GRL Engineers, Inc.

El Dorado National Forest Bike Trail

Challenge:

GRL Engineers were contracted by Granite Construction to perform dynamic load testing on fiberglass piles. The piles were installed to support a bike trail at El Dorado National Forest. The bike trail spanned 5 miles of terrain with varying soil conditions. Parts of the trail bridged over a pond where weaker, wet soil conditions were present. The wet soil posed questionable load capacity. Dynamic testing offered load bearing capacity data and soil resistance distribution information.

The composite piles consisted of ECR (E-Glass Corrosion Resistant) Glass Fibers, a material that is durable and chemical resistant. These fiberglass piles are known to have comparable tensile strength to steel, but the material properties made test equipment installation difficult.

Method:

Dynamic load tests were performed on a total of 48 fiberglass piles. The tested piles were installed approximately 15-21 feet below ground elevation and were 5x5 inches of square sections with a wall thickness of .025 inches. 8 of the 48 tested piles were installed approximately 16-36 feet deep and 2 of the 48 were installed at approximately 28-33 feet deep. GRL Engineers provided an impact hammer system which was utilized for high-strain dynamic testing. The system, also known as the APPLE VII, included a ram mechanism which was guided by a boxed lead configuration with dimensions of 9 x 4 x 4 ft (l x w x h). The weight selected for this ram was 500 lbs. A cushion was utilized to protect the top of the pile from high impact compressive stresses.

Strain measurements were collected with 2 strain gages located approximately 12 inches from the pile top and acceleration measurements were made on the side of pile at 12 inches below the pile top.

Results:

CAPWAP® results are summarized in Tables 1 and 2 which include total shaft friction and end bearing components for each pile. The typical, predicted load vs displacement curves can be viewed in Figures 1 and 2.

In some areas the piles met the required pile penetration. However, the piles installed in the soft soil conditions did not meet the required tip elevation due to the seasonal high-water table. Pile load testing using the APPLE system was provided to assess the in place pile capacity. To supplement the load capacity, it was recommended that more piles be installed in the soft soil conditions.

Dynamic load testing on fiberglass piles is an uncommon practice and the testing provided by GRL Engineers was exploratory in nature. GRL Engineers offers services for large-scale projects and small specialized testing jobs like this one. To learn more about GRL Engineers, visit www.grlengineers.com or email us at info@grlengineers.com.

Project Details

Client: Granite Construction, Inc.

Location: Placerville, CA

GRL Office: California

GRL Services

- APPLE Load Testing
- CAPWAP® Analyses

Union Valley Boardwalk - El Dorado County, CA

LOCATION 8

Pile	Pile Set	Capacity			Smith Damping		Soil Quake	
		Total	Shaft	Toe	Skin	Toe	Skin	Toe
	in	kips	kips	kips	s/ft	s/ft	in	in
P261 - Location 8	0.15	35	24	11	0.08	0.11	0.06	0.19
P262 - Location 8	0.25	31	22	9	0.06	0.06	0.04	0.33

Table 1. Summary of CAPWAP results for test piles driven 28-33 feet deep

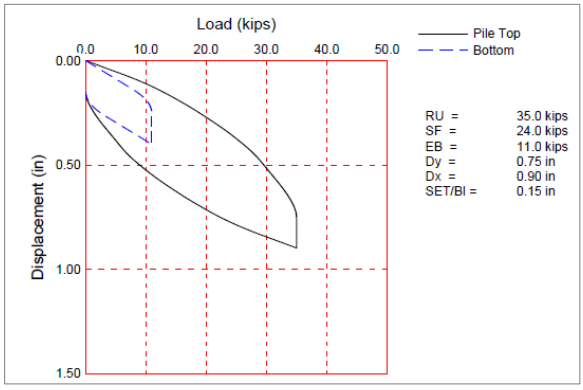

Figure 1. Load vs displacement for test pile driven 28-33 feet deep

Union Valley Boardwalk - El Dorado County, CA

LOCATIONS 3 & 4

Pile	Pile Set	Capacity			Smith Damping		Soil Quake	
		Total	Shaft	Toe	Skin	Toe	Skin	Toe
	in	kips	kips	kips	s/ft	s/ft	in	in
P67B - Location 3*	0.20	30	22	8	0.40	0.22	0.16	0.16
P68C - Location 3*	0.12	31	23	8	0.25	0.06	0.15	0.05
P79 - Location 4	0.20	28	21	7	0.09	0.02	0.04	0.19
P83 - Location 4	0.10	32	25	7	0.11	0.08	0.08	0.14
P84 - Location 4	0.20	28	22	6	0.04	0.15	0.12	0.28
P87 - Location 4	0.12	29	21	8	0.10	0.17	0.17	0.23
P164 - Location 4	0.20	28	20	8	0.02	0.12	0.04	0.08
P166 - Location 4	0.25	28	19	9	0.06	0.11	0.07	0.26

Table 2. Summary of CAPWAP results for test piles driven 16-36 feet deep

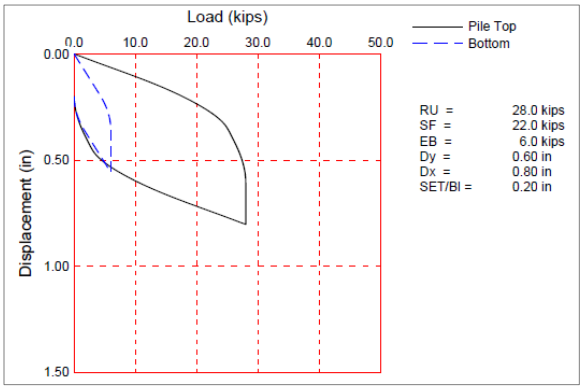

Figure 2. Load vs displacement for test pile driven 16-36 feet deep