

# Drilled Pier Analysis (Bored Pile)

Organization: **CASE STUDY P499**  
 Project Name: **Whitaker & Cooke 1966 Pile P**  
 Job #:  
 Design by: **REESE & O'NEIL 1988**  
 Date: **December 24, 2014**

## INPUT DATA

### Loading and Geometry

Units	English	Pier Length	53.30 ft
Top of Pier Condition	Free Head	Lateral Load (Shear)	0.01 kips
Passive Wedge	2.5	Moment Load	0.01 kip-ft
Pier Diameter	3.08 ft	Vertical Load	660.0 kips
Torsional Moment	0.00 kip-ft	Uplift Load	0.0 kips
Conc. Strength (f'c)	3500 psi	Groundwater Depth	53.30 ft
F.S. Skin Friction	2.0	F.S. Torsional Moment	3.3
Shaft Type	Vertical	Cracked	Uncracked •
	Belled •		50% cracked
Bell Diameter	6.08 ft	F.S. End Bearing	2.5

### 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	Cohesive Soil	CL	24.0 0 - 24	Very Stiff	100.0- 160.0	1800	2.50	1.33	0.90	110.0	20.00
2	Cohesive Soil	CL	24.0 24 - 48	Hard	160.0- 240.0	2400	2.50	1.33	1.20	112.0	20.00
3	Cohesive Soil	CL	1.5 48 - 49.5	Very Hard	240.0- 280.0	3200	2.50	1.33	1.50	115.0	20.00
4	Cohesive Soil	CL	3.8 49.5 - 53.	Very Hard	280.0- 310.0	3200	2.50	1.33	1.50	115.0	20.00

### Results

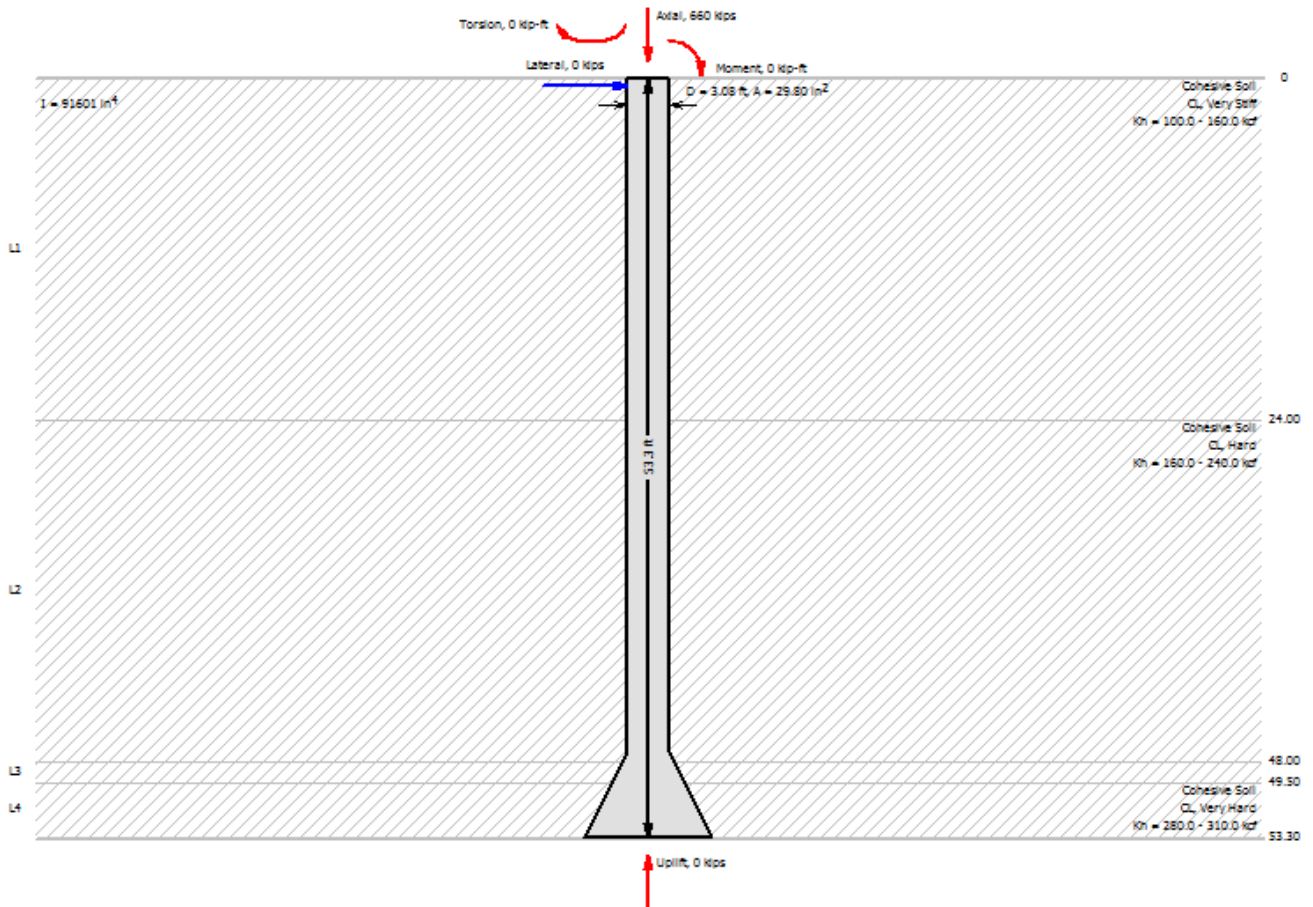
Conc. Elast. Modulus	3372 ksi	Conc. Strength (f'c)	3500 psi
Cross Section Area	1072.9 in <sup>2</sup>	Section Modulus	4956.7 in <sup>3</sup>
Allowable Geot. Torsion	1462.3 k-ft	Moment of Inertia	91601 in <sup>4</sup>

#### Allowable Structural Capacities

Axial Compression	2134.2 kips	Maximum Deflection is 0.00 in at 0.00 ft	
Axial Tension	-864.0 kips	Maximum Moment is 0.05 k-ft at 8.00 ft	
Torsional Moment	92.9 k-ft	Maximum Shear is 0.01 kips at 0.00 ft	
Bending Moment (#1)	1089 k-ft	Pier Tip Movement is 0.00 in at the bottom (53.30 ft)	

#### Allowable Geotechnical Capacities

Vertical Settlement	0.94 in	Axial Tension	-434.8 kips
Axial Compression	869.6 kips	Torsional Moment	1462.3 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,  $P_u$  shall equal to  $1.2(\text{Dead Load})$  plus  $1.6 (\text{Live Load} + \text{Downdrag Load})$ . 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	308	0.01	0.01	0.00	0.00	6.17
2	1.33	318	0.01	0.02	0.00	0.00	6.86
3	2.67	329	0.01	0.03	0.00	0.00	7.55
4	4.00	339	0.00	0.04	0.00	0.00	8.24
5	5.33	349	0.00	0.04	0.00	0.00	8.92
6	6.66	359	0.00	0.05	0.00	0.00	9.61
7	8.00	370	0.00	0.05	0.00	0.00	10.30
8	9.33	380	0.00	0.05	0.00	0.00	10.99
9	10.66	390	0.00	0.04	0.00	0.00	11.68
10	11.99	400	0.00	0.04	0.00	0.00	12.37
11	13.33	411	0.00	0.04	0.00	0.00	13.06
12	14.66	421	0.00	0.04	0.00	0.00	13.75
13	15.99	431	0.00	0.03	0.00	0.00	14.44
14	17.32	441	0.00	0.03	0.00	0.00	15.12
15	18.66	452	0.00	0.03	0.00	0.00	15.81
16	19.99	462	0.00	0.02	0.00	0.00	16.50
17	21.32	472	0.00	0.02	0.00	0.00	17.19
18	22.65	482	0.00	0.02	0.00	0.00	17.88
19	23.99	493	0.00	0.01	0.00	0.00	18.57
20	25.32	506	0.00	0.01	0.00	0.00	21.55
21	26.65	520	0.00	0.01	0.00	0.00	22.25
22	27.98	534	0.00	0.01	0.00	0.00	22.95
23	29.32	547	0.00	0.00	0.00	0.00	23.66
24	30.65	561	0.00	0.00	0.00	0.00	24.36
25	31.98	575	0.00	0.00	0.00	0.00	25.06
26	33.31	588	0.00	0.00	0.00	0.00	25.76
27	34.65	602	0.00	0.00	0.00	0.00	26.46
28	35.98	616	0.00	0.00	0.00	0.00	27.16
29	37.31	629	0.00	0.00	0.00	0.00	27.86
30	38.64	643	0.00	0.00	0.00	0.00	28.56
31	39.98	657	0.00	0.00	0.00	0.00	29.27
32	41.31	670	0.00	0.00	0.00	0.00	29.97
33	42.64	684	0.00	0.00	0.00	0.00	30.67
34	43.97	698	0.00	0.00	0.00	0.00	31.37
35	45.31	712	0.00	0.00	0.00	0.00	32.07
36	46.64	725	0.00	0.00	0.00	0.00	32.77
37	47.97	739	0.00	0.00	0.00	0.00	33.47
38	49.30	846	0.00	0.00	0.00	0.00	36.93
39	50.64	890	0.00	0.00	0.00	0.00	37.65
40	51.97	922	0.00	0.00	0.00	0.00	38.37
41	53.30	955	0.00	0.00	0.00	0.00	39.09

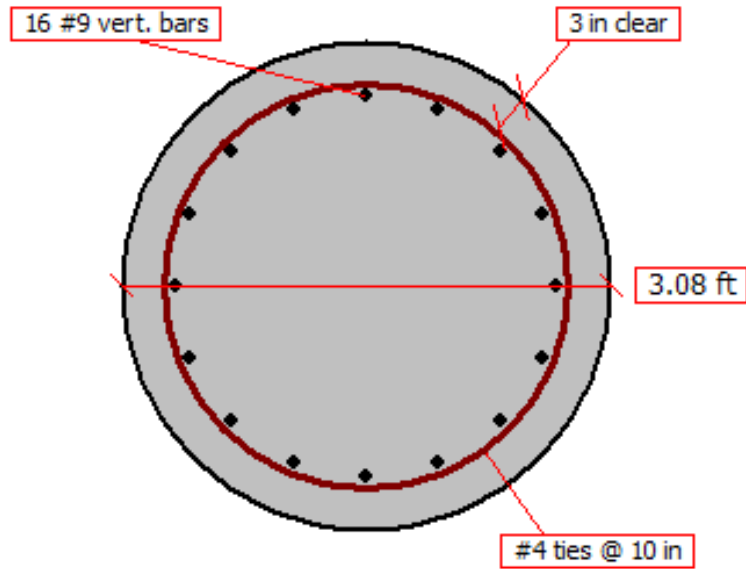
## Axial Table

Layer #	Depth, ft	Unit wt, pcf	Tot. Stress, psf	Porewater, psf	Eff. Stress, psf	Skin Fric, psf
1	0.00 - 24.00	110.00	2640.00	0.00	2640.00	1800
2	24.00 - 48.00	112.00	5328.00	0.00	5328.00	2400
3	48.00 - 49.50	115.00	5500.50	0.00	5500.50	3200
4	49.50 - 53.30	115.00	5937.50	0.00	5937.50	3200

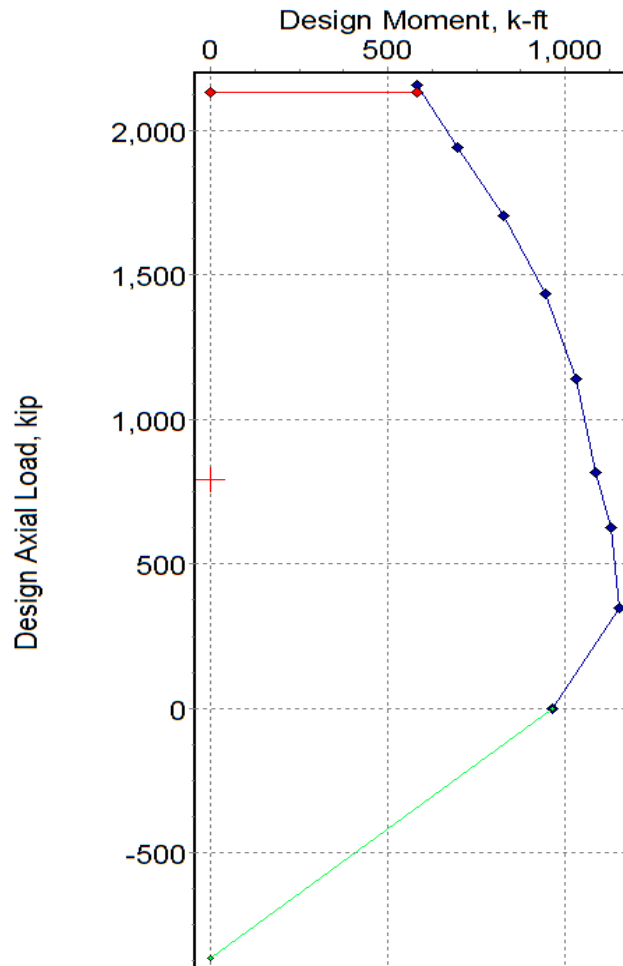
  

Layer #	TSA Sk.Fr, kips	Fr. Ang, Deg	ESA Sk.Fr, kips	Neg.Sk.Fr.	Downdrag, kip	Beta	Geo. Tors. Cap, kip-ft
1	337.5	20.00	101.3	No	0.00	0.55	536.44
2	557.3	20.00	334.4	No	0.00	0.55	715.26
3	46.4	20.00	459.8	No	0.00	0.55	59.60
4	-73.1	20.00	437.9	No	0.00	0.55	151.00

## Reinforcement

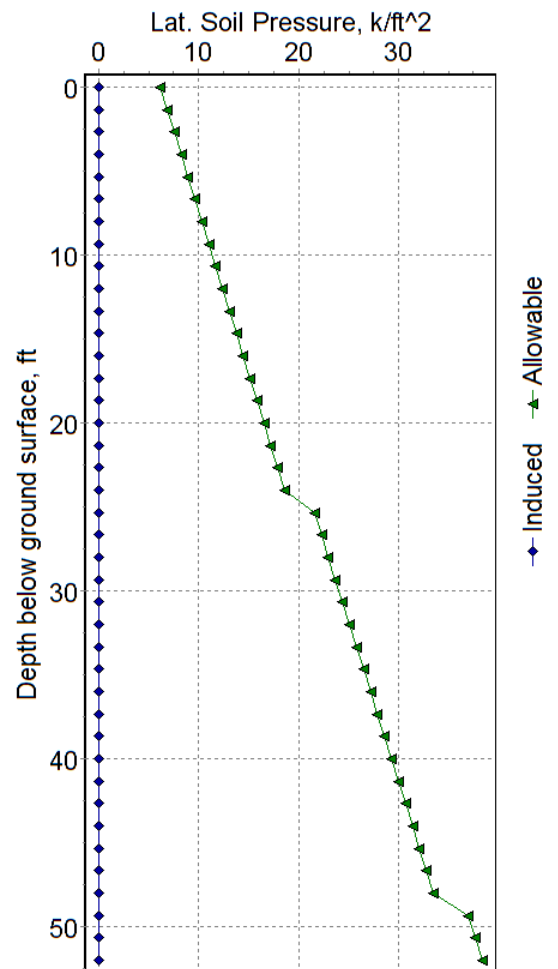
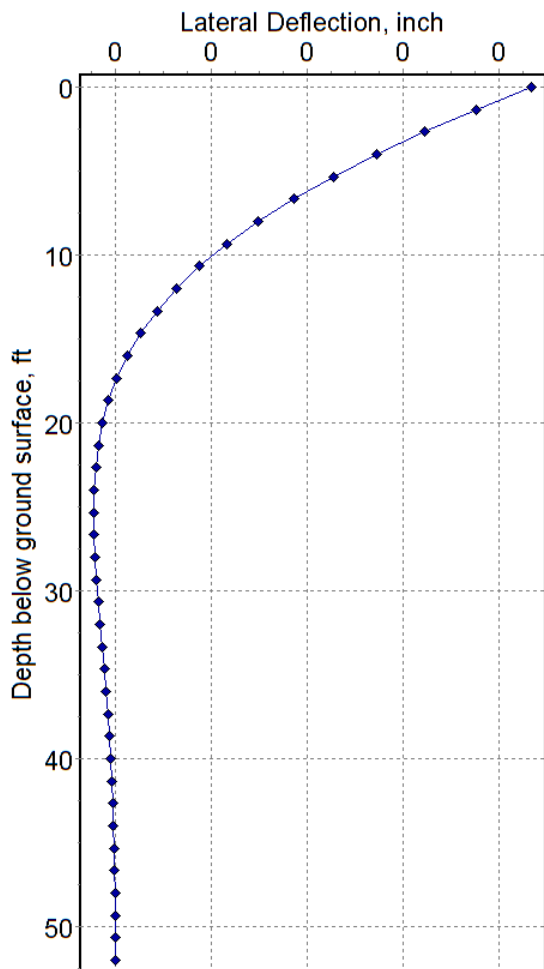
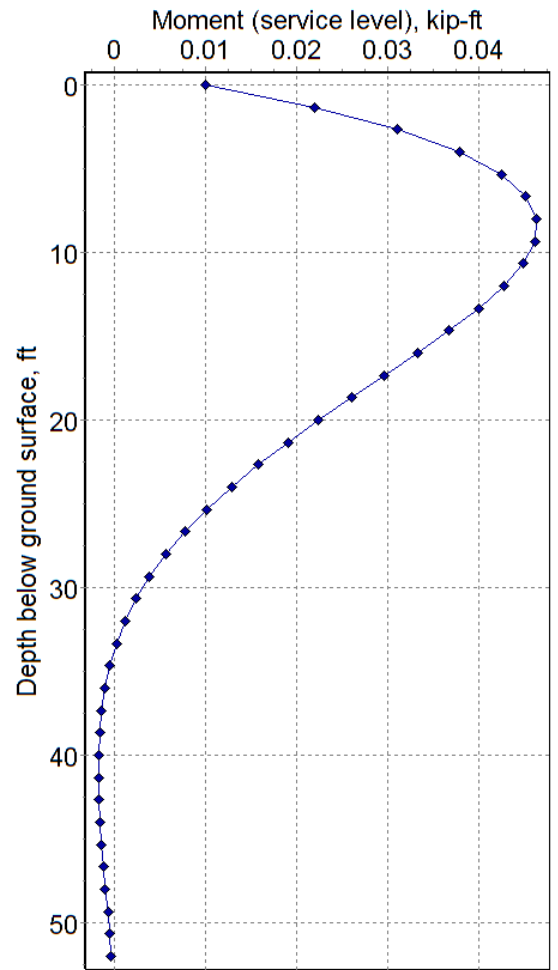
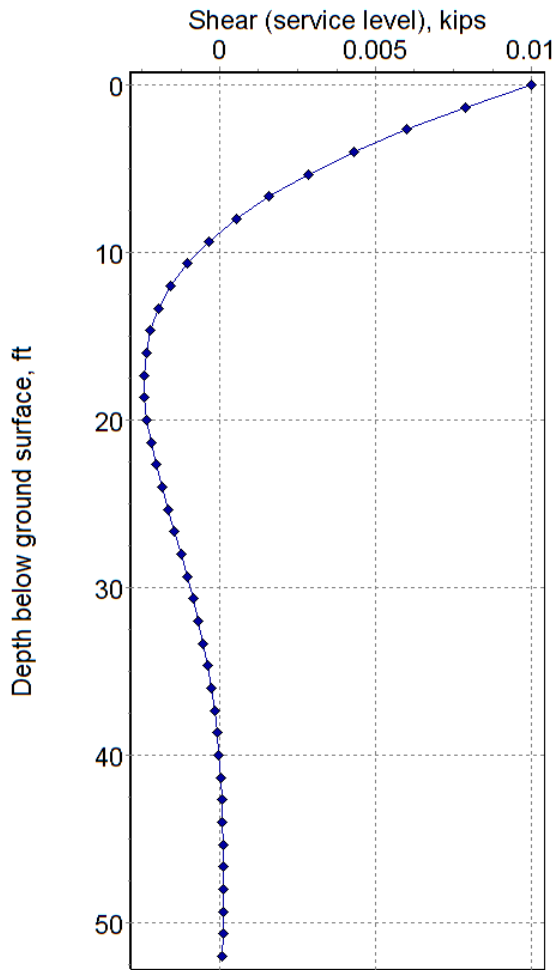


## Column Interaction Diagram



### 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.



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