

STATNAMIC Testing Newsletter

by Applied Foundation Testing

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New STATNAMIC Test Record 5,026 tons(45MN)

We are very happy to announce that STATNAMIC load testing capacity has been increased to 5,000 tons. To answer industry requests, AFT and Bermingham-boosted test capacity of the familiar 30 MN device to 40 MN. Equipment modifications were made to allow increased working pressure within the piston chamber along with constructing additional reaction mass.

On the recently completed load test program at the Miami International Airport Intermodal Connector, a drilled shaft was Statnamic load tested to 5,026 tons (45 MN).

Drilled shaft installation was performed by TREVIICOS SOUTH. The 54 inch diameter, 65 foot deep shaft was constructed under FDOT specifications. The shaft extended through the upper sandy overburden soils and was socketed 30 feet into the upper Miami limestone formation. Quality assurance testing included down hole camera inspection via a MINI-SID and Crosshole Sonic Logging (CSL).

The measured total and permanent displacement from the loading was 0.878 and 0.515 inches, respectively.

Internal strain measurements from 6 levels were used to calculate load distribution. Unit side shear values in segments 4 to 7 (located in the limestone) ranged from approximately 11.5 ksf to 17 ksf. Side shear in segment 8 was only 4.7 ksf which is attributed to lower rock quality since side shear was fully mobilized. The strain measurements also showed approximately 53 ksf of mobilized unit end bearing. It is also noted that the end bearing stiffness observed suggests the shaft bottom cleanout procedures were very effective.

Same STATNAMIC Equipment

Larger Test Capacity

Florida's Condo Boom

It has been an extremely busy summer doing Statnamic load testing largely in connection with the Florida condominium boom. AFT performed Statnamic testing at 26 condominium projects over the summer months with a total of 58 Statnamic load tests. One of the most notable was the Trump Tower Tampa project. At 52 stories it will be the tallest building on Florida's West Coast.

**5,026 Ton
STATNAMIC load test
at MICMIA project.**

Trump Tower 30 MN STATNAMIC



STATNAMIC Tests Cylinder Piles in Portsmouth

Construction projects in marine applications require demanding foundation designs. Large diameter spun cast concrete cylinder piles have many advantages in this application, most notable is their ability to resist large axial and lateral loads as well as good corrosion resistance. As designers continue to push the capacity envelope, STATNAMIC load testing has become a preferred method of testing high capacity foundations. Mainly because STATNAMIC load testing is a very efficient, cost effective, and reliable means of applying the large test loads needed to verify these demanding designs.

On a large wharf project in Portsmouth, Virginia, WEEKS MARINE, INC. in cooperation with AFT performed axial Statnamic load testing on eleven (11) strain instrumented spun cast cylinder piles. The first eight piles were part of an indicator pile program performed prior to installation of any production piles. Three additional cylinder piles were Statnamic load tested during the production phase. AFT also contracted to perform dynamic testing of the indicator piles and numerous production piles.

To measure side shear and tip resistance, AFT installed four levels of embedded strain gages in each of the 11 spun cast cylinder piles. This is a very challenging process in itself which AFT has perfected through the instrumentation of 25 spun cast cylinder piles to date.



The indicator pile program was comprised of two groups of four piles. At each test site, there were two 36-inch diameter cylinder piles and two 54-inch diameter cylinder piles. Pile lengths for the 36-inch piles were 152 feet and 164 feet for the 54-inch piles. At each test site, a variety of installation means and methods were employed and evaluated. These included, varying the pile tip elevation, hammer driving systems, stroke height, cushion thickness, pre-drilling depths, and various waiting times between test methods. A 19 MN Statnamic device was used during indicator pile testing. There was a wide range of test results which varied according to installation method. The results of the load tests were used to refine pile lengths and installation criteria. Three additional 54-inch production piles were Statnamic load tested with a 30 MN Statnamic device to verify final criteria.

The load testing program was extremely successful in many ways including cost effectively performing the load tests, optimizing the pile design, developing an efficient installation criteria, and providing confidence in the foundation construction.

Driving Concrete Cylinder Piles at Portsmouth Wharf Project



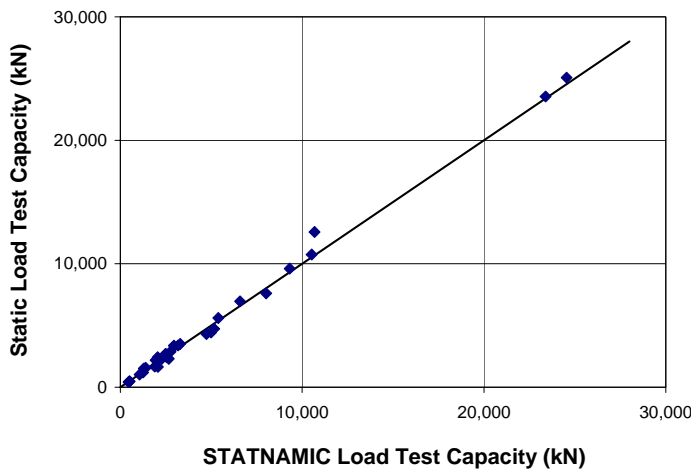
30 MN Statnamic Load Test on 54-inch Production Cylinder Pile



19 MN Catch mechanism STATNAMIC Device Testing Indicator Piles.

Analysis Paralysis

In the early years of Statnamic, a variety of far flung methods were used to analyze the results. Mostly leading to inconsistent correlations. The Unloading Point Method developed by Peter Middendorp in 1993 was the first breakthrough in analysis technique. This method was shown to provide a good job of determining the static capacity of foundations in sand and rock. It wasn't until 1997 when Dr. Gray Mullins, Ph.D., P.E. of the University of South Florida developed further innovations in Statnamic analysis. These new methods improved upon the work of Middendorp's Unloading Point Method (UPM) and are called the Modified Unloading Point Method (MUP) and the Segmental Unloading Point Method (SUP). These methods allow better quantification of inertia and damping components of foundations that were once troublesome to analyze.



Even with these advancements, it was necessary to account for rate of loading effects. A recent study of Statnamic correlations with 34 static load tests was assembled under a research project (NCHRP 21-08). In this study, rate factors were empirically derived for all soil types such that the results would always be slightly on the conservative side. The results of this study which are summarized in the Figure and Table below illustrate the excellent correlations after rate factors were applied. Included in the table are the bias factors (λ) and standard deviations for each soil subgroup, as well as the entire study (All Soils). A λ value less than 1.0 would signify an over prediction of the static capacity. This summary shows a good correlation between the Statnamic and Static capacities for Rock and Sand indicated by a bias factor nearly equal to 1.0 and a standard deviation of 7% to 8%. The results also show good correlation between the Statnamic and Static capacities for Silt and Clay with bias factors larger than 1.0 and standard deviations less than 12%. The combined values of all soil types show that the capacity analysis method performs very well with a bias factor slightly larger than 1.0 and a standard deviation of less than 10%.

Highly reliable determination of the static capacity of foundations is now at our disposal. The powerful SUP method has solid theoretical background and when used in conjunction with rate factors has proven correlation with static load tests in all soil types. These are now the standard analysis procedures used by Applied Foundation Testing and other Engineers.

	Rock	Sand	Silt	Clay	All Soils
Bias Factor, λ	0.999	0.994	1.041	1.035	1.017
Standard Deviation	0.068	0.083	0.116	0.119	0.097

STATNOMIC has proven correlations with static load tests in all soil types

Recent STATNOMIC Publications

- **Statnamic Load Testing of High Capacity Marine Foundations**, Muchard, 54th Annual Geotechnical Engineering Conference ASCE, University of Minnesota, 2006
- **Multiple Axial Statnamic Tests on a Drilled Shaft Embedded in Shale**, Paul Axtell, Eric Loher, Daniel Jones, DFI Conference Washington DC, 2006.
- **Statnamic Testing of Large Diameter Cylinder Piles**, Robertson and Muchard 2007, GeoDenver, 2007.

Please contact AFT for a courtesy copy.

Applied Foundation Testing



STATNAMIC



Please call us to answer your foundation load testing and quality assurance needs.

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Additional Foundation Testing Services from AFT

AFT can compliment your team with our specialty test methods:

- STATNAMIC® Load Testing
- Dynamic Pile Testing (PDA®, CAPWAP®, Wave Equation)
- Smartpile® Wireless Dynamic Pile Testing
- Static Load Testing (equipment and monitoring)
- Geotechnical and Structural Instrumentation
- Miniature Drilled Shaft Inspection Device (Mini-SID)
- Crosshole Sonic Logging (CSL & Tomography)
- Pile Integrity Testing (PIT, SIT, Sonic Echo)
- Post Grouted Drilled Shafts
- Unknown Bridge Foundation Investigations - Parallel Seismic, Sonic Echo
- Vibration Monitoring
- Pile Driving Inspection
- Drilled Shaft Inspection



PDA Testing



Crosshole Sonic Logging



Static Load testing



Shaft Inspection Device



Instrumentation

Lateral Static Load testing

