CAPWAP Signal Matching

Benefits of CAPWAP Signal Matching

- Computes the total mobilized static soil resistance, the shaft resistance magnitude and its distribution along the shaft, and the toe resistance
- Predicts the load-displacement behavior of the tested deep foundation
- Calculates a simulated static load test curve under compression and tension loading
- Computes compression and tension stresses at any point of the deep foundation

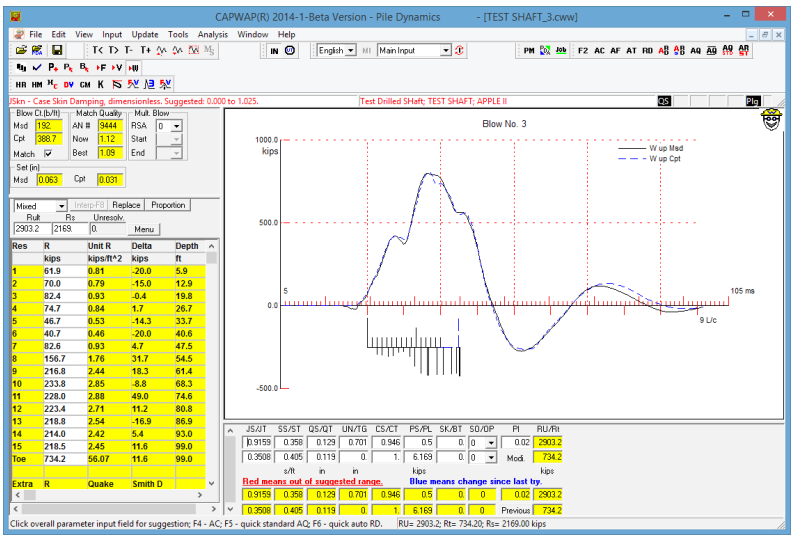
What Is CAPWAP®

CAPWAP® is the most accurate analysis method to determine deep foundation capacity from pile top dynamic measurements. In pile driving analysis, there are three sets of unknowns: internal pile forces, pile motions, and external pile forces. CAPWAP is a signal matching software program that uses pile or shaft top force and velocity measurements collected by a Pile Driving Analyzer® (PDA) to extract the external deep foundation forces consisting of the static and dynamic soil resistance models.

CAPWAP Analysis Procedure

A CAPWAP analysis is performed on a representative hammer blow or impact acquired near the end of driving or beginning of restrike testing. The basic CAPWAP procedure consists of the following steps.

1. Retrieve force and velocity data measured by the PDA
2. Input the pile model of known pile material types, their lengths and cross sectional areas.
3. Assume a set of soil parameters including resistance, quake, and damping.

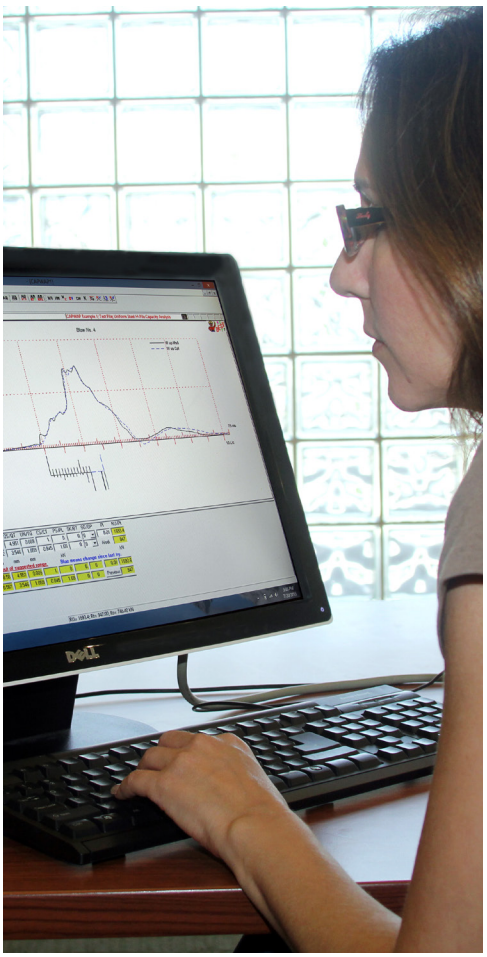


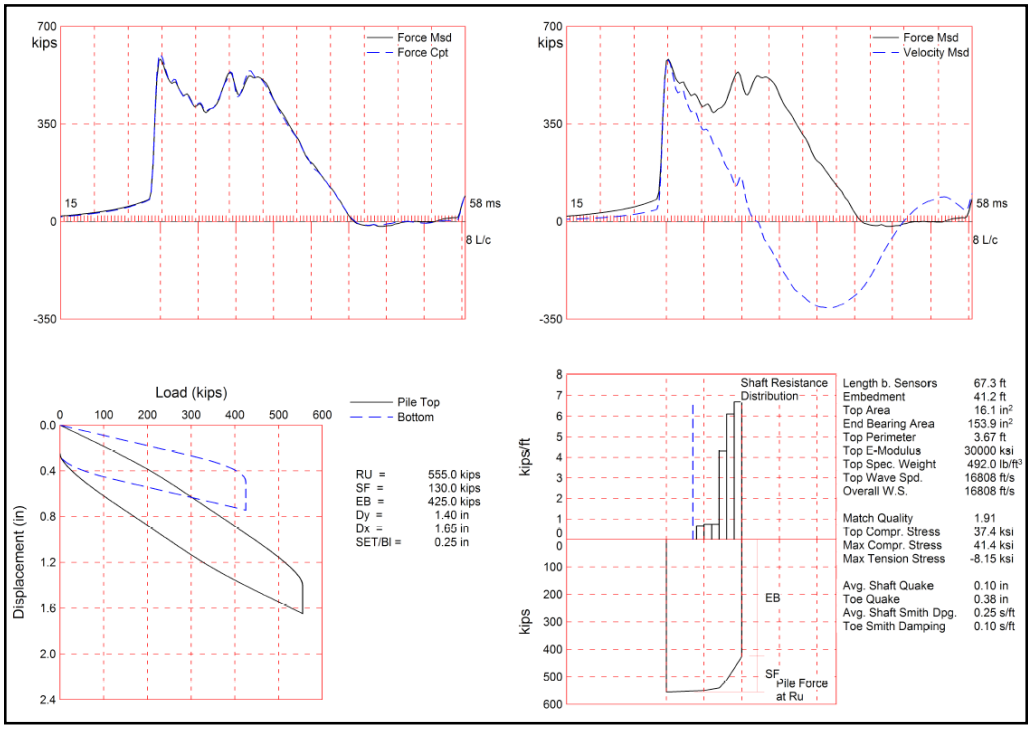
4. Perform analysis using one of the measured quantities as an input and calculate the complementary quantity.
5. Compare the measured and computed complementary quantity and assess the match quality.
6. If match is not satisfactory, adjust soil model and return to step 3.
7. Output soil model, extrema table, plot of satisfactory match, table summarizing the deep foundation model, and simulated static load-movement curve.

CAPWAP Results

CAPWAP results include the deep foundation's mobilized total bearing capacity as well as the soil resistance distribution along the foundation length. CAPWAP graphical results include the measured force and velocity record, the best match, the resistance distribution versus depth, and a simulated static load test load-set curve.

CAPWAP numerical results include the CAPWAP summary results table detailing the resistance distribution, the dynamic soil models, match quality, and pile stress maxima. For driven piles, the CAPWAP determined soil resistance and dynamic soil models are often used to develop GRLWEAP refined wave equation input parameters and establish the pile installation criterion.





CAPWAP® Graphical Results

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 555.0; along Shaft 130.0; at Toe 425.0 kips

Soil Sgmnt No.	Dist. Below Gages ft	Depth Below Grade ft	Ru kips	Force in Pile kips	Sum of Ru kips	Unit Resist. (Depth) kips/ft	Unit Resist. (Area) ksf
				555.0			
1	33.6	7.5	5.0	550.0	5.0	0.66	0.18
2	40.4	14.3	5.0	545.0	10.0	0.74	0.20
3	47.1	21.0	5.0	540.0	15.0	0.74	0.20
4	53.8	27.7	29.0	511.0	44.0	4.31	1.18
5	60.5	34.4	41.0	470.0	85.0	6.10	1.66
6	67.3	41.2	45.0	425.0	130.0	6.69	1.83
Avg. Shaft			21.7			3.16	0.86
Toe			425.0				397.56

Soil Model Parameters/Extensions		Shaft	Toe
Smith Damping Factor		0.25	0.10
Quake	(in)	0.10	0.38
Case Damping Factor		1.13	1.48
Damping Type		Viscous	Sm+Visc
Unloading Quake	(% of loading quake)	31	73
Reloading Level	(% of Ru)	100	100
Resistance Gap (included in Toe Quake)	(in)		0.01
Soil Plug Weight	(kips)		0.190

CAPWAP match quality = 1.91 (Wave Up Match) ; RSA = 0
Observed: Final Set = 0.25 in; Blow Count = 48 b/ft
Computed: Final Set = 0.23 in; Blow Count = 52 b/ft

max. Top Comp. Stress = 37.4 ksi (T= 26.0 ms, max= 1.108 x Top)
max. Comp. Stress = 41.4 ksi (Z= 53.8 ft, T= 32.0 ms)
max. Tens. Stress = -8.15 ksi (Z= 53.8 ft, T= 50.0 ms)
max. Energy (EMX) = 49.4 kip-ft; max. Measured Top Displ. (DMX)= 1.38 in

CAPWAP® Numerical Results

For additional information on **CAPWAP Signal Matching Service** or any other GRL Engineers service please contact info@GRLengineers.com or visit us at www.GRLengineers.com.

GRL engineers, inc.
www.GRLengineers.com