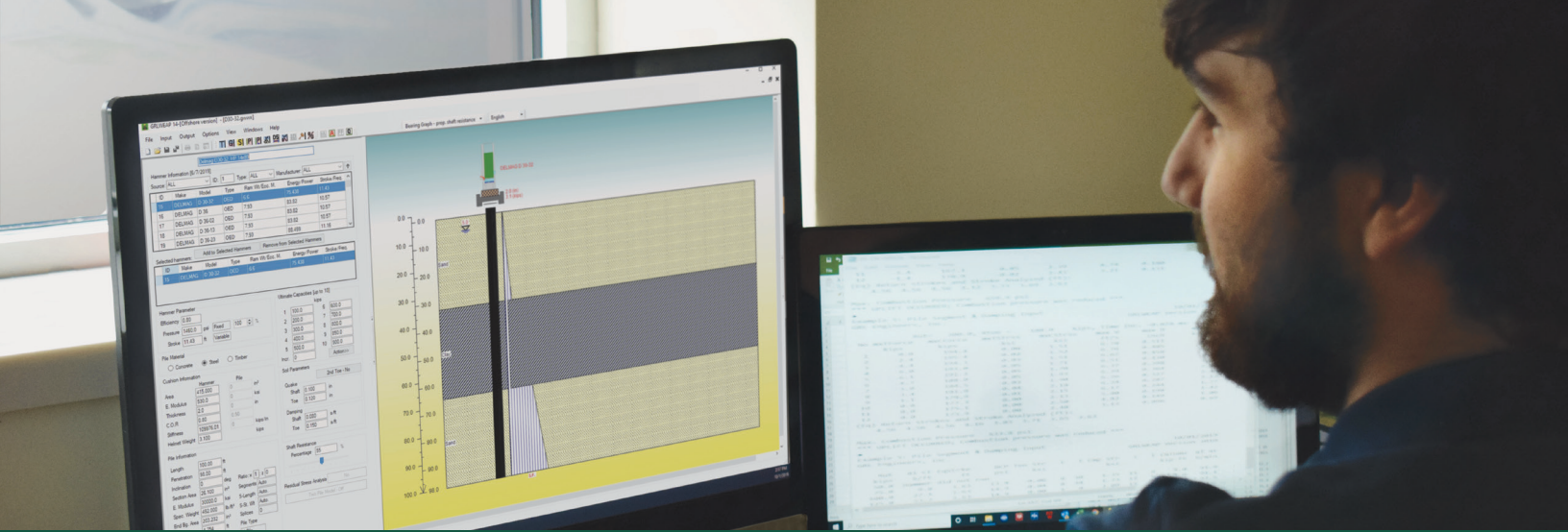


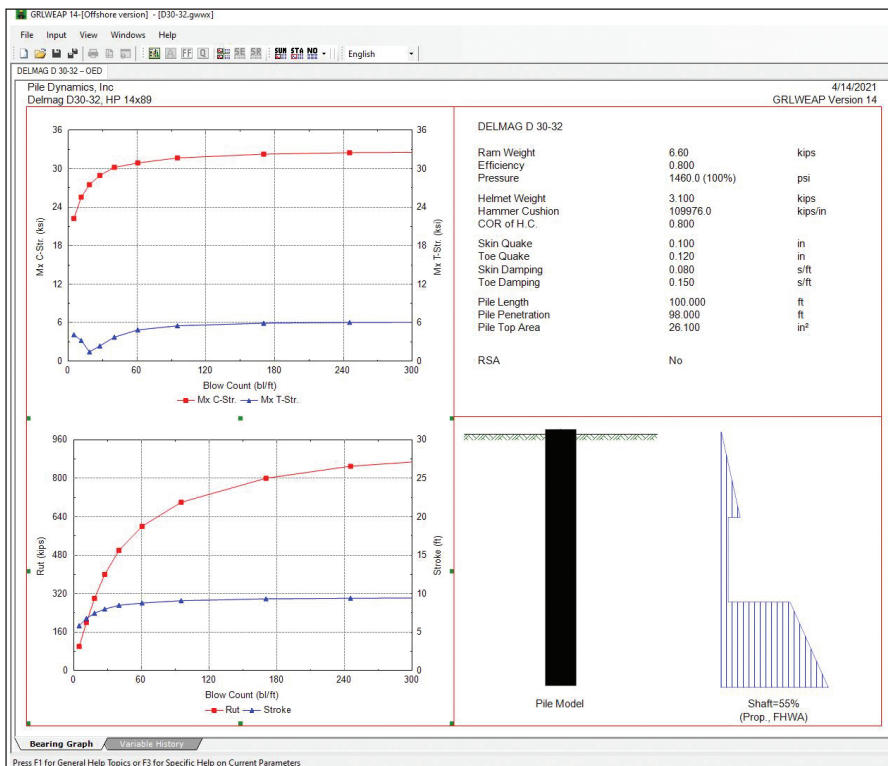


GRL Wave Equation Analysis (GRLWEAP14)

GRLWEAP14 Wave Equation Analysis is a one-dimensional software program that models the pile driving process. The program simulates the motions and forces in a pile foundation as it is installed with either an impact or vibratory hammer. It can be used to perform a bearing graph analysis (blow count and stresses versus capacity for multiple capacities), an inspector's chart analysis (blow count and stresses versus stroke for a single capacity), or a driveability analysis (blow count and stresses for a calculated capacity at a given penetration depth or multiple penetration depths).

Benefits of Wave Equation Analysis

- Assists in selection of appropriate pile driving equipment and pile installation procedures
- Computes the blow count vs capacity and blow count vs driving stress relationships for a given hammer-pile-soil system
- Predicts driving stress levels which can be used to reduce the risk of pile damage
- Predicts hammer performance which can be used to optimize hammer selection and driving time
- Models both onshore and offshore pile installations



GRLWEAP14 Bearing Graph Output

GRL Engineers, Inc.

Corporate Office
Ohio

Office Locations

California	Georgia	Pennsylvania	Louisiana
Colorado	Hawaii	Texas	North Carolina
Florida	Illinois	Washington	

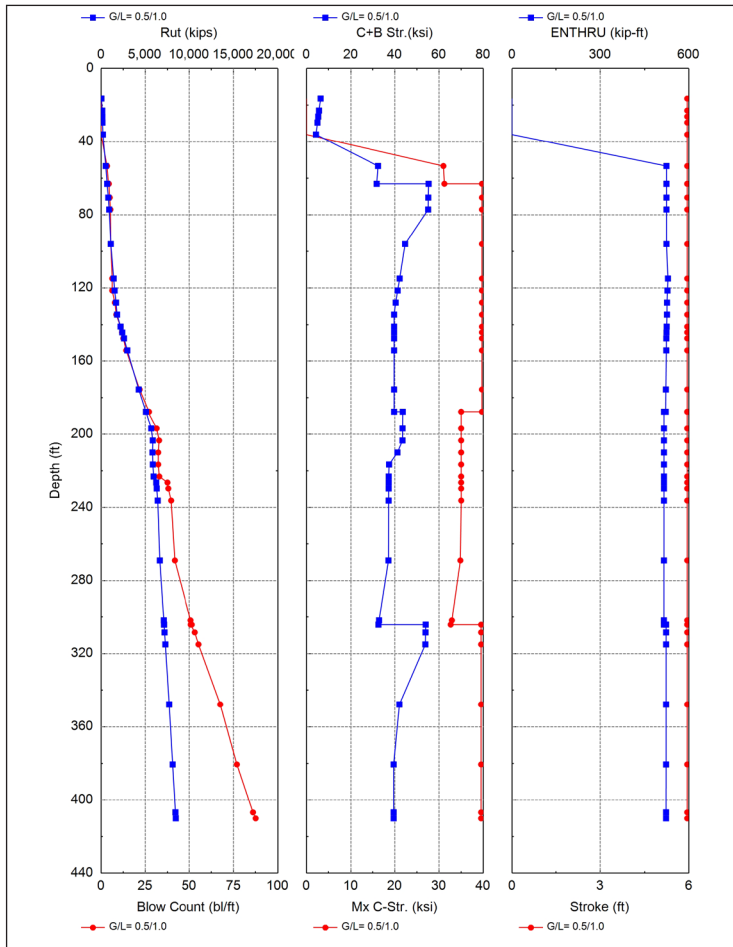


Analysis Procedure

The GRL engineer assembles the project information necessary to perform a wave equation analysis, including details on the proposed pile hammer as well as the hammer cushion, helmet, and for a concrete pile, the pile cushion. The engineer also obtains the pertinent project details including pile type, pile length, required ultimate capacity, specified driving stress limits, and geotechnical information. Details on any special pile installation procedures such as predrilling or jetting, if proposed, are also gathered, to determine their influence on the soil modeling. Appropriate wave equation input parameters for the hammer, pile, and soil models are then selected based on this information and input into the

GRLWEAP14 program. Depending upon the project needs or requirements, a wave equation bearing graph, inspectors chart, or driveability analysis is performed. The GRL engineer prepares a final report summarizing the wave equation analyses performed, the analysis results, and applicable pile installation recommendations.

For additional information on Wave Equation Analysis or any other GRL Engineers service please contact info@GRLengineers.com or visit us at www.GRLengineers.com.



GRLWEAP14 Driveability Analysis Graphical Results

Driveability Analysis Summary										
Gain/Loss Factor at Shaft/Toe = 0.500/1.000										
Depth ft	Rut kips	Rshaft kips	Rtoe kips	Blow C/Mx bl/ft	C-Str. ksi	C+B Str. ksi	Stroke ft	ENTHRU kip-ft	Hammer	
16.4	45.7	41.1	4.6	0.0	0.000	6.357	5.95	0.0	MHU 800S	
23.0	136.7	55.8	80.9	0.0	0.000	5.630	5.95	0.0	MHU 800S	
26.2	147.9	67.0	80.9	0.0	0.000	5.275	5.95	0.0	MHU 800S	
29.5	161.9	81.0	80.9	0.0	0.000	4.926	5.95	0.0	MHU 800S	
36.1	210.9	165.4	45.5	0.0	0.000	4.244	5.95	0.0	MHU 800S	
53.3	532.5	487.0	45.5	3.4	30.988	32.433	5.95	524.3	MHU 800S	
63.0	691.1	645.6	45.5	4.2	31.207	31.827	5.95	524.2	MHU 800S	
63.0	691.1	645.6	45.5	4.4	39.691	55.298	5.95	524.3	MHU 800S	
70.5	821.2	775.6	45.5	4.9	39.691	55.153	5.95	524.3	MHU 800S	
77.1	922.6	841.7	80.9	5.3	39.691	55.083	5.95	524.3	MHU 800S	
96.0	1101.6	1020.7	80.9	5.5	39.691	44.666	5.95	524.3	MHU 800S	
114.8	1427.0	1346.1	80.9	6.3	39.691	42.213	5.95	529.3	MHU 800S	
121.4	1533.7	1479.1	54.6	6.3	39.691	41.296	5.95	527.7	MHU 800S	
128.0	1694.6	1640.0	54.6	7.8	39.691	40.409	5.95	526.2	MHU 800S	
134.5	1810.1	1755.5	54.6	8.6	39.691	39.691	5.95	526.0	MHU 800S	
141.1	2204.0	1900.6	303.4	11.0	39.691	39.691	5.95	524.9	MHU 800S	
144.4	2398.2	2094.8	303.4	11.8	39.691	39.691	5.95	524.4	MHU 800S	
147.6	2595.0	2291.6	303.4	12.6	39.691	39.691	5.95	523.8	MHU 800S	
154.2	2968.8	2665.4	303.4	14.2	39.691	39.691	5.95	523.6	MHU 800S	
175.5	4257.8	3954.4	303.4	21.8	39.691	39.691	5.95	522.3	MHU 800S	
187.7	5071.7	4768.3	303.4	27.1	39.691	39.691	5.95	521.6	MHU 800S	
187.7	5071.7	4768.3	303.4	26.5	34.998	43.600	5.95	515.9	MHU 800S	
196.9	5674.4	5371.0	303.4	31.4	34.998	43.516	5.95	515.9	MHU 800S	
203.4	5845.1	5788.2	56.9	32.8	34.998	43.475	5.95	515.9	MHU 800S	
210.0	5814.4	5757.5	56.9	32.3	34.998	41.224	5.95	515.9	MHU 800S	
216.5	5847.2	5790.3	56.9	32.3	34.998	37.437	5.95	515.9	MHU 800S	
223.1	5939.2	5882.3	56.9	32.9	34.998	37.263	5.95	515.9	MHU 800S	
226.4	6236.5	5933.1	303.4	37.5	34.998	37.253	5.95	515.9	MHU 800S	
229.7	6287.4	5984.0	303.4	38.0	34.999	37.243	5.95	515.9	MHU 800S	
236.2	6402.7	6099.3	303.4	39.6	35.010	37.224	5.95	515.9	MHU 800S	
269.0	6642.0	6582.9	59.2	41.7	34.823	37.153	5.95	515.8	MHU 800S	
301.8	7087.6	7028.4	59.2	50.7	32.899	32.899	5.95	515.7	MHU 800S	
304.2	7116.6	7057.5	59.2	51.4	32.630	32.630	5.95	515.6	MHU 800S	
304.2	7117.8	7058.6	59.2	50.8	39.499	53.975	5.95	522.9	MHU 800S	
4/12/2021							2/6	GRLWEAP Version 14		

GRLWEAP14 Driveability Analysis Numerical Results

