Axial Design of Drilled Shafts in Chalk and Marl

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Test Data

Table 2 - Summary of Load Test Data

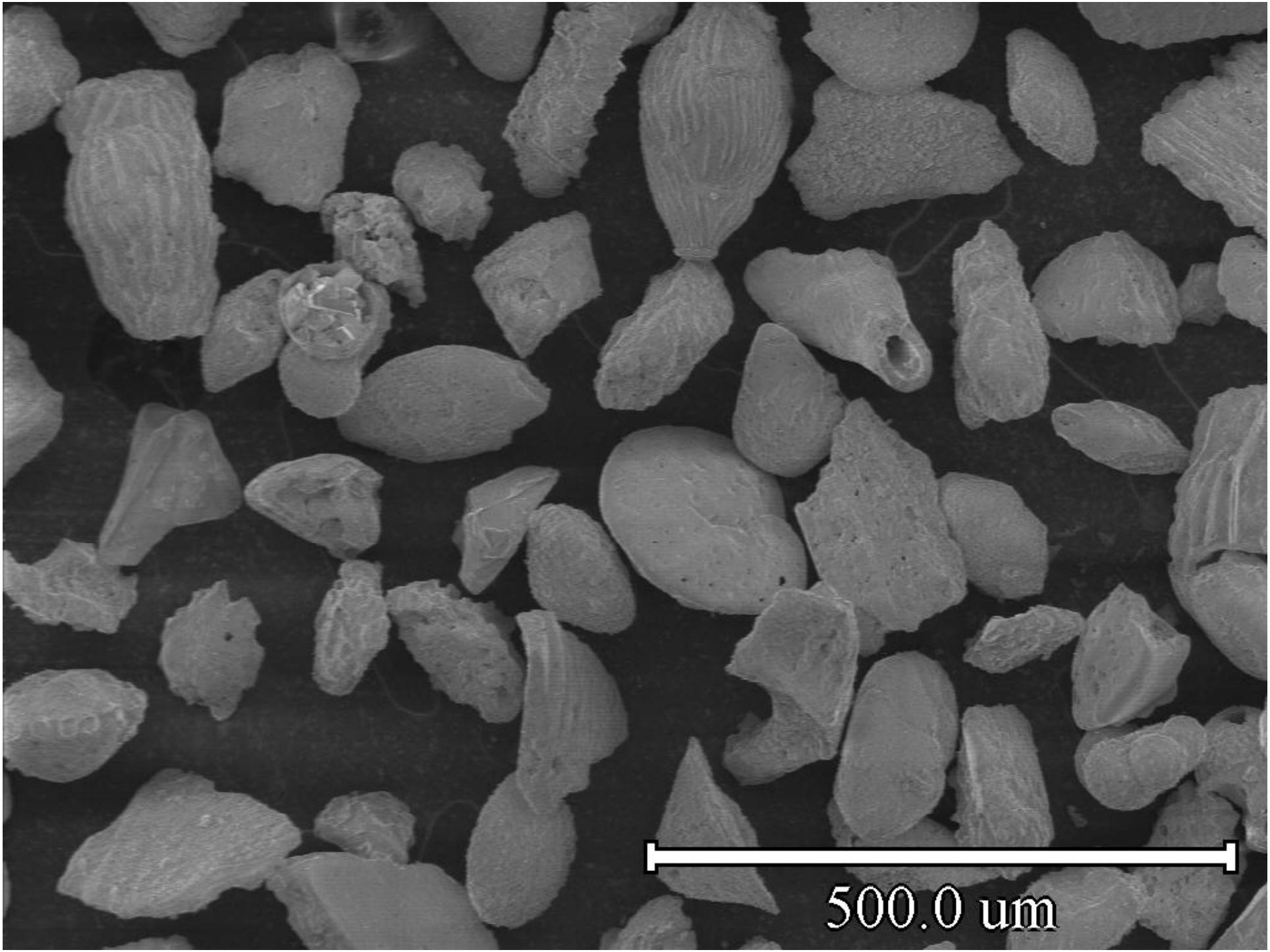
State	*Project*	*Test No.*	*Reference*	*Test Type*	*Material*	*SPT N values (bpf)*	*q_u (ksf)*	*Unit Side Shear (ksf)*	*Unit End Bearing (ksf)*
AL	US 80 over Mill Creek	AFT-106058	1	Statnamic	Demopolis/Mooreville Chalk (hard gray, clayey silt)	N > 100	---	5.8 – 10.7	41.6
AL	SR 10 Blue Springs	LT-8571	2	O-Cell	Claystone	N > 100	---	0.9 - 1.7	27.4
AL	Hyundai Motor Manufacturing	LT-8904	2	O-Cell	Demopolis Chalk	42 - 62	18.4	3.4 – 9.4	90.9
AL	Andalusia, AL	WRT-1-1	3	Conventional	Claystone	---	17 - 127	7.0 - 9.6	---
MS	US 45 over Town Creek	LT-8194	2	O-cell	Mooreville Chalk (Hard grey, clayey, silt)	---	23.5	5.1	197.0
MS	SR 25 over Talking Warrior Creek	LT-8373	2	O-cell	Basal Formation (Hard Clayey Silt and Silty Clay)	---	6.1 - 27.9	2.2 - 5.9	67.8
MS	US 82 Oktibbeha County	LT-8461-1	2	O-cell	Demopolis Formation (Hard, Argillaceous Chalk)	---	10.9 - 38.6	3.1 - 7.3	214.0
MS	US 82 Oktibbeha County	LT-8461-2	2	O-cell	Prairie Bluff Formation (Hard, Silty, Clay) and Ripley Formation (Hard, Sandy, Silt)	---	27.1 - 28.8	2.1 - 3.9	108.0
MS	SR 42 over Thompson Creek	LT-8487	2	O-cell	Very stiff to hard, clayey silt and silty sand	---	7.1	1.9 - 5.0	24.8
MS	I-55 at Old Agency Rd.	LT-8788	2	O-cell	Yazoo Formation (Hard, tan, silty clay)	---	9.0 - 11.1	0.3 - 1.5	52.3
MS	SR 9 over SR 6	LT-8912-1	2	O-cell	Clayton Formation (Hard, clayey silt and silty clay)	N > 100	18.0	7.7 - 8.4	202.8
MS	SR 9 over SR 6	LT-8912-2	2	O-cell	Ripley Formation (Hard, very fossiliferous, sandy silt)	N > 100	18.0	8.8 - 12.9	221
MS	Leake County, MS	WRT-4	3	O-cell	Chalk		12.1	3.2	46.2
SC	Mt. Pleasant, SC	WRT-5-1	3	Conventional	Cooper Marl	9 - 100+	2.9	3.6	28.6
SC	Mt. Pleasant, SC	WRT-5-2	3	Conventional	Cooper Marl	9 - 100+	2.9	3.6	---
SC	Cooper River Bridge Charleston/Mt. Pleasant, SC	LT-86500	2	O-cell (10 tests)	Cooper Marl (Clayey sand, sandy clay, sandy silt)	15 - 100+	---	2.0 - 6.5	43.5 - 80
SC	Breach inlet Bridge	LT-8661	2	O-cell	Cooper Marl (Clayey sand, sandy clay, sandy silt)	15 - 28	4.2 - 5.9	0.2 - 2.8	49.4

Reference:

1. AFT-XXXXXX: Statnamic test report from AFT, Inc. with permission of owning state DOT
2. LT-XXXX: O-Cell test report from Loadtest, Inc. with permission of owning state DOT;;
3. WRT-X: Test data from Thompson, W.R. III (1994) *Axial Capacity of Drilled Shafts Socketed into Soft Rock*, M.S. Thesis, Auburn University, AL

Drilling & Sampling

- Conventional Rock Coring Tools
- Pitcher Barrel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Data Summary (example)

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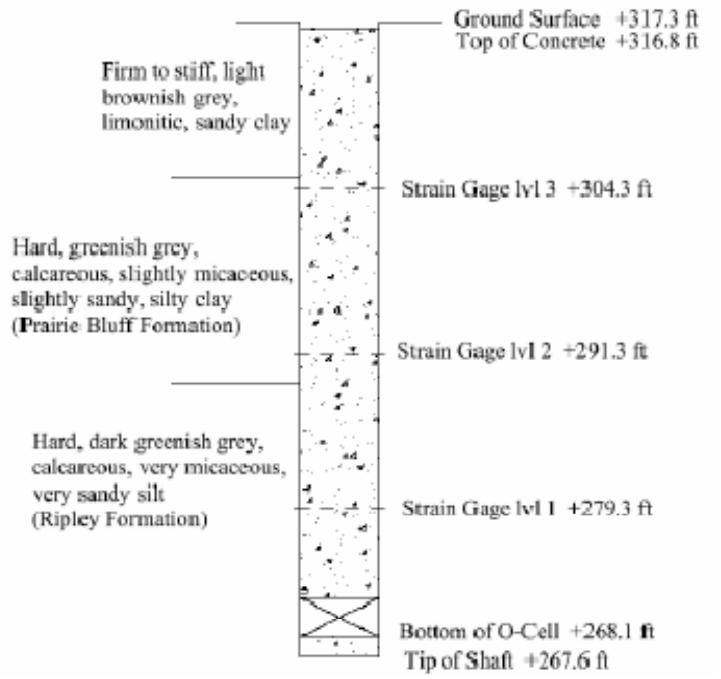
US 82 Oktibbeha County, Mississippi Test Shaft 2

The test shaft was constructed on June 23, 1998. The 48-in test shaft was constructed to a total length of 39.7 ft. There were no unusual problems during the construction of the test shaft.



Shaft Summary

Shaft Diameter (in)	Shaft Length (ft)	Shaft Length Below O-cell (ft)	Shaft Length Above O-cell (ft)	O-cell Size (in)	Max Net Load (kips)	Max Deflection Up (in)	SS Creep Load (kips)	EB Creep Load (kips)
48.0	39.7	0.5	39.2	26.0	1396.00	0.51	1320.00	800.00

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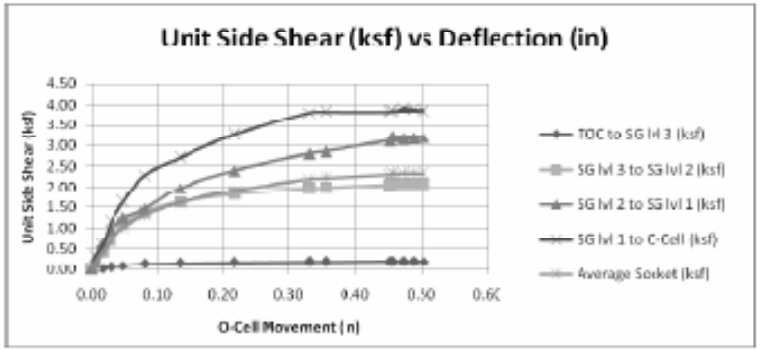
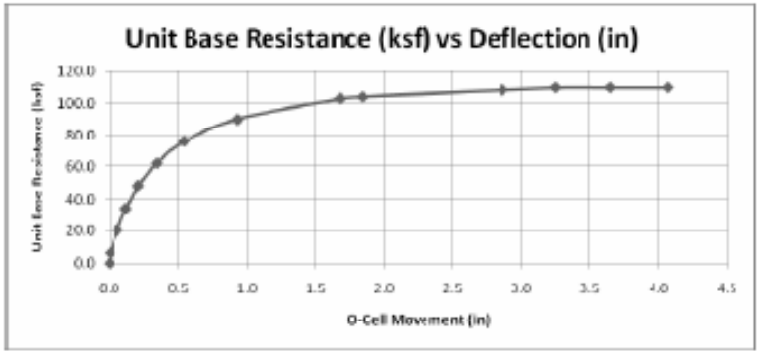
Data Summary

Elevation (ft.)	Material	Location	Average Undrained Shear Strength, S_u (ksf)	Avg. ϕ (°)	Average Unconfined Compressive Strength, q_u (ksf)	Unit End Bearing (ksf)	Defl. For End Bearing (in)	Unit Side Shear (ksf)	Defl. For Side Shear (in)
316.8	Firm, sandy, clay	Top of Shaft	2.46					0.2	0.47
305.0	Hard, silty, clay		4.06	35	28.5				
304.3	Hard, silty, clay	Strain Gage lvl 3						2.06	
291.3	Hard, silty, clay	Strain Gage lvl 2						3.16	
280.0	Hard, sandy, silt		3.06	30	27.1				
279.3	Hard, sandy, silt	Strain Gage lvl 1						3.92	
268.1	Hard, sandy, silt	Bottom of O-Cell							
267.6	Hard, sandy, silt	Bottom of Shaft				109	3.25		





Nominal Axial Resistance in Shales and Weak Rock

Side Resistance:

$$\frac{f_{SN}}{p_a} = C\sqrt{\frac{q_u}{p_a}}$$

$$\frac{f_{su}}{p_a} = 0.65\sqrt{\frac{q_u}{p_a}}$$

Horvath & Kenney (1979)
Normalized by atm press

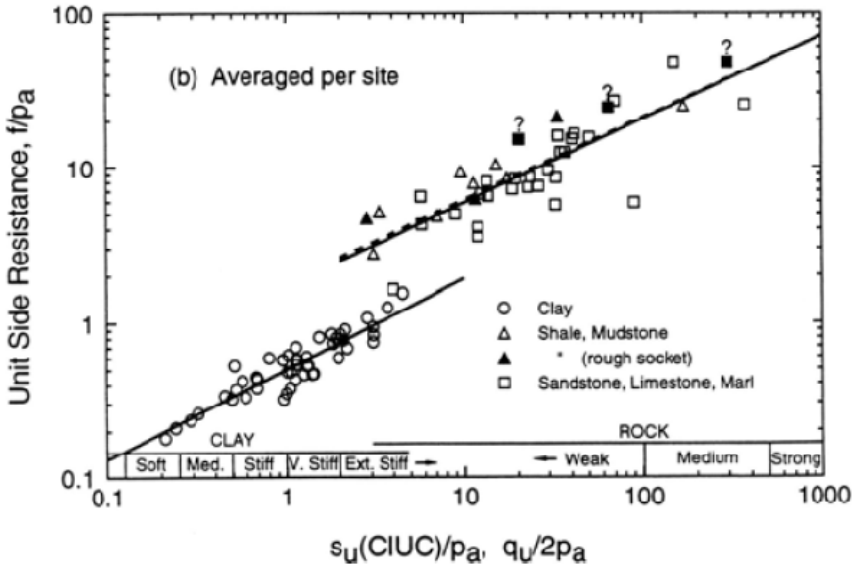
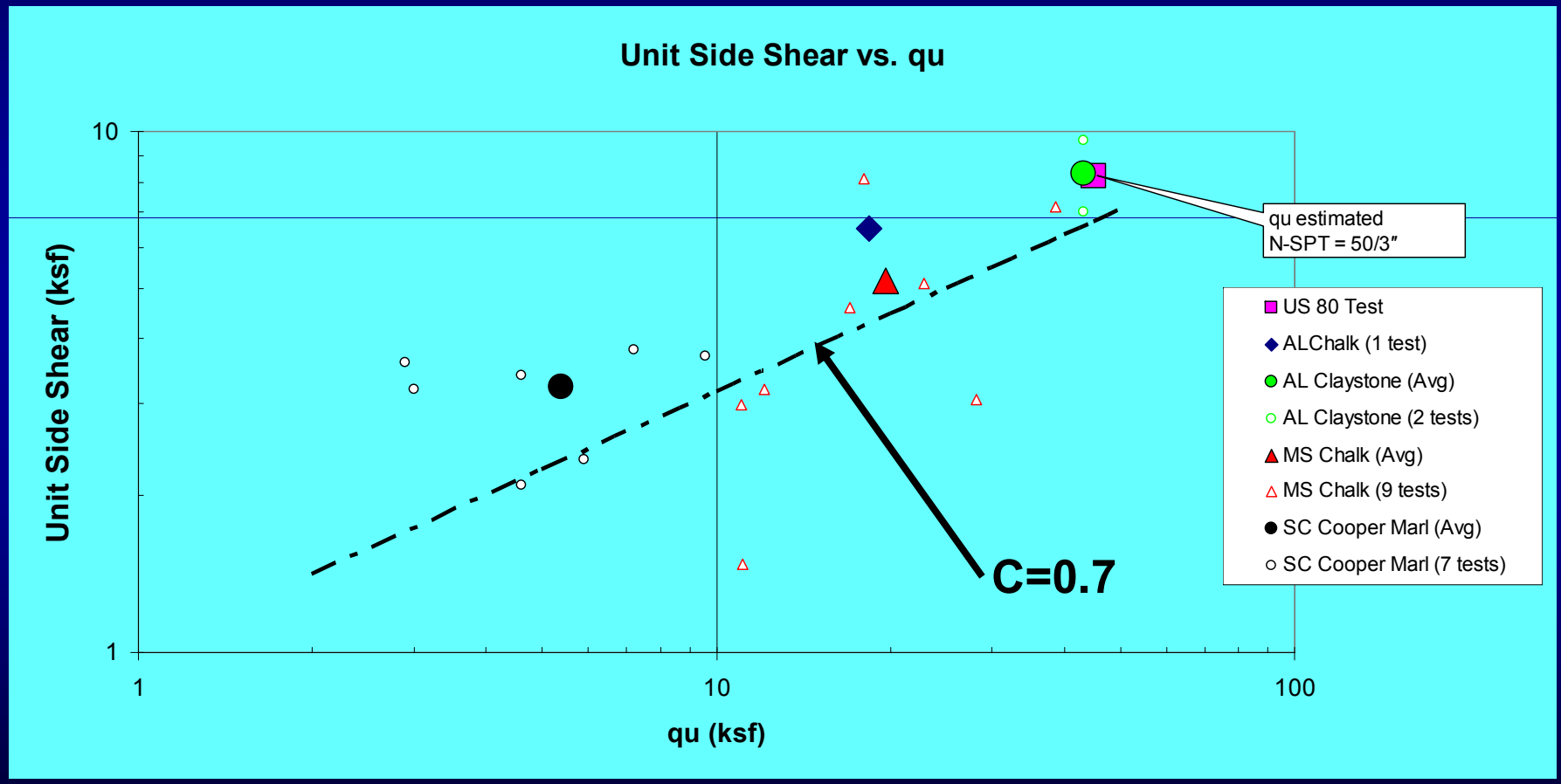
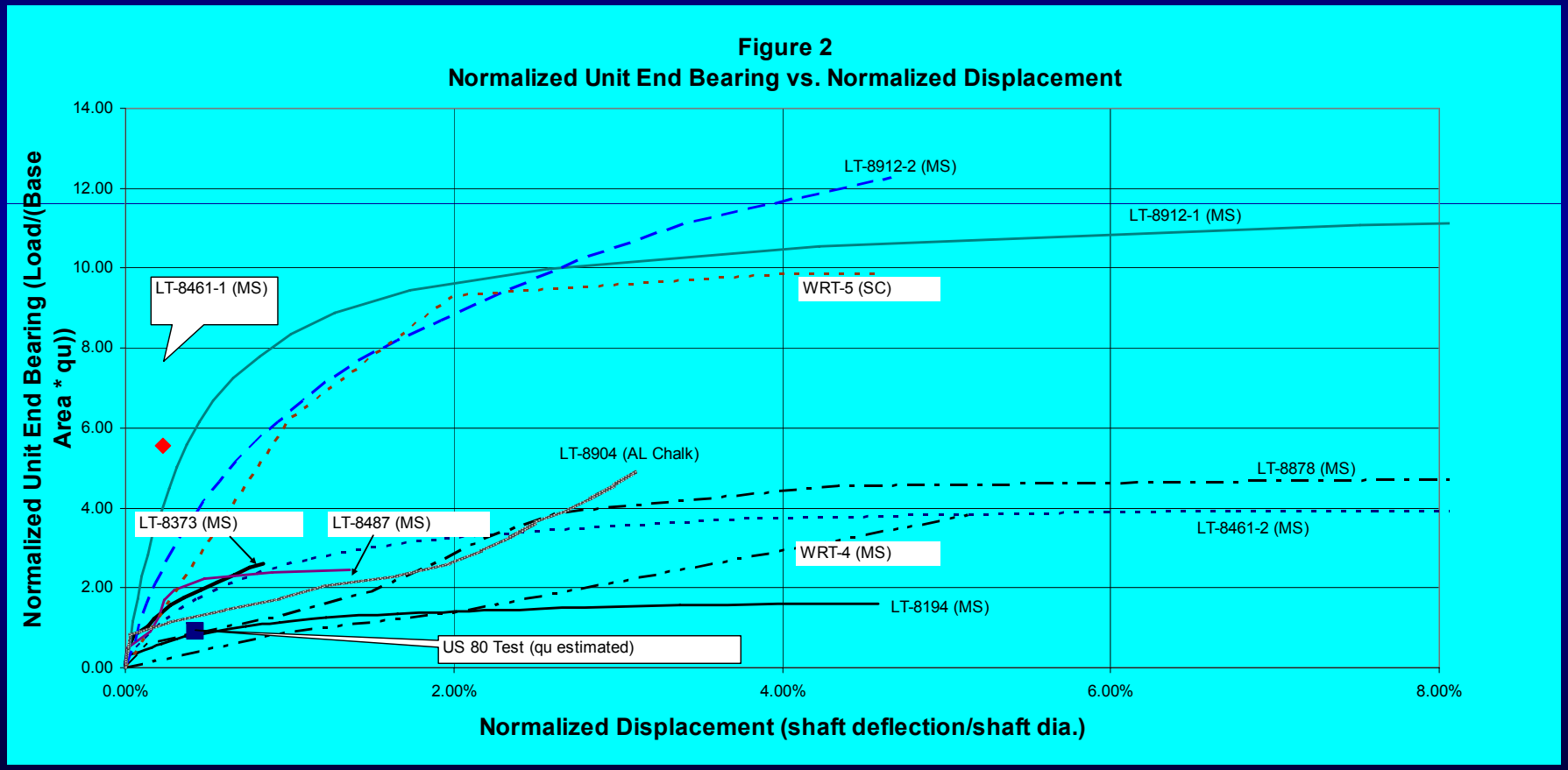


FIGURE 24 Unit side resistance versus strength (Kulhawy and Phoon 1993).

Marls and Chalks in SE U.S.



End Bearing Resistance in Marl, SE U.S.



Thanks for Listening!