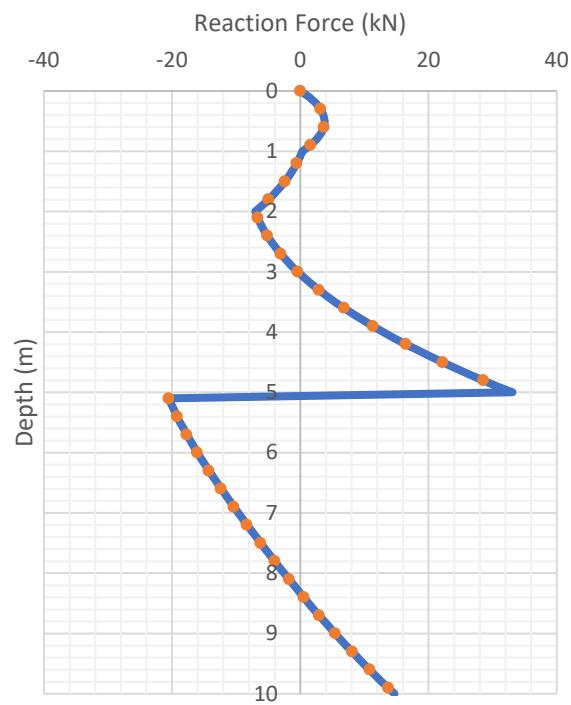
Table 10.13: Pile and Loading Properties

Parameter	Value
Cross Section	Circle
Diameter	0.5 m
Young's Modulus	200,000,000 kPa
Length	10 m

c. Results



Soil Reaction Force vs. Depth



Case 7

a. Problem description

Problem 10, case 7 is a statically loaded pile in a single layer of sand. Soil and pile properties are listed in the tables below. This case will test PY multipliers with shear loading.

b. Material Properties

Table 10-14: Sand Properties

Parameter	Value
General Properties	
Unit Weight	8 kN/m ³
Friction Angle	30 degrees
Modulus (Kpy)	5400 kN/m ³
Laterally Loaded Piles	
Soil type	Sand
Soil Layer Thickness	10 m

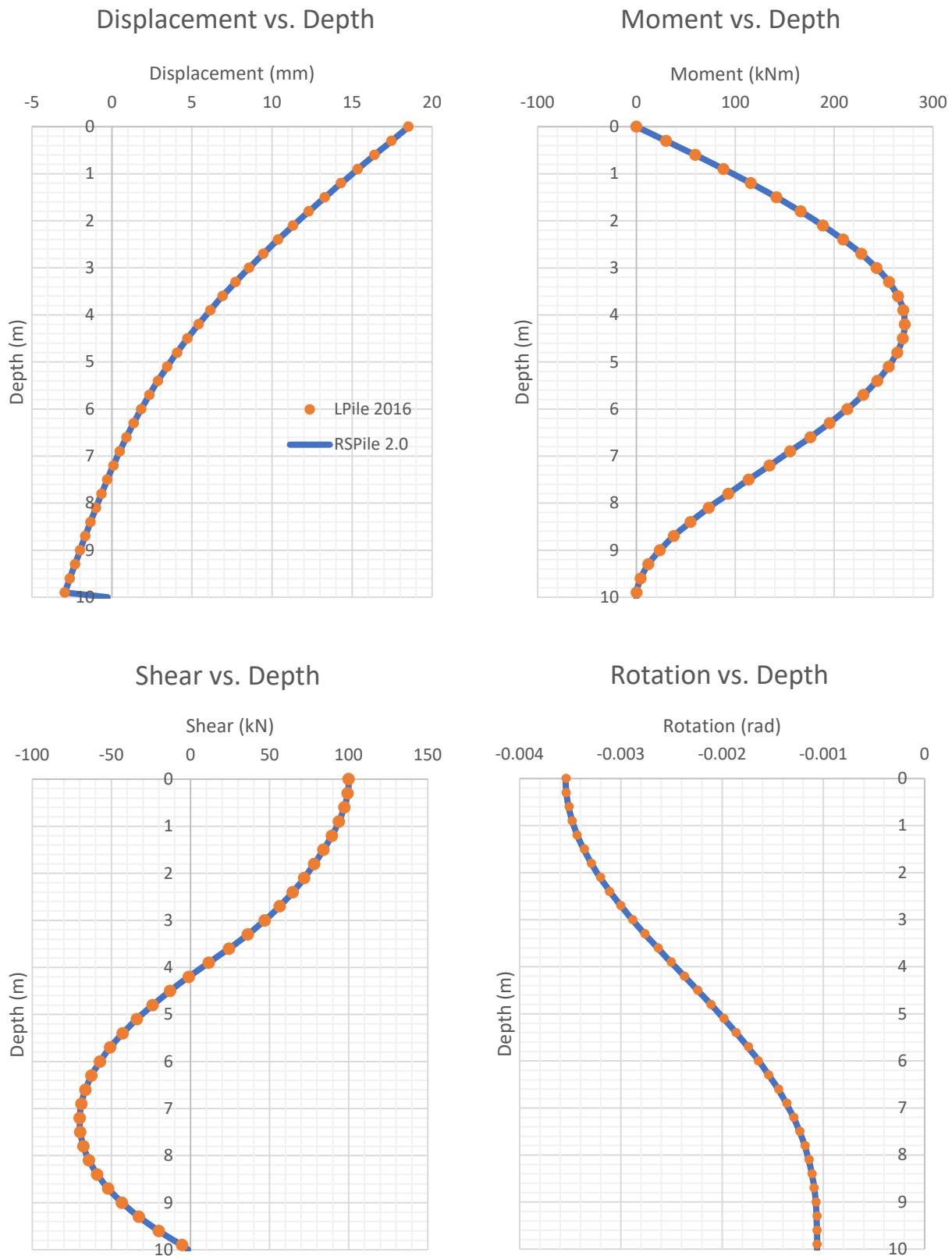
Table 10-15: PY Multipliers

Depth (m)	P-Multiplier	Y-Multiplier
0	0.5	1.5
10	0.5	1.5

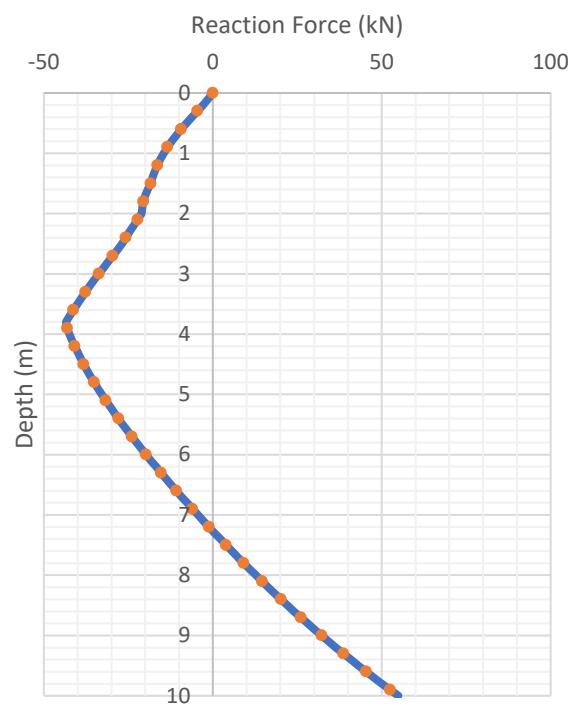
Table 10-16: Pile and Loading Properties

Parameter	Value
Cross Section	Circle
Diameter	0.5 m
Young's Modulus	200,000,000 kPa
Length	10 m
Shear	100 kN

c. Results



Soil Reaction Force vs. Depth



Case 8

a. Problem description

Problem 10, case 8 is a statically loaded pile in a single layer of sand. Soil and pile properties are listed in the tables below. This case will test an application of rotational stiffness with shear loading.

b. Material Properties

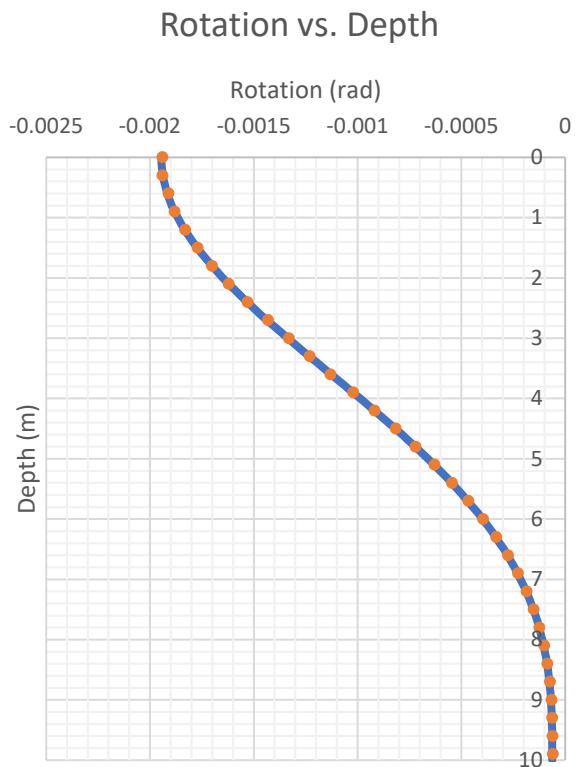
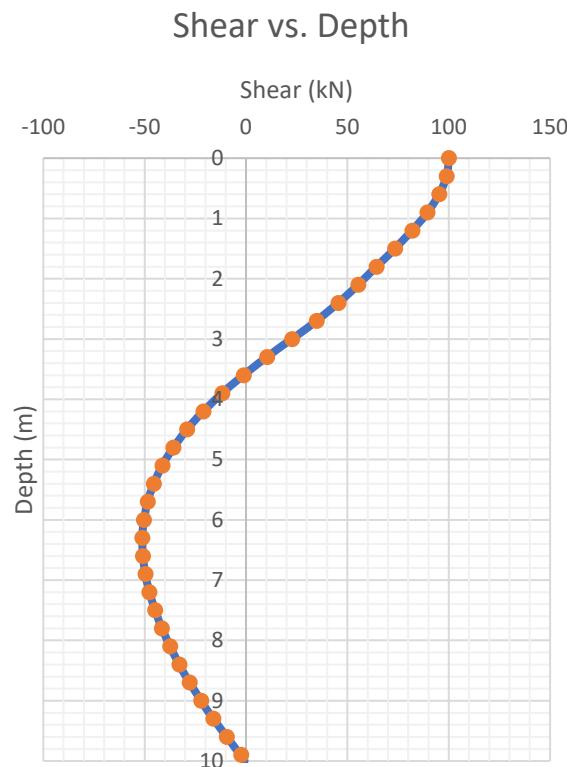
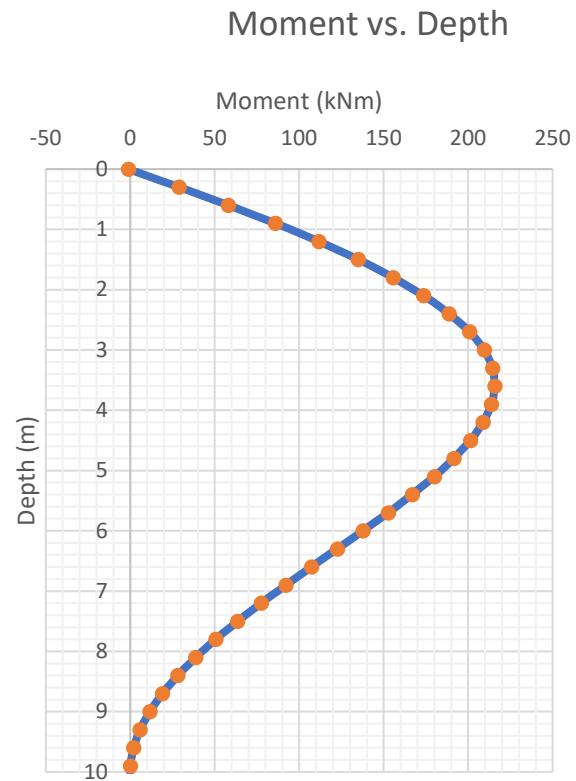
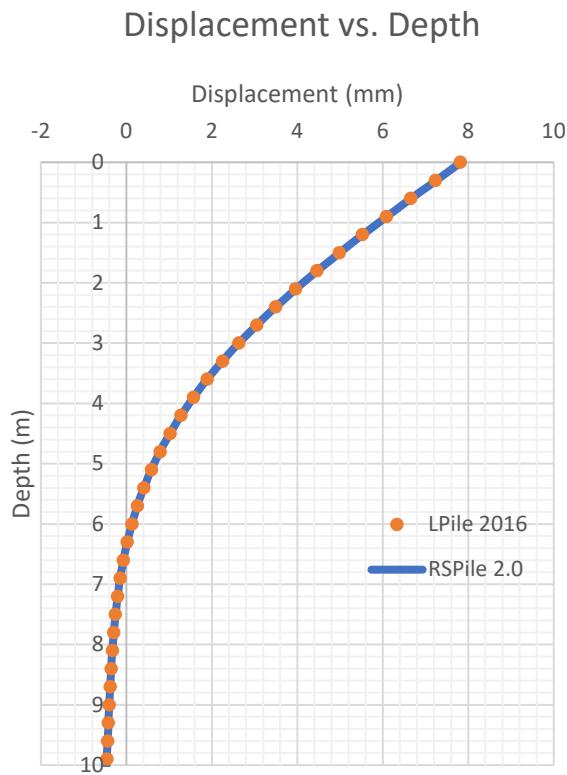
Table 10-17: Sand Properties

Parameter	Value
General Properties	
Unit Weight	8 kN/m ³
Friction Angle	30 degrees
Modulus (Kpy)	5400 kN/m ³
Laterally Loaded Piles	
Soil type	Sand
Soil Layer Thickness	10 m

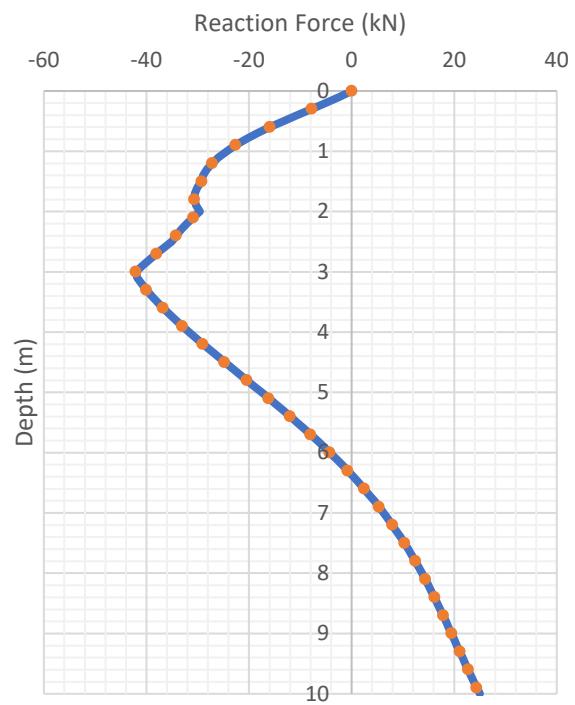
Table 10-18: Pile and Loading Properties

Parameter	Value
Cross Section	Circle
Diameter	0.5 m
Young's Modulus	200,000,000 kPa
Length	10 m
Rotational Stiffness	500 kNm/rad
Shear	100 kN

c. Results



Soil Reaction Force vs. Depth



Case 9

a. Problem description

Problem 10, case 9 is a statically loaded pile in a single layer of sand. Soil and pile properties are listed in the tables below. This case will test an applied slope at the pile head.

b. Material Properties

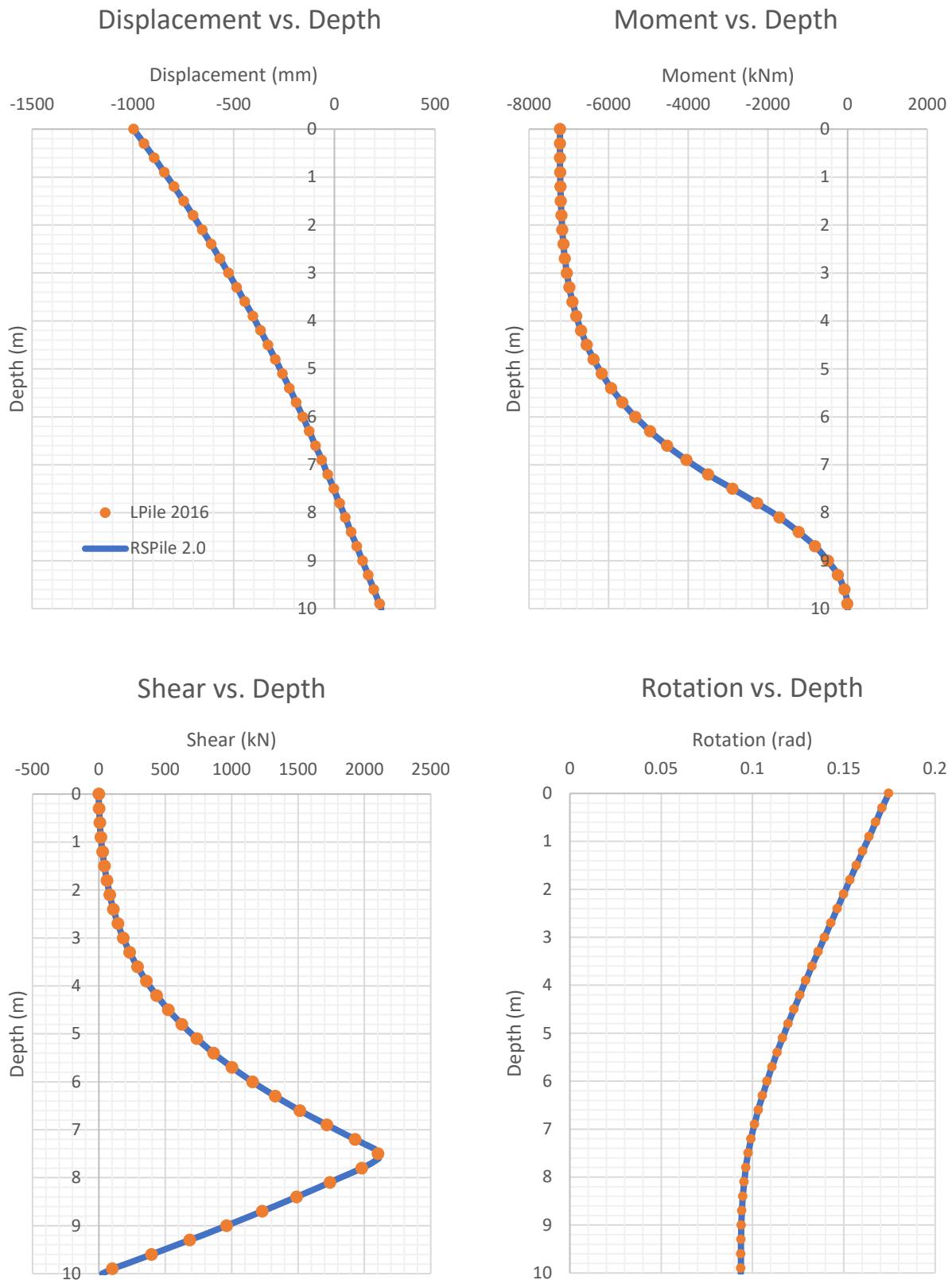
Table 10-19: Sand Properties

Parameter	Value
General Properties	
Unit Weight	8 kN/m ³
Friction Angle	30 degrees
Modulus (Kpy)	5400 kN/m ³
Laterally Loaded Piles	
Soil type	Sand
Soil Layer Thickness	10 m

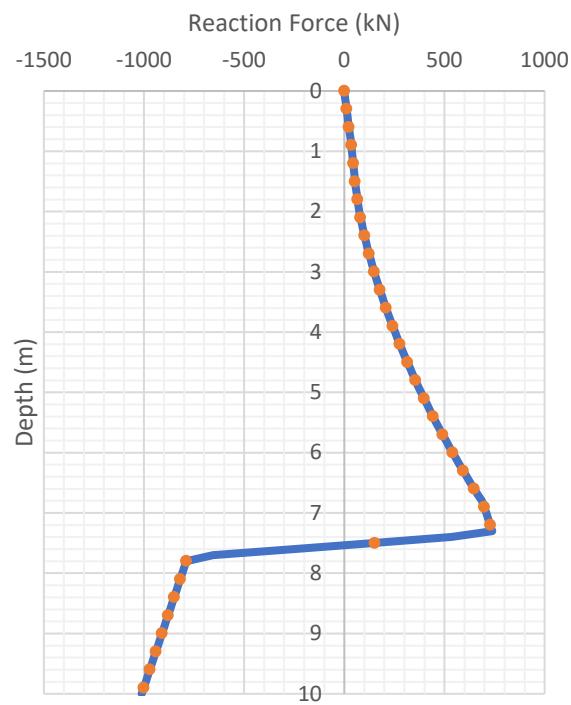
Table 10-20: Pile and Loading Properties

Parameter	Value
Cross Section	Circle
Diameter	0.5 m
Young's Modulus	200,000,000 kPa
Length	10 m
Slope	10 degrees

c. Results



Soil Reaction Force vs. Depth



RSPile Verification Problem #11

Soft Clay, normal, battered, and tapered piles

Case 1

a. Problem Description

Problem 11, case 1 is a statically loaded pile in soft clay soil. Soil and pile properties are listed in tables 11-1 and 11-2 below.

b. Material Properties

Table 11-1: Soft Clay Properties

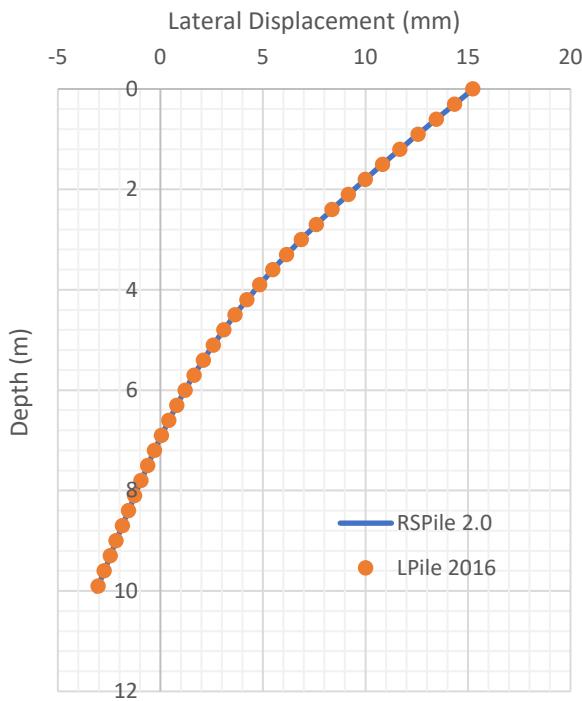
Parameter	Value
General Properties	
Unit Weight	8 kN /m ³
Strain Factor	0.02
Cohesion	25 kPa
Laterally Loaded Piles	
Soil type	Soft Clay
Soil Layer Thickness	10 m

Table 11-2: Pile and Loading Properties

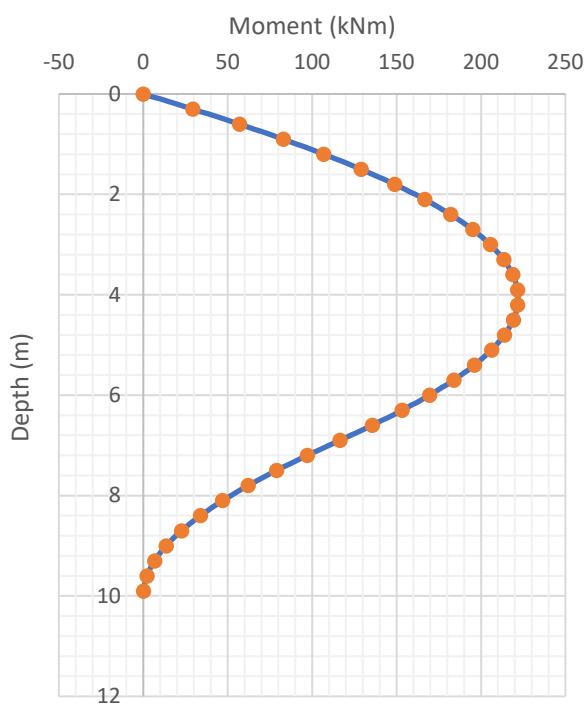
Parameter	Value
Cross Section	Circle
Diameter	0.5 m
Young's Modulus	200,000,000 kPa
Length	10 m
Lateral / Shear Load	100 kN

c. Results

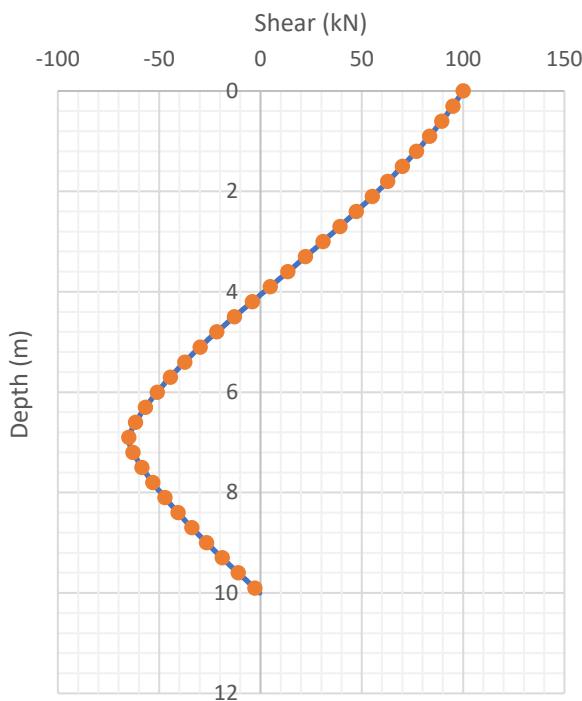
Lateral Displacement Vs. Depth



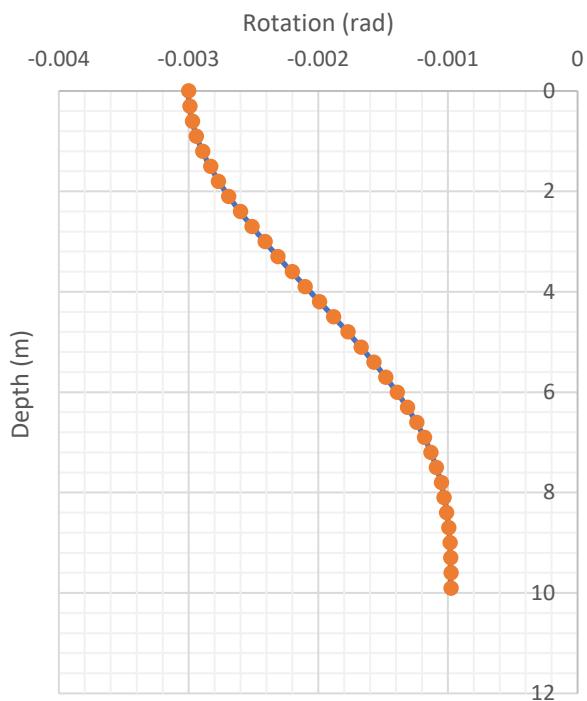
Moment Vs. Depth



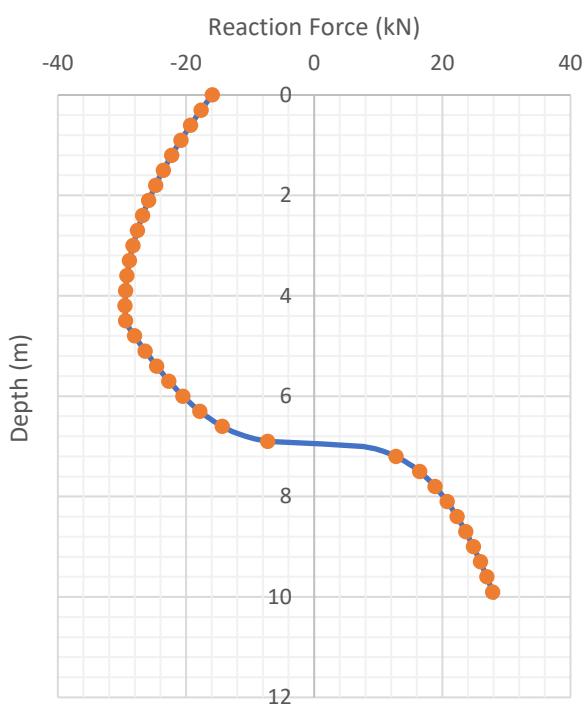
Shear Vs. Depth



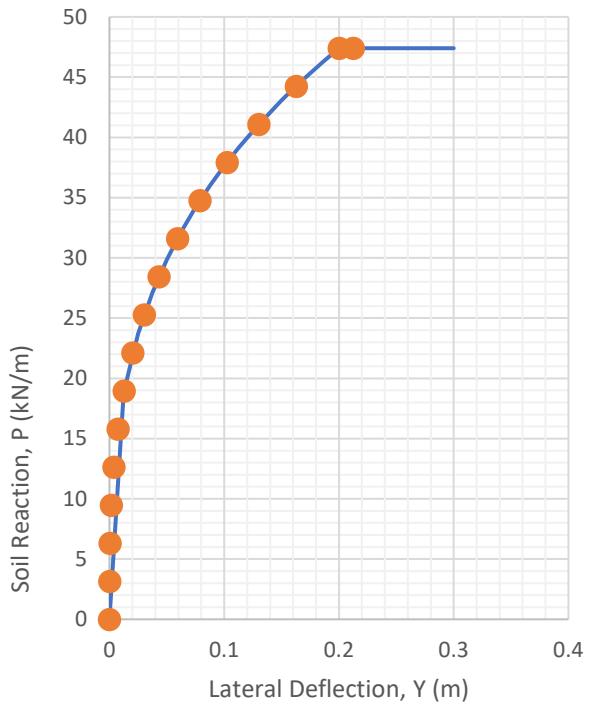
Rotation Vs. Depth



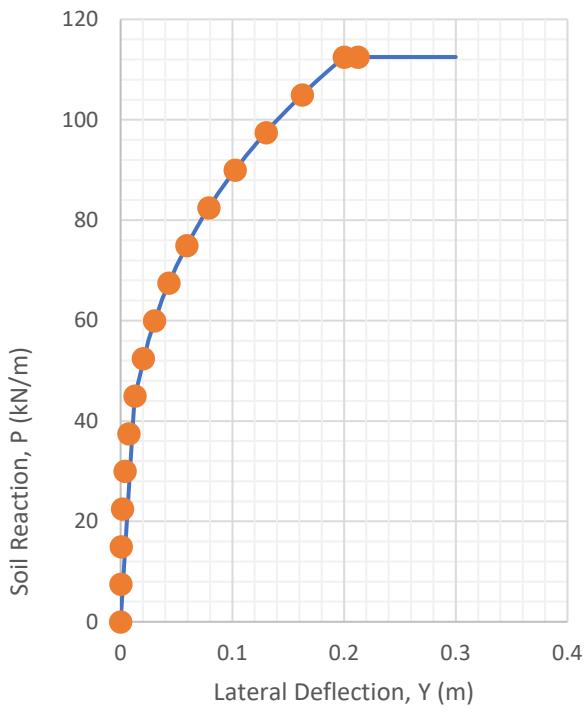
Soil Reaction Force Vs. Depth



PY Curve at 0.6 m Depth



PY Curve at 6.1 m Depth



Case 2

a. Problem Description

Problem 11, case 2 is a statically loaded pile in soft clay soil. The soil properties are different at the top and bottom of the soil layer. Soil and pile properties are listed in tables 11-3 and 11-4 below.

b. Material Properties

Table 11-3: Soft Clay Properties

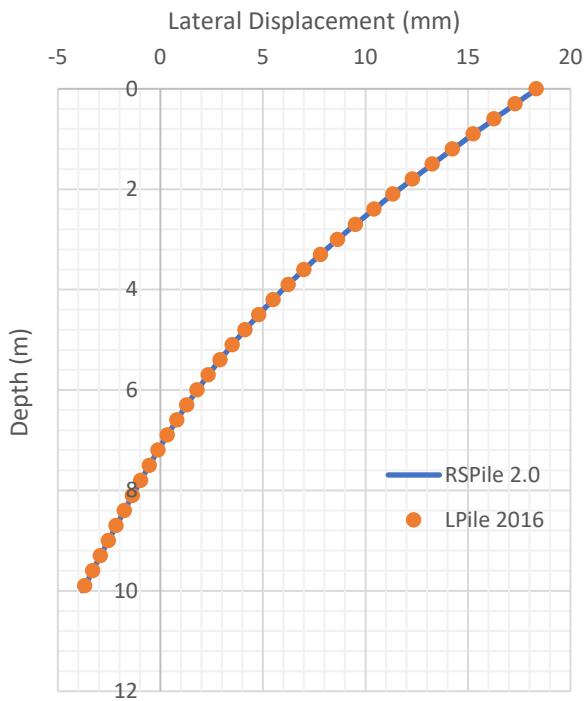
Parameter	Value
General Properties	
Unit Weight	Top: 8 kN/m ³ Bottom: 15 kN/m ³
Cohesion	Top: 20 kPa Bottom: 30 kPa
Strain Factor	Top: 0.02 Bottom: 0.025
Laterally Loaded Piles	
Soil Type	Soft Clay
Soil Layer Thickness	10 m

Table 11-4: Pile and Loading Properties

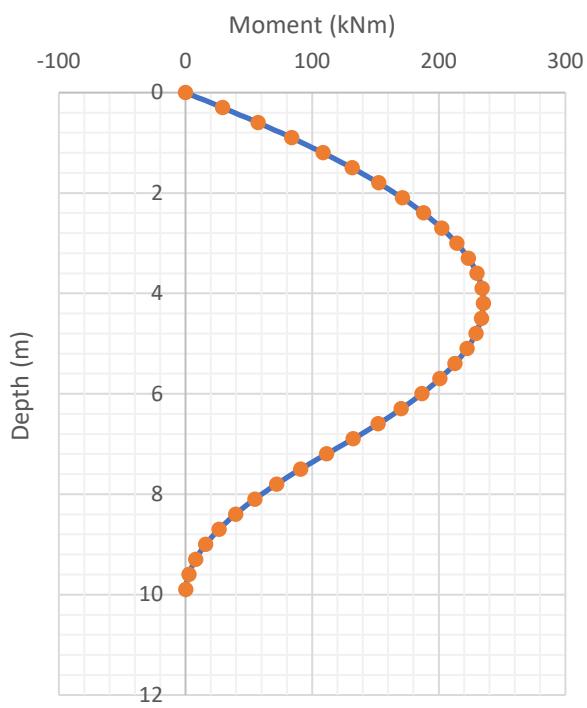
Parameter	Value
Cross Section	Circle
Diameter	0.5 m
Young's Modulus	200,000,000 kPa
Length	10 m
Lateral / Shear Load	100 kN

c. Results

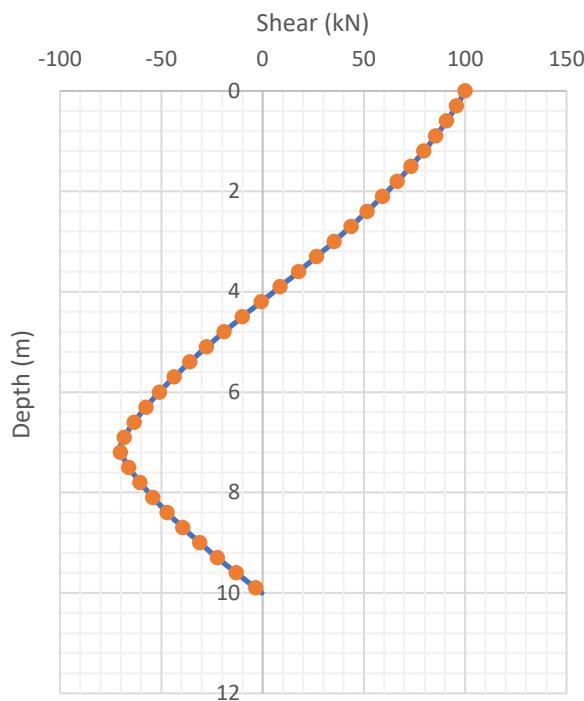
Lateral Displacement Vs. Depth



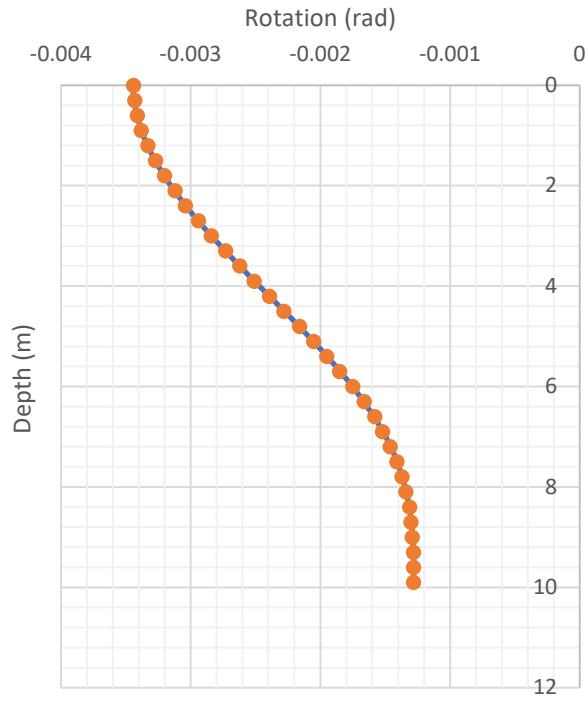
Moment Vs. Depth



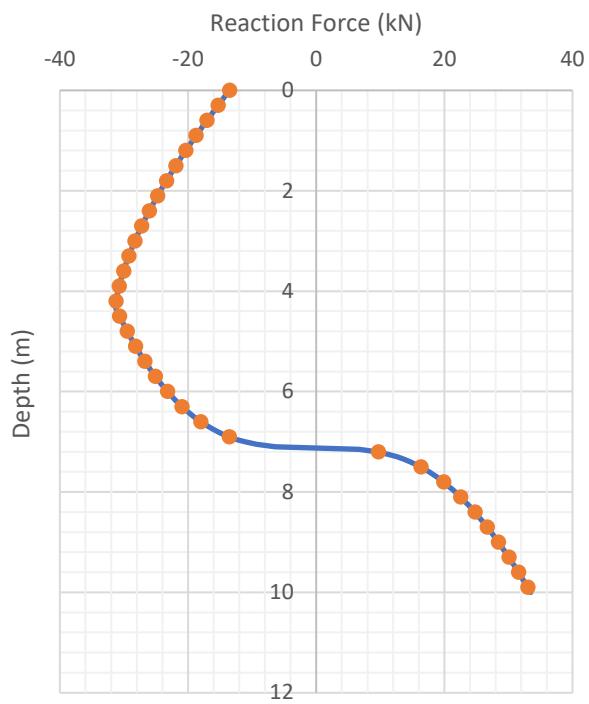
Shear Vs. Depth



Rotation Vs. Depth



Soil Reaction Force Vs. Depth



Case 3

a. Problem Description

Problem 11, case 3 is a statically loaded pile in soft clay soil. Soil and pile properties are listed in tables 11-5 and 11-6 below.

b. Material Properties

Table 11-5: Soft Clay Properties

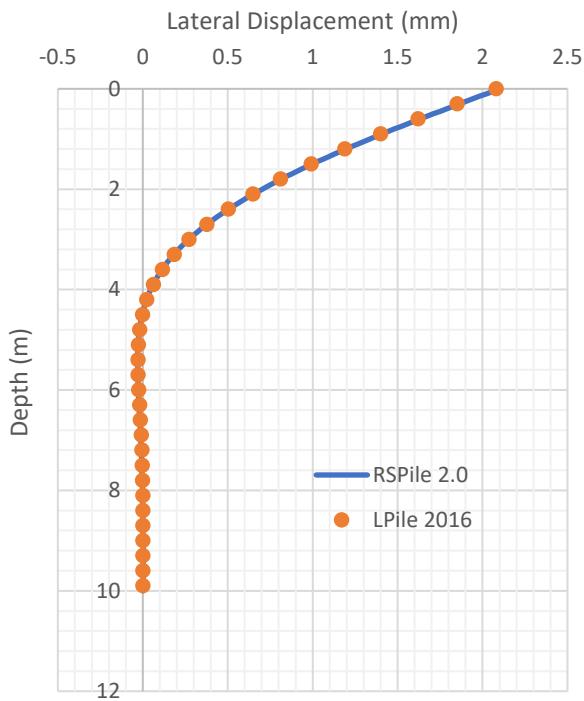
Parameter	Value
General Properties	
Unit Weight	20 kN/m ³
Strain Factor	0.02
Cohesion	100 kPa
Laterally Loaded Piles	
Soil type	Soft Clay
Soil Layer Thickness	10 m

Table 11-6: Pile and Loading Properties

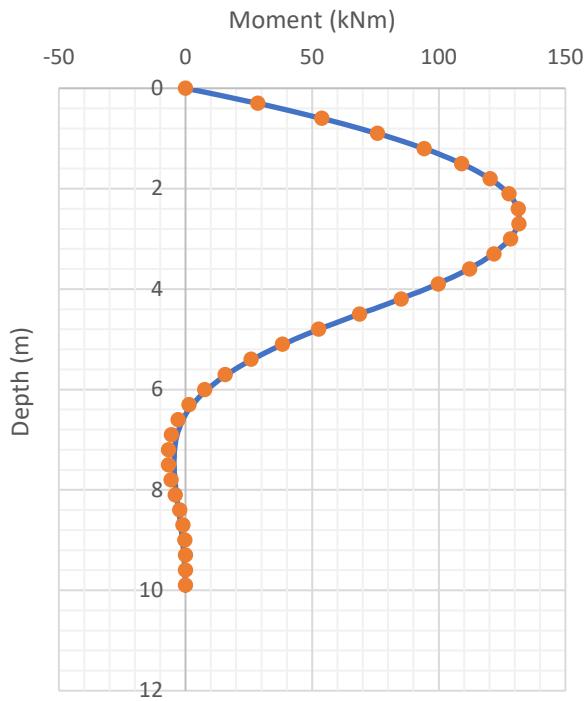
Parameter	Value
Cross Section	Circle
Diameter	0.5 m
Young's Modulus	200,000,000 kPa
Length	10 m
Lateral / Shear Load	100 kN

c. Results

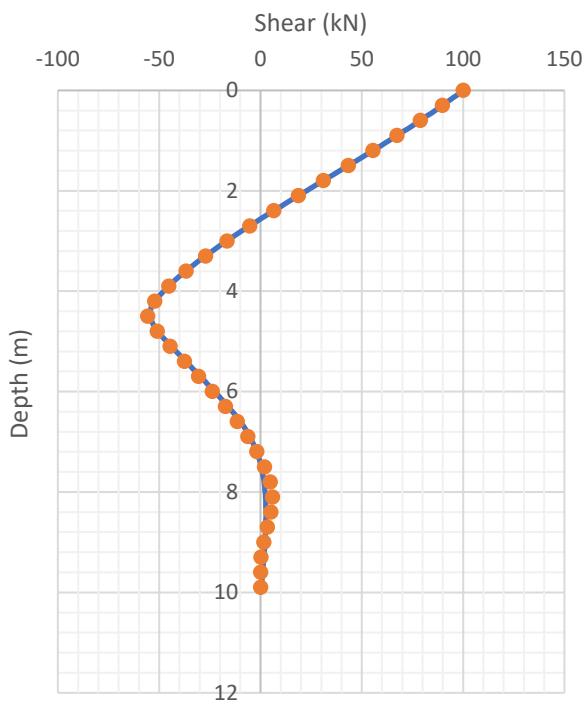
Lateral Displacement Vs. Depth



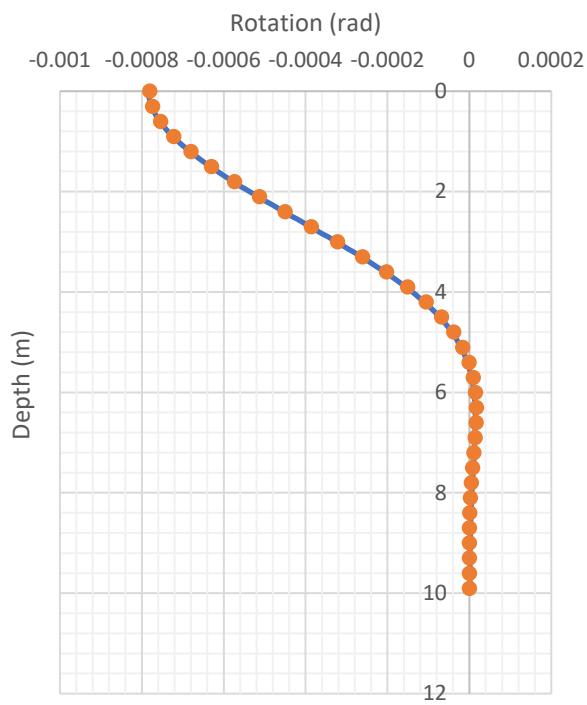
Moment Vs. Depth



Shear Vs. Depth



Rotation Vs. Depth



Case 4

a. Problem Description

Problem 11, case 4 is a statically loaded pile in soft clay soil. Soil and pile properties are listed in tables 11-7 and 11-8 below and are given in imperial units.

b. Material Properties

Table 11-7: Soft Clay Properties

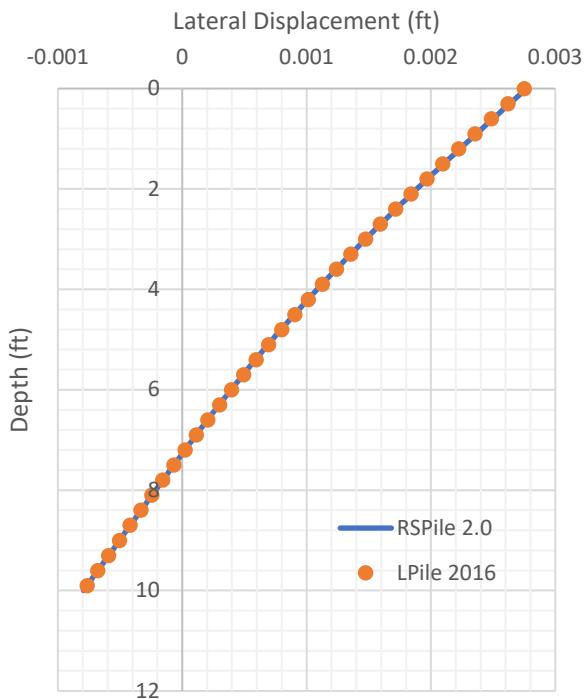
Parameter	Value
General Properties	
Unit Weight	50 lb/ft ³
Strain Factor	0.02
Cohesion	500 psf
Laterally Loaded Piles	
Soil type	Soft Clay
Soil Layer Thickness	10 ft

Table 11-8: Pile and Loading Properties

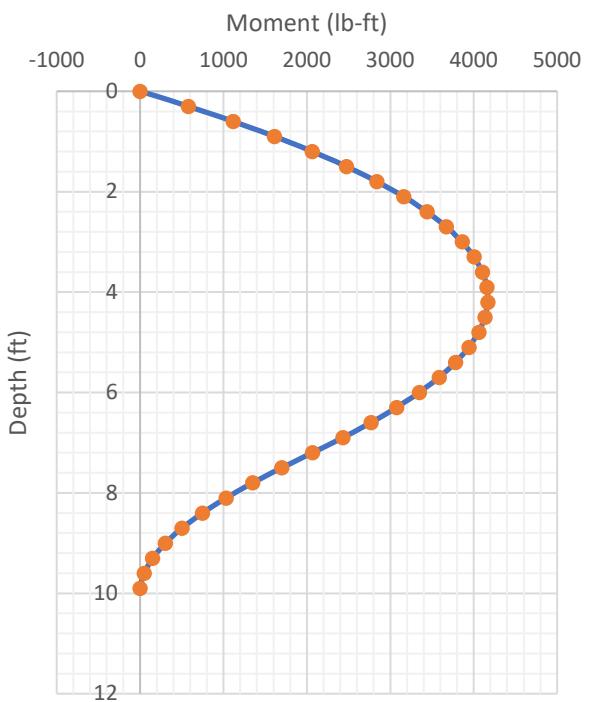
Parameter	Value
Cross Section	Circle
Diameter	2 ft
Young's Modulus	200,000,000 psf
Length	10 ft
Lateral/Shear Load	2000 lb

c. Results

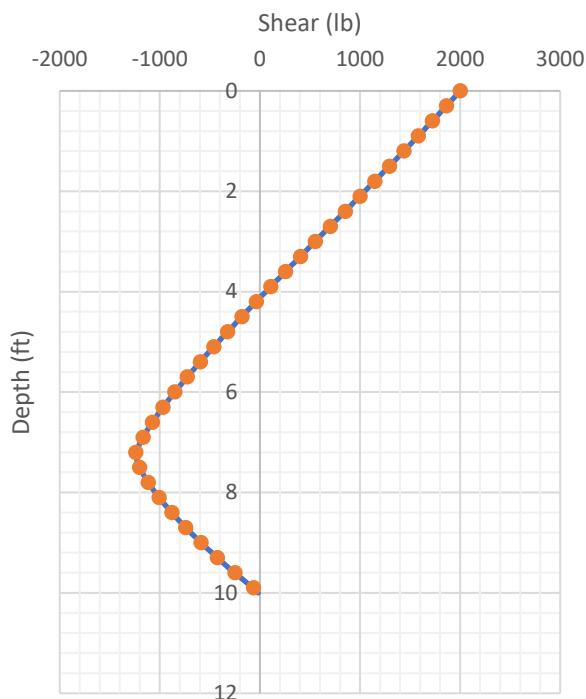
Lateral Displacement Vs. Depth



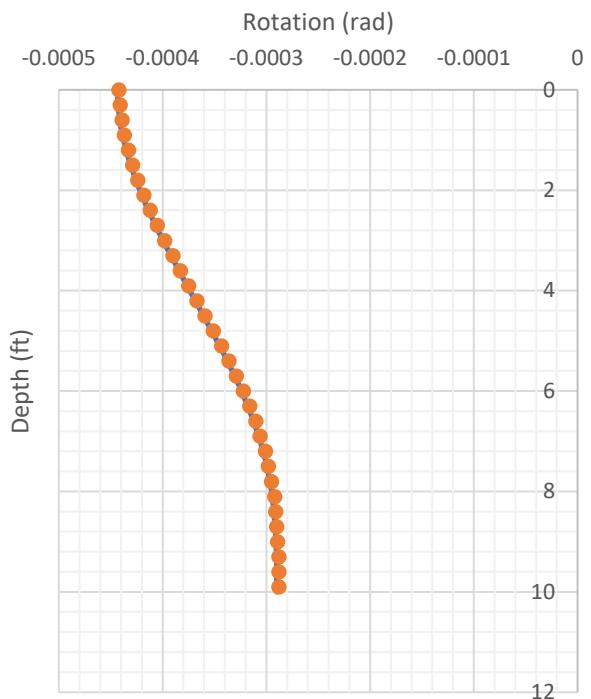
Moment Vs. Depth



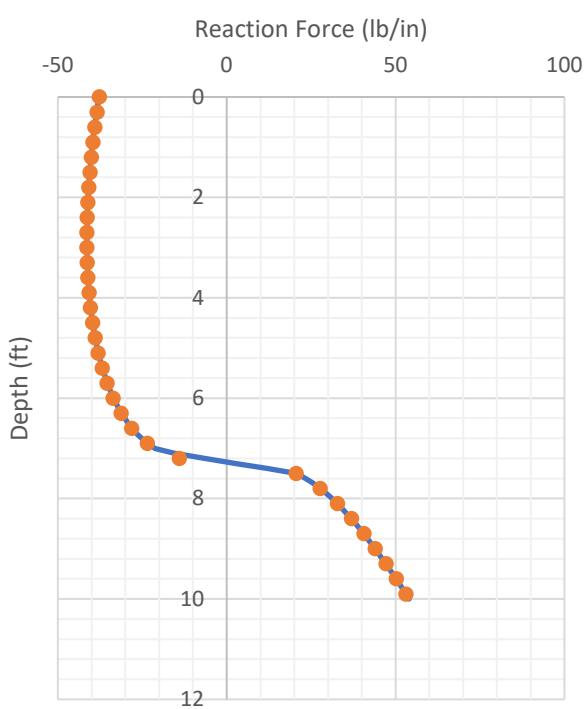
Shear Vs. Depth



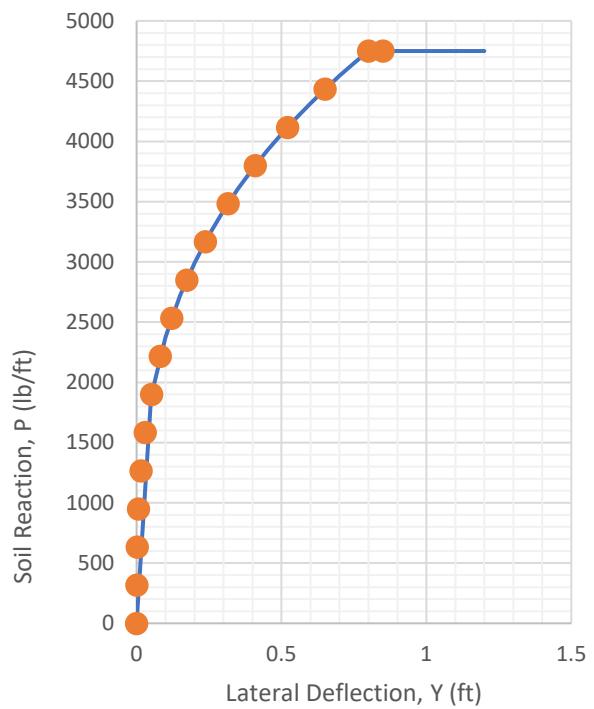
Rotation Vs. Depth



Soil Reaction Force Vs. Depth



PY Curve at 5 ft Depth



RSPile Verification Problem #12

Modified dry stiff clay, battered piles

Case 1

a. Problem Description

Problem 12, case 1 is a statically loaded pile in a single layer of modified dry stiff clay. Soil and pile properties are listed in tables 12-1 and 12-2 below.

b. Material Properties

Table 12-1: Modified Dry Stiff Clay Properties

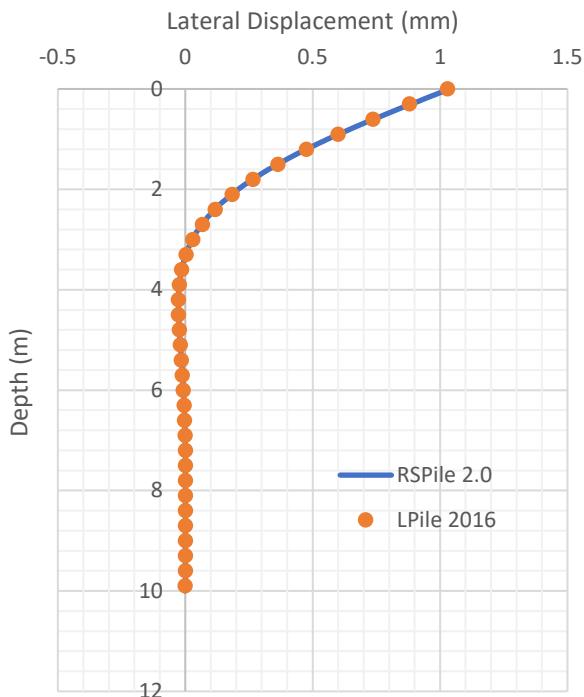
Parameter	Value
General Properties	
Unit Weight	8 kN/m ³
Undrained Shear Strength	100 kPa
Initial Stiffness	200,000 kN/m ³
Strain Factor	0.005
Laterally Loaded Piles	
Soil type	Modified dry stiff clay
Soil Layer Thickness	10 m

Table 12-2: Pile and Loading Properties

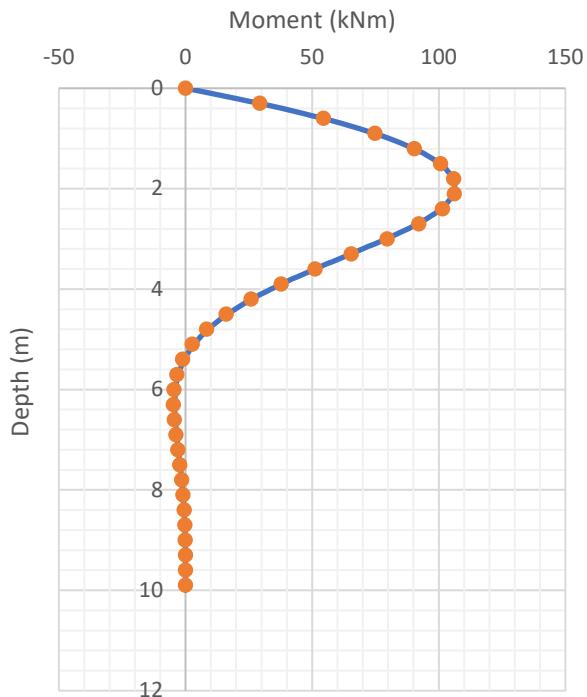
Parameter	Value
Cross Section	Circle
Diameter	0.5 m
Young's Modulus	200,000,000 kPa
Length	10 m
Lateral / Shear Load	100 kN

c. Results

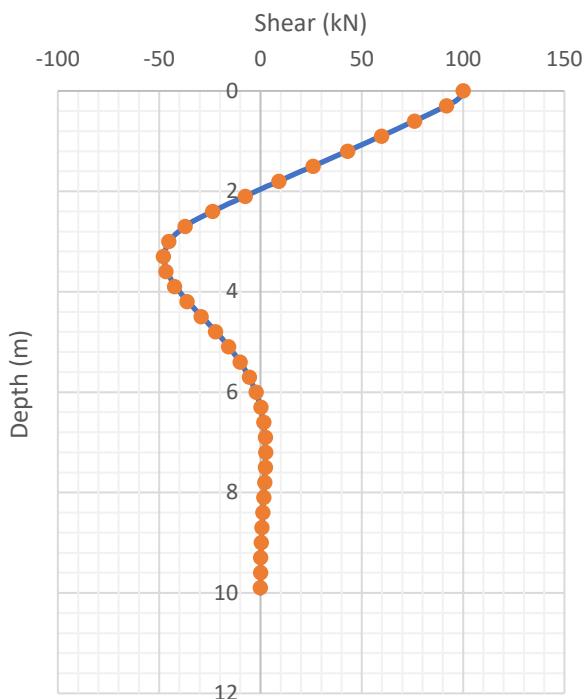
Lateral Displacement Vs. Depth



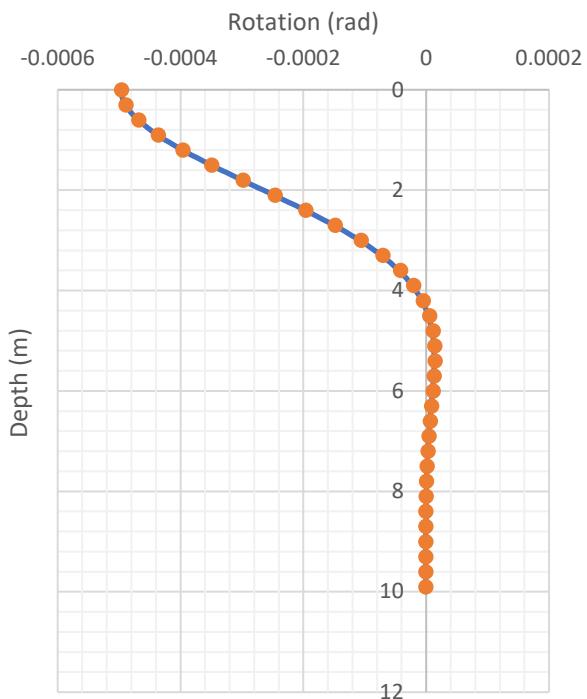
Moment Vs. Depth



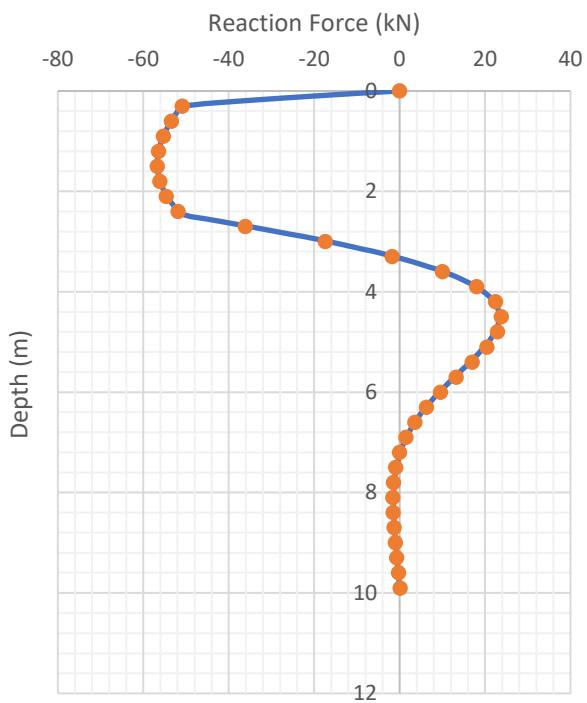
Shear Vs. Depth



Rotation Vs. Depth



Soil Reaction Force Vs. Depth



Case 2

a. Problem Description

Problem 12, case 2 is a statically loaded pile in a single layer of modified dry stiff clay. Soil and pile properties are listed in tables 12-3 and 12-4 below.

b. Material Properties

Table 12-3: Modified Dry Stiff Clay Properties

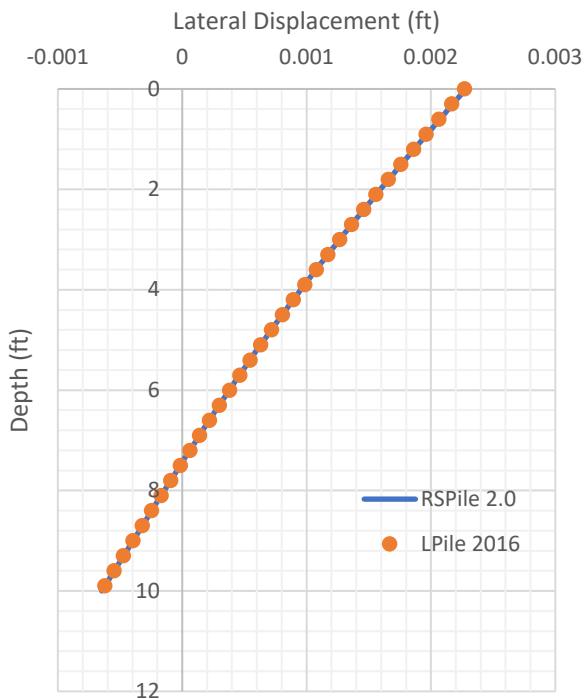
Parameter	Value
General Properties	
Unit Weight	50 lb/ft ³
Strain Factor	0.005
Cohesion	500 psf
Initial Stiffness	86,400 lb/ft ³
Laterally Loaded Piles	
Soil type	Modified dry stiff clay
Soil Layer Thickness	10 ft

Table 12-4: Pile and Loading Properties

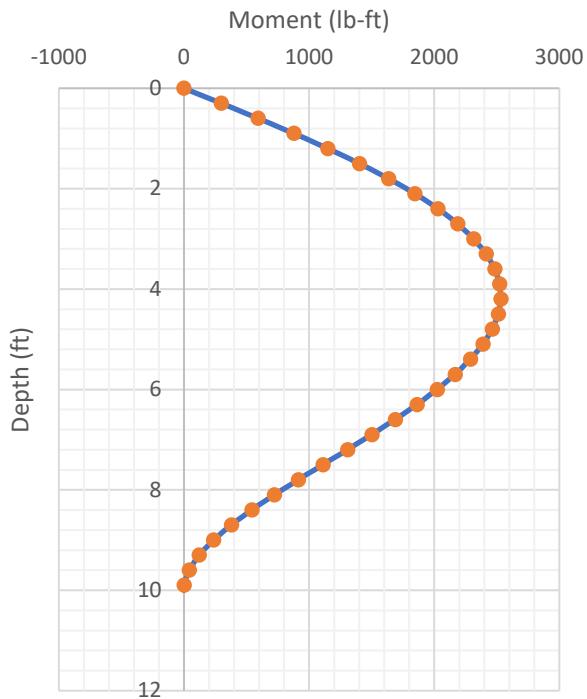
Parameter	Value
Cross Section	Circle
Diameter	2 ft
Young's Modulus	200,000,000 psf
Length	10 ft
Lateral/Shear Load	1000 lb

c. Results

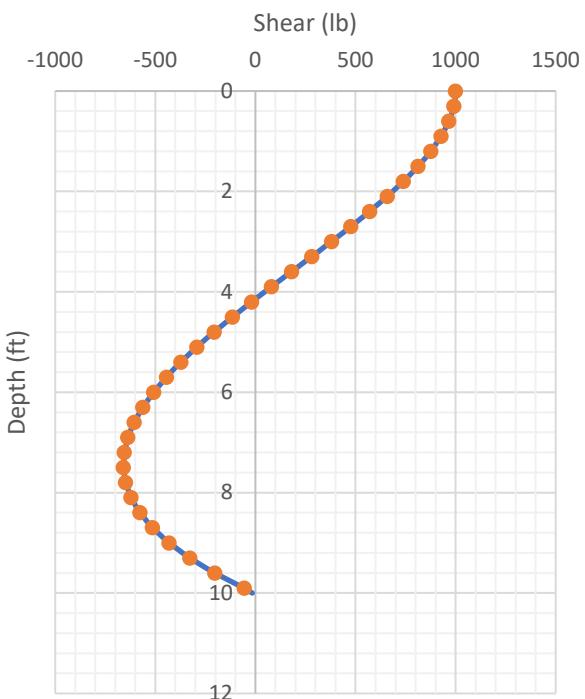
Lateral Displacement Vs. Depth



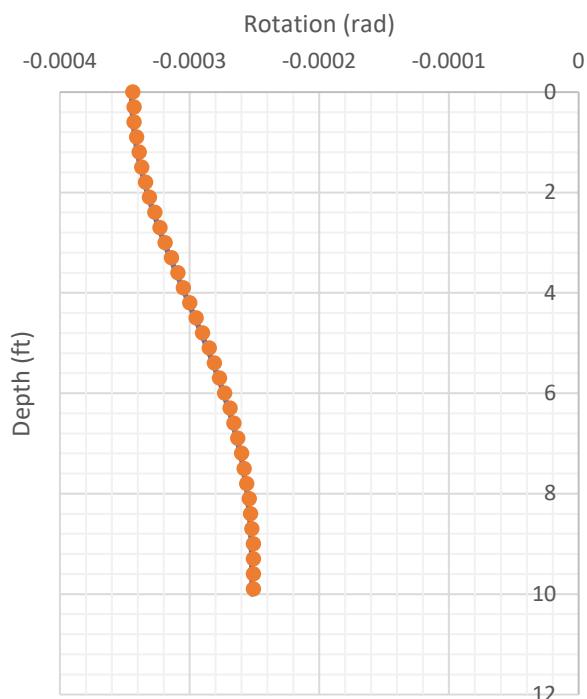
Moment Vs. Depth



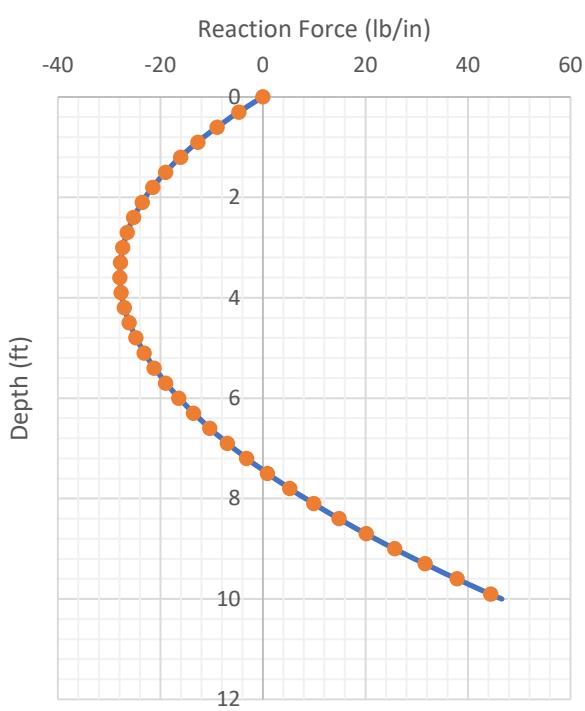
Shear Vs. Depth



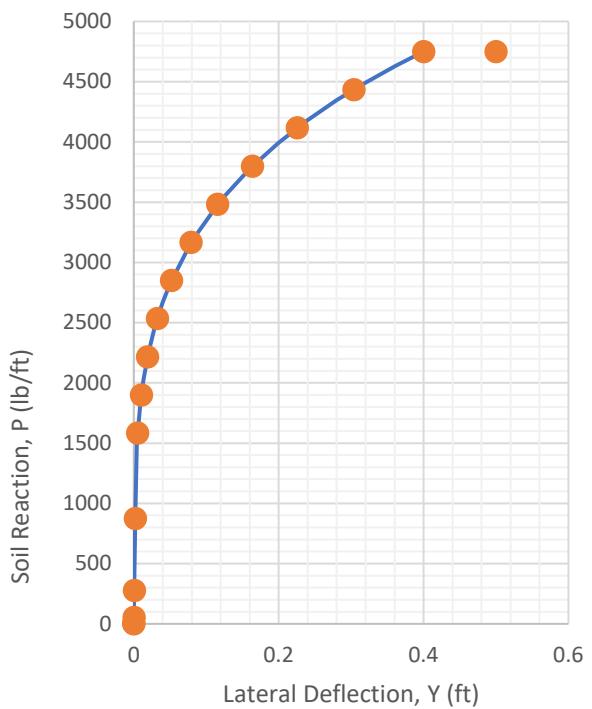
Rotation Vs. Depth



Soil Reaction Force Vs. Depth



PY Curve at 5 ft Depth



Case 3

a. Problem Description

Problem 12, case 3 is a statically loaded pile in a single layer of modified dry stiff clay. Soil and pile properties are listed in tables below.

b. Material Properties

Table 12-3: Modified Dry Stiff Clay Properties

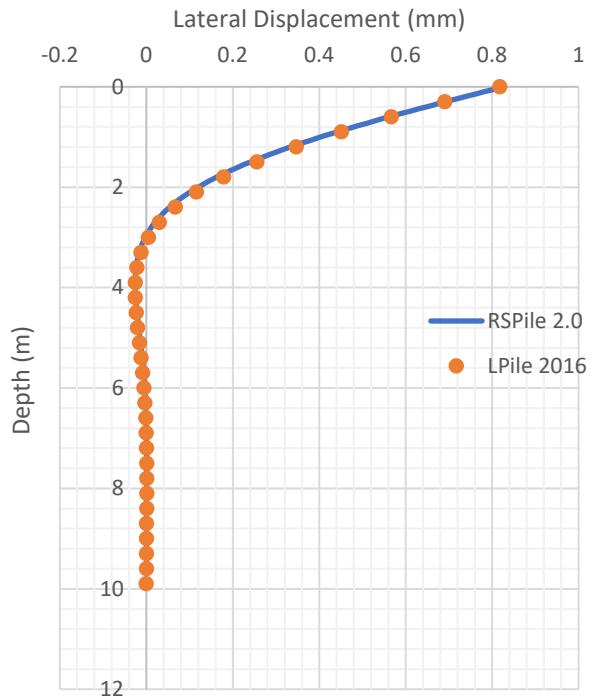
Parameter	Value
General Properties	
Unit Weight	8 kN/m ³
Strain Factor	0.005
Cohesion	100 kPa
Initial Stiffness	200,000 kN/m ³
Laterally Loaded Piles	
Soil type	Modified dry stiff clay
Soil Layer Thickness	10 m

Table 12-4: Pile and Loading Properties

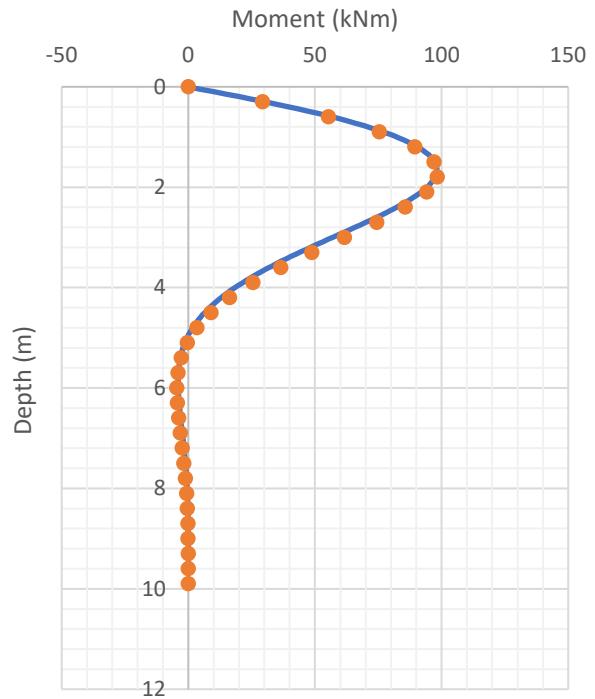
Parameter	Value
Cross Section	Circle
Diameter	0.5 m
Young's Modulus	200,000,000 kPa
Length	10 m
Lateral/Shear Load	100 kN
Batter Angle	12 degrees

c. Results

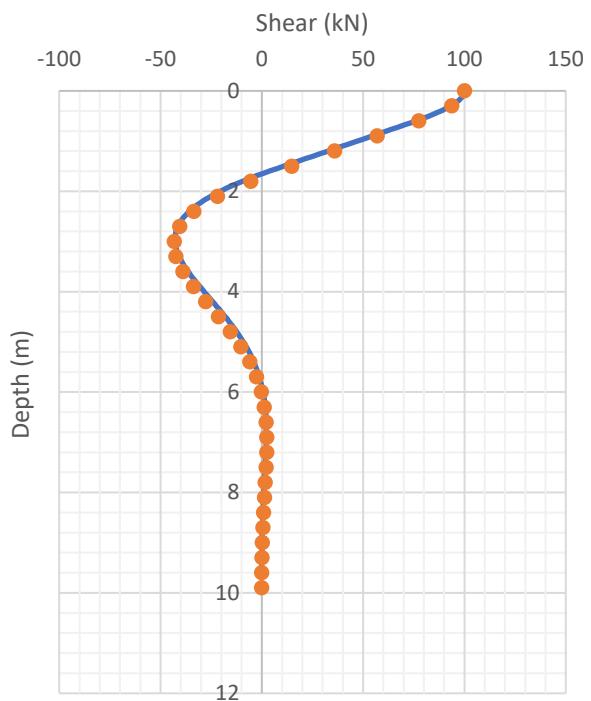
Lateral Displacement Vs. Depth



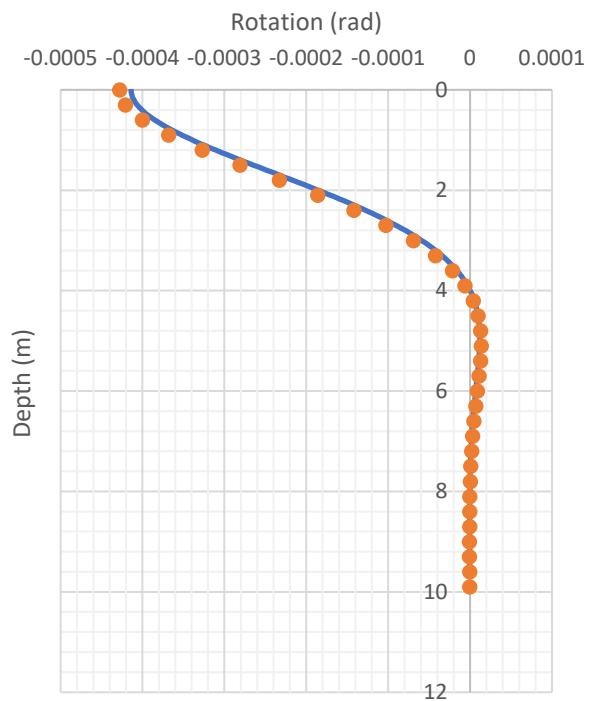
Moment Vs. Depth



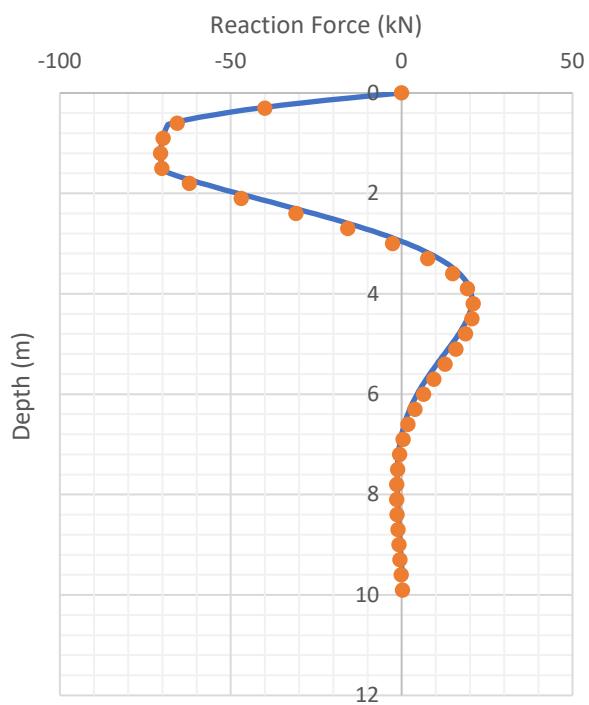
Shear Vs. Depth



Rotation Vs. Depth



Soil Reaction Force Vs. Depth



RSPile Verification Problem #13

Layered Soil, lateral loading, ground slope

Case 1

a. Problem Description

Problem 13, case 1 is a statically loaded pile in soil layers of liquefied sand, dry stiff clay and piedmont residual soils. Soil and pile properties are listed in tables 13-1 to 13-4 below. This test case involves lateral shear and ground slope.

b. Material Properties

Table 13-1: Layer 1 – Liquefied Sand / Depth 0 m to 3 m

Parameter	Value
Unit Weight	Top: 12 kN/m ³ Bottom: 13 kN/m ³

Table 13-2: Layer 2 – Dry Stiff Sand / Depth 3 m to 6 m

Parameter	Value
Unit Weight (top)	Top: 15 kN/m ³ Bottom: 18 kN/m ³
Cohesion	Top: 80 kPa Bottom: 100 kPa
E50	0.01

Table 13-3: Layer 3 – Piedmont Residual Soil / Depth 6 m to 10 m

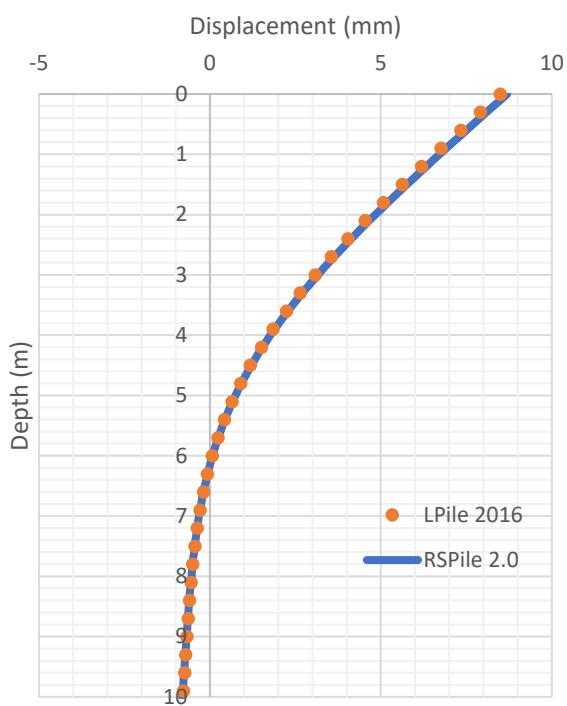
Parameter	Value
Unit Weight	Top: 15 kN/m ³ Bottom: 18 kN/m ³
Standard Cone Penetration Test	Top: 15 Bottom: 17

Table 13-4: Pile and Loading Properties

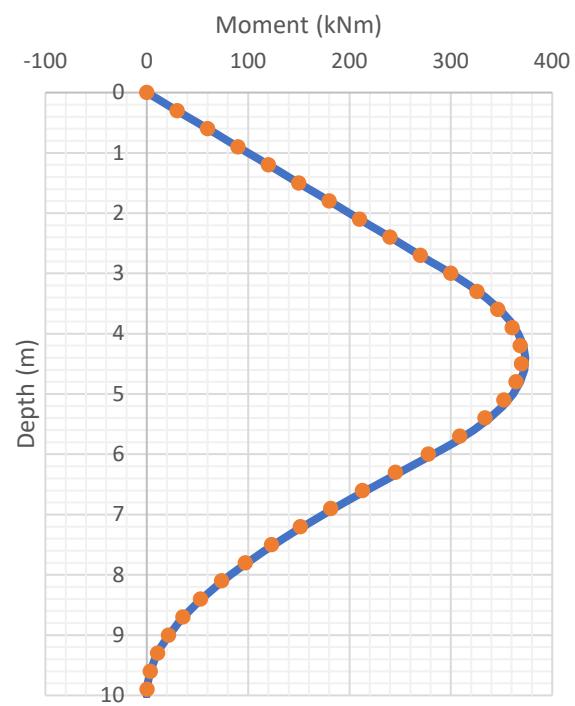
Parameter	Value
Cross Section	Pipe
Outer Diameter	0.6 m
Wall Thickness	0.1 m
Young's Modulus	200,000,000 kPa
Length	10 m
Ground Slope	5 degrees
Lateral/Shear Load	100 kN

c. Results

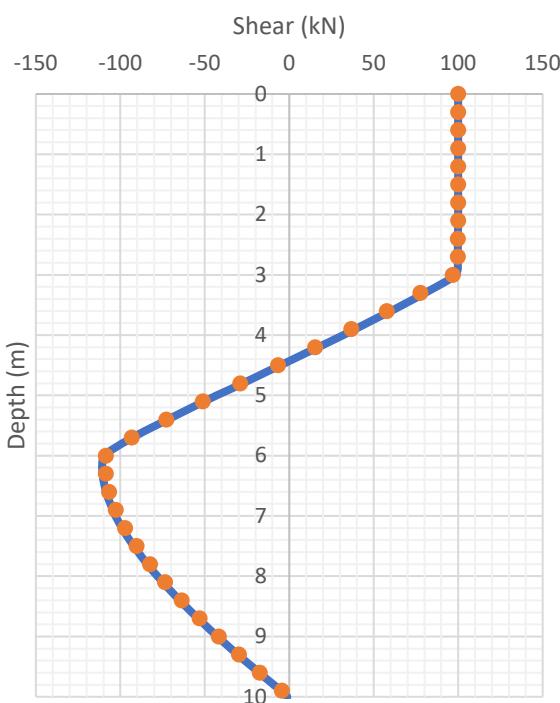
Displacement vs. Depth



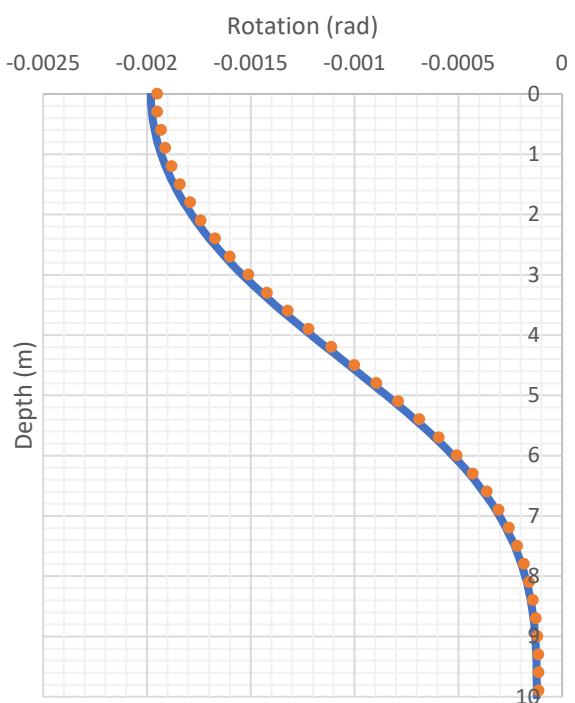
Moment vs. Depth



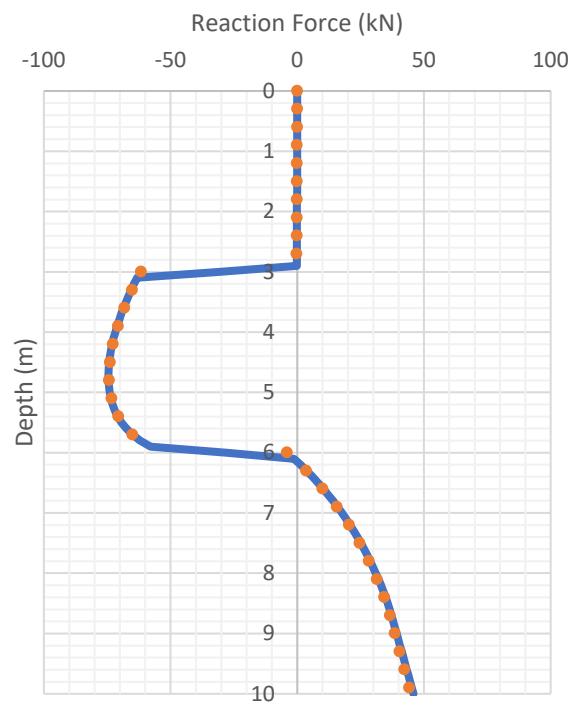
Shear vs. Depth



Rotation vs. Depth



Soil Reaction Force vs. Depth



Case 2

a. Problem Description

Problem 13, case 2 is a statically loaded pile in soil layers of sand and soft clay. The default PY curve was modified with py multipliers. Soil and pile properties are listed in tables 13-5 to 13-8 below.

b. Material Properties

Table 13-5: Layer 1 – Sand / Depth 0 m to 5 m

Parameter	Value
Unit Weight	15 kN/m ³
Friction Angle	30 degrees
Modulus (Kpy)	5400 kN/m ³

Table 13-6: Layer 2 – Soft Clay / Depth 5 m to 10 m

Parameter	Value
Unit Weight	10 kN/m ³
Undrained Shear Strength	25 kPa
E50	0.02

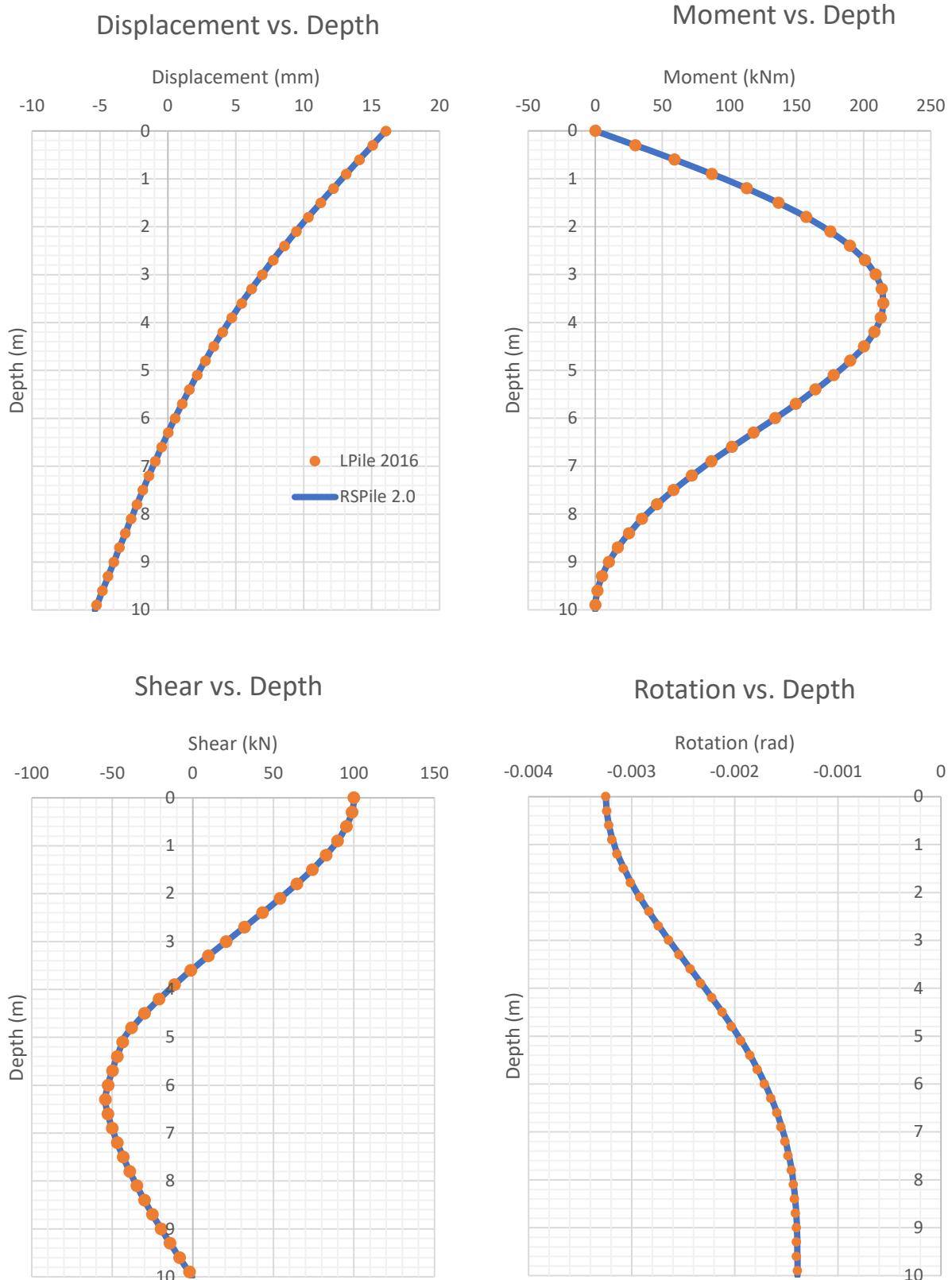
Table 13-7: PY Multipliers

Depth	P-Mult	Y-Mult
0	0.5	1.5
4	0.5	1.5
14	0.8	1.1

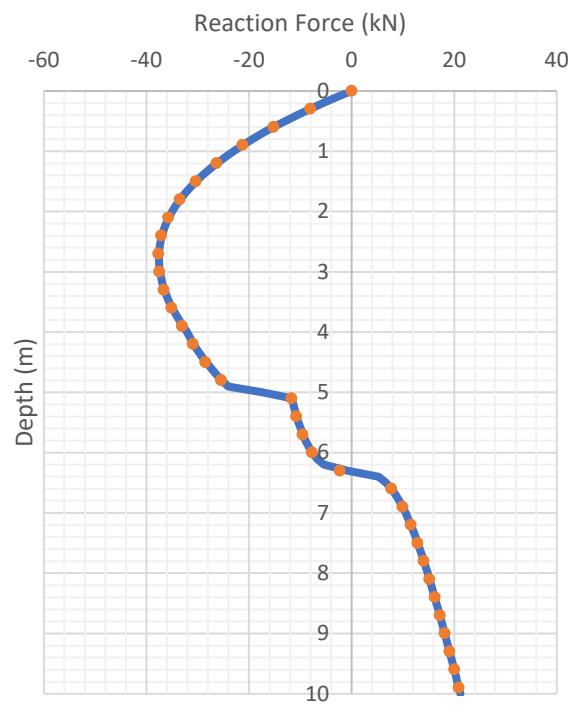
Table 13-8: Pile and Loading Properties

Parameter	Value
Cross Section	Circle
Outer Diameter	0.5 m
Young's Modulus	200,000,000 kPa
Length	10 m
Lateral/Shear Load	100 kN

c. Results



Soil Reaction Force vs. Depth



Case 3

a. Problem Description

Problem 13, case 3 is a statically loaded pile in soil layers of sand and liquefied sand. Soil and pile properties are listed in tables 13-9 to 13-11 below.

b. Material Properties

Table 13-9: Layer 1 – Sand / Depth 0 m to 5 m

Parameter	Value
Unit Weight	15 kN/m ³
Friction Angle	30 degrees
Modulus (Kpy)	5400 kN/m ³

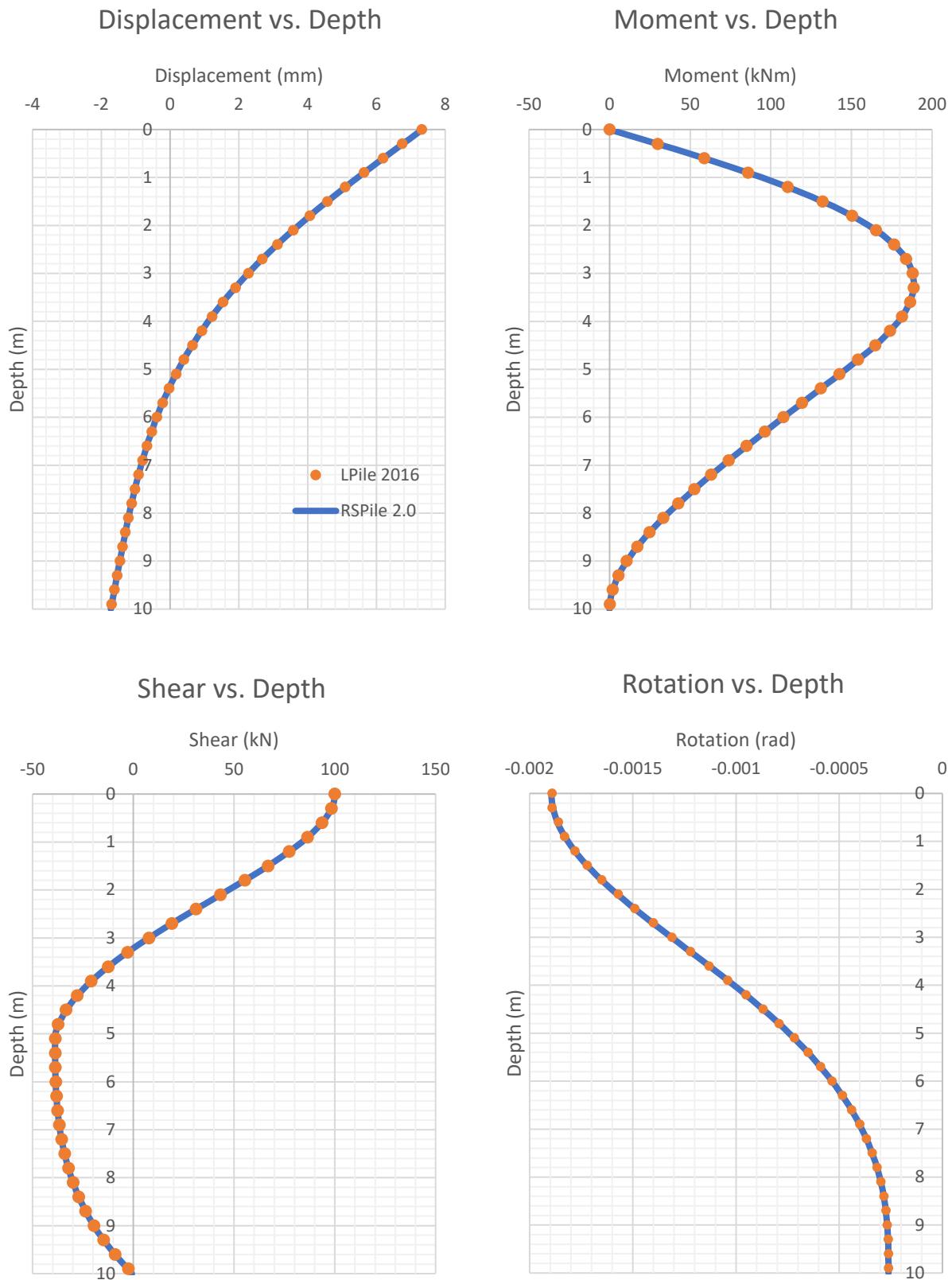
Table 13-10: Layer 2 –Liquefied Sand / Depth 5 m to 10 m

Parameter	Value
Unit Weight	8 kN/m ³

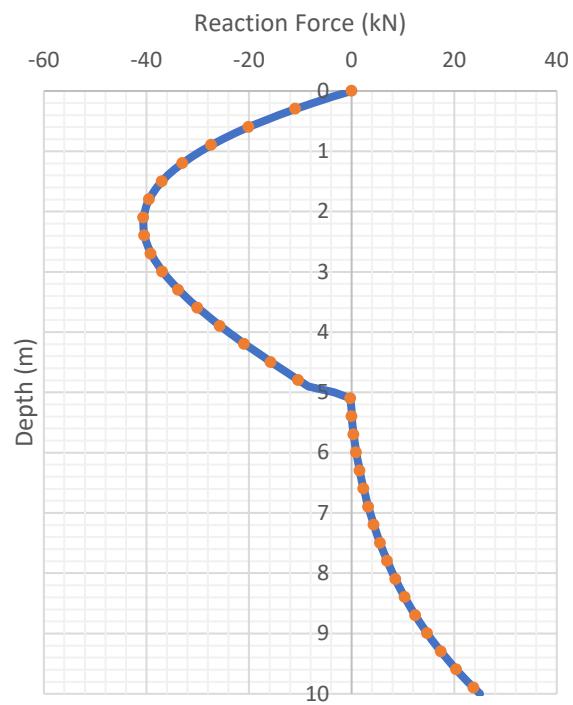
Table 13-11: Pile and Loading Properties

Parameter	Value
Cross Section	Circle
Outer Diameter	0.5 m
Young's Modulus	200,000,000 kPa
Length	10 m
Lateral/Shear Load	100 kN

c. Results



Soil Reaction Force vs. Depth



Case 4

a. Problem Description

Problem 13, case 4 is a statically loaded pile in soil layers of sand and soft clay. Soil and pile properties are listed in tables 13-12 to 13-14 below.

b. Material Properties

Table 13-12: Layer 1 –Sand / Depth 0 m to 5 m

Parameter	Value
Unit Weight	15 kN/m ³
Friction Angle	30 degrees
Modulus (Kpy)	5400 kN/m ³

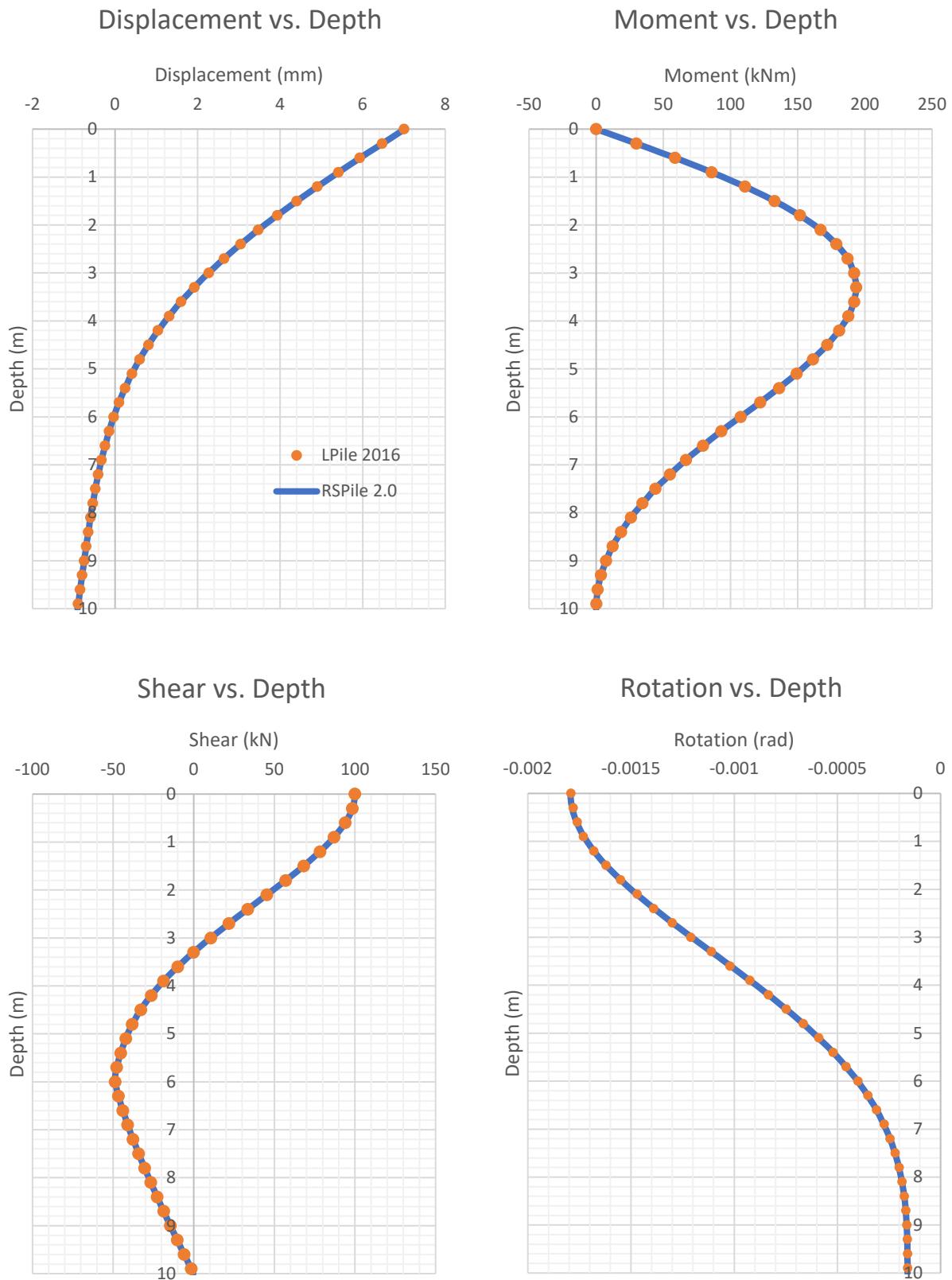
Table 13-13: Layer 2 – Soft Clay / Depth 0 m to 5 m

Parameter	Value
Unit Weight	8 kN/m ³
Cohesion	20 kPa
E50	0.02

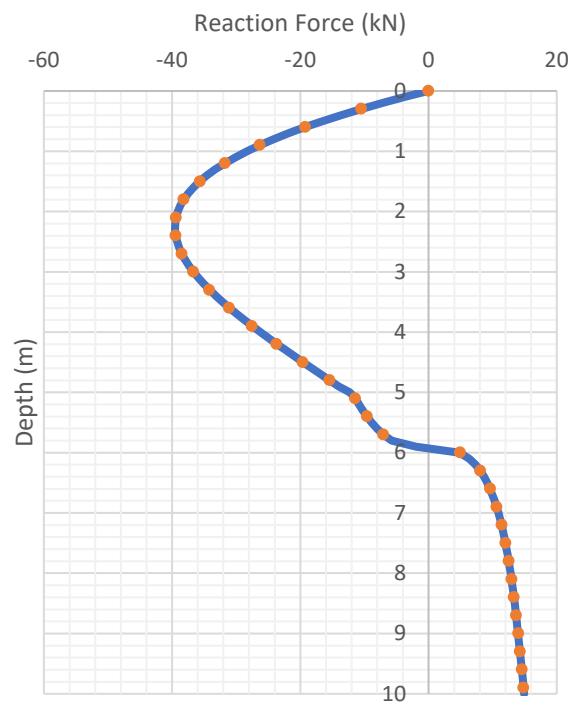
Table 13-14: Pile and Loading Properties

Parameter	Value
Cross Section	Circle
Outer Diameter	0.5 m
Young's Modulus	200,000,000 kPa
Length	10 m
Lateral/Shear Load	100kN

c. Results



Soil Reaction Force vs. Depth



Case 5

a. Problem Description

Problem 13, case 5 is a statically loaded pile in soil layers of sand and soft clay. Soil and pile properties are listed in the tables below.

b. Material Properties

Table 13-15: Layer 1 – API Sand / Depth 0 m to 2.5 m

Parameter	Value
Unit Weight	Top: 12 kN/m ³
Friction Angle	Top: 30 degrees Bottom: 20 degrees
Modulus (Kpy)	5,000 kN/m ³

Table 13-16: Layer 2 – Soft Clay / Depth 2.5 m to 5 m

Parameter	Value
Unit Weight	Top: 14 kN/m ³ Bottom: 15 kN/m ³
Cohesion	Top: 20 kPa Bottom: 30 kPa
E50	Top: 0.02 Bottom: 0.01

Table 13-17: Layer 3 – Reese Sand / Depth 5 m to 7.5 m

Parameter	Value
Unit Weight	Top: 15 kN/m ³ Bottom: 18 kN/m ³
Friction Angle	Top: 20 kPa Bottom: 30 kPa
Modulus (Kpy)	Top: 0.02 Bottom: 0.01

Table 13-18: Layer 4 – Submerged Stiff Clay / Depth 7.5 m to 10 m

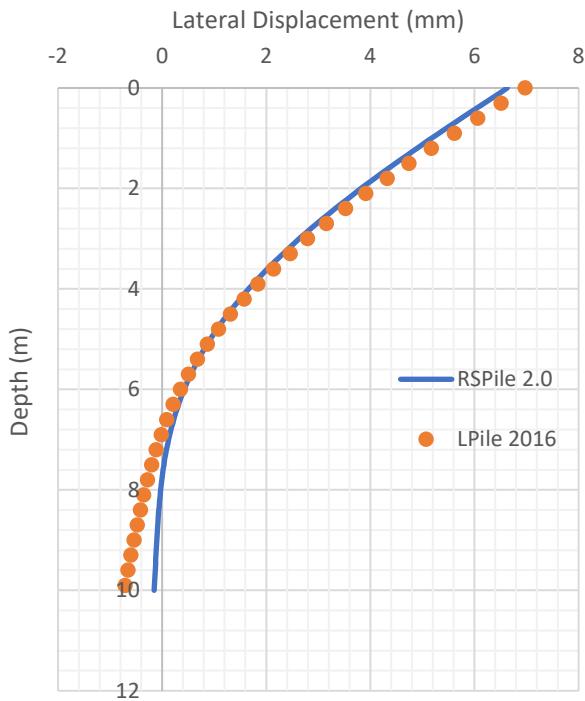
Parameter	Value
Unit Weight	Top: 17 kN/m ³ Bottom: 19 kN/m ³
Cohesion	Top: 80 kPa Bottom: 100 kPa
E50	0.01
Initial Stiffness Factor (K _s)	Top: 5000 kN/m ³ Bottom: 6000 kN/m ³

Table 13-19: Pile and Loading Properties

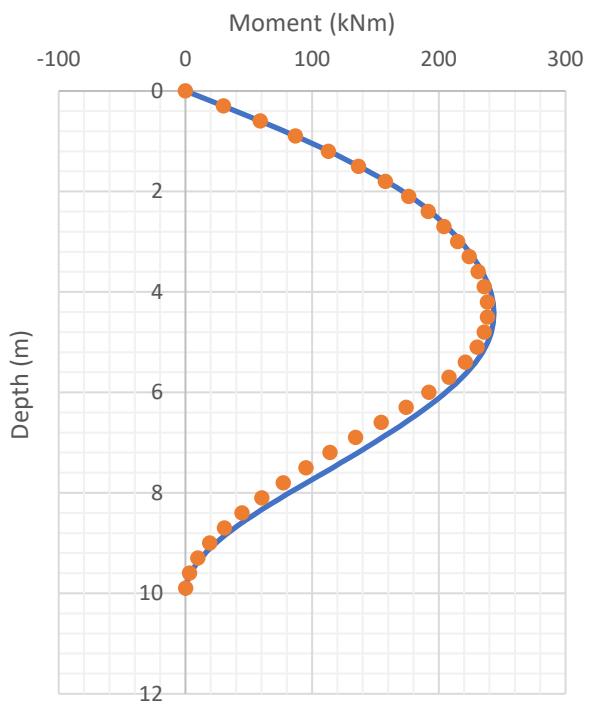
Parameter	Value
Cross Section	Pipe
Outer Diameter	0.6
Thickness	0.1
Young's Modulus	200,000,000 kPa
Length	10 m
Lateral/Shear Load	100kN

c. Results

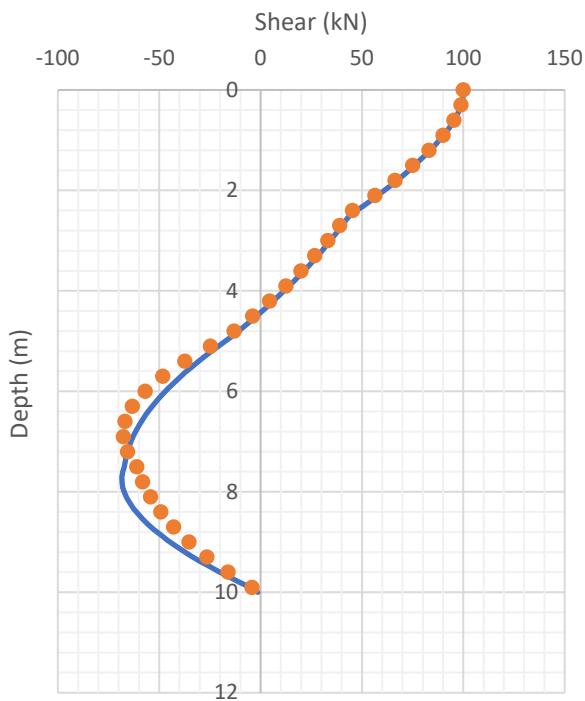
Lateral Displacement Vs. Depth



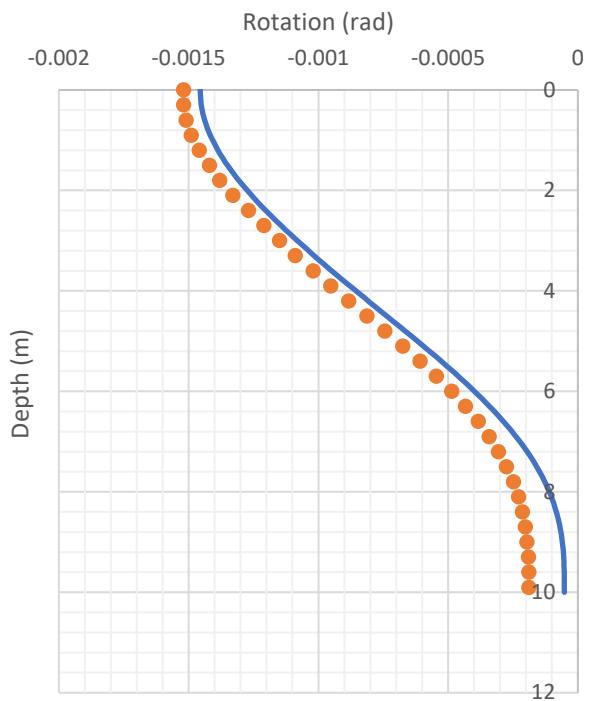
Moment Vs. Depth



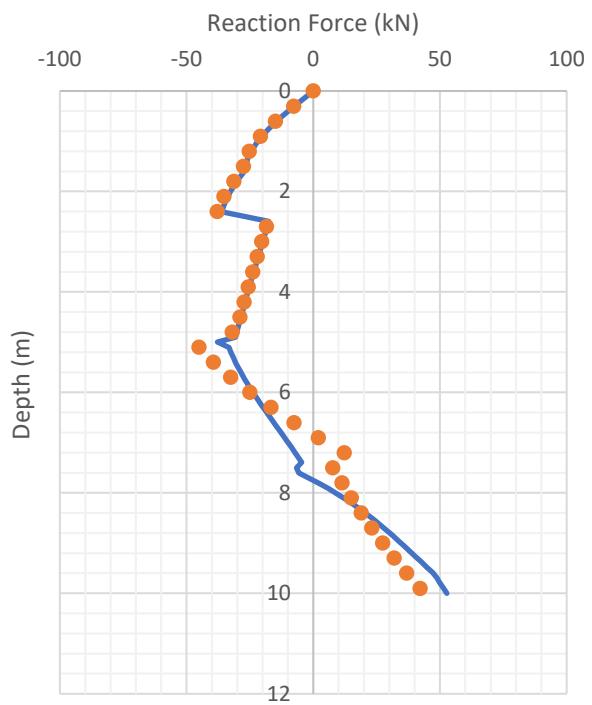
Shear Vs. Depth



Rotation Vs. Depth



Soil Reaction Force Vs. Depth



Case 6

a. Problem Description

Problem 13, case 6 is a statically loaded pile in soil layers of API Sand, Liquefied Hybrid Sand, Elastic, and Sand. Soil and pile properties are listed in the tables below.

b. Material Properties

Table 13-20: Layer 1 – API Sand / Depth 0 m to 2.5 m

Parameter	Value
Unit Weight	12 kN/m ³
Friction Angle	20 degrees
Modulus (Kpy)	5,000 kN/m ³

Table 13-21: Layer 2 – Liquefied Hybrid Sand / Depth 2.5 m to 5 m

Parameter	Value
Unit Weight	10 kN/m ³
SPT Blow count	13

Table 13-22: Layer 3 – Elastic / Depth 5 m to 7.5 m

Parameter	Value
Unit Weight	15 kN/m ³
Modulus (Kpy)	5,000 kN/m ³

Table 13-23: Layer 4 – Reese Sand / Depth 7.5 m to 10 m

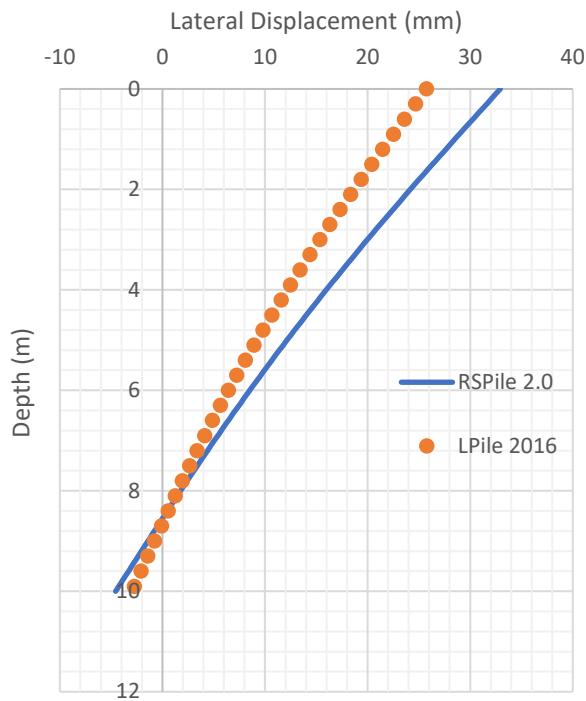
Parameter	Value
Unit Weight	15 kN/m ³
Friction Angle	30 degrees
Modulus (Kpy)	5,000 kN/m ³

Table 13-24: Pile and Loading Properties

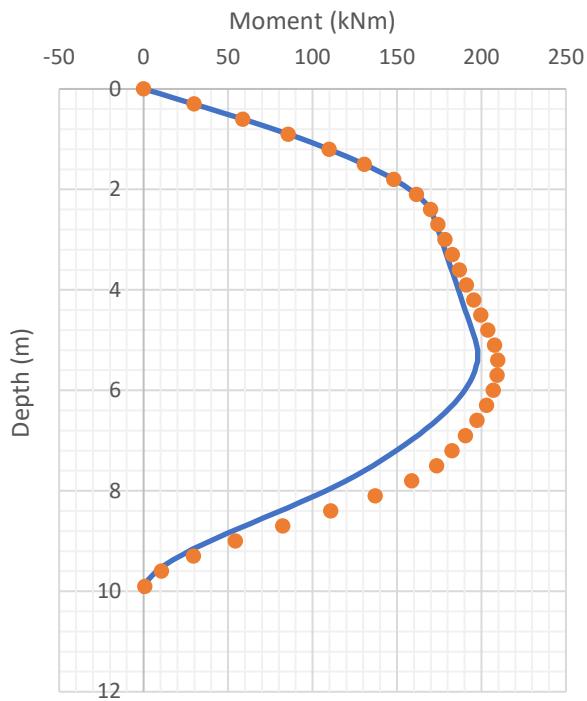
Parameter	Value
Cross Section	Pipe
Outer Diameter	0.6
Thickness	0.1
Young's Modulus	200,000,000 kPa
Length	10 m
Lateral/Shear Load	100kN

c. Results

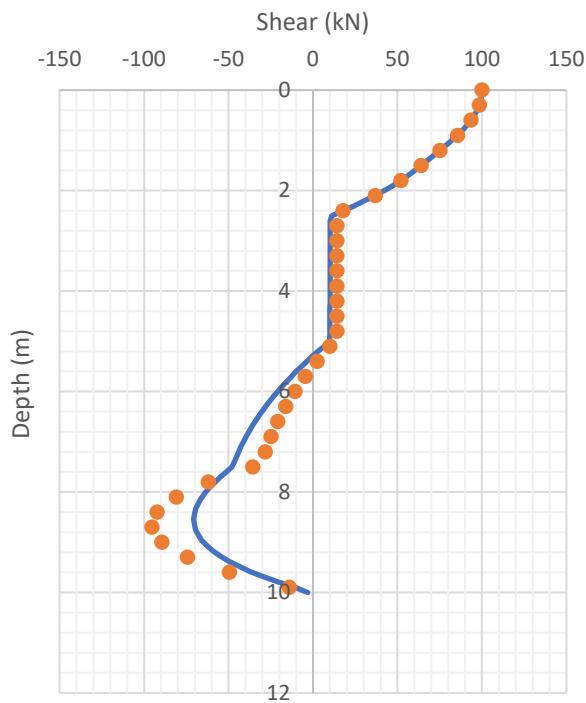
Lateral Displacement Vs. Depth



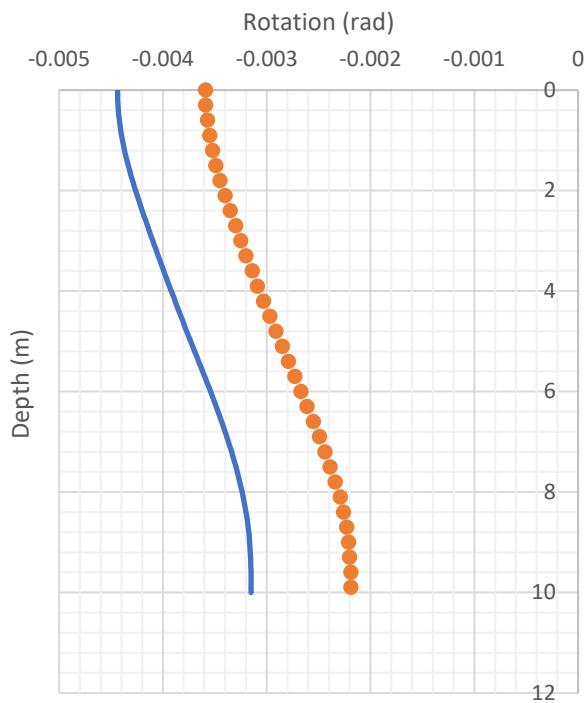
Moment Vs. Depth



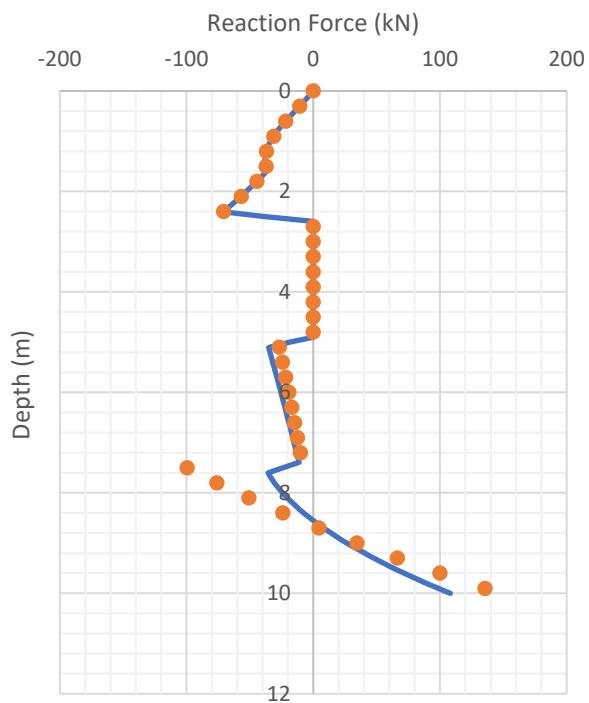
Shear Vs. Depth



Rotation Vs. Depth



Soil Reaction Force Vs. Depth



Case 7

a. Problem Description

Problem 13, case 7 is a statically loaded pile in soil layers of API Sand, Strong Rock, Soft Clay, and Reese Sand. Soil and pile properties are listed in the tables below.

b. Material Properties

Table 13-25: Layer 1 – API Sand / Depth 0 m to 2.5 m

Parameter	Value
Unit Weight	12 kN/m ³
Friction Angle	20 degrees
Modulus (Kpy)	5,000 kN/m ³

Table 13-26: Layer 2 – Strong Rock / Depth 2.5 m to 5 m

Parameter	Value
Unit Weight	18 kN/m ³
UCS	5,000 kPa

Table 13-27: Layer 3 – Soft Clay / Depth 5 m to 7.5 m

Parameter	Value
Unit Weight	15 kN/m ³
Cohesion	20 kPa
E50	0.01

Table 13-28: Layer 4 – Reese Sand / Depth 7.5 m to 10m

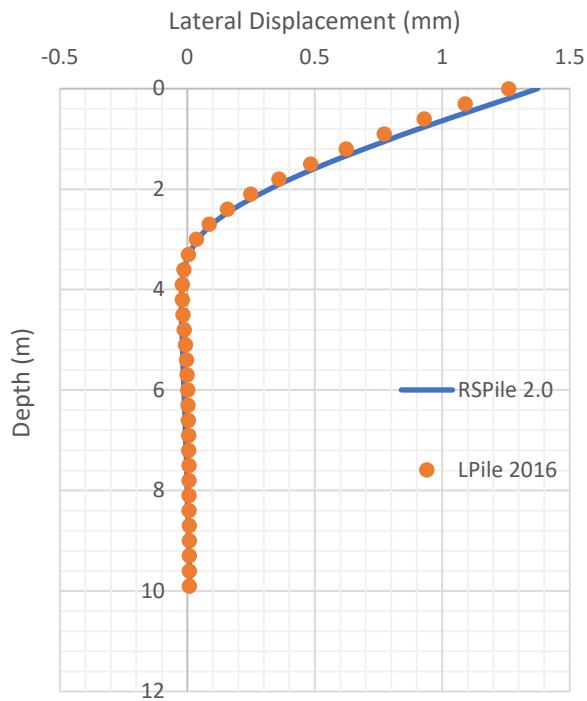
Parameter	Value
Unit Weight	16 kN/m ³
Friction Angle	30 degrees
Modulus (Kpy)	5,000 kN/m ³

Table 13-29: Pile and Loading Properties

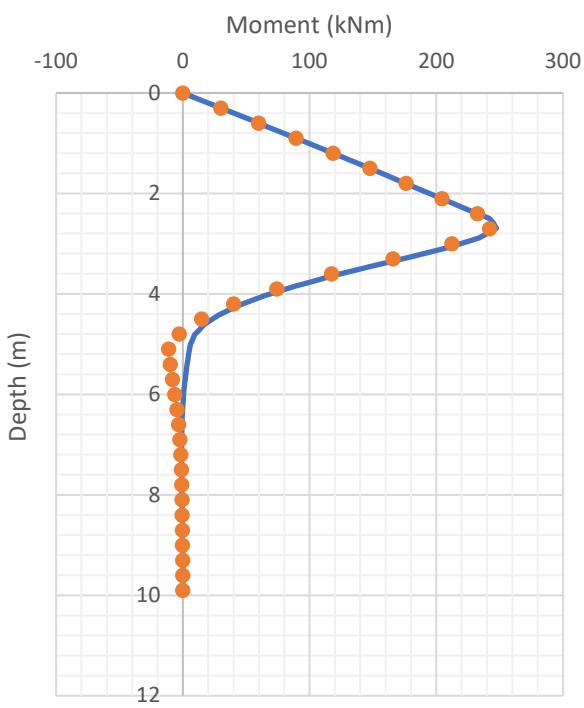
Parameter	Value
Cross Section	Pipe
Outer Diameter	0.6
Thickness	0.1
Young's Modulus	200,000,000 kPa
Length	10 m
Lateral/Shear Load	100kN

c. Results

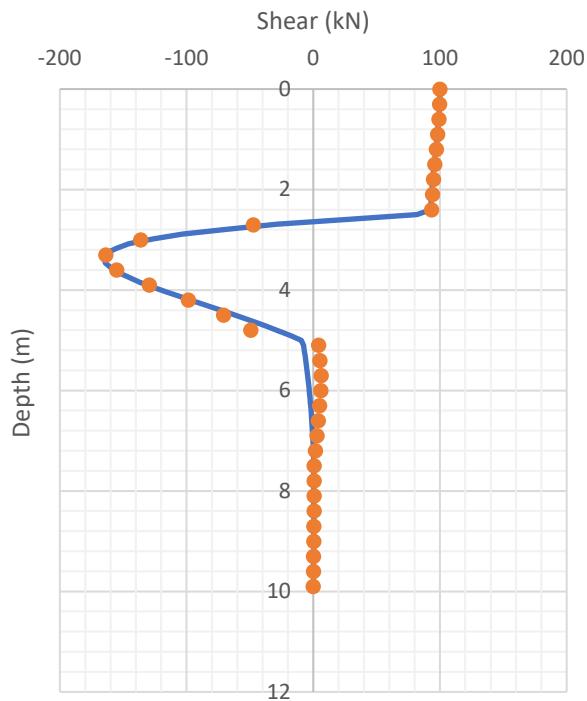
Lateral Displacement Vs. Depth



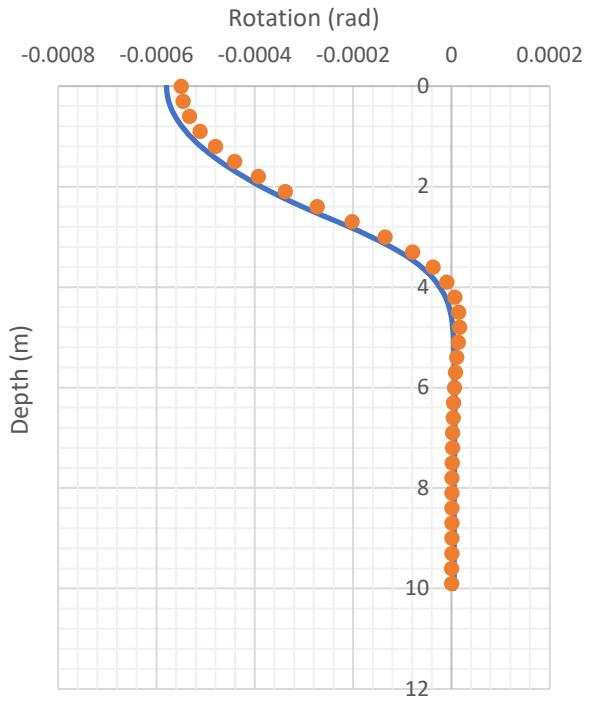
Moment Vs. Depth



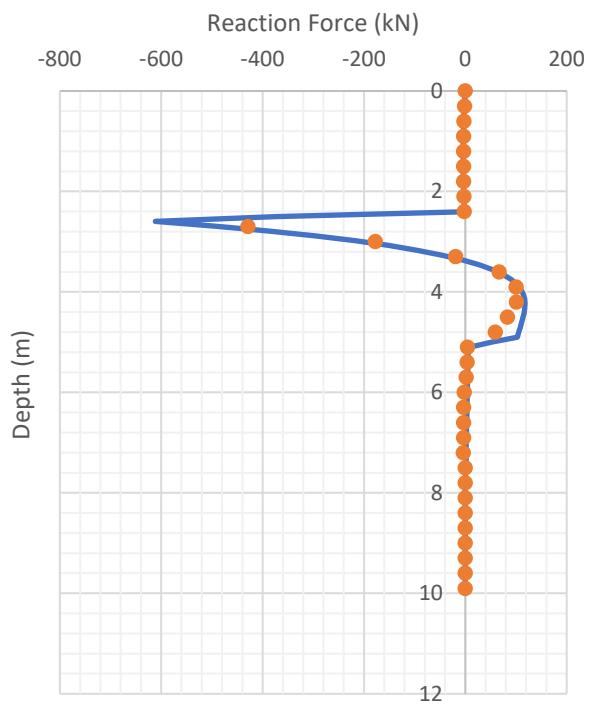
Shear Vs. Depth



Rotation Vs. Depth



Soil Reaction Force Vs. Depth



RSPile Verification Problem #14

Hybrid liquefied sand, lateral and axial loading

Case 1

a. Problem Description

Problem 14, case 1 is a statically loaded pile in a single layer of hybrid liquefied sand. Soil and pile properties are listed in tables 14-1 and 14-2 below.

b. Material Properties

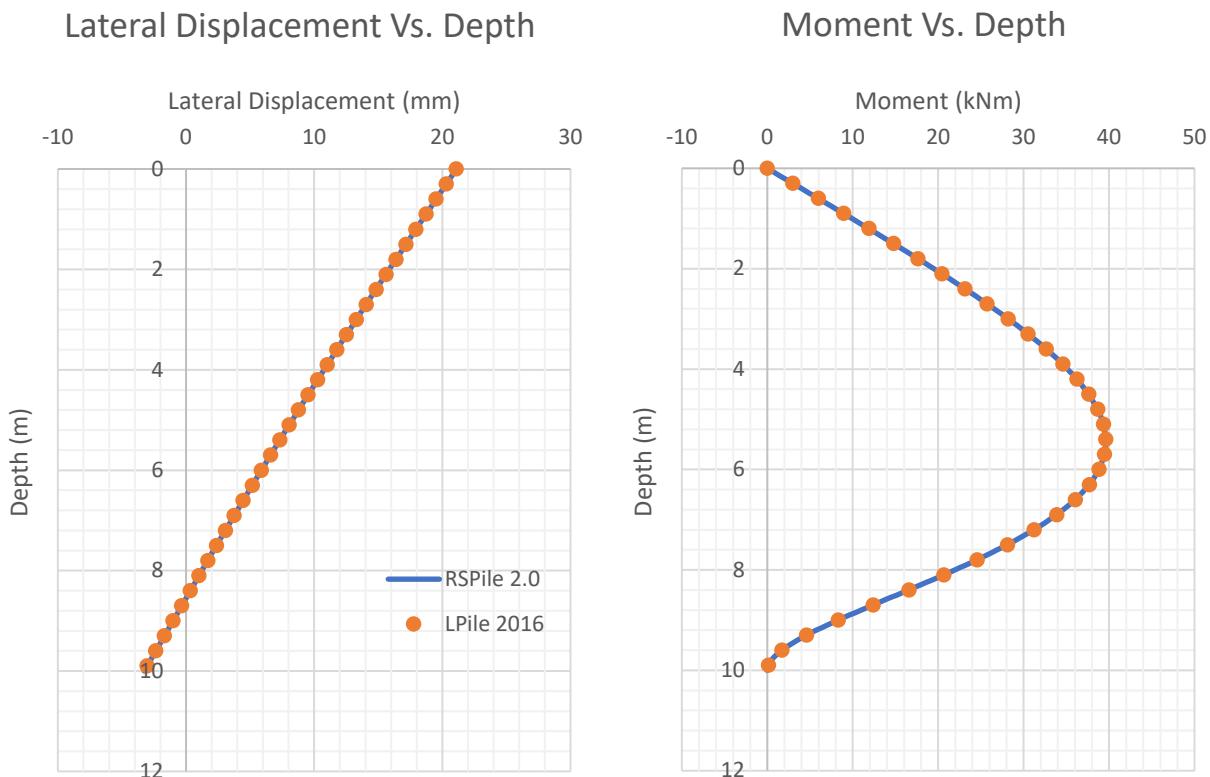
Table 14-1: Hybrid Liquefied Sand Properties

Parameter	Value
General Properties	
Unit Weight	8 kN/m ³
Strain Factor	-
Cohesion	-
SPT	15
Laterally Loaded Piles	
Soil type	Hybrid liquefied sand
Soil Layer Thickness	10 m

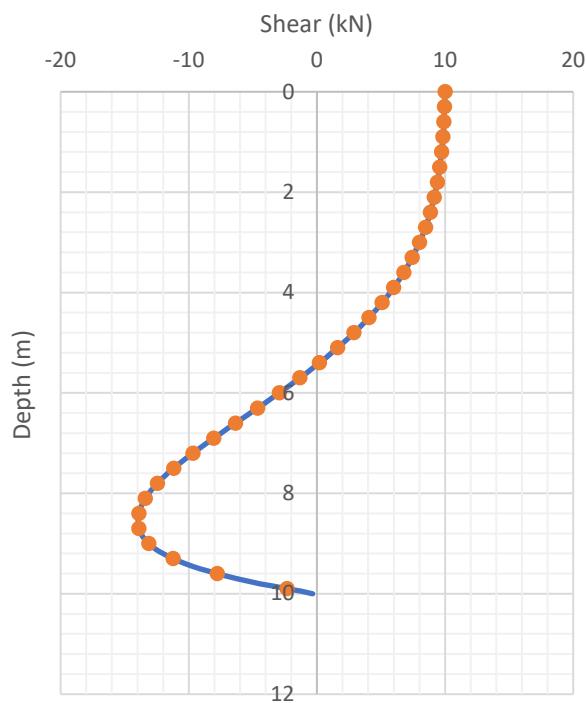
Table 14-2: Pile and Loading Properties

Parameter	Value
Cross Section	Circle
Diameter	0.5 m
Young's Modulus	200,000,000 kPa
Length	10 m
Lateral / Shear Load	10 kN
Axial Load (for LPile only)	1 kN

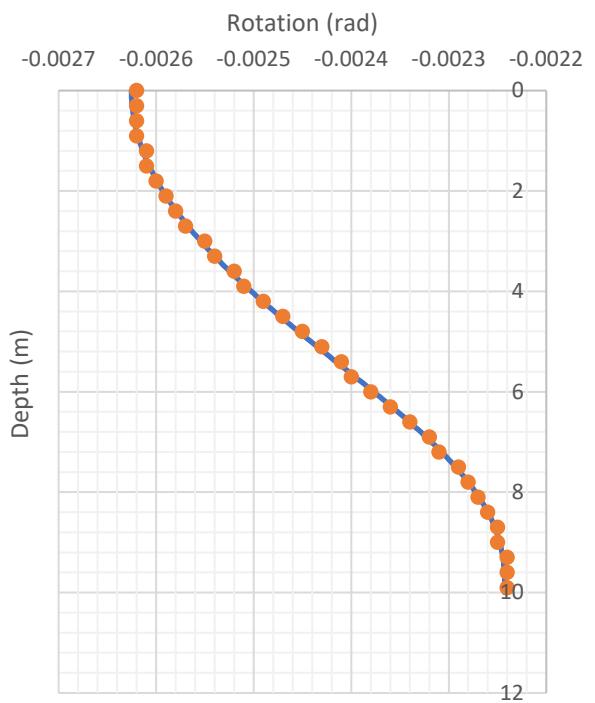
c. Results



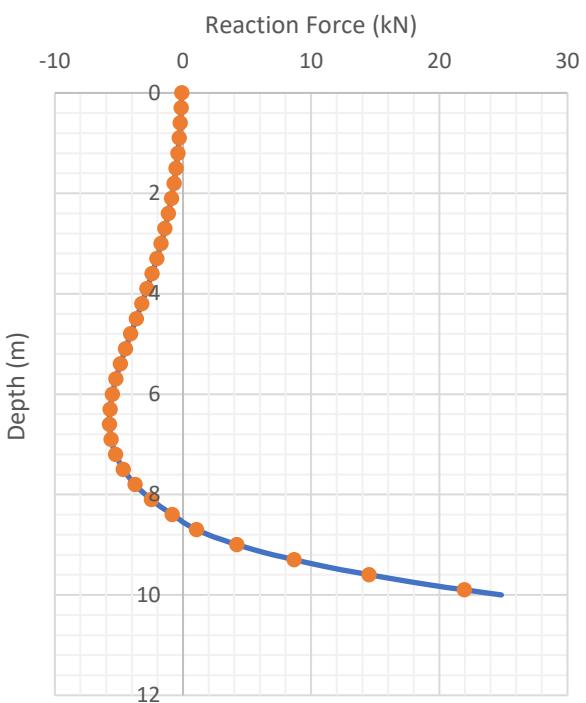
Shear Vs. Depth



Rotation Vs. Depth



Soil Reaction Force Vs. Depth



Case 2

a. Problem Description

Problem 14, case 2 is a statically loaded pile in a single layer of hybrid liquefied sand. Soil and pile properties are listed in the tables below.

b. Material Properties

Table 14-3: Hybrid Liquefied Sand Properties

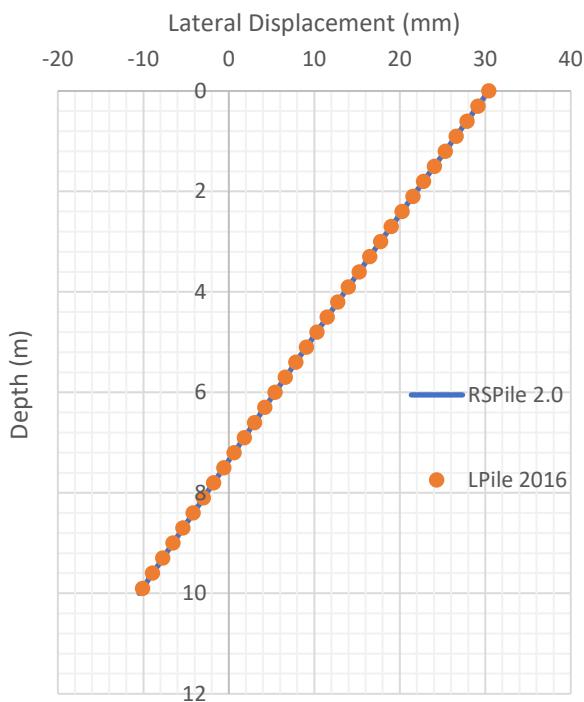
Parameter	Value
General Properties	
Unit Weight	8 kN/m ³
Strain Factor	-
Cohesion	-
SPT	5
Laterally Loaded Piles	
Soil type	Hybrid liquefied sand
Soil Layer Thickness	10 m

Table 14-4: Pile and Loading Properties

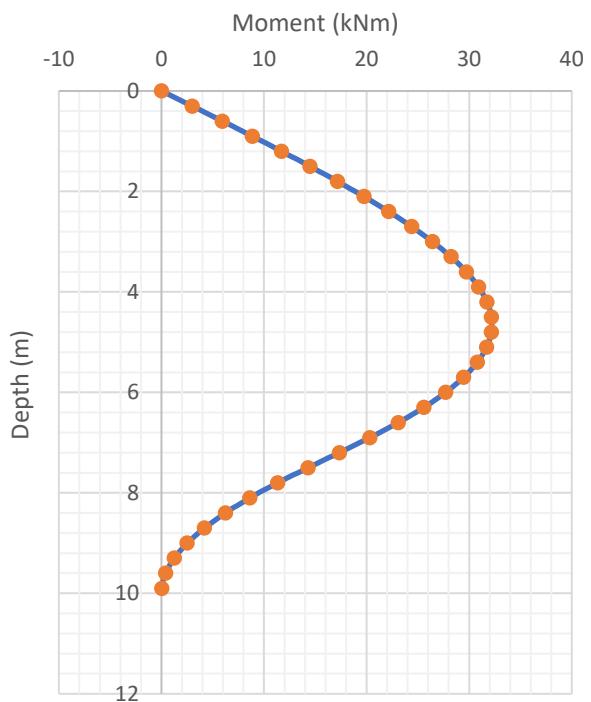
Parameter	Value
Cross Section	Circle
Diameter	0.5 m
Young's Modulus	200,000,000 kPa
Length	10 m
Lateral / Shear Load	10 kN
Axial Load (for LPile only)	1 kN

c. Results

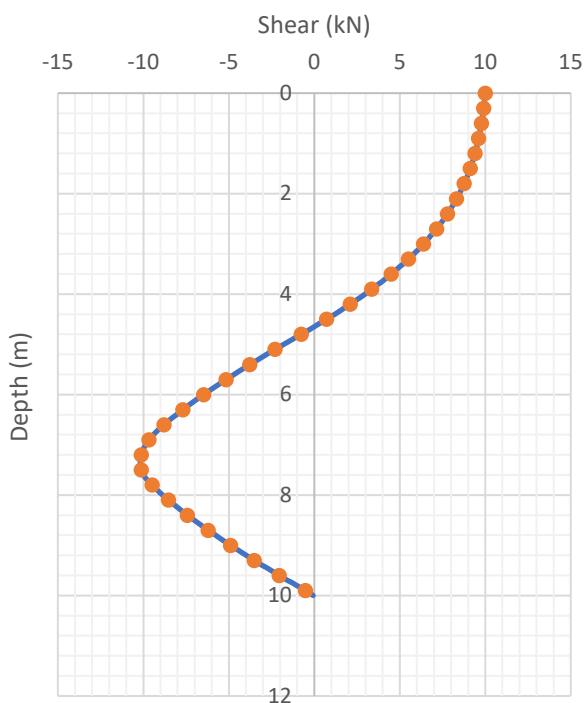
Lateral Displacement Vs. Depth



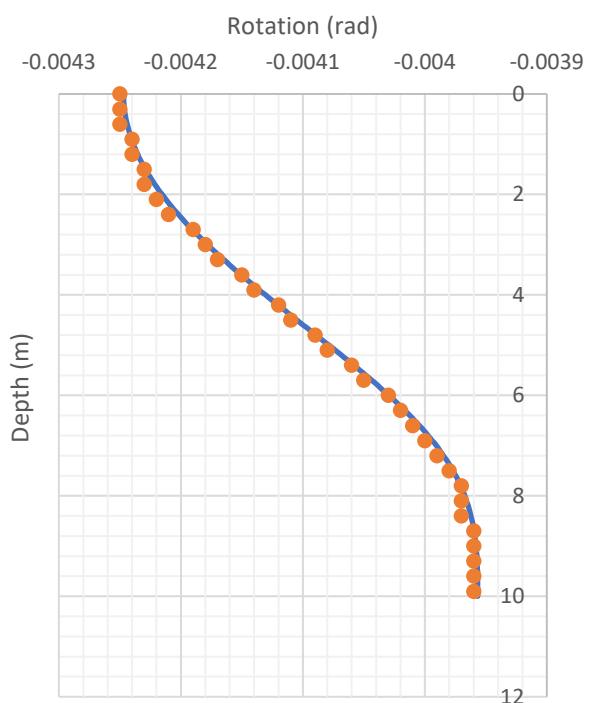
Moment Vs. Depth



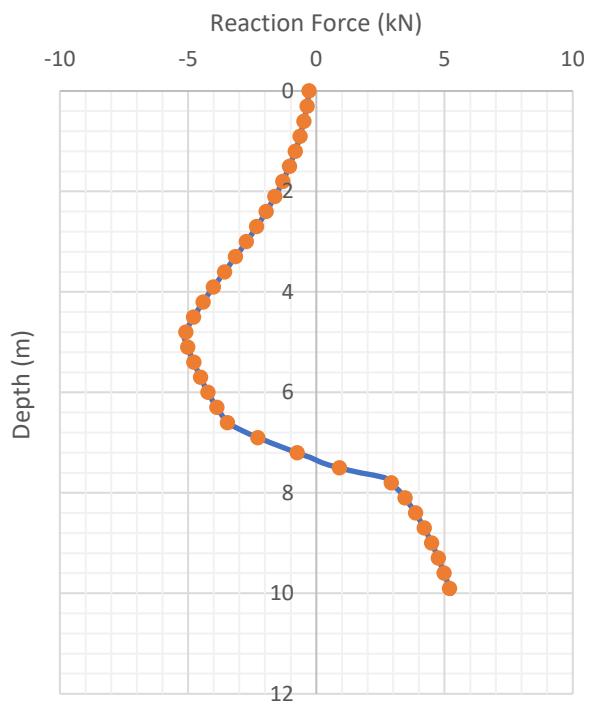
Shear Vs. Depth



Rotation Vs. Depth



Soil Reaction Force Vs. Depth



Case 3

a. Problem Description

Problem 14, case 3 is a statically loaded pile in a single layer of hybrid liquefied sand. Soil and pile properties are listed in the tables below.

b. Material Properties

Table 14-5: Hybrid Liquefied Sand Properties

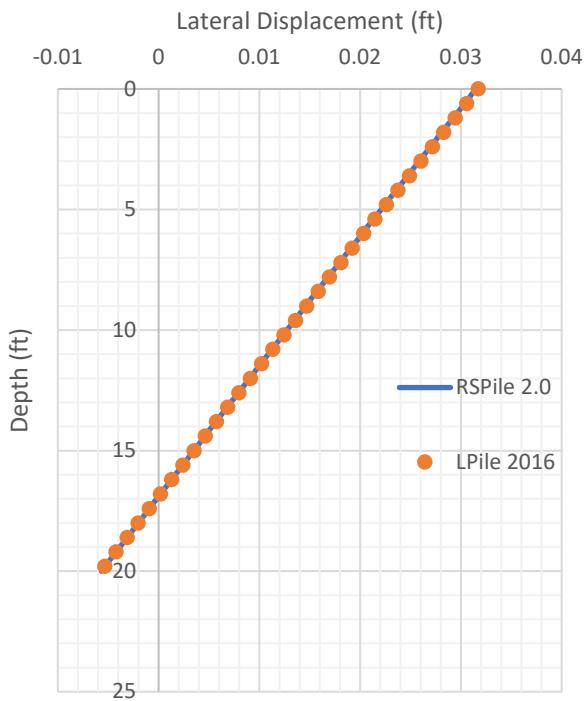
Parameter	Value
General Properties	
Unit Weight	50 lb/ft ³
Laterally Loaded Piles	
Soil type	Hybrid liquefied sand
SPT	12
Soil Layer Thickness	20 ft

Table 14-6: Pile and Loading Properties

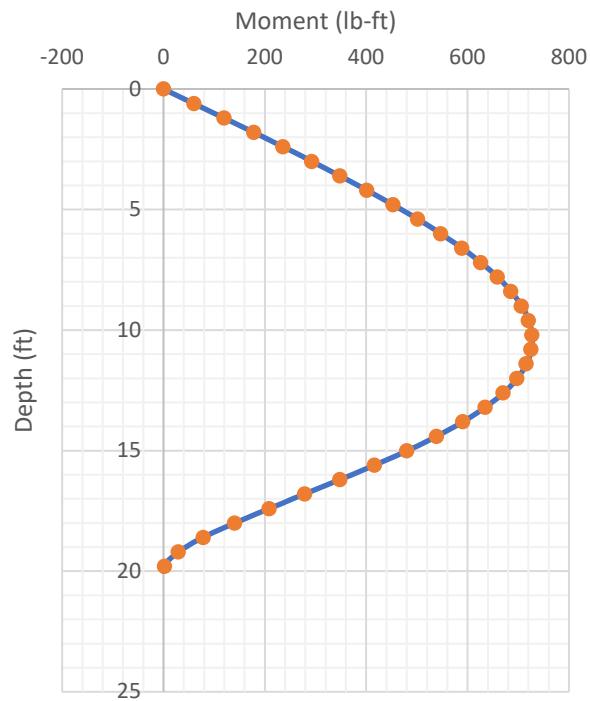
Parameter	Value
Cross Section	Circle
Diameter	2 ft
Young's Modulus	200,000,000 psf
Length	20 ft
Lateral / Shear Load	100 lb
Axial Load (for LPile only)	2 lb

c. Results

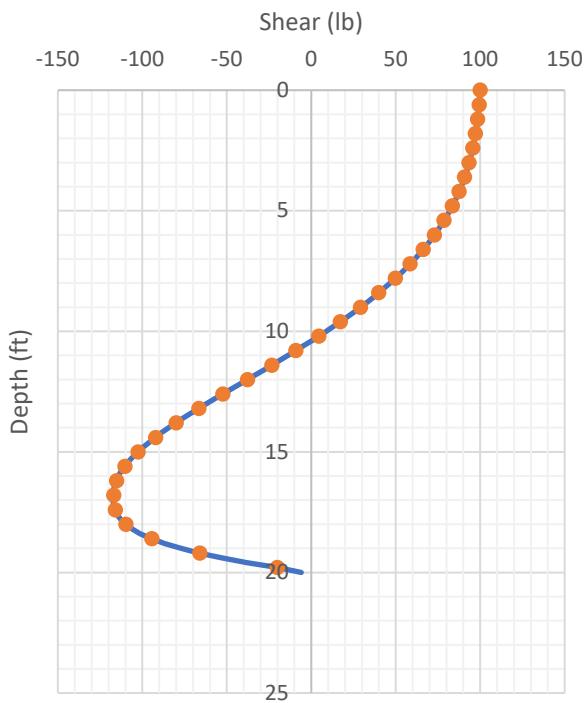
Lateral Displacement Vs. Depth



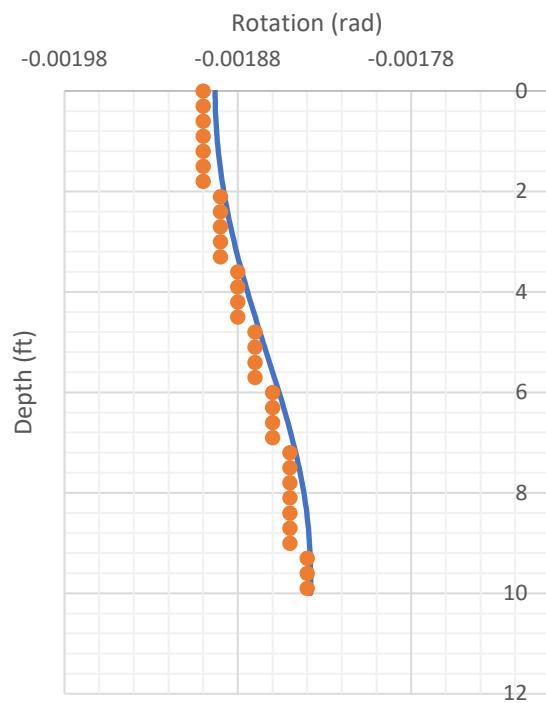
Moment Vs. Depth



Shear Vs. Depth



Rotation Vs. Depth



RSPile Verification Problem #15

Submerged Stiff Clay, static lateral loading

Case 1

a. Problem Description

Problem 15, case 1 is a statically loaded pile in a single layer of submerged stiff clay. Soil and pile properties are listed in tables below.

b. Material Properties

Table 15-1: Submerged Stiff Clay Properties

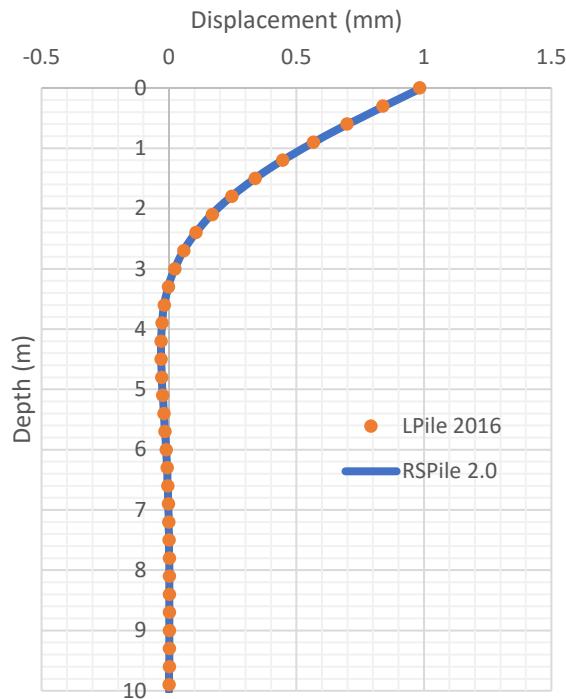
Parameter	Value
General Properties	
Unit Weight	8 kN/m ³
Strain Factor	0.005
Undrained Shear Strength	100 kPa
Initial Stiffness	135,000 kN/m ³
Laterally Loaded Piles	
Soil Type	Submerged stiff clay
Soil Layer Thickness	10 m

Table 15-2: Pile and Loading Properties

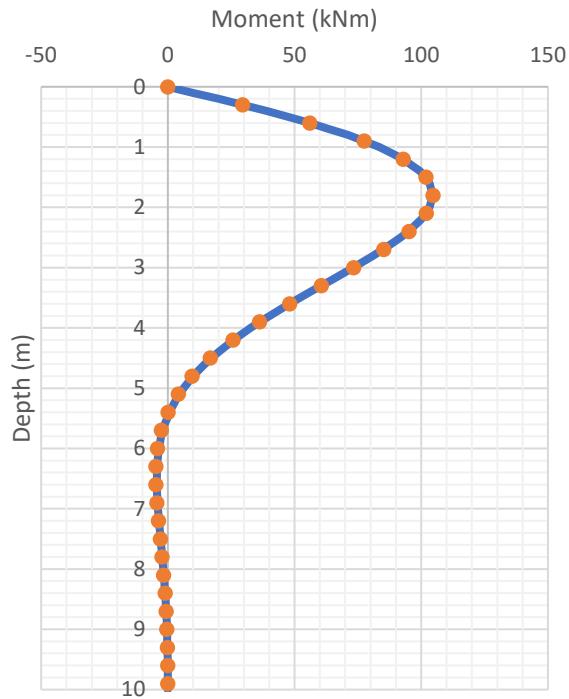
Parameter	Value
Cross Section	Circle
Diameter	0.5m
Young's Modulus	200,000,000 kPa
Length	10 m
Lateral/Shear Load	100 kN

c. Results

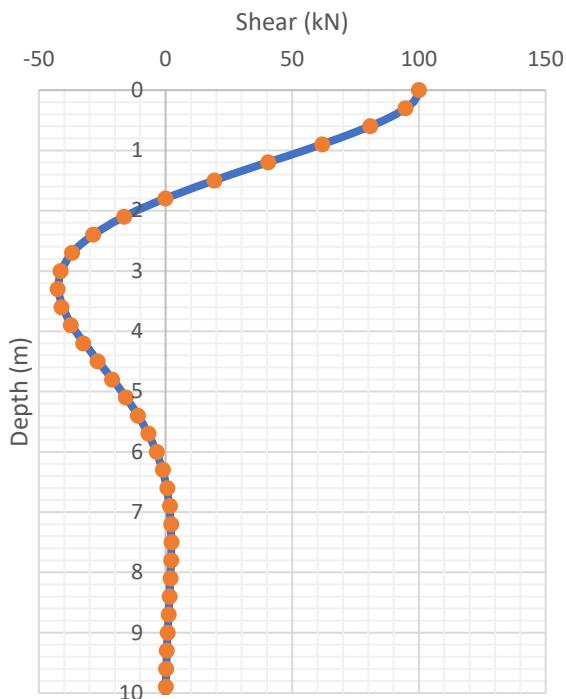
Displacement vs. Depth



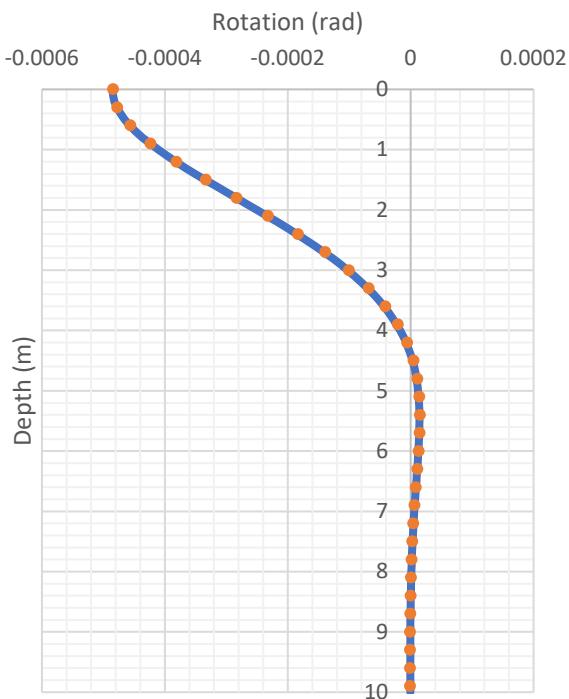
Moment vs. Depth



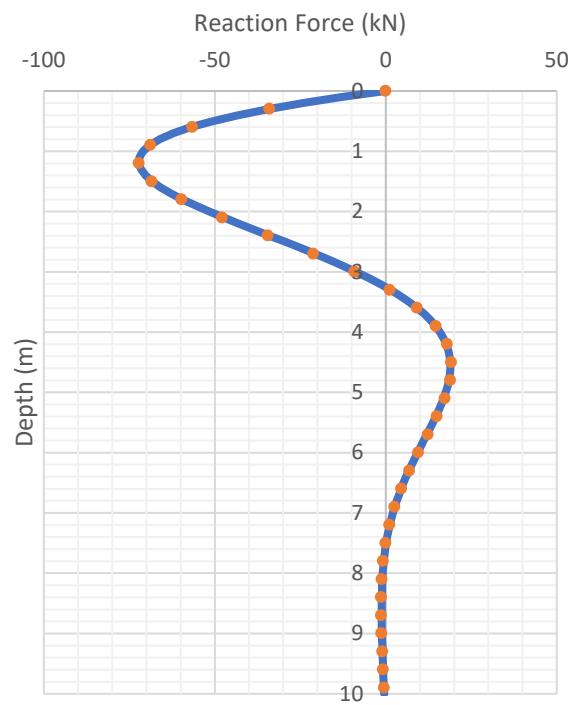
Shear vs. Depth



Rotation vs. Depth



Soil Reaction Force vs. Depth



Case 2

a. Problem Description

Problem 15, case 2 is a laterally loaded pile in submerged stiff clay subjected to a cyclic load. The pile and soil properties are listed in the tables below.

b. Material Properties

Table 15-3: Submerged Stiff Clay Properties

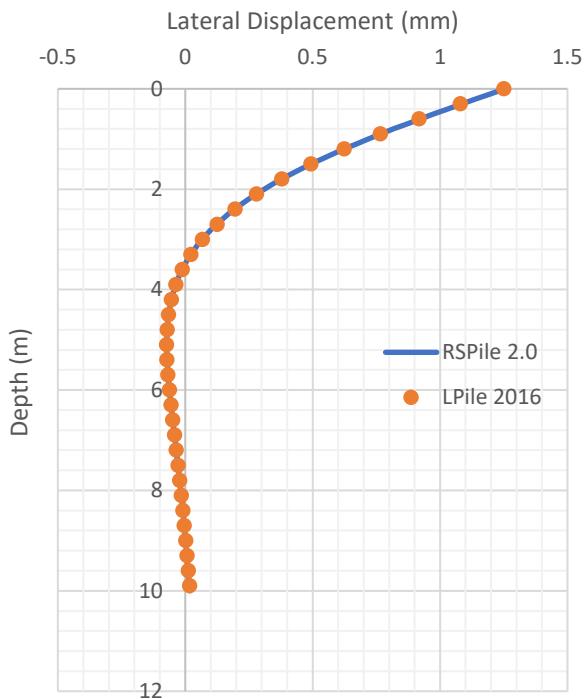
Parameter	Value
General Properties	
Unit Weight	8 kN/m ³
Strain Factor	0.005
Undrained Shear Strength	100 kPa
Initial Stiffness	135,000 kN/m ³
Laterally Loaded Piles	
Soil Type	Submerged stiff clay
Soil Layer Thickness	10 m

Table 15-2: Pile and Loading Properties

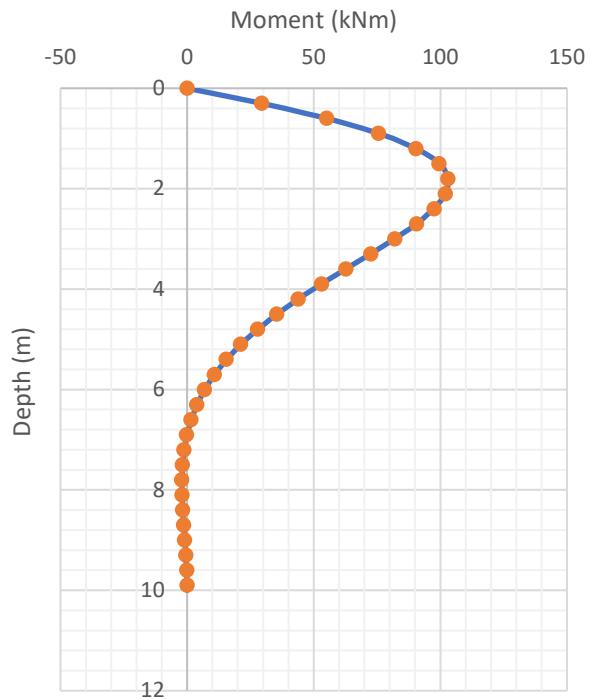
Parameter	Value
Cross Section	Circle
Diameter	0.5m
Young's Modulus	200,000,000 kPa
Length	10 m
Lateral/Shear Load	100 kN
Number of Load Cycles	50

c. Results

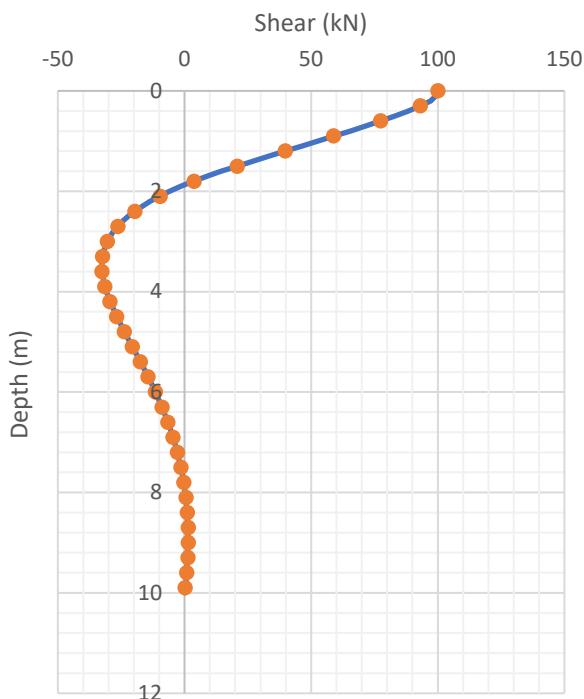
Lateral Displacement Vs. Depth



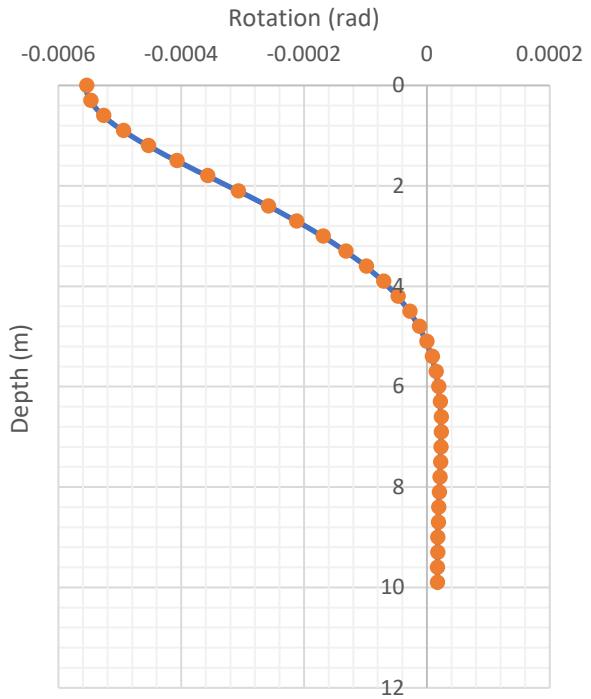
Moment Vs. Depth



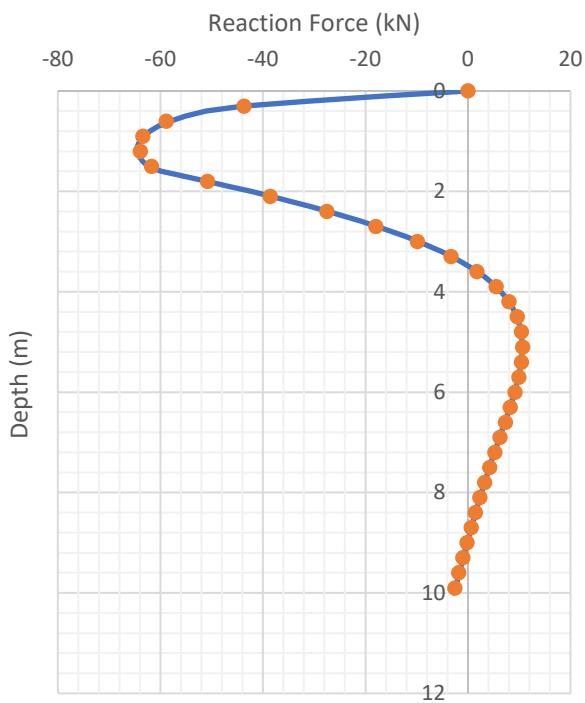
Shear Vs. Depth



Rotation Vs. Depth



Soil Reaction Force Vs. Depth



Case 3

a. Problem Description

Problem 15, case 3 is a laterally loaded pile in submerged stiff clay. The pile and soil properties are listed in the tables below.

b. Material Properties

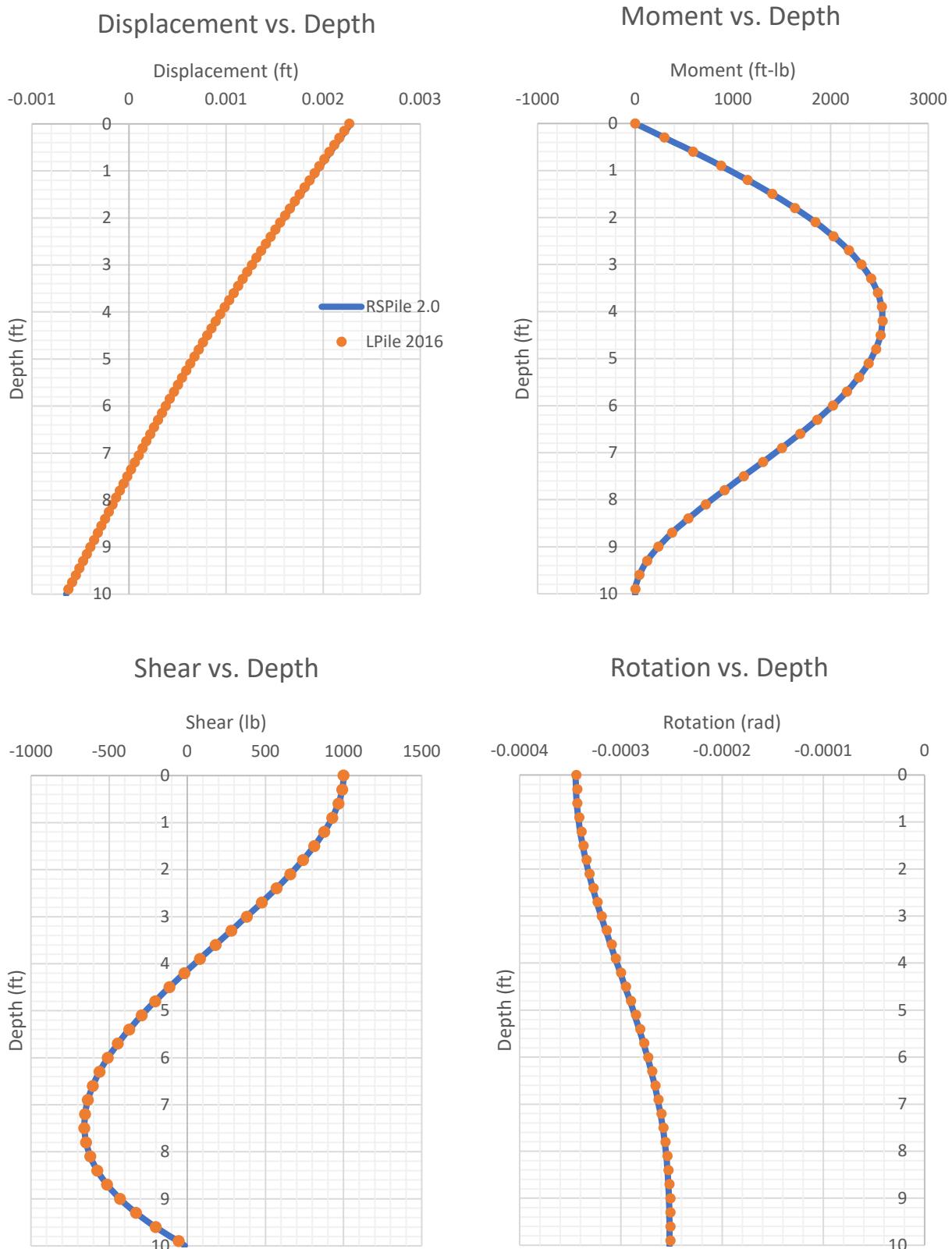
Table 15-3: Submerged Stiff Clay Properties

Parameter	Value
General Properties	
Unit Weight	50 lb/ft ³
Strain Factor	0.01
Undrained Shear Strength	500 psf
Initial Stiffness	86,400 lb/ft ³
Laterally Loaded Piles	
Soil Type	Submerged stiff clay
Soil Layer Thickness	10 ft

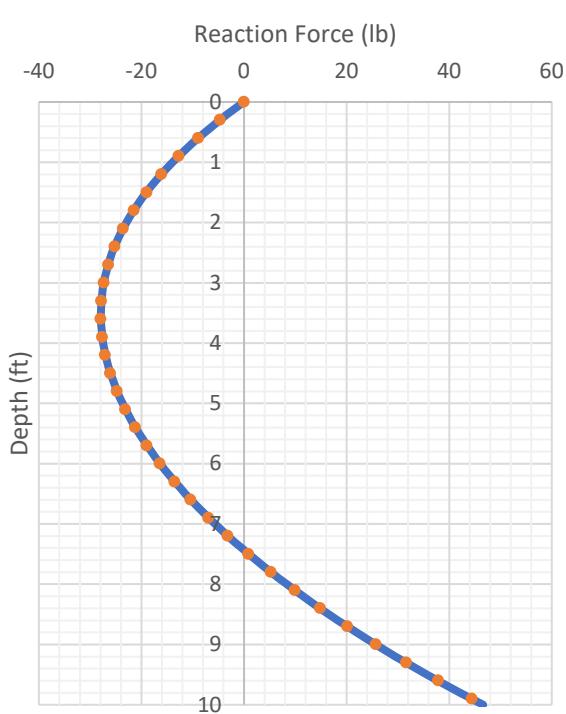
Table 15-2: Pile and Loading Properties

Parameter	Value
Cross Section	Circle
Diameter	2 ft
Young's Modulus	200,000,000 psf
Length	10 ft
Lateral/Shear Load	1000 lb

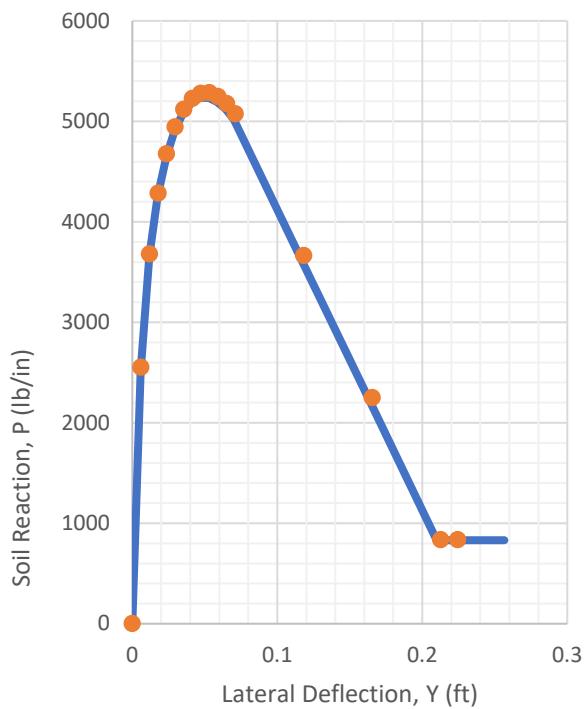
c. Results



Soil Reaction Force vs. Depth



PY Curve at 5 ft Depth



RSPile Verification Problem #16

Strong rock soil, lateral loading

Case 1

a. Problem Description

Problem 16, case 1 is a statically loaded pile in a single layer of strong rock. Soil and pile properties are listed in tables 16.1 and 16.2 below.

b. Material Properties

Table 16-1: Strong Rock Properties

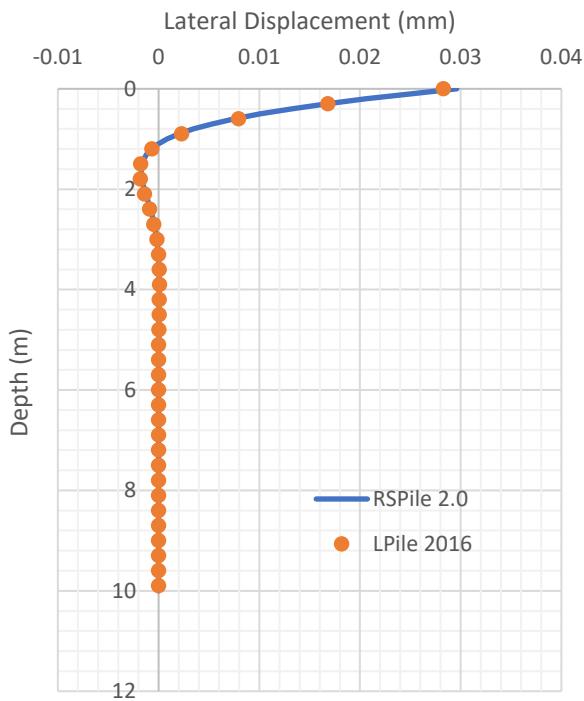
Parameter	Value
General Properties	
Unit Weight	20 kN/m ³
Laterally Loaded Piles	
Soil Type	Strong Rock
Uniaxial Strength	10,000 kPa

Table 16-2: Pile and Loading Properties

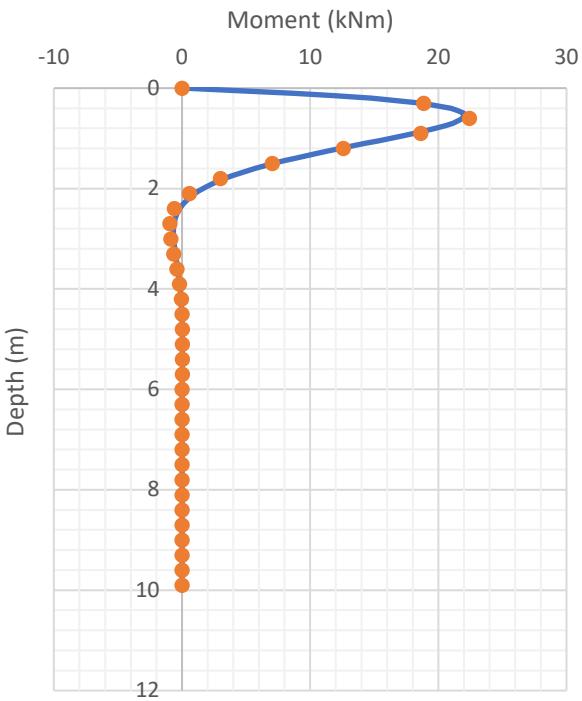
Parameter	Value
Cross Section	Circle
Diameter	0.5m
Young's Modulus	200,000,000 kPa
Length	10 m
Lateral/Shear Load	100 kN

c. Results

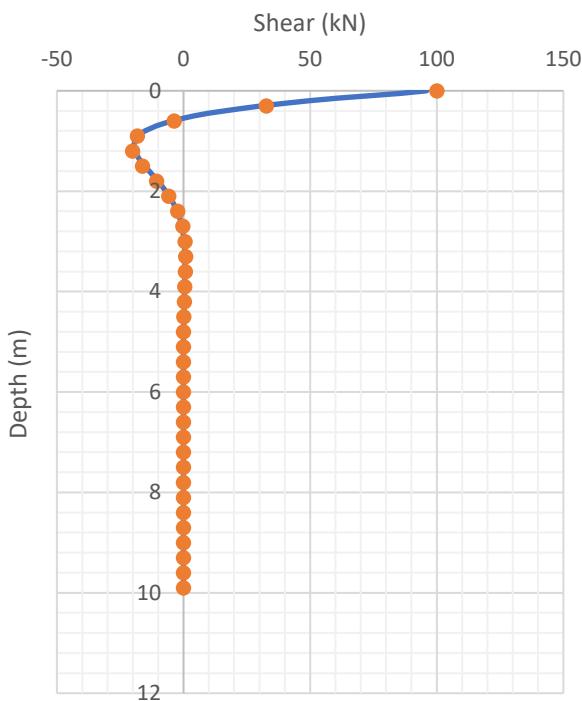
Lateral Displacement Vs. Depth



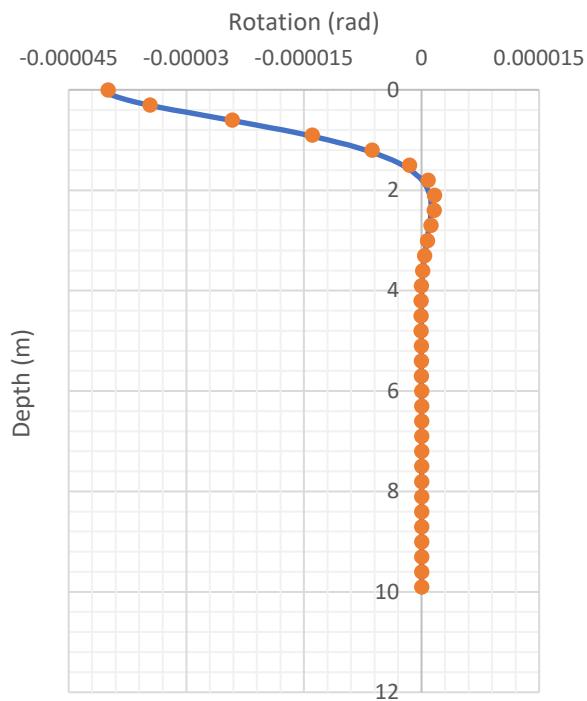
Moment Vs. Depth



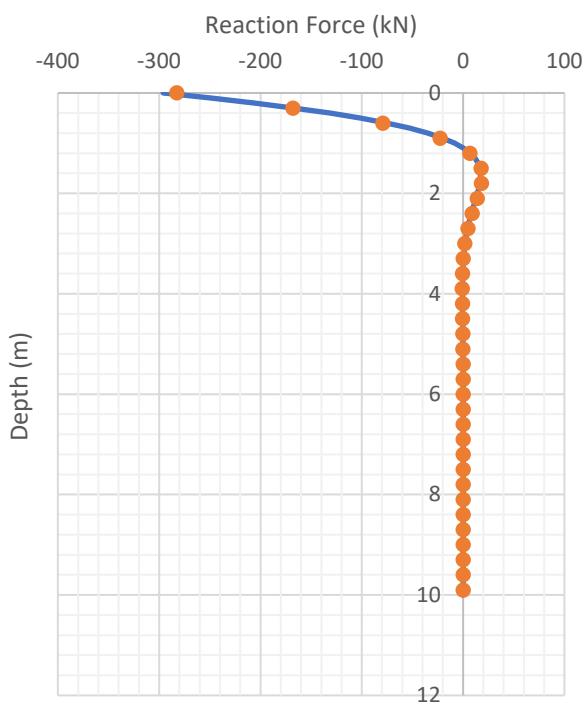
Shear Vs. Depth



Rotation Vs. Depth



Soil Reaction Force Vs. Depth



Case 2

a. Problem Description

Problem 16, case 2 is a laterally loaded pile in a single layer of strong rock. Soil and pile properties are listed in the tables below. The pile loading is specified as a lateral head displacement rather than as a force.

b. Material Properties

Table 16-3: Strong Rock Properties

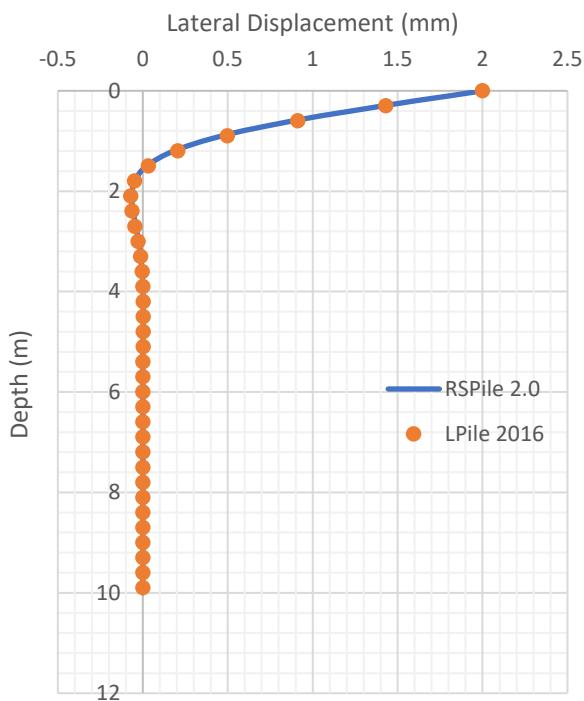
Parameter	Value
General Properties	
Unit Weight	20 kN/m ³
Laterally Loaded Piles	
Soil Type	Strong Rock
Uniaxial Strength	10,000 kPa

Table 16-4: Pile and Loading Properties

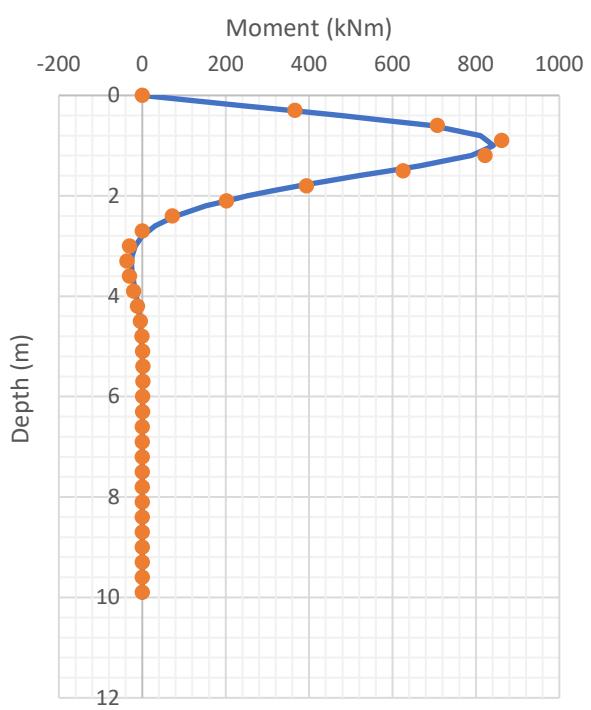
Parameter	Value
Cross Section	Circle
Diameter	0.5 m
Young's Modulus	200,000,000 kPa
Length	10 m
Head Displacement	2 mm

c. Results

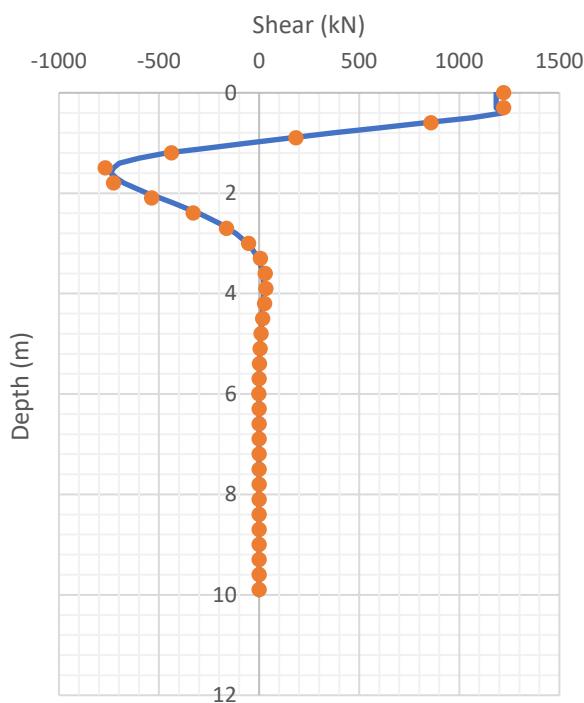
Lateral Displacement Vs. Depth



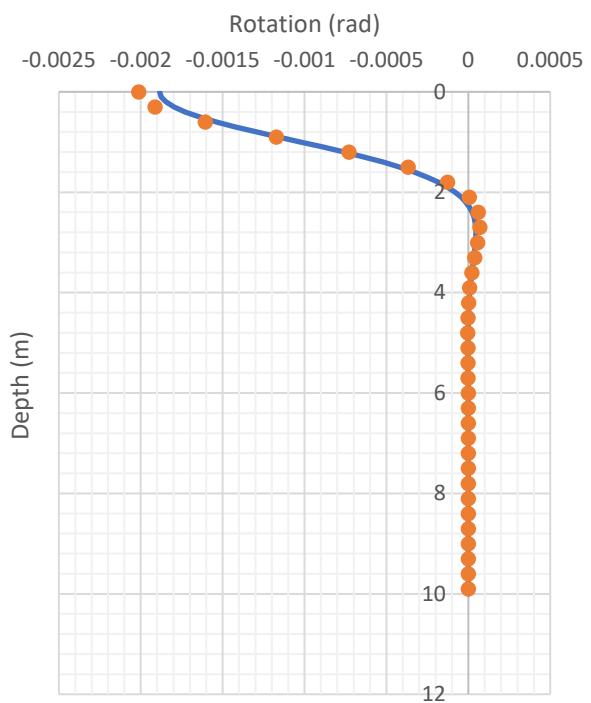
Moment Vs. Depth



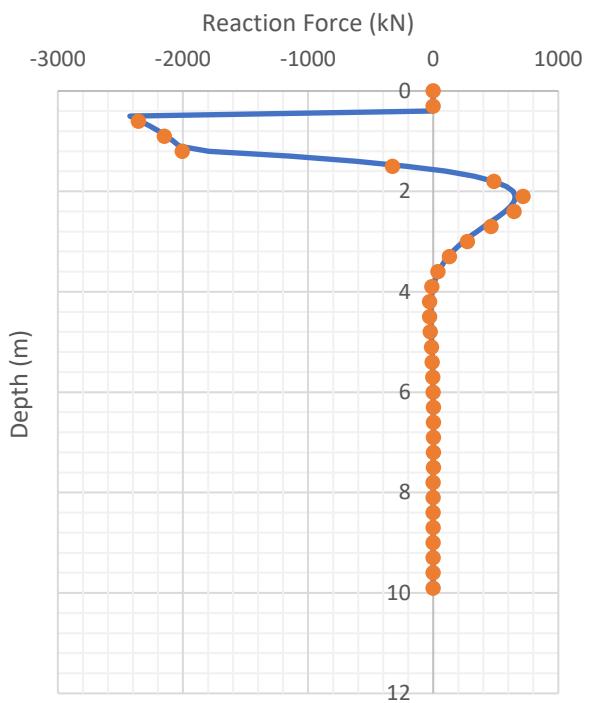
Shear Vs. Depth



Rotation Vs. Depth



Soil Reaction Force Vs. Depth



Case 3

a. Problem Description

Problem 16, case 3 is a laterally loaded pile in a single layer of strong rock. Soil and pile properties are listed in the tables below.

b. Material Properties

Table 16-5: Strong Rock Properties

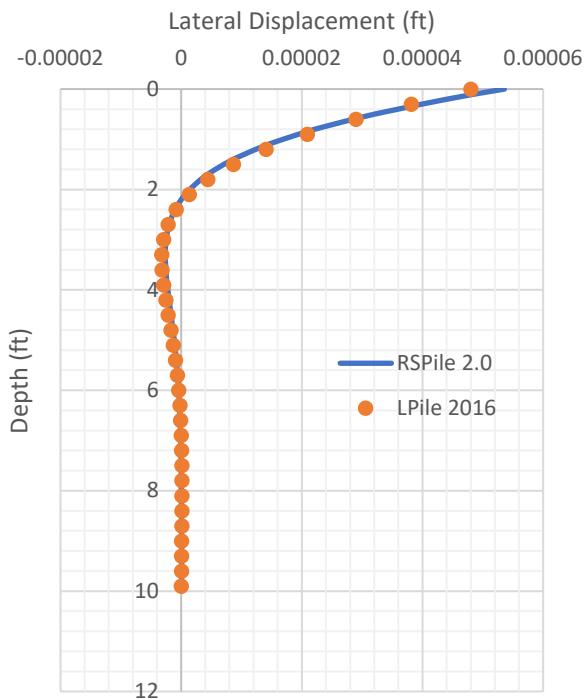
Parameter	Value
General Properties	
Unit Weight	100 lbs/ft ³
Laterally Loaded Piles	
Soil Type	Strong Rock
Uniaxial Strength	144,000 psf

Table 16-6: Pile and Loading Properties

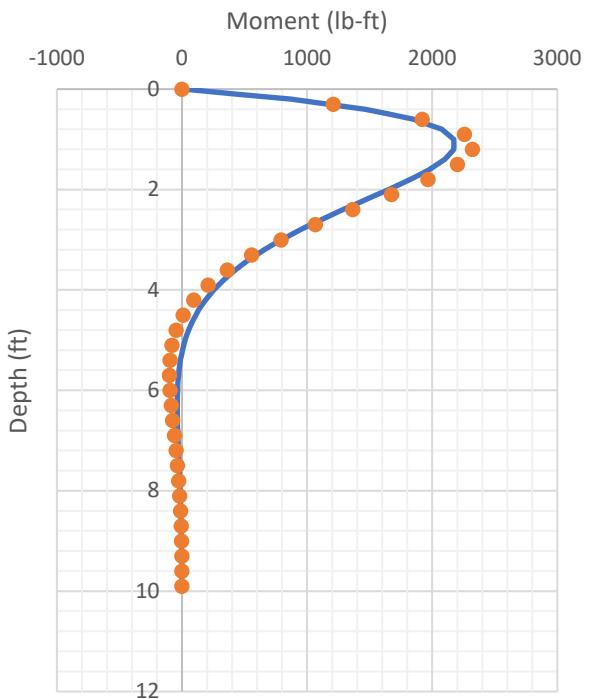
Parameter	Value
Cross Section	Circle
Diameter	2 ft
Young's Modulus	200,000,000 psf
Length	10 ft
Lateral/Shear Load	5000 lb

c. Results

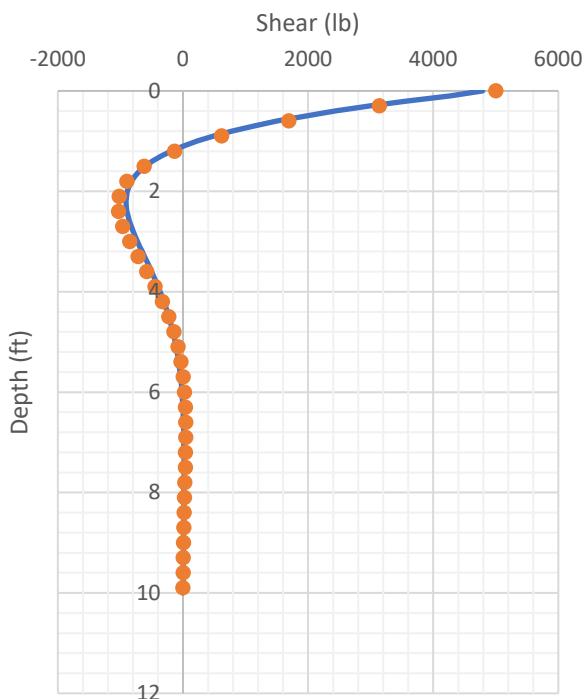
Lateral Displacement Vs. Depth



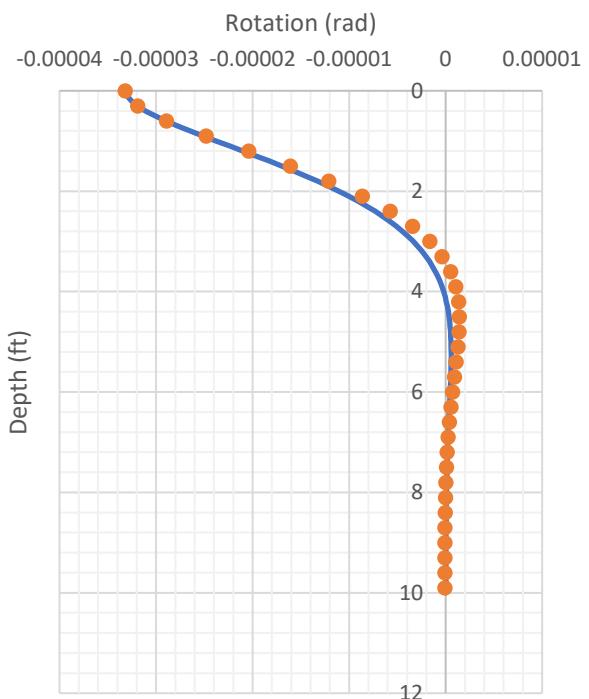
Moment Vs. Depth



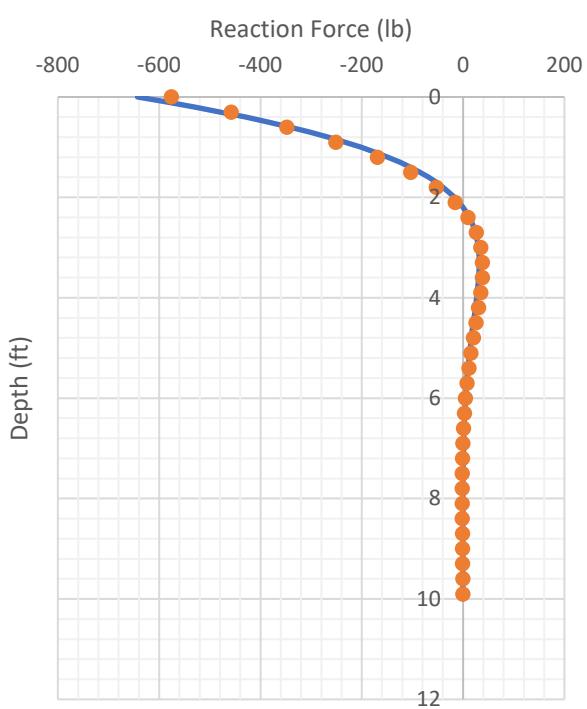
Shear Vs. Depth



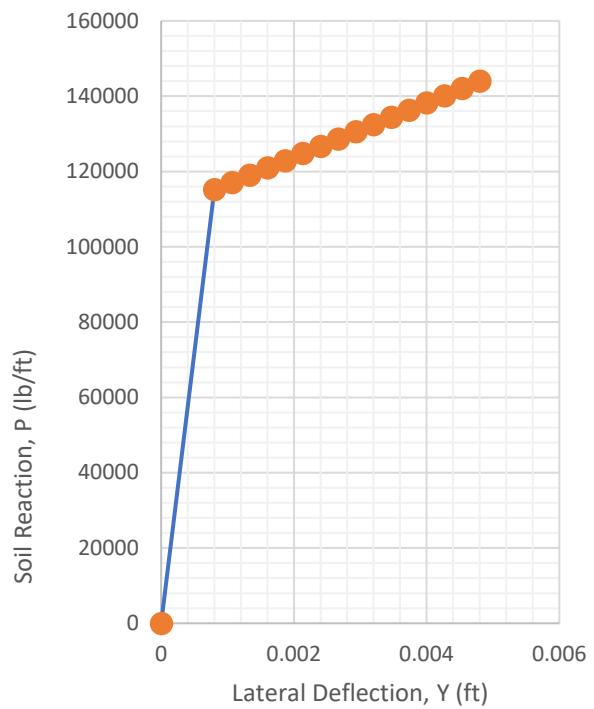
Rotation Vs. Depth



Soil Reaction Force Vs. Depth



PY Curve at 5 ft Depth



RSPile Verification Problem #17

Massive rock

Case 1

a. Problem Description

Problem 17, case 1 is a statically loaded pile in a single layer of massive rock. Soil and pile properties are listed in the tables below.

b. Material Properties

Table 17-1: Massive Rock Properties

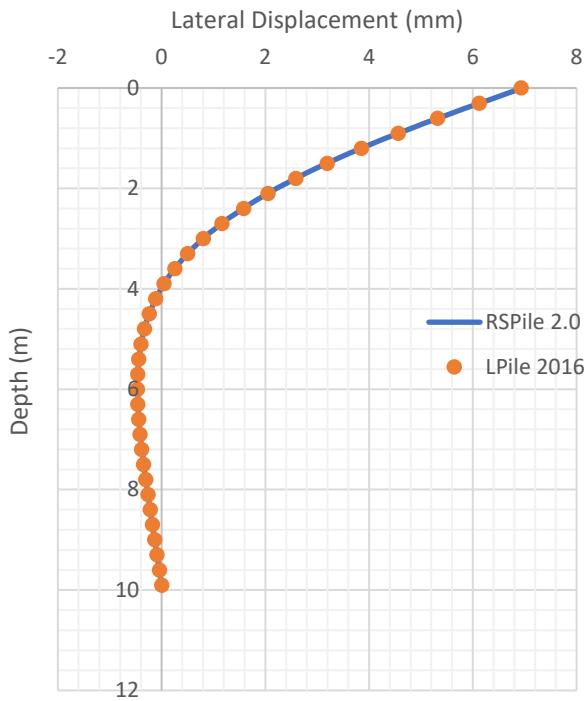
Parameter	Value
General Properties	
Unit Weight	20 kN/m ³
Laterally Loaded Piles	
Soil Type	Massive Rock
Uniaxial Compressive Strength	50,000 kPa
Poisson Ratio	0.3
GSI	50.00
Material Index	12.00
Intact Rock Modulus	100,000 kPa

Table 17-2: Pile and Loading Properties

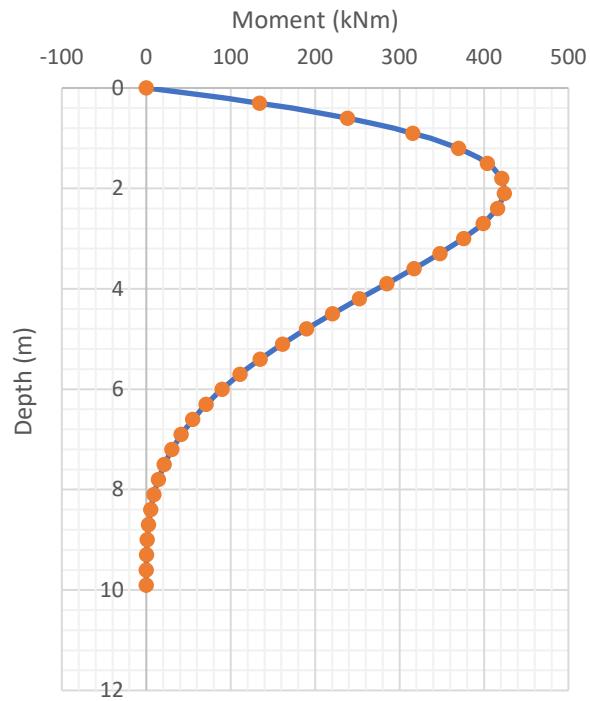
Parameter	Value
Cross Section	Circle
Diameter	0.5m
Young's Modulus	200,000,000 kPa
Length	10 m
Lateral/Shear Load	500 kN

c. Results

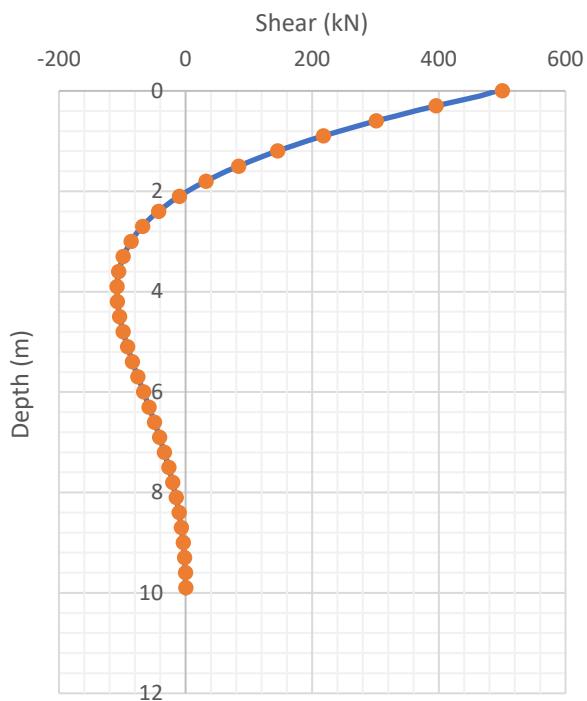
Lateral Displacement Vs. Depth



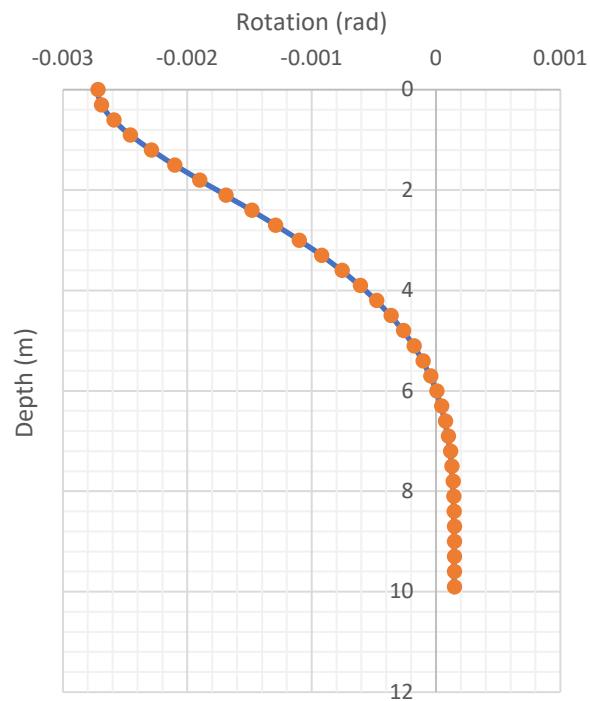
Moment Vs. Depth



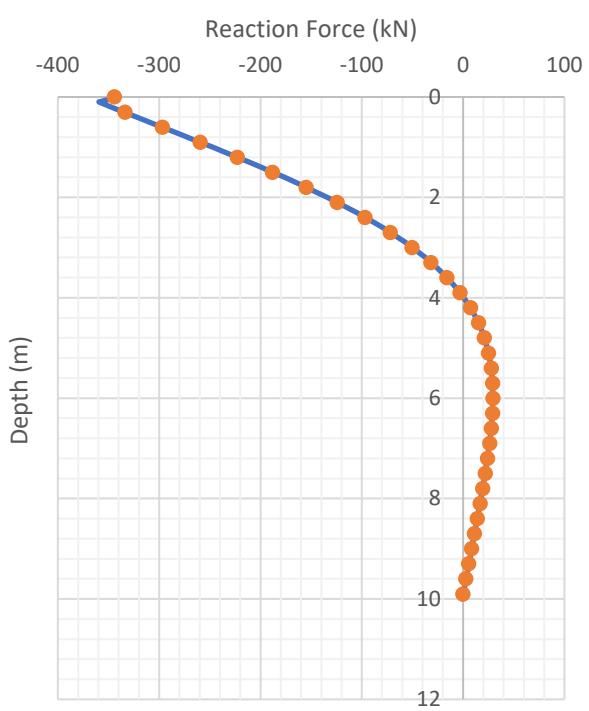
Shear Vs. Depth



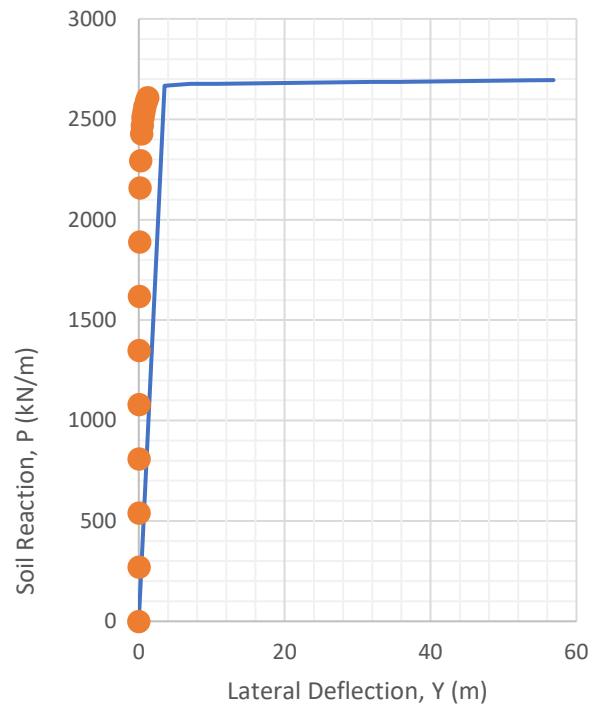
Rotation Vs. Depth



Soil Reaction Force Vs. Depth



PY Curve at 3.55 m Depth



Case 2

a. Problem Description

Problem 17, case 2 is a statically loaded pile in a single layer of massive rock. Soil and pile properties are listed in the tables below.

b. Material Properties

Table 17-3: Massive Rock Properties

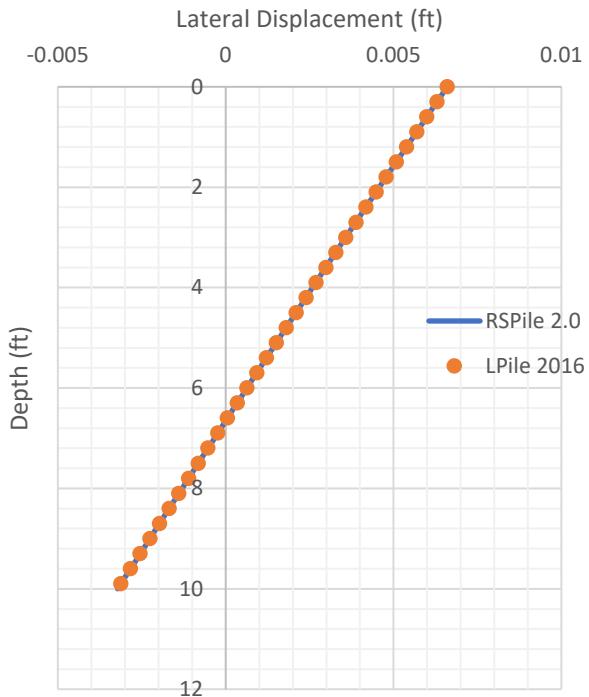
Parameter	Value
General Properties	
Unit Weight	100 lb/ft ³
Laterally Loaded Piles	
Soil Type	Massive Rock
Uniaxial Compressive Strength	288,000 psf
Poisson Ratio	0.3
GSI	50.00
Material Index	12.00
Intact Rock Modulus	72,000 psf

Table 17-4: Pile and Loading Properties

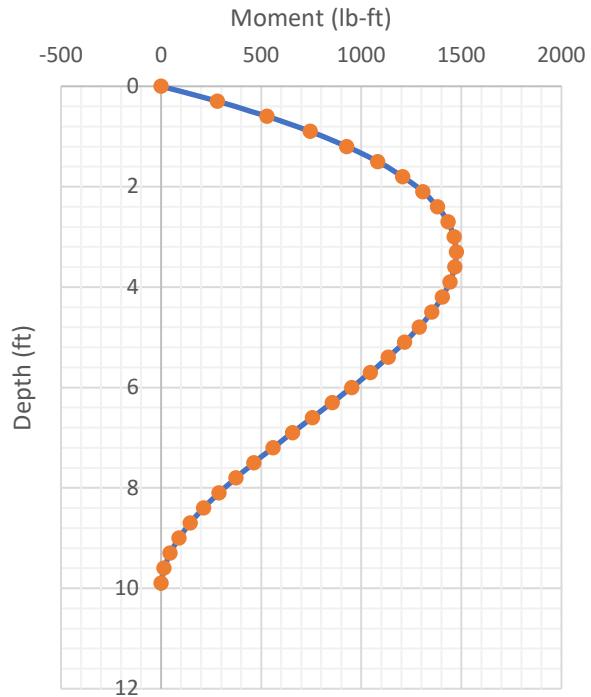
Parameter	Value
Cross Section	Circle
Diameter	2 ft
Young's Modulus	200,000,000 psf
Length	10 ft
Lateral/Shear Load	1000 lb

c. Results

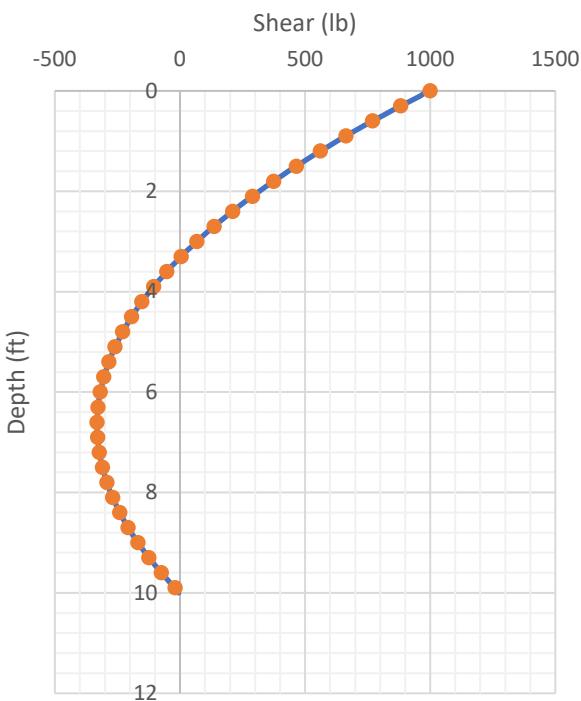
Lateral Displacement Vs. Depth



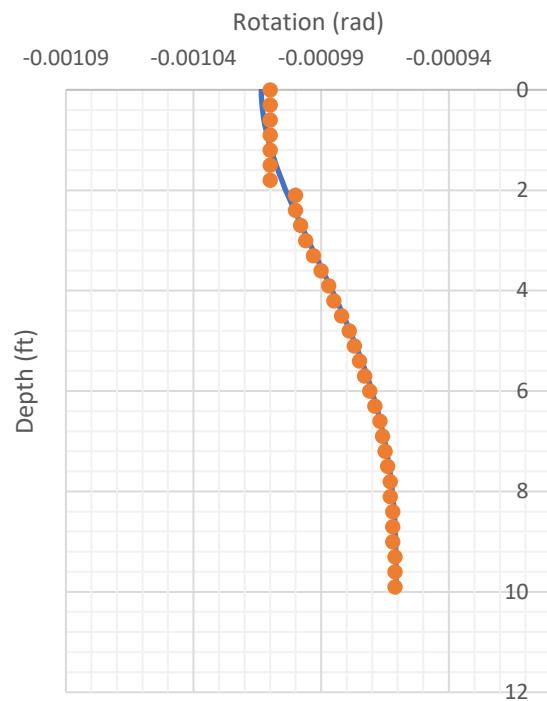
Moment Vs. Depth



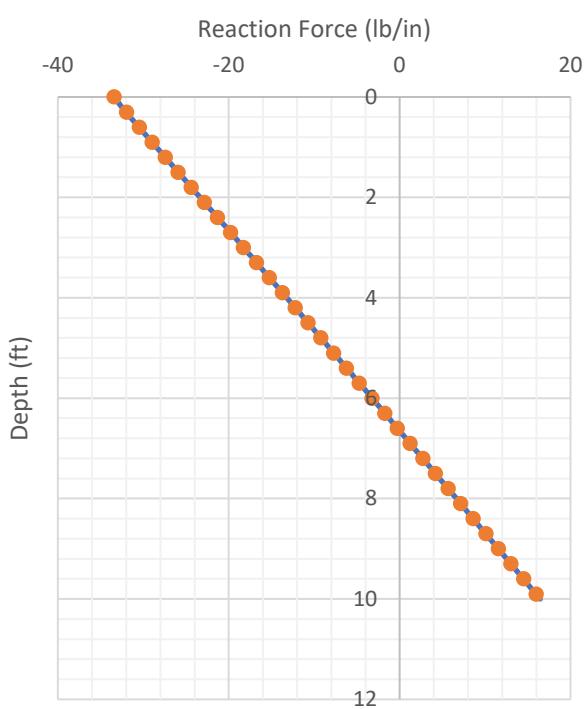
Shear Vs. Depth



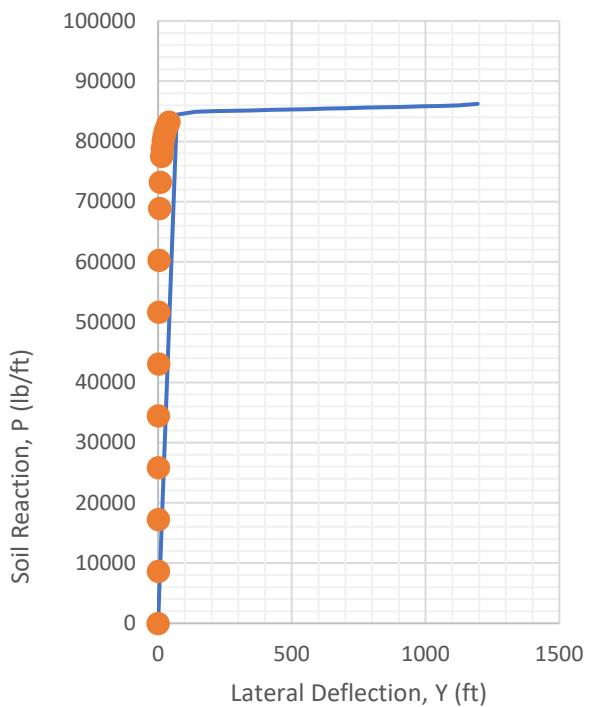
Rotation Vs. Depth



Soil Reaction Force Vs. Depth



PY Curve at 5 ft Depth



RSPile Verification Problem #18

Weak rock soil

Case 1

a. Problem Description

Problem 18, case 1 is a statically loaded pile in a single layer of weak rock. Soil and pile properties are listed in the tables below.

b. Material Properties

Table 18-1: Weak Rock Properties

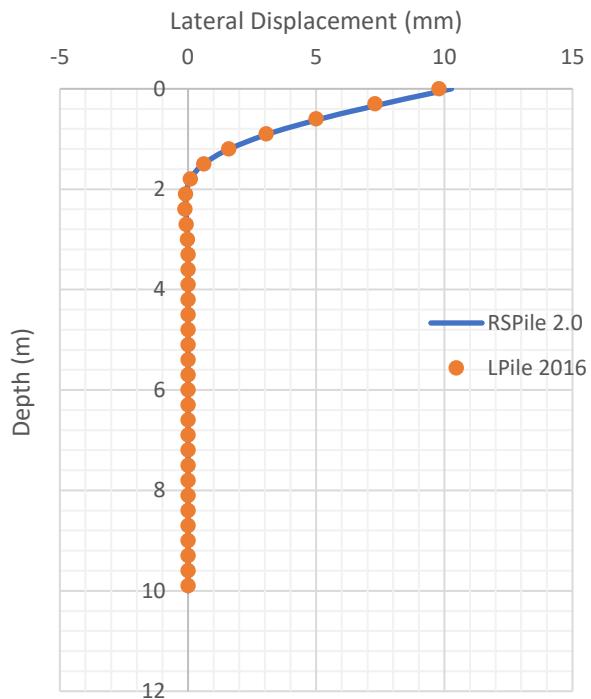
Parameter	Value
General Properties	
Unit Weight	8 kN/m ³
Laterally Loaded Piles	
Soil Type	Weak Rock
Uniaxial Compressive Strength	3450 kPa
Reaction Modulus	7,240,000
Rock Quality Designation	0%
Krm	0.0005

Table 18-2: Pile and Loading Properties

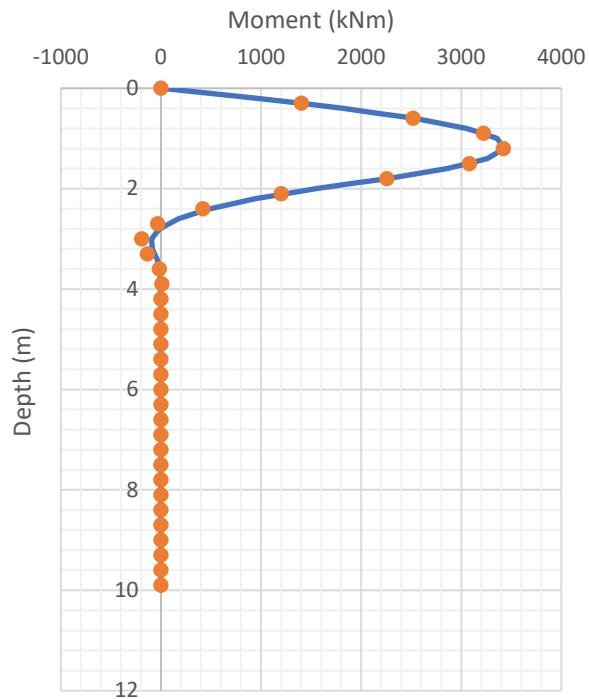
Parameter	Value
Cross Section	Circle
Diameter	0.5 m
Young's Modulus	200,000,000 kPa
Length	10 m
Lateral/Shear Load	5000 kN

c. Results

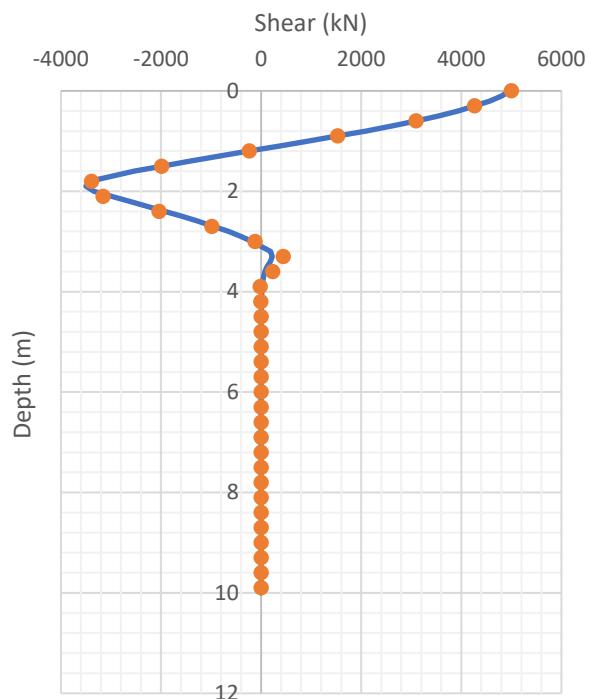
Lateral Displacement Vs. Depth



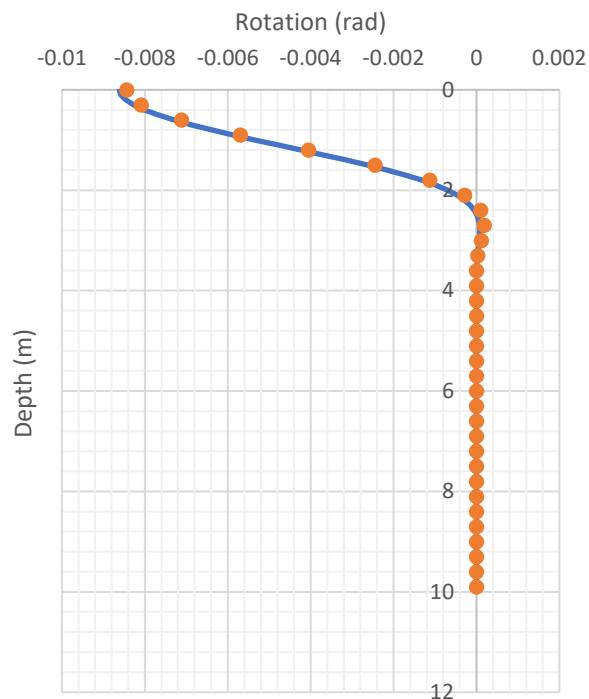
Moment Vs. Depth



Shear Vs. Depth



Rotation Vs. Depth



Soil Reaction Force Vs. Depth

