1-1-2007

Lateral STATNAMIC Testing

Purdue ECT Team
Purdue University, ectinfo@ecn.purdue.edu

DOI: 10.5703/1288284315788

EMERGING CONSTRUCTION TECHNOLOGIES

Civil - Foundation

LATERAL STATNAMIC TESTING

THE NEED

Lateral loads, which are analyzed using static soil response parameters, usually control the foundation design. These are normally dynamic loads caused by earthquakes, ship impacts and wind. When feasible, design parameters are checked with full scale static loading testing. The traditional static testing is very costly, dangerous, time consuming, and limited to loads that can be generated by a hydraulic jack. Dynamic load testing methods do not provide direct measurements, induce high accelerations, and load-displacement behavior is controlled by the action of stress waves.

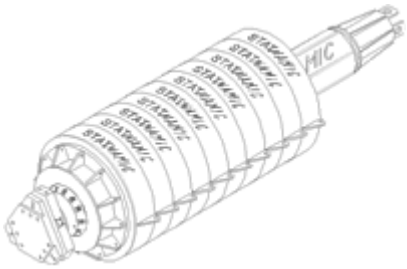

FIGURE 1 STATNAMIC DEVICE

THE TECHNOLOGY

STATNAMIC testing overcomes the practical difficulties of both static and dynamic load tests. Lateral STATNAMIC testing was developed to better model dynamic loading on structures and foundations. The measured dynamic response provided by STATNAMIC can also be used to calculate the derived static response. STATNAMIC system was developed by adapting an axial test device. The device consists of three main parts: piston, cylinder/silencer, and reaction masses.

The piston contains a load cell for measuring force and a laser sensor to measure displacement. Solid propellent is burned inside the piston to generate a gas pressure. The piston is mounted horizontally on a foundation using a hemispherical bearing to minimize any eccentricities in the load. The cylinder/silencer which fits over the piston is accelerated by the expanding gas to over 15g's. A sled holding the reaction masses and cylinder/silencer separates from the piston and slides down a track.

CONSTRUCTION ENGINEERING & MANAGEMENT PURDUE • UNIVERSITY

http://dx.doi.org/10.5703/1288284315788

The accelerated masses generate a force equal to the mass times acceleration. A patented system of motion sensors placed horizontally in inclinometer casing embedded in the foundation measures the lateral acceleration of the foundation at various depths. Strain gages embedded in the foundation measure the strain at those same depths. This allows the engineer to calculate soil response which then can be used to create computer model of the soils and foundation.

FIGURE 2 14MN LATERAL OVER-WATER STATNAMIC TEST, MISSISSIPPI

THE BENEFITS

- STATNAMIC applies loads up to 30 MN (3,400 tons).
- Foundations tested include high capacity drilled shafts, steel piles, auger cast piles, timber piles, batter piles in clay, rock, silt, and sand.
- STATNAMIC can test bridge foundations, pile groups, spread footings, and off-shore piles.
- STATNAMIC can test the lateral capacity of foundations.
- Production piles can be tested without prior planning. No reaction piles are required.
- Three 600 ton tests can be conducted in a one day shift.
- Several STATNAMIC tests can be conducted for the cost of a single static test.
- STATNAMIC loads the pile and soil together.
- The duration of loading is on the order of 10 Hz.
- STATNAMIC's built-in load cell and laser sensor provide direct measurements of load-displacement behavior.
- STATNAMIC produces load-displacement results immediately on site.

STATUS

This system was most recently used on a bridge replacement project in Mississippi where a lateral loads of 7.32 MN (823 tons) was imparted on a bridge pier founded on two drilled shafts. The bridge was designed to accommodate heavy automobile and truck traffic, relatively high wind loads and must withstand possible ship impact from vessels using a very active channel passing underneath the bridge. The site also has the potential for deep scour.

http://dx.doi.org/10.5703/1288284315788

Two large bridge projects and one large retaining wall project are planned for the remainder of 1998 and early 1999. STATNAMIC has also been widely used all over the world such as Australia, Egypt, Holland, Indonesia, Japan, Malaysia, Taiwan, U.E.A., U.K., and U.S.

This technology was honored as one of 1999 Nova Award Finalists by Construction Industry Forum.

Points of Contact

Michael Justason, Berminghammer Foundation Equipment
Tel: (905) 528-0425, Fax: 528-6187, Email: mailto:mjustason@berminghammer.com

References

1. 1999 Nova Award Nominations, The Nova Award, Construction Innovation Forum, Inc., October 1998

Reviewers

Peer reviewed as an emerging construction technology

Disclaimer

Purdue University does not endorse this technology or represents that the information presented can be relied upon without further investigation.

Publisher

Emerging Construction Technologies, Division of Construction Engineering and Management, Purdue University, West Lafayette, Indiana

http://dx.doi.org/10.5703/1288284315788