EDC Phase II - LRFD Resistance Factors

FDOT BDV31 977-13

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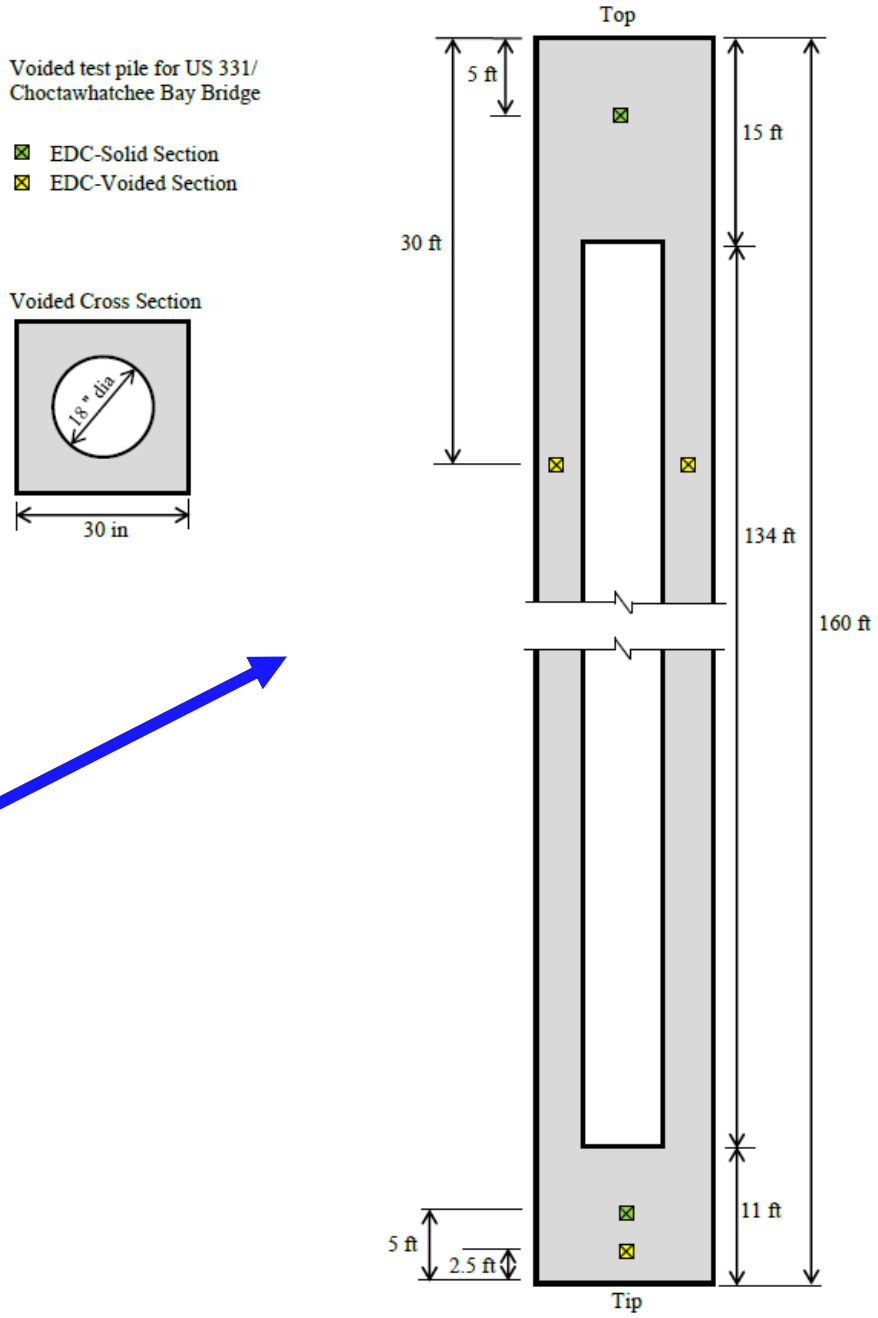
Scope of Work

- Task 1 – Test piles (5) at Choctawhatchee Bay bridge (AFT)
  - EDC install
  - EDC monitoring during install
  - EDC measurements during static load tests
- Task 2 – Analysis and comparisons (AFT, Clarkson University and UF)
  - Smart Pile Review analysis for total, skin and tip
  - New methods for analysis of skin and tip
  - Analyze EOID and BOR blows for all 5 piles
  - Compare measured load test vs. EDC predicted (i.e., Smart Pile Review and New methods)
- Task 3 – Develop LRFD resistance factors (UF)
  - Augment existing dataset (**FDOT BDK-75-977-24**) 6 sites, 12 piles, 17 independent values: total, skin and tip

Choctawhatchee Bay Bridge Test Piles

- Pier 13 test pile
  - 30 in square
  - Gauges 2B from top and bottom
  - 160 ft long
- Piers 25, 33, 59 & 84
  - 30 in square with void
  - Gauges in solid and voided sections
  - 160 ft long



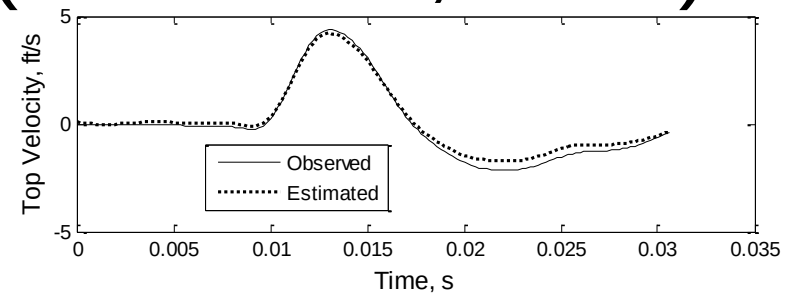
Choctawhatchee Bay – Pier 13

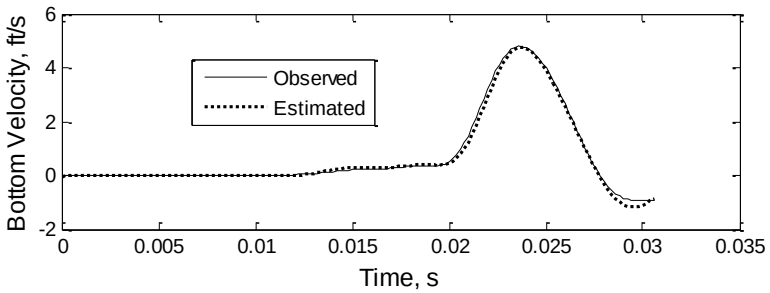
Pile Gauge Locations	Fixed Method	UF Method			New Method (Tran et al.)			CAPWAP			Load Test
	Total Capacity (Kips)	Total Capacity (Kips)	Skin Capacity (Kips)	Tip Capacity (Kips)	Total Capacity (Kips)	Skin Capacity (Kips)	Tip Capacity (Kips)	Total Capacity (Kips)	Skin Capacity (Kips)	Tip Capacity (Kips)	Total Capacity (Kips)
Top and Tip Gauges	593	548	414	134	625	425	200	699.6	434.7	264.9	1500

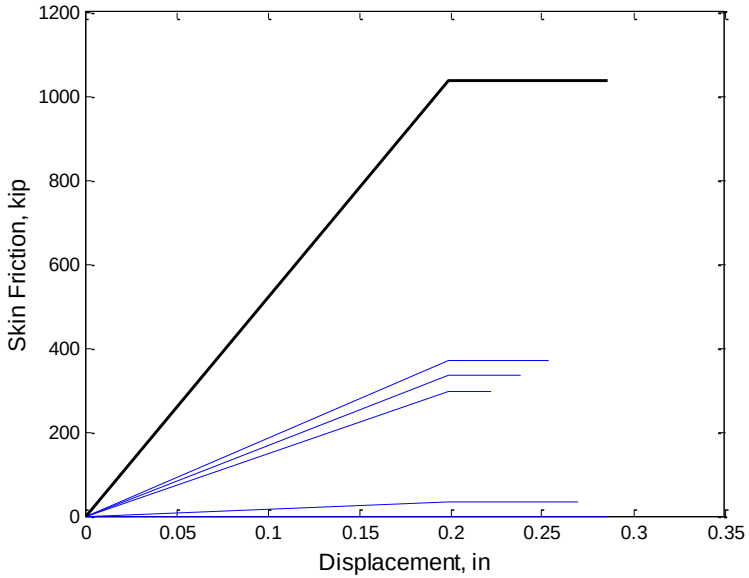
- Pile was cutoff, driven, load tested and then driven an additional 7 ft
- EDC not accessible due to cutoff
- Load test did not reach Davisson failure
- Not used in data set

Choctawhatchee Bay – EDC New method (Tran et al., 2012)

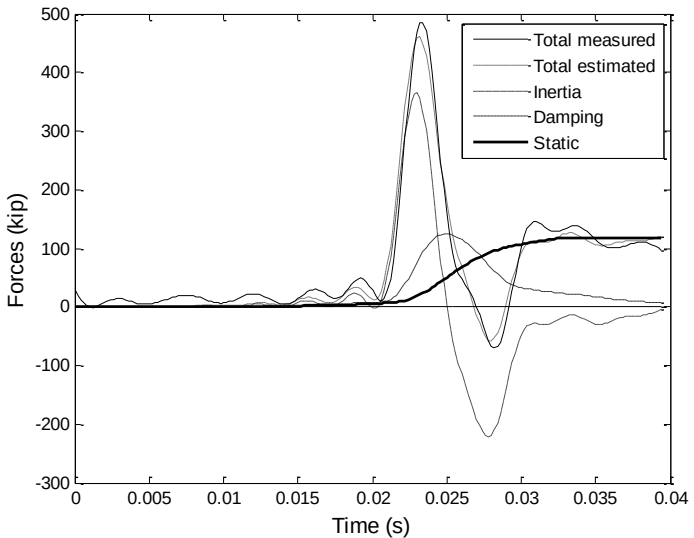
Skin

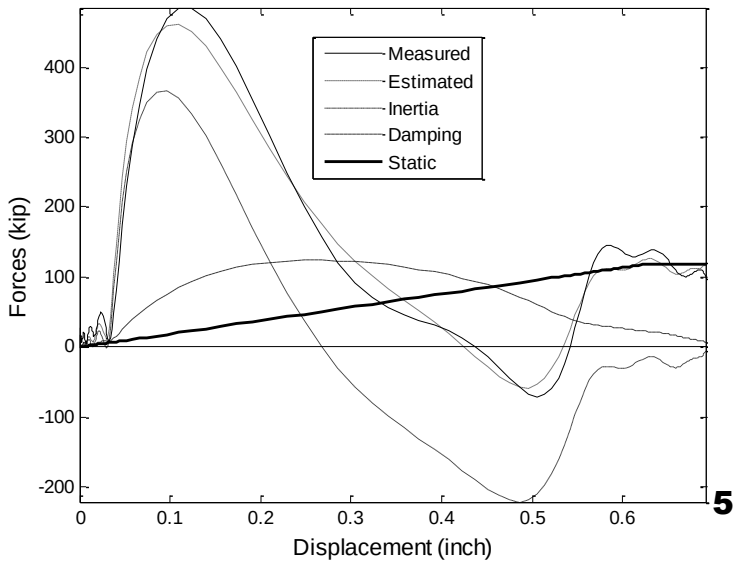




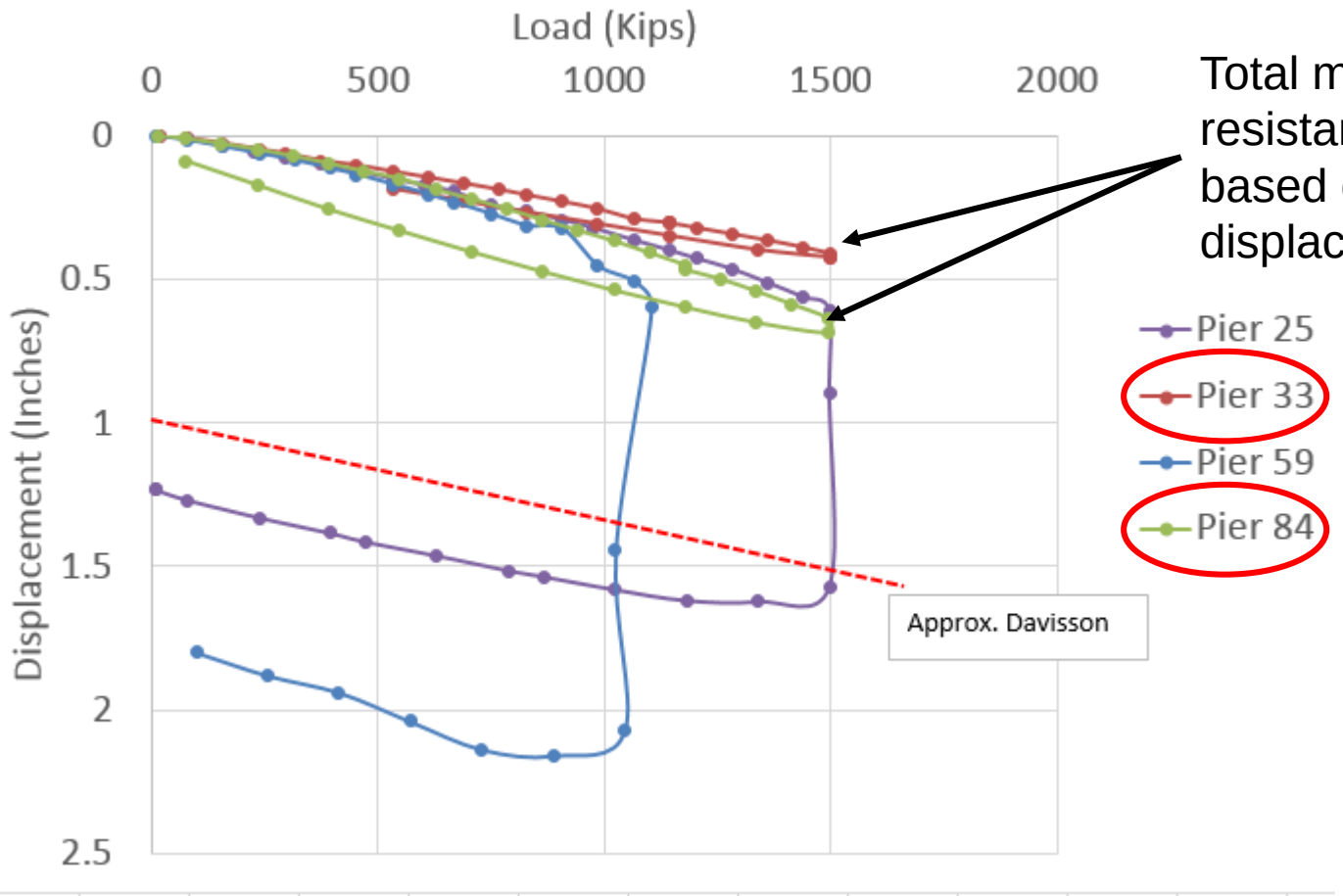


Tip



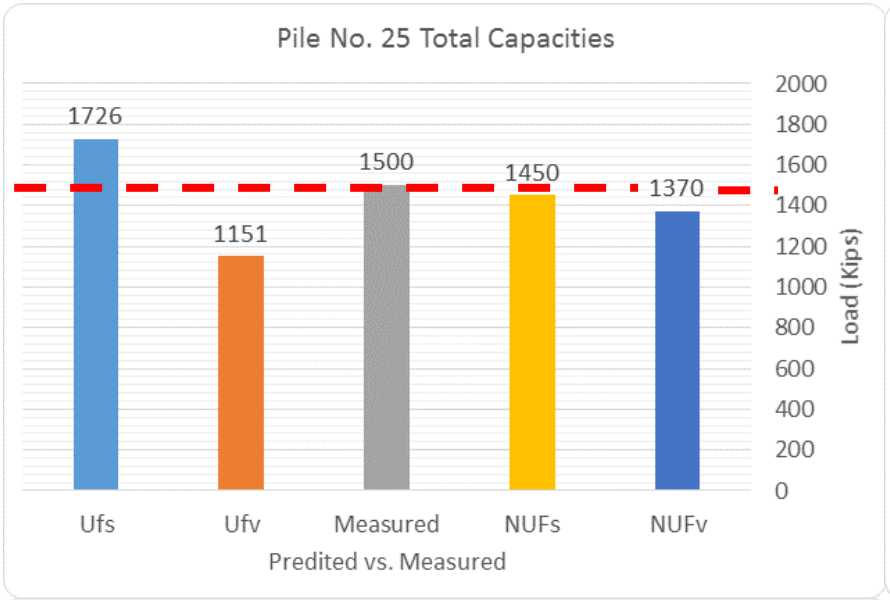


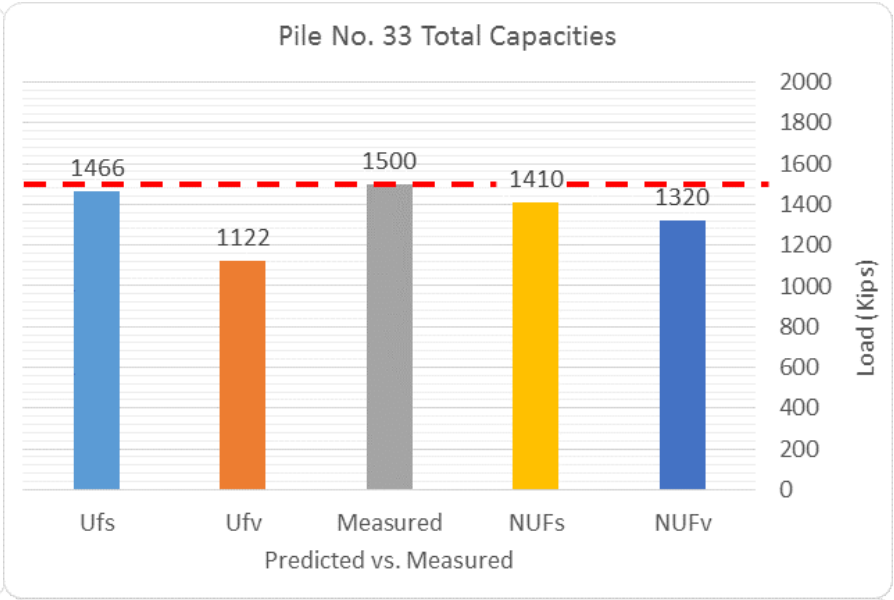
Choctawhatchee Bay – Measured Load Tests

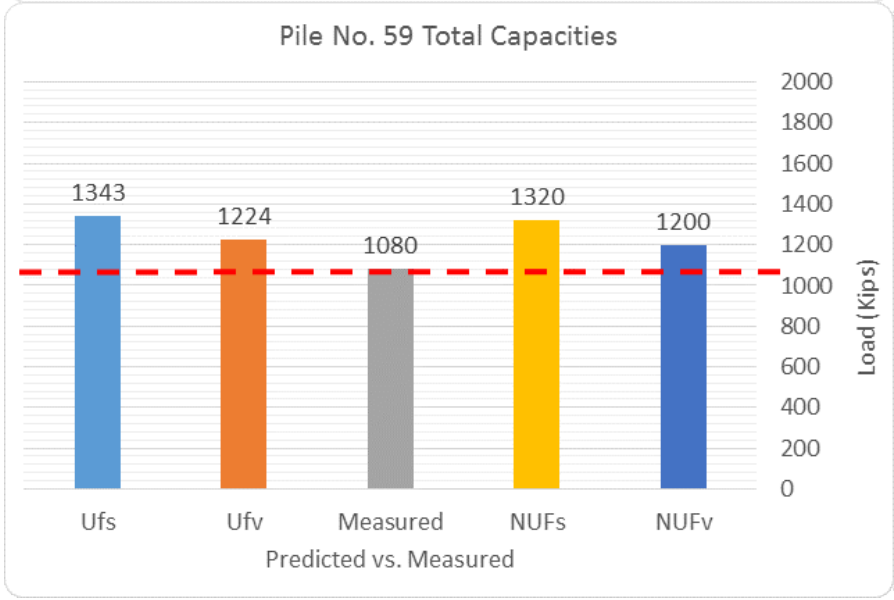


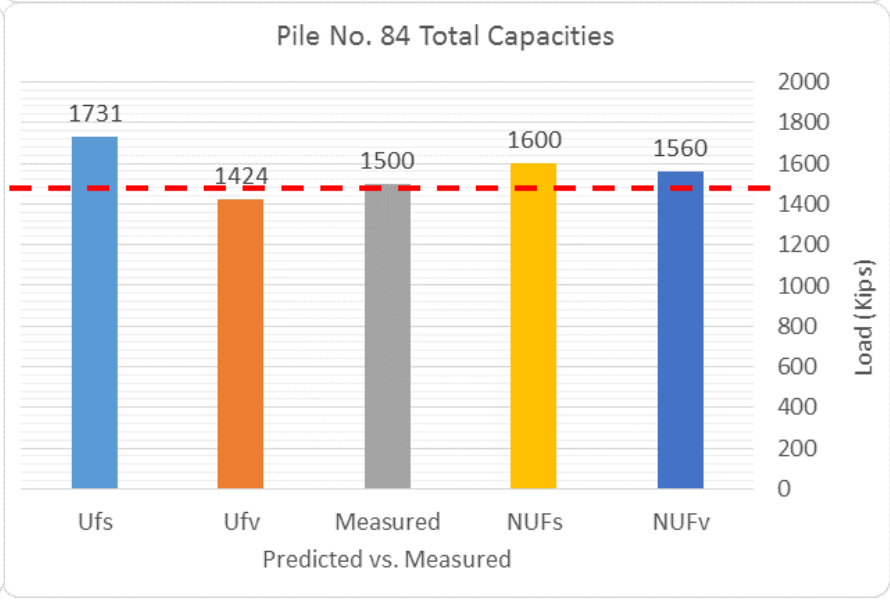
Total measured resistance based on displacement

Choctawhatchee Bay – Piers 25, 33, 59 & 84









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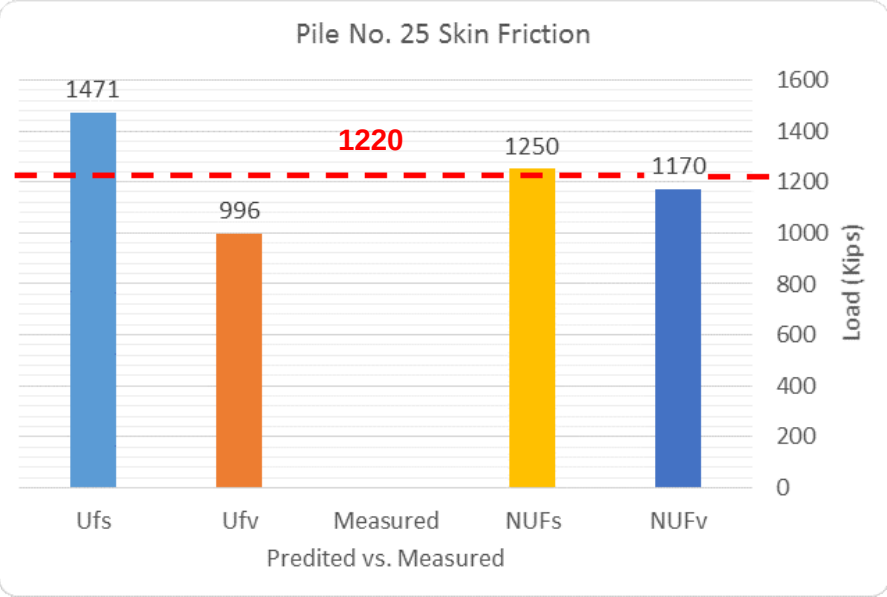
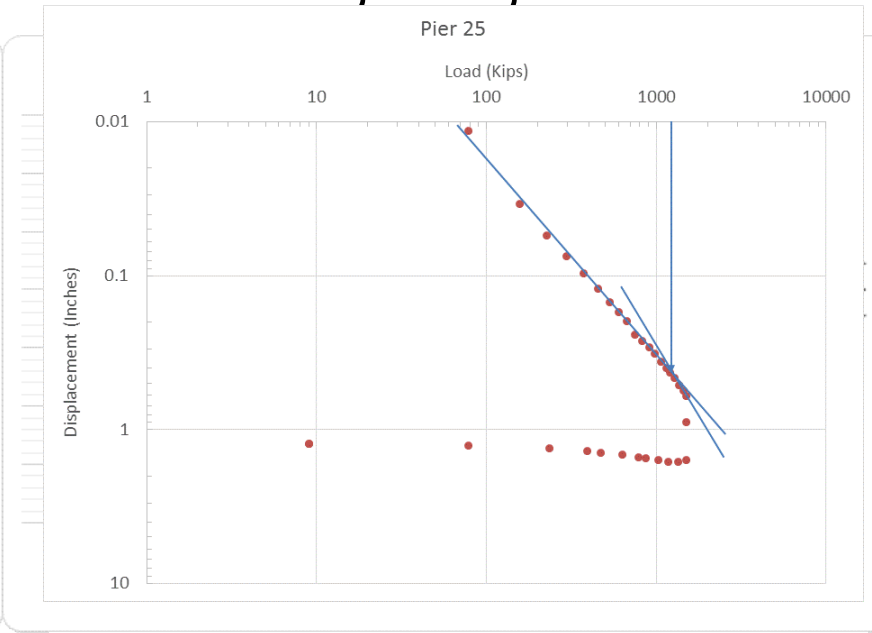
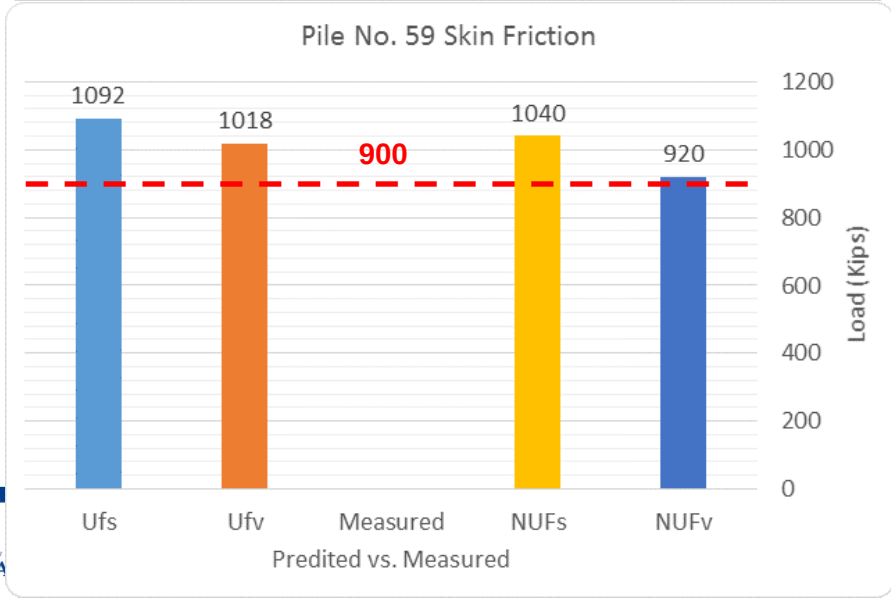
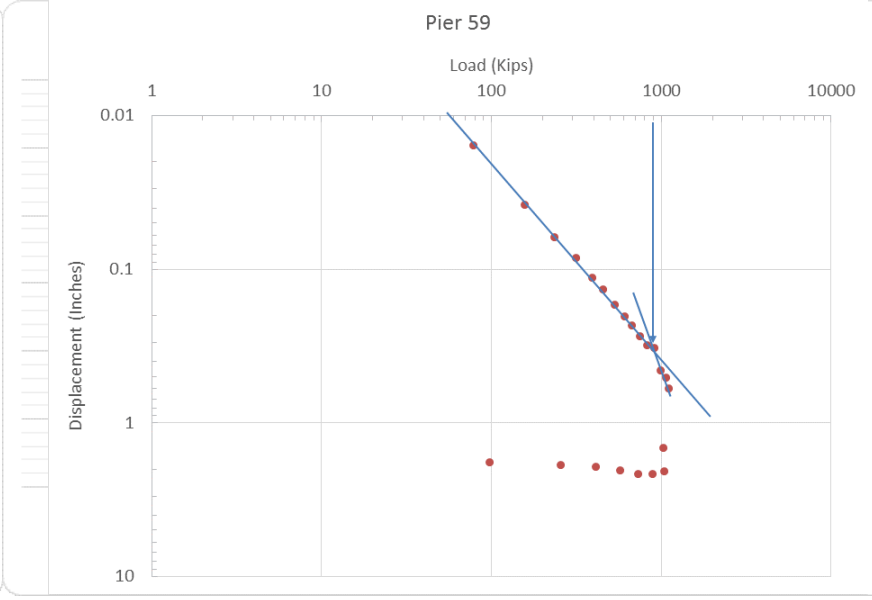
Choctawhatchee Bay – Piers 25, 33, 59 & 84

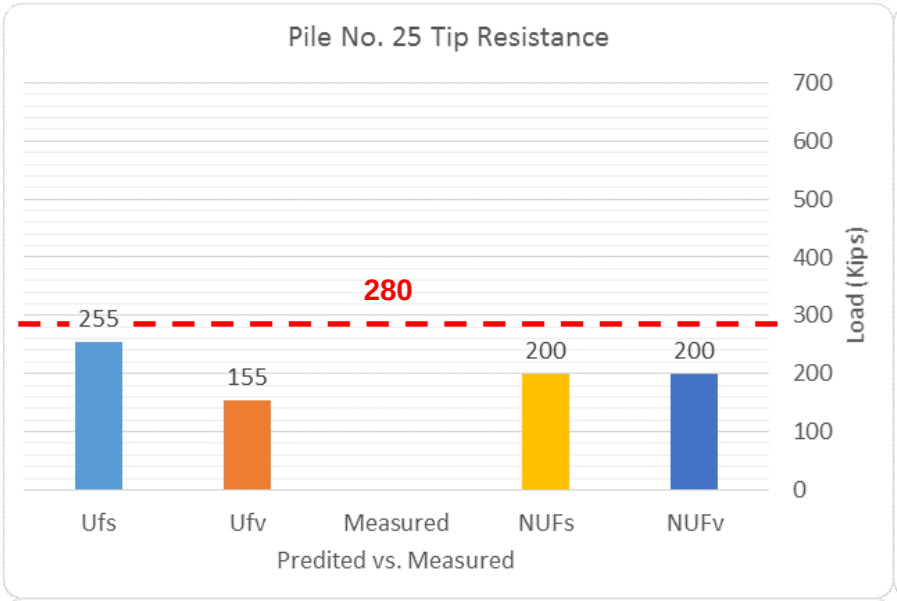


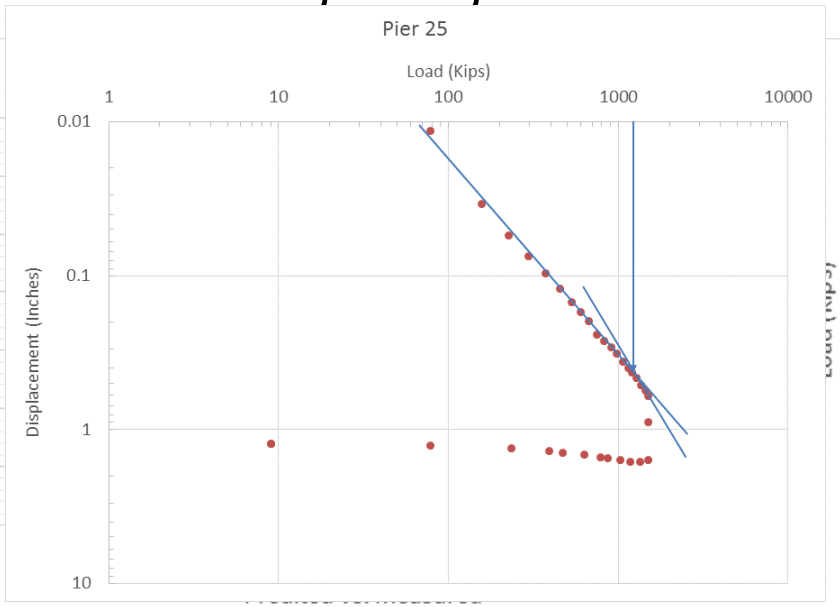


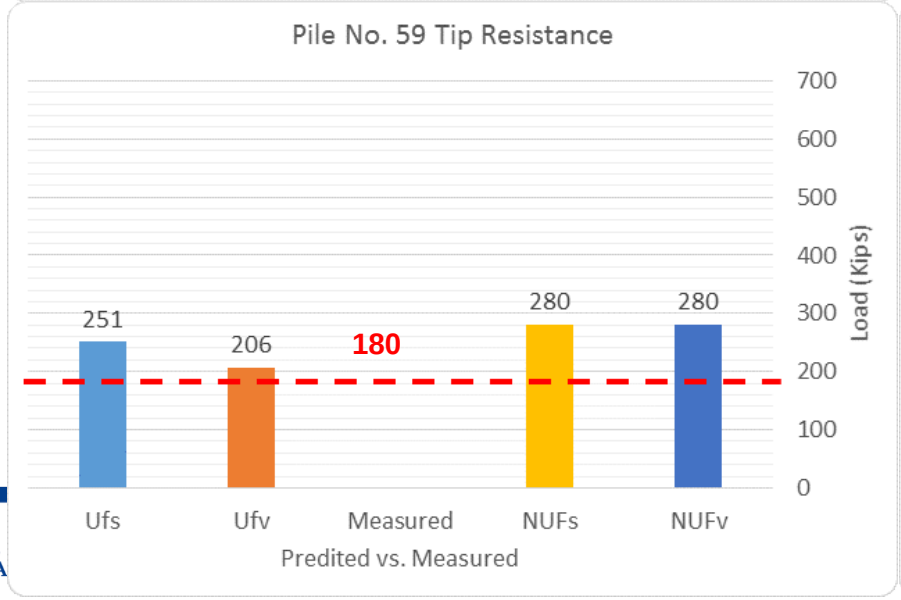


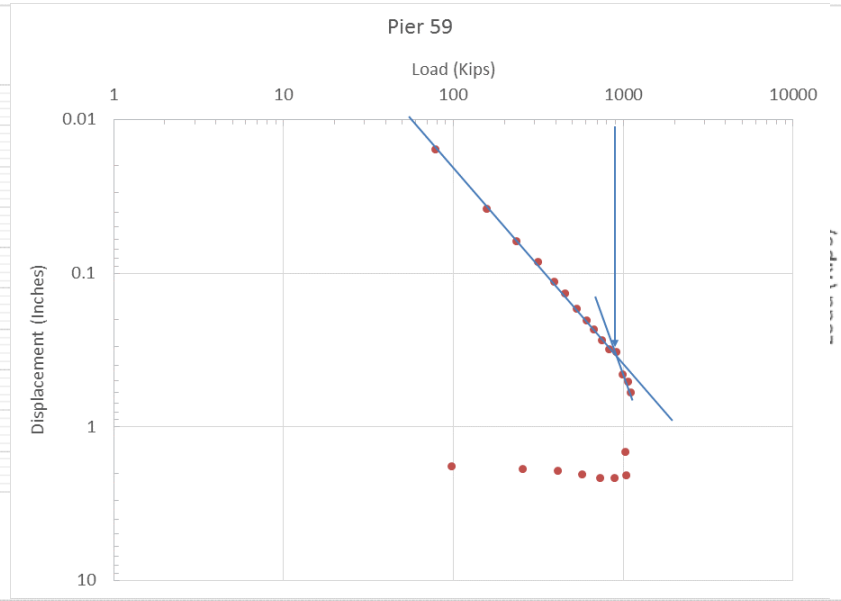


Choctawhatchee Bay – Piers 25, 33, 59 & 84









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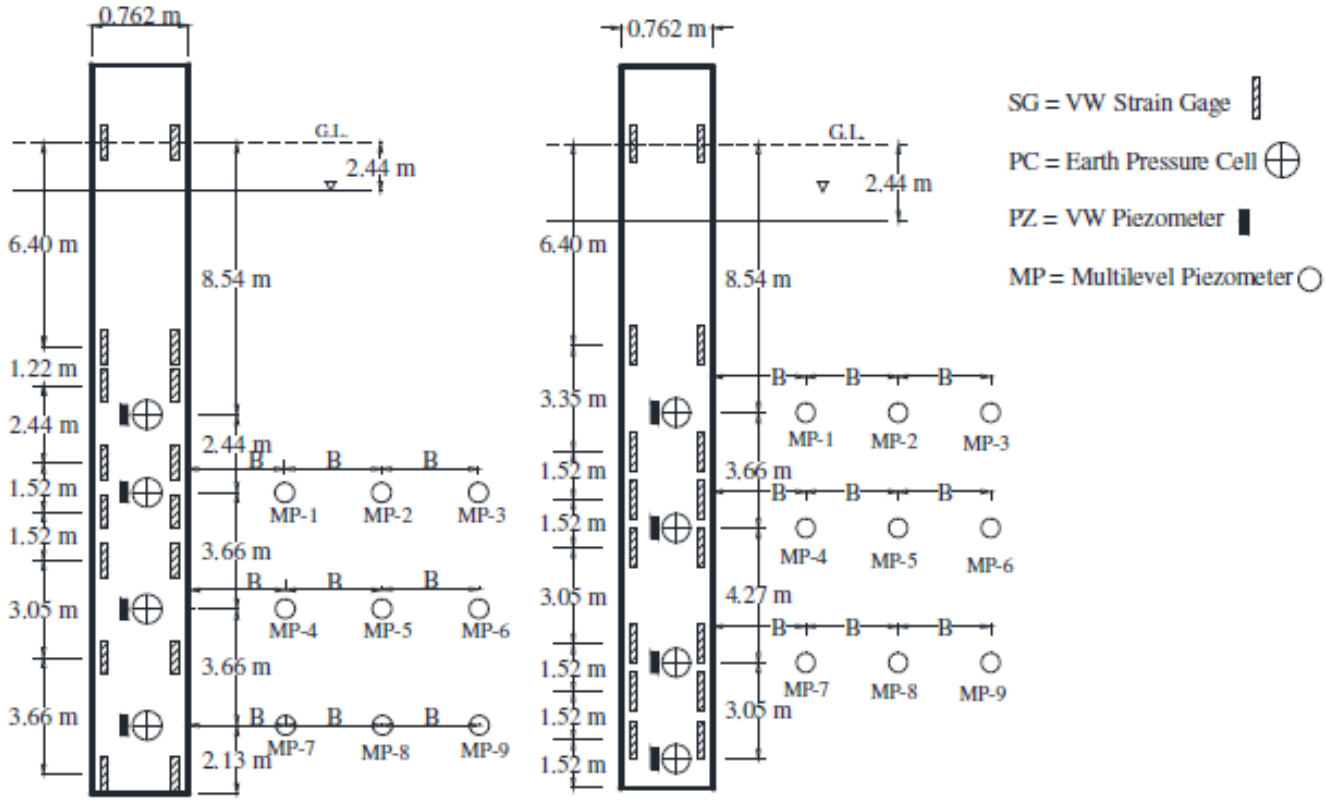
Bayou Lacassine Bridge, Louisiana

- 2 Test piles (Haque et al., 2014)
  - 30 in square piles with 16.5 in diameter void



Collected Measured versus Predicted

- 16 sites
- 34 values

	Measured			Predicted		
Site & Pile	Davisson Capacity	Tip Capacity	Skin Capacity	SmartPile Total Capacity	SmartPile Tip Capacity	SmartPile Skin Capacity
	(Kip)	(Kip)	(Kip)	(Kip)	(Kip)	(Kip)
Dixie Highway End Bent 1	430	296	134	448	349	99
Dixie Highway Pier 8	380	200	180	470	250	220
Caminada Bay Bent 1 LADOT	540	144.8	395.2	574	94	480
Caminada Bay Bent 7 LADOT	625	80	545	587	67	520
Bayou Lacassine Bent 1 Pile 1 LADOT	452	71	381	432	91	341
Bayou Lacassine Bent 1 Pile 3LADOT	850	153	697	745	74	671
I-95 Jax	380	200	180	369	263	106
Dixie Highway Pier 4			212			171
5th St Bascule Pier 2 Pile 37			185			220
5th St Bascule Pier 2 Pile 53			180			200
5th St Bascule Pier 3 Pile 9			68			150
5th St Bascule Pier 3 Pile 42			153			215
US 331 Choctawhatchee Bay Pier 25	1500	*280*	*1220*	1726	255	1471
US 331 Choctawhatchee Bay Pier 33	*1500*			1466	158	1308
US 331 Choctawhatchee Bay Pier 59	1080	*180*	*900*	1343	251	1092
US 331 Choctawhatchee Bay Pier 84	*1500*			1731	866	865
US 331 Choctawhatchee Bay Pier 25	1500	*280*	*1220*	1151	155	996
US 331 Choctawhatchee Bay Pier 33	*1500*			1122	96	1026
US 331 Choctawhatchee Bay Pier 59	1080	*180*	*900*	1224	206	1018
US 331 Choctawhatchee Bay Pier 84	*1500*			1424	793	631

Solid Section

Voided Section

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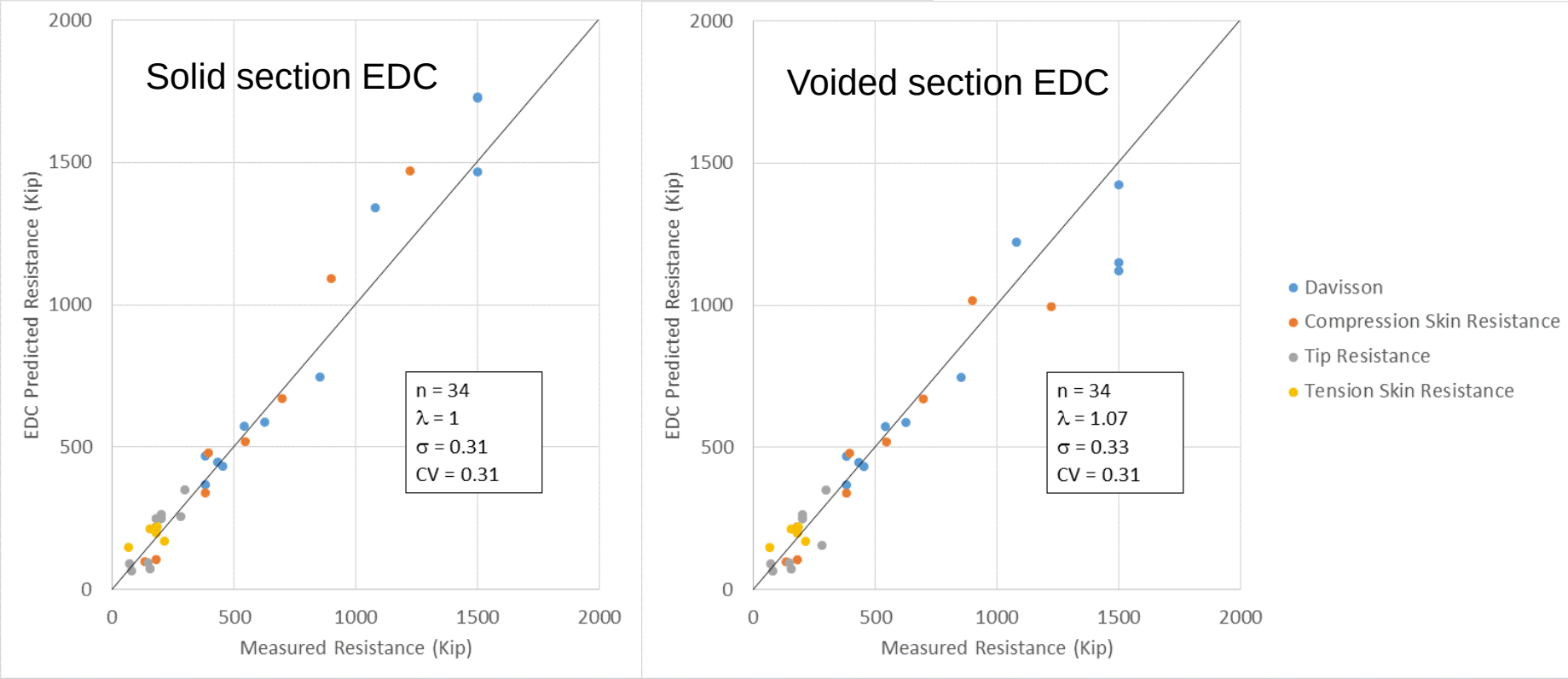
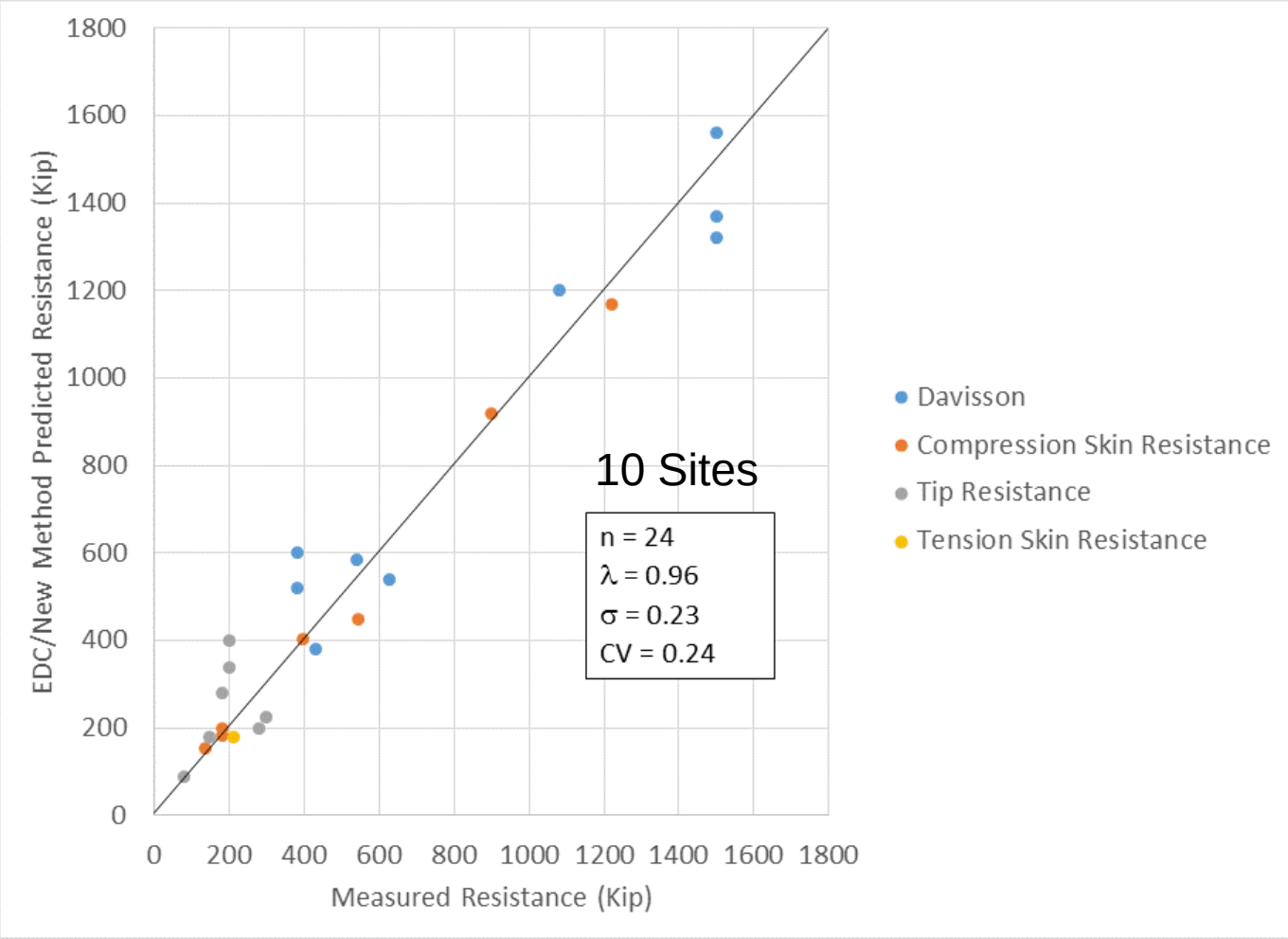
Collected Measured versus Predicted



- LRFD Φ for AASHTO (2012) parameters: $q_D/q_L = 2$, dead load factor γ_D=1.25, live load factor γ_L=1.75, dead load bias λ_D=1.08, live load bias λ_L=1.15, CV_D=0.128, CV_L=0.18, β = 2.33
  - Φ = 0.65 based on predictions using solid section EDC
  - Φ = 0.61 based on predictions using void section EDC

EDC/New Method Performance



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Thank You!

Questions?