Drilled Pier Analysis (Bored Pile)

Organization: **CROWTHER REFERENCE**
Project Name: **P 126-134**
Job #:
Design by:
Date: **December 27, 2014**

INPUT DATA

Loading and Geometry

Units	English	Pier Length	65.00 ft
Top of Pier Condition	Free Head	Lateral Load (Shear)	12.00 kips
Passive Wedge	3.0	Moment Load	0.00 kip-ft
Pier Diameter	1.00 ft	Vertical Load	180.0 kips
Torsional Moment	0.00 kip-ft	Uplift Load	90.0 kips
Conc. Strength (f'c)	4000 psi	Groundwater Depth	3.00 ft
F.S. Skin Friction	2.0	F.S. Torsional Moment	3.3
Shaft Type	Vertical • Belled	Cracked	Uncracked • 50% cracked

Geotechnical Properties

Lay #	Material Type	USCS	Layer Thick, ft	Consistency	Lat. S.G, kcf	Sk.Fr, psf	Kp	F.S. on Kp	Cohesion, ksf	Gamma, pcf	Phi, Deg
1	Granular Soil	SM	5.0 0 - 5	Loose	115.0-130.0	900	3.33	1.33	0.50	120.0	33.00
2	Granular Soil	SM	12.0 5 - 17	Medium Dense	130.0-275.0	1500	3.33	1.33	0.50	125.0	33.00
3	Granular Soil	SM	5.0 17 - 22	Loose	275.0-130.0	900	3.33	1.33	0.50	120.0	29.00
4	Cohesive Soil	CL	6.0 22 - 28	Firm	130.0-100.0	700	2.50	1.33	1.00	120.0	22.00
5	Granular Soil	SM	15.0 28 - 43	Medium Dense	100.0-230.0	1500	3.00	1.33	0.50	125.0	29.00
6	Granular Soil	SC	5.0 43 - 48	Loose	230.0-140.0	900	3.00	1.33	0.75	120.0	25.00
7	Granular Soil	SM	6.0 48 - 54	Medium Dense	140.0-300.0	1500	3.30	1.33	0.50	125.0	32.00
8	Granular Soil	SW	11.0 54 - 65	Dense	300.0-550.0	3000	4.00	1.33	0.50	130.0	36.00

Results

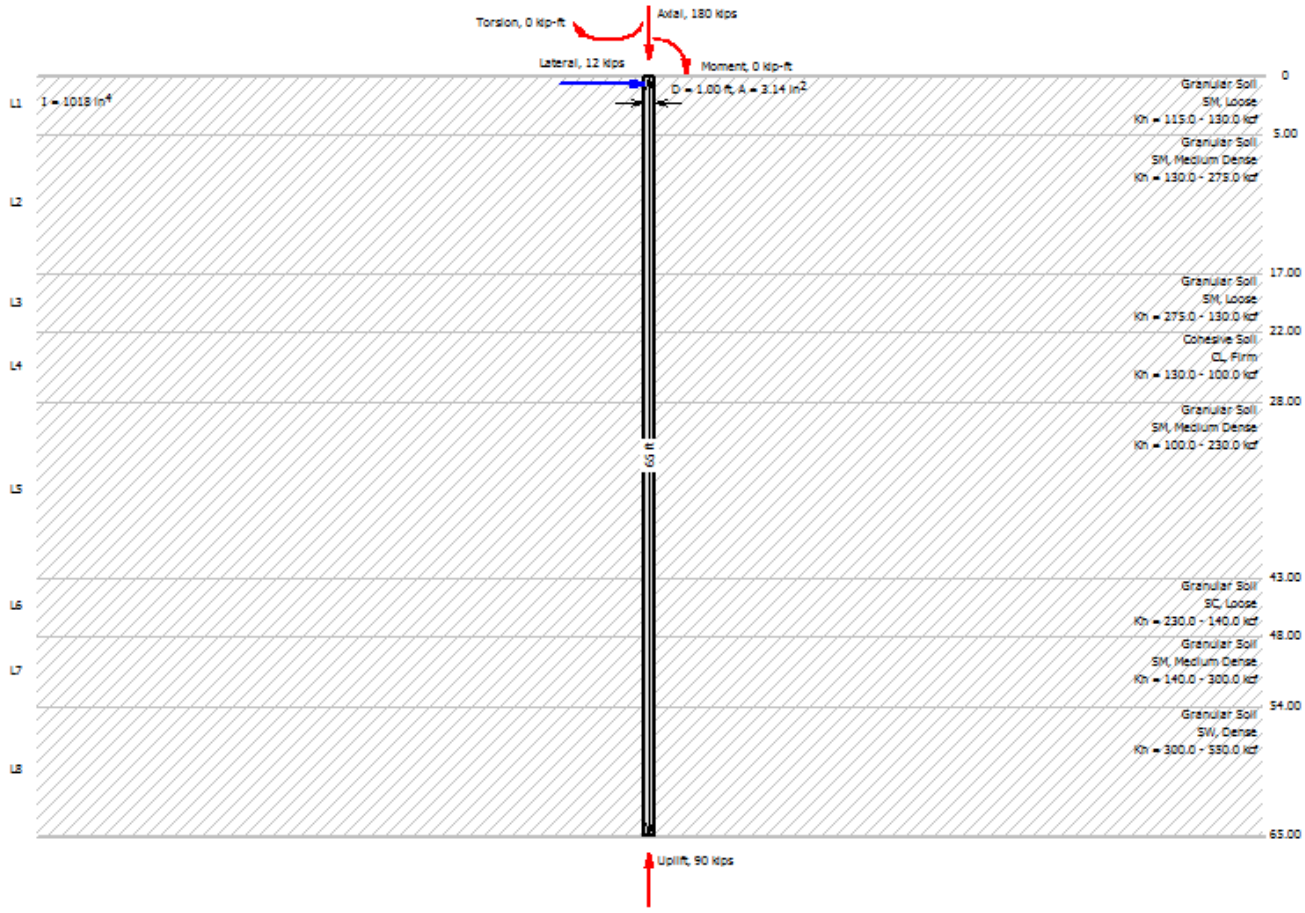
Conc. Elast. Modulus	3605 ksi	Conc. Strength (f'c)	4000 psi
Cross Section Area	113.1 in^2	Section Modulus	169.6 in^3
Allowable Geot. Torsion	165.4 k-ft	Moment of Inertia	1018 in^4

Allowable Structural Capacities

Axial Compression	339.5 kips	Maximum Deflection is 0.46 in at 0.00 ft	
Axial Tension	-256.0 kips	Maximum Moment is 20.15 k-ft at 4.88 ft	
Torsional Moment	10.7 k-ft	Maximum Shear is 12.00 kips at 0.00 ft	
Bending Moment (#1)	39 k-ft	Pier Tip Movement is 0.00 in at the bottom (65.00 ft)	

Allowable Geotechnical Capacitities

Vertical Settlement	0.32 in	Axial Tension	-90.2 kips
Axial Compression	180.3 kips	Torsional Moment	165.4 k-ft



NOTES:

1. Downdrag is a function of skin friction. If the user inputs a side friction of zero (designed for end bearing only), Downdrag will not be calculated by the program. Therefore, the user should independently calculate the Negative Skin Friction or Downdrag magnitude by other means.
2. The user shall ensure Positive side friction capacity + end bearing capacity (Geotechnical Axial Compression) exceeds axial load plus downdrag force (all service level). This may require additional pier embedment.
3. In reinforcement design, Pu shall equal to 1.2(Dead Load) plus 1.6 (Live Load + Downdrag Load). These load factors may vary with time and governing code.

Lateral Table

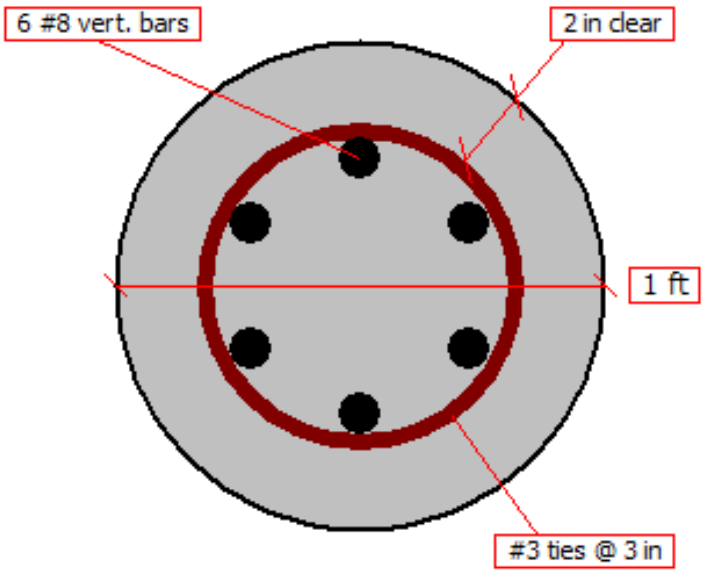
Node #	Depth, ft	Soil Modulus, ksf	Shear, kips	Moment, kip-ft	Deflection, in	Lat. Soil Pr, k/ft^2	Allow. Soil Pr, k/ft^2
1	0.00	115	12.00	0.00	0.46	4.40	4.75
2	1.63	120	5.85	14.22	0.31	3.14	6.21
3	3.25	125	1.63	19.95	0.19	2.01	7.68
4	4.88	130	-0.91	20.15	0.10	1.09	9.14
5	6.50	148	-2.22	16.50	0.03	0.39	10.85
6	8.13	168	-2.48	11.57	0.00	-0.06	12.38
7	9.75	187	-2.13	6.94	-0.02	-0.29	13.90
8	11.38	207	-1.51	3.36	-0.02	-0.34	15.43
9	13.00	227	-0.90	1.03	-0.02	-0.29	16.95
10	14.63	246	-0.42	-0.21	-0.01	-0.21	18.48
11	16.25	266	-0.11	-0.68	-0.01	-0.12	20.00
12	17.88	250	0.02	-0.75	0.00	-0.07	20.86
13	19.50	203	0.05	-0.77	0.00	-0.05	22.32
14	21.13	155	0.06	-0.80	0.00	-0.04	23.79
15	22.75	126	0.08	-0.81	0.00	-0.03	23.62
16	24.38	118	0.10	-0.71	0.00	-0.01	24.72
17	26.00	110	0.11	-0.59	0.00	0.00	25.82
18	27.63	102	0.10	-0.49	0.00	0.01	26.92
19	29.25	111	0.08	-0.27	0.00	0.01	29.25
20	30.88	125	0.05	-0.10	0.00	0.01	30.62
21	32.50	139	0.02	0.00	0.00	0.01	32.00
22	34.13	153	0.01	0.03	0.00	0.01	33.37
23	35.75	167	0.00	0.04	0.00	0.00	34.75
24	37.38	181	0.00	0.03	0.00	0.00	36.12
25	39.00	195	0.00	0.02	0.00	0.00	37.49
26	40.63	209	0.00	0.01	0.00	0.00	38.87
27	42.25	224	0.00	0.00	0.00	0.00	40.24
28	43.88	214	0.00	0.00	0.00	0.00	42.39
29	45.50	185	0.00	0.00	0.00	0.00	43.71
30	47.13	156	0.00	0.00	0.00	0.00	45.03
31	48.75	160	0.00	0.00	0.00	0.00	50.09
32	50.38	203	0.00	0.00	0.00	0.00	51.60
33	52.00	247	0.00	0.00	0.00	0.00	53.11
34	53.63	290	0.00	0.00	0.00	0.00	54.62
35	55.25	328	0.00	0.00	0.00	0.00	70.01
36	56.88	365	0.00	0.00	0.00	0.00	71.91
37	58.50	402	0.00	0.00	0.00	0.00	73.82
38	60.13	439	0.00	0.00	0.00	0.00	75.73
39	61.75	476	0.00	0.00	0.00	0.00	77.63
40	63.38	513	0.00	0.00	0.00	0.00	79.54
41	65.00	550	0.00	0.00	0.00	0.00	81.44

Axial Table

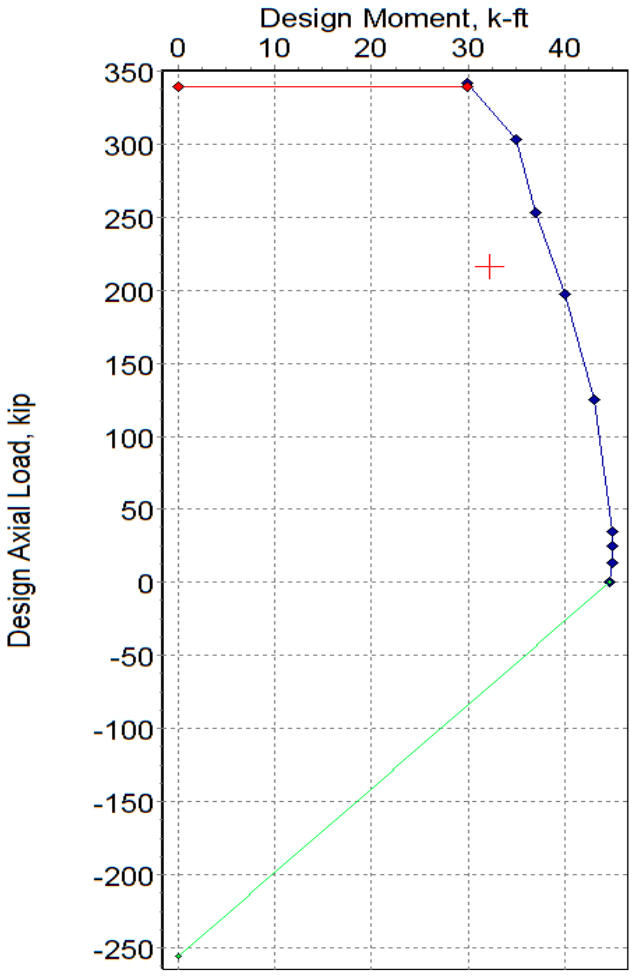
Layer #	Depth, ft	Unit wt, pcf	Tot. Stress, psf	Porewater, psf	Eff. Stress, psf	Skin Fric, psf
1	0.00 - 5.00	120.00	600.00	124.84	475.16	900
2	5.00 - 17.00	125.00	2100.00	873.88	1226.12	1500
3	17.00 - 22.00	120.00	2700.00	1185.98	1514.02	900
4	22.00 - 28.00	120.00	3420.00	1560.50	1859.50	700
5	28.00 - 43.00	125.00	5295.00	2496.80	2798.20	1500
6	43.00 - 48.00	120.00	5895.00	2808.90	3086.10	900
7	48.00 - 54.00	125.00	6645.00	3183.42	3461.58	1500
8	54.00 - 65.00	130.00	8075.00	3870.04	4204.96	3000

Layer #	TSA Sk.Fr, kips	Fr. Ang, Deg	ESA Sk.Fr, kips	Neg.Sk.Fr.	Downdrag, kip	Beta	Geo. Tors. Cap, kip-ft
1	9.9	33.00	1.5	No	0.00	0.70	7.50
2	56.5	33.00	12.0	No	0.00	0.70	29.99
3	14.1	29.00	9.3	No	0.00	0.70	7.50
4	13.2	22.00	18.5	No	0.00	0.55	5.50
5	70.7	29.00	30.4	No	0.00	0.70	37.48
6	14.1	25.00	20.4	No	0.00	0.70	7.50
7	28.3	32.00	38.2	No	0.00	0.70	14.99
8	84.8	36.00	89.1	No	0.00	0.70	54.98

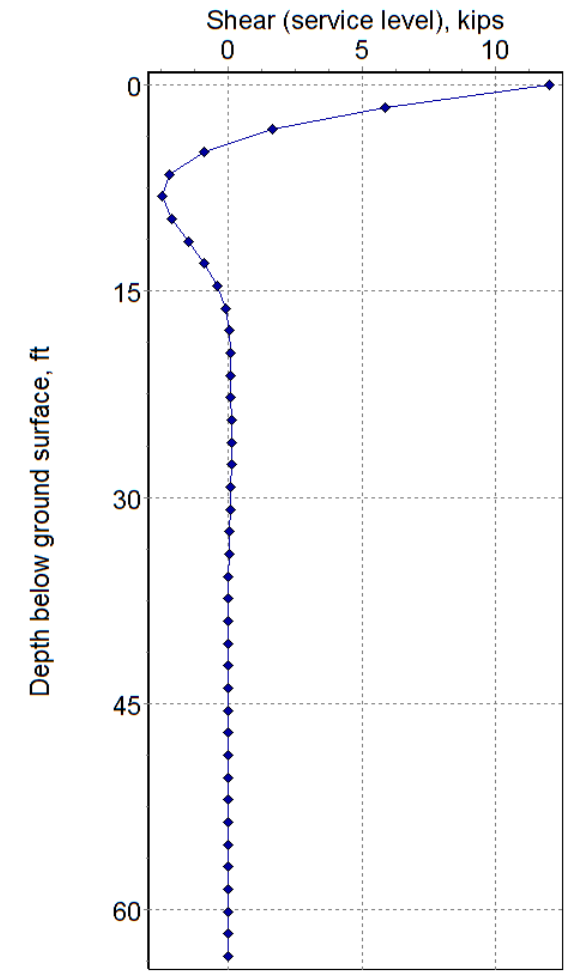
Reinforcement

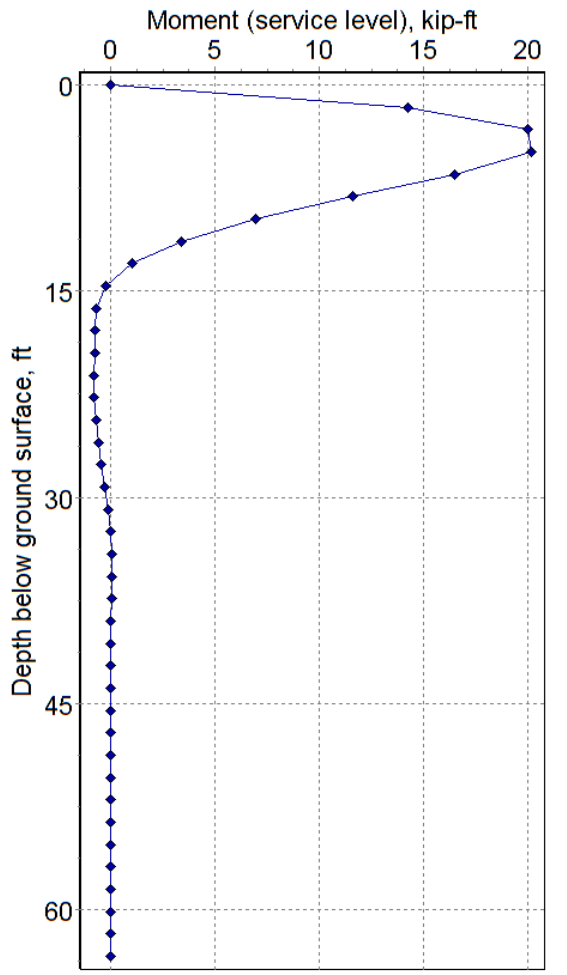


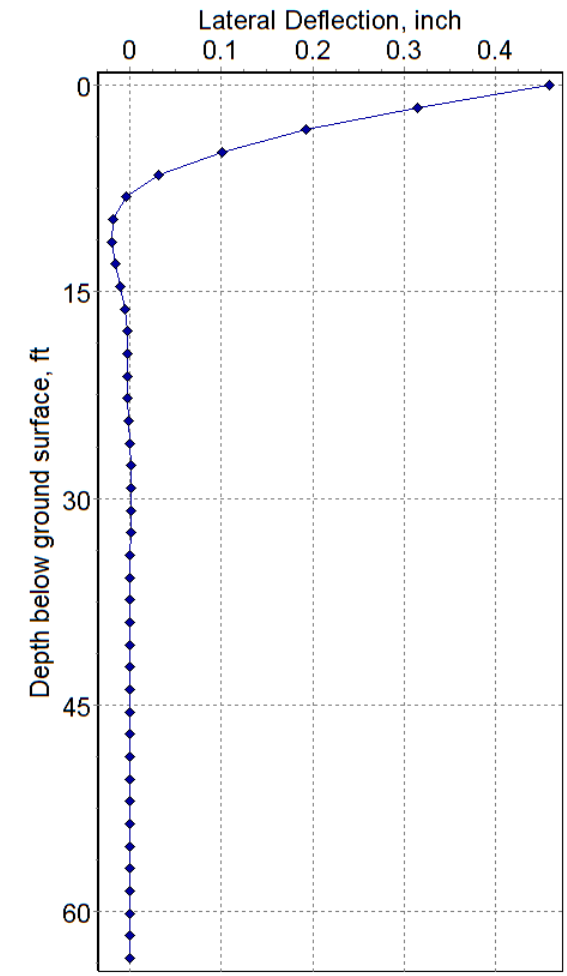
Column Interaction Diagram

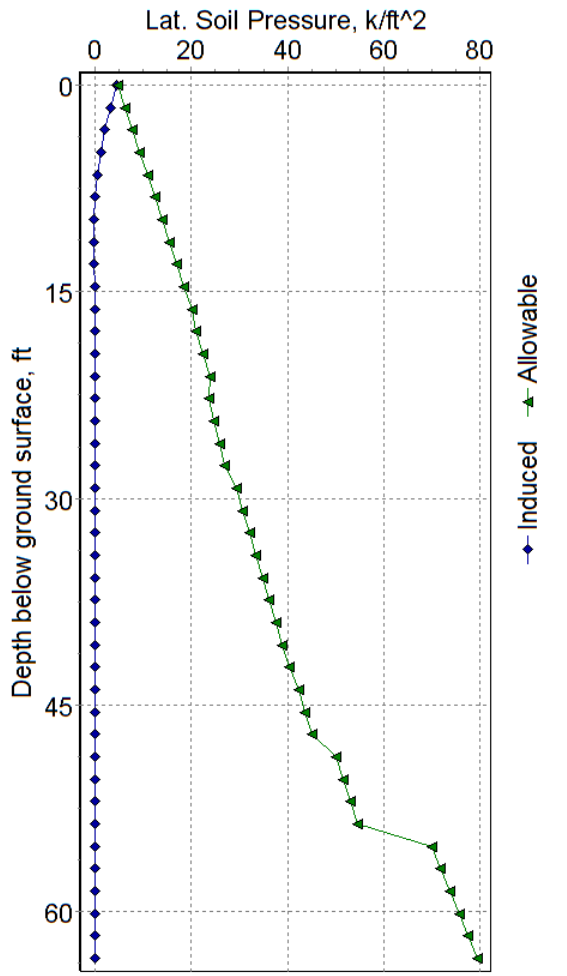


NOTES:
1. If Torsional Moments are included, an additional check shall be made for concrete breakout due to shear directed parallel to the edge of anchors. Concrete Anchorage Breakout may govern.
2. If Torsional Moments are included in addition to Lateral Loads, Lateral capacity shall be reduced by 40% if Torsional Moment Load/Lateral Load ratio (TML/LL) is 15 and unaffected if TML/LL ratio is 7.5 or less. You may interpolate linearly for TML/LL ratio between 7.5 to 15. See Report # 4910-4504-723-12 by The University of Florida, April, 2003, available online.


Shear (service level), kips
0
5
10
Depth below ground surface, ft
0
15
30
45
60


Moment (service level), kip-ft
0
5
10
15
20
Depth below ground surface, ft
0
15
30
45
60


Lateral Deflection, inch
0
0.1
0.2
0.3
0.4
Depth below ground surface, ft
0
15
30
45
60


Lat. Soil Pressure, k/ft^2
0
20
40
60
80
Depth below ground surface, ft
0
15
30
45
60
Induced
Allowable

References:

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