

September 4, 2019

Mr. Tyler Wallace
Decks & Docks Lumber Co.
1281 Court St.
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Subject: **Report of Product Testing**
Product: Pile Comparison Testing
TEC Services Project No. TEC 11-0873
TEC Lab ID: 19-1073

Dear Mr. Wallace:

Testing Engineering & Consulting Services, Inc. (TEC Services) is an AASHTO R18, ANS/IEC/ISO 17025:2005, and Army Corps of Engineering accredited laboratory. TEC Services is pleased to present this report of field observations and flexural testing performed on August 8th, 2019. The testing was witnessed by Mr. Trey McCants of SGS TEC Services, Inc. The purpose of the testing was to compare the properties of Fortress Piling's 10" diameter x 3/8" wall thickness (FP100-038) with Creative Pultrusion's Superpile 10". Our services were performed in accordance with the terms and conditions of our Service Agreement TEC PRO 11-0873. The test results presented only pertain to the samples tested.

Four 10ft tube sections from each manufacturer were tested in a cantilever arm loading configuration in a similar fashion to the actual intended use of the products for boat dock anchorage. Photos of the testing configuration and schematic for the location of the applied load are attached to this report. Each piling was mounted in the test machine in the same manner to ensure that the spacing of the load and reaction points were kept constant. Dimensional measurements for each pile were also made prior to the start of testing which included the wall thickness and outer diameter. Load was measured using a 50,000 lbf. load cell. Measurements for displacement were determined using an instrument grade string potentiostat transducer mounted on the underside of the pile at the point of load application. The data acquisition rate was 1 Hz for the entire duration of each test. Specimens were loaded until failure. Summary test results are reported in Table 1. Complete test results are reported in Table 2. Figures of Load vs. Displacement are shown in Figures 2-7. Select photo of testing are shown in Photos 1-5.

Table 1 – Summary Average Test Results

Product ID	Fortress Pilings FP100-038	Creative Pultrusion's Superpile 10"
Average Outside Diameter (in.)	10.34	9.89
Average Wall Thickness (in.)	0.38	0.39
Area - A (in ²)	11.77	11.60
Moment of Inertia - I (in. ⁴)	146.27	131.08
Section Modulus - S (in. ³)	28.29	26.51
Radius of Gyration - r (in.)	3.53	3.36
Deflection at First Crack (in.)	1.50	1.45
Deflection at Peak Load (in.)	1.62	1.83
First Crack Load (lbf.)	5,431	3,850
Peak Load (lbf.)	5,466	4,420
Distance from R1 to R2 (in.)	51	51
Distance from R2 to P (in.)	48	48
Reaction at Location No. 1 (lbf.)	5,144	4,160
Reaction at Location No. 2 (lbf.)	10,610	8,580
Maximum Applied Moment at R2 (lbf-in.)	262,368	212,160
Modulus of Elasticity (ksi)	364.61	287.91
Maximum Uniform Bending Stress (psi)	9,273	8,010
Stiffness (lbf./in.)	3,656	3,216

Figure 1 – Loading Diagram

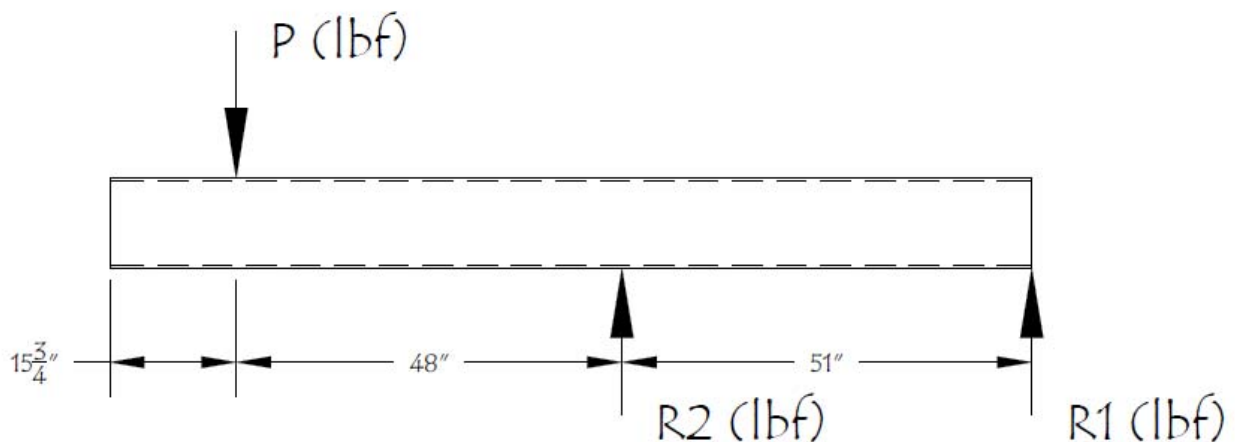


Table 2 – Complete Test Results

Product ID	Fortress Pilings FP100-038				Creative Pultrusion's Superpile 10"			
Sample #	1	2	3	AVG	1	2	3	AVG
Average Outside Diameter (in.)	10.34	10.34	10.34	10.34	9.89	9.89	9.89	9.89
Average Wall Thickness (in.)	0.38	0.38	0.38	0.38	0.39	0.38	0.39	0.39
Area - A (in ²)	11.77	11.80	11.74	11.77	11.61	11.47	11.73	11.60
Moment of Inertia - I (in. ⁴)	146.27	146.62	145.93	146.27	131.23	129.75	132.42	131.08
Section Modulus - S (in. ³)	28.29	28.36	28.23	28.29	26.54	26.24	26.78	26.51
Radius of Gyration - r (in.)	3.53	3.52	3.53	3.53	3.36	3.36	3.36	3.36
Deflection at First Crack (in.)	1.75	1.24	1.53	1.50	1.10	1.71	1.53	1.45
Deflection at Peak Load (in.)	2.11	1.24	1.53	1.62	1.73	1.78	1.88	1.83
First Crack Load (lbf.)	6,525	4,896	4,872	5,431	4,725	3,211	3,614	3,850
Peak Load (lbf.)	6,630	4,896	4,872	5,466	5,250	4,750	4,090	4,420
Distance from R1 to R2 (in.)	51	51	51	51	51	51	51	51
Distance from R2 to P (in.)	48	48	48	48	48	48	48	48
Reaction at Location No. 1 (lbf.)	6,240	4,608	4,585	5,144	4,941	4,471	3,849	4,160
Reaction at Location No. 2 (lbf.)	12,870	9,504	9,457	10,610	10,191	9,221	7,939	8,580
Maximum Applied Moment (lbf-in.)	318,240	235,008	233,856	262,368	252,000	228,000	196,320	212,160
Modulus of Elasticity (ksi)	333.65	420.02	340.14	364.61	359.30	320.12	255.69	287.91
Maximum Uniform Bending Stress (psi)	11,248	8,287	8,285	9,273	9,496	8,690	7,331	8,010
Stiffness (lbf./in.)	3,371	3,915	3,682	3,656	4,085	2,858	3,573	3,216

Figure 2 – Load vs. Displacement

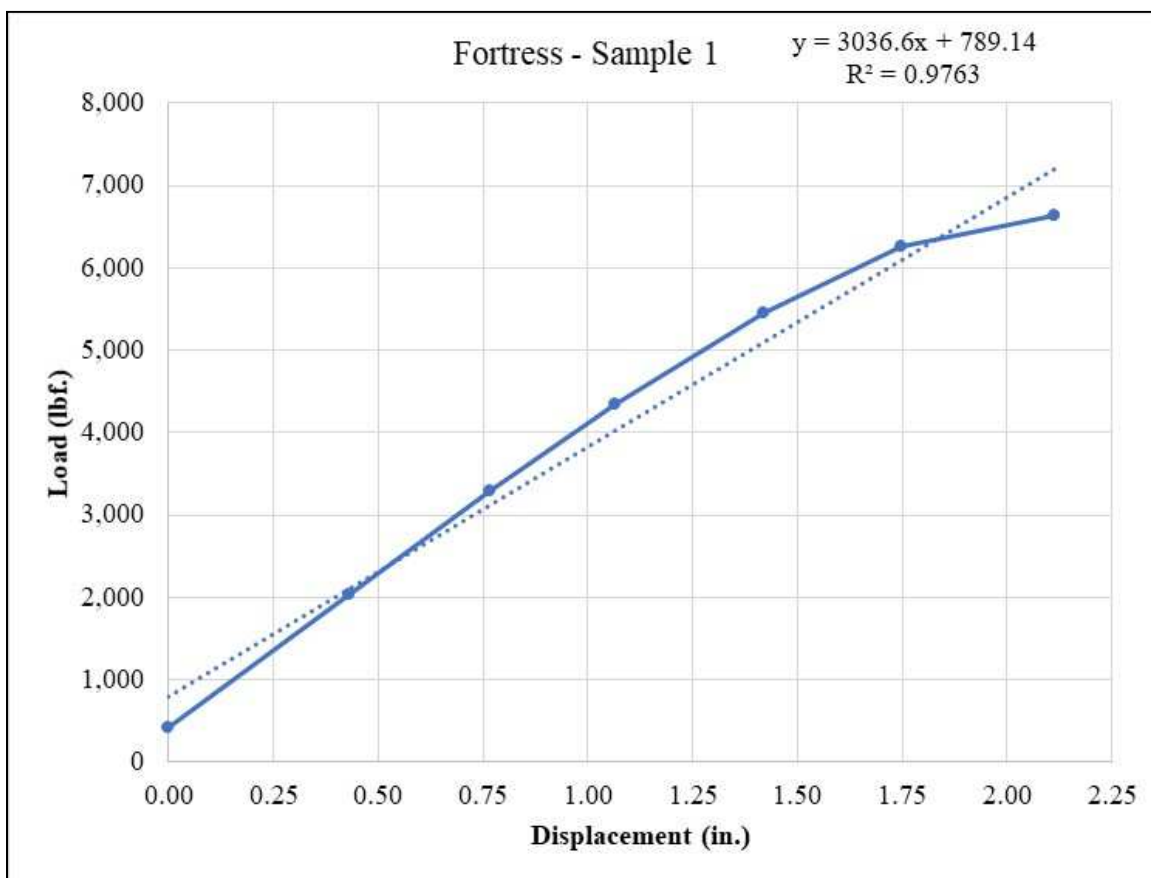


Figure 3 – Load vs. Displacement

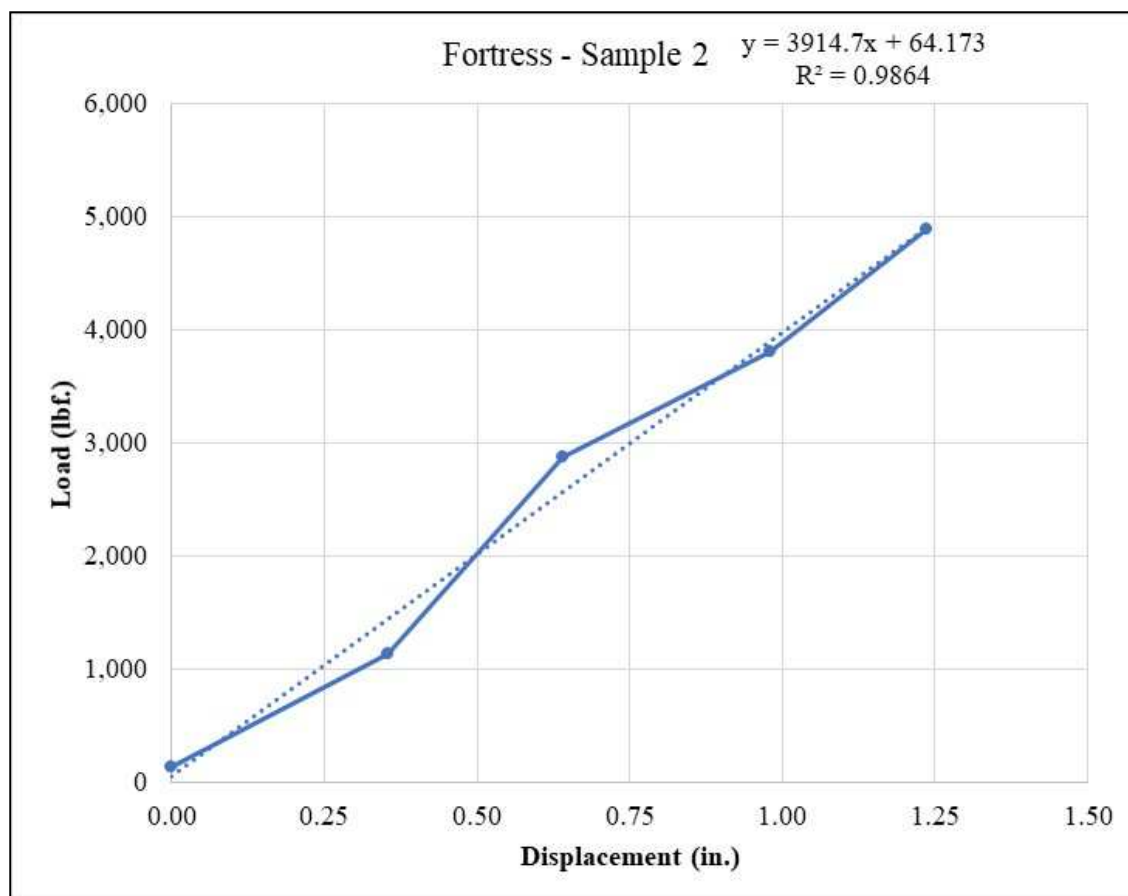


Figure 4 - Load vs. Displacement

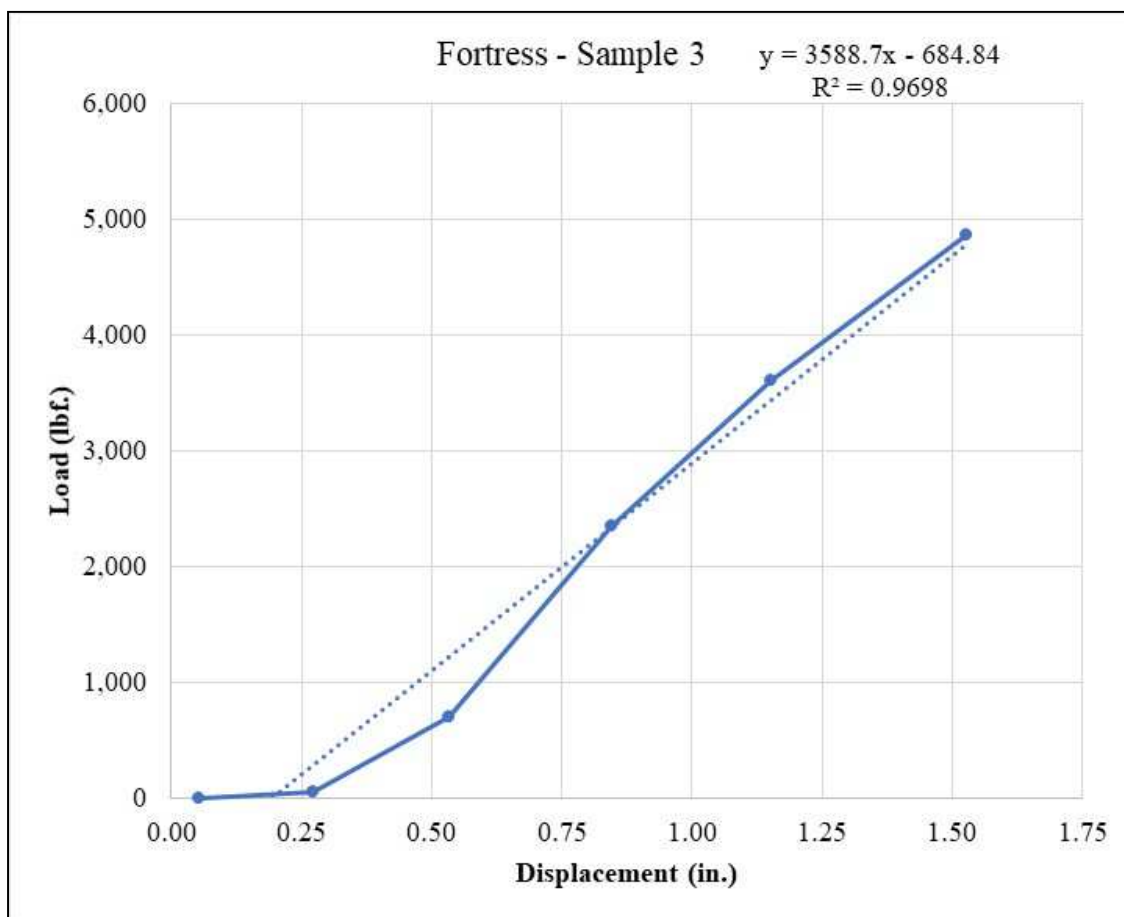


Figure 5 - Load vs. Displacement

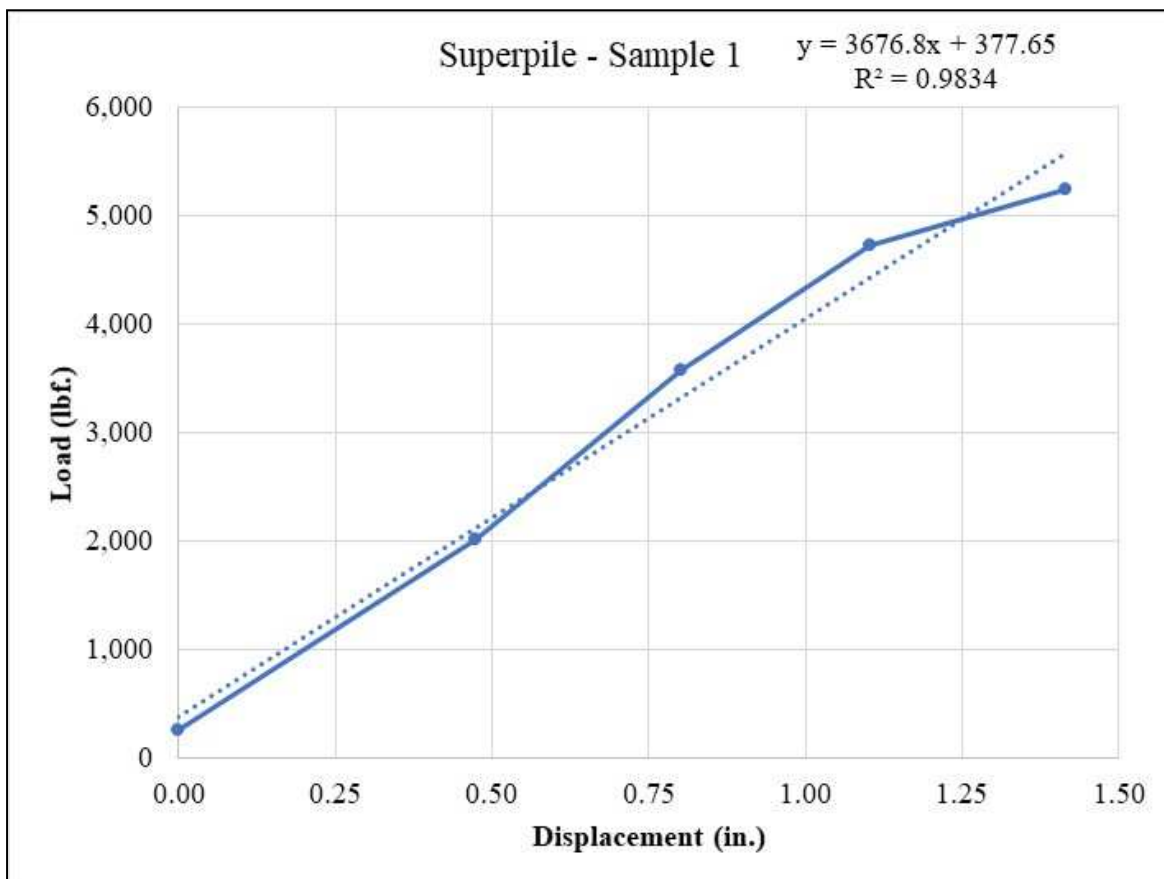


Figure 6 - Load vs. Displacement

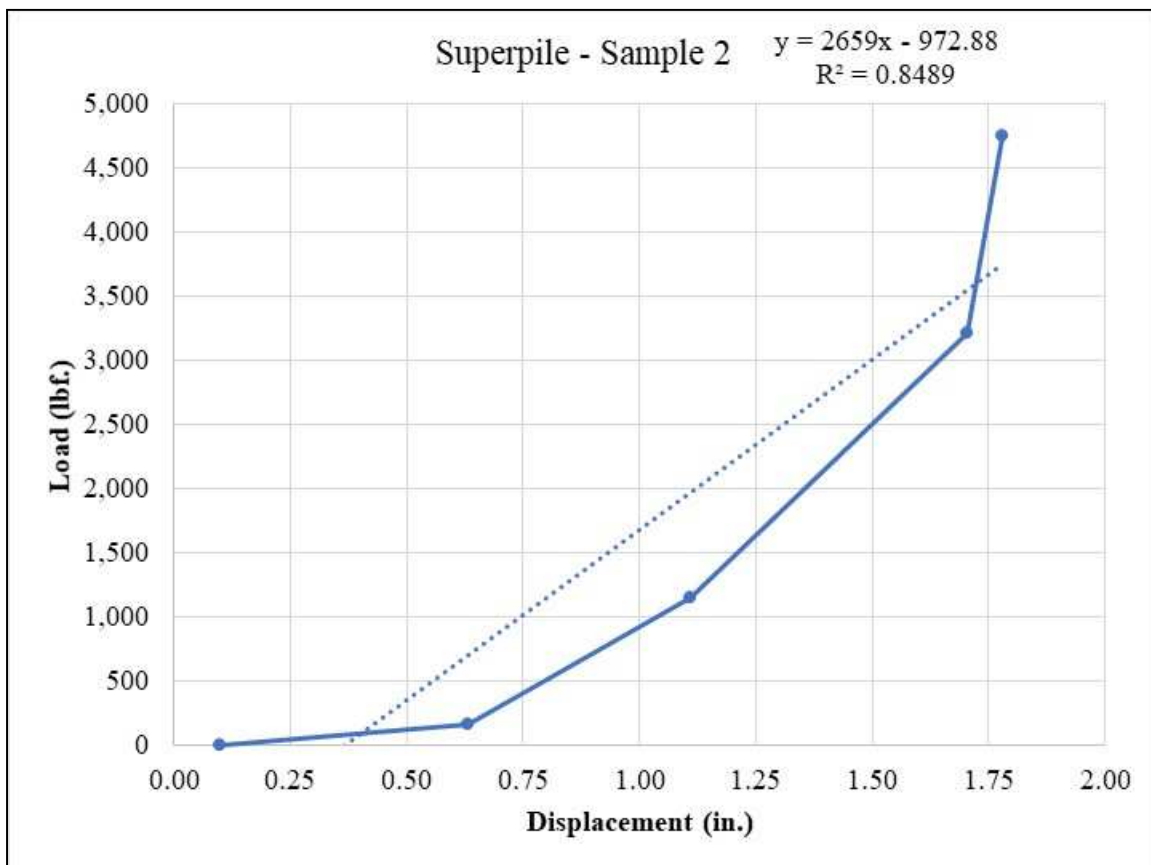


Figure 7 - Load vs. Displacement

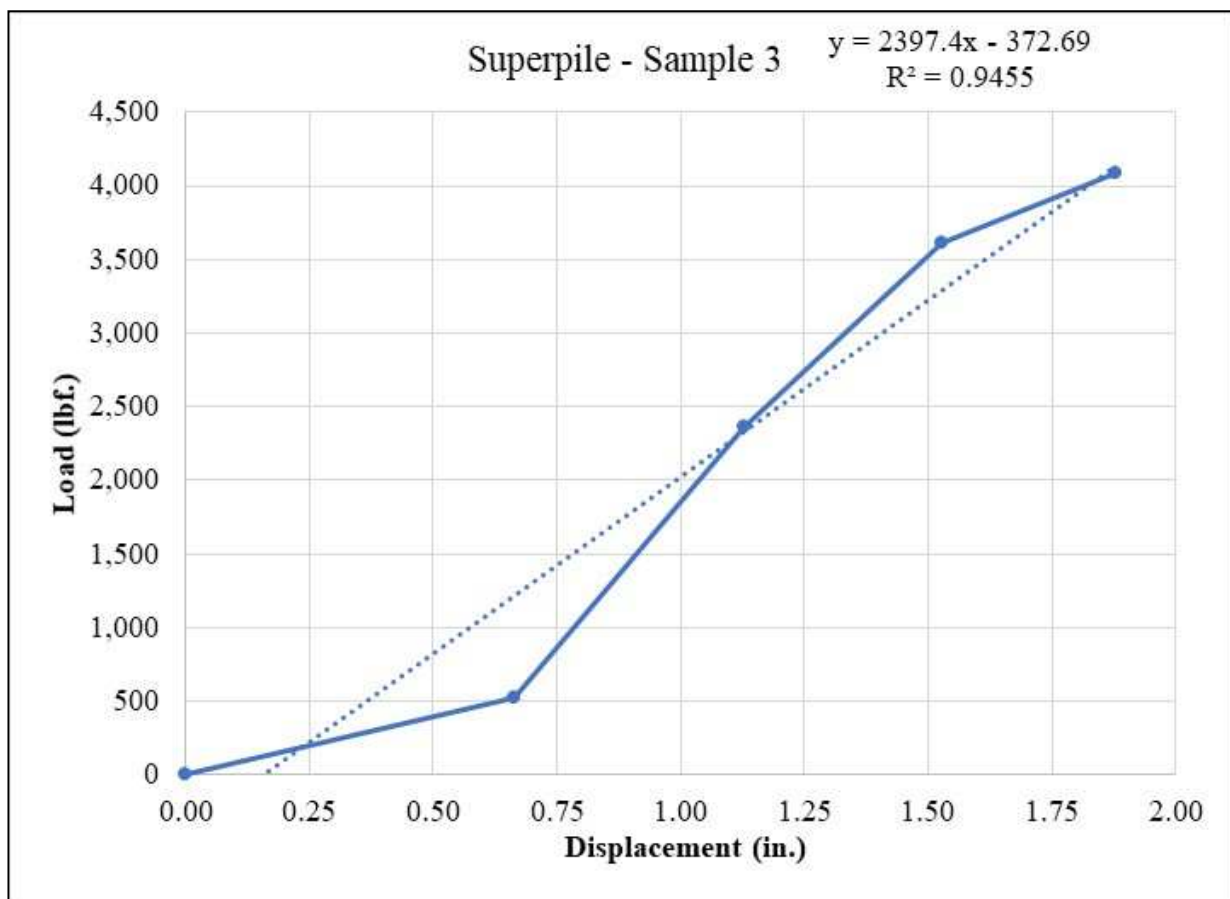


Photo 1 – Test Setup



Photo 2 – Test Setup – Side View



Photo 3 – Test Samples



Photo 4 – Typical Failure of Fortress Pilings – Single Lateral Crack at Reaction #2



Photo 5 – Typical Failure of Superpile – Longitudinal Cracking from P to Reaction #2



We appreciate the opportunity to provide our services to you on this project. Please do not hesitate to contact us at your convenience if you have any questions about this report or if we may be of further assistance.

Sincerely,

TESTING, ENGINEERING & CONSULTING SERVICES, INC.

A handwritten signature in blue ink, appearing to read 'James G. McCants III'.

James G. McCants III
Laboratory Manager, Chemist

A handwritten signature in blue ink, appearing to read 'Joshua R. Lloyd'.

Joshua R. Lloyd, P.E.
Project Engineer