Statnamic Pile Load Testing

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Load Testing Methods

- **STATIC**
  - Load: 100%
  - Displacement
  - High pressure gas

- **DYNAMIC**
  - Load: 1-2%
  - Displacement
  - Strain
  - Acceleration

- **STATNAMIC**
  - Load: 5-10%
  - Displacement
Description Stanamic

A = Pile
B = Load cell
C = Cylinder
D = Piston with chamber
E = Platform
F = Silencer
G = Reaction mass
H = Gravel Container
I = Gravel
J = Laser
K = Laser beam
L = Laser sensor
Description Stanamic

Fugro

Profound

10
9
8
7
6
5
4
3
2
1m

30 MN

16 MN

16 MN

8 MN

8 MN

5 MN

5 MN

0.6 MN

Clients Word wide

Knowledge and experience Statnamic (Peter Middendorp)
Description Stanamic

Hydraulic Catching Mechanism

Containers filled with local material (gravel or equivalent)

4 test a day

Simple inspection ignition system

Transport on one trailer
Description Stanamic

Equipment:
80 tons reaction mass
7 trailers for transport
2 to 3 days a test
one cycle of testing
Video of Test
Application, Static Load Test

Advantages:
- Static behaviour
- Separation of:
  - End Bearing
  - Shaft Friction

Disadvantages:
- Cost
- Selection of Test Piles
Application, Dynamic Load Test

Advantages:
• Low Cost
• Test on all Piles

Disadvantages:
• Dynamic Pile-Soil behaviour
• High stresses in Pile
• Requires advanced analyzing Techniques
• Applicable only for Steel Pipe Piles
Application, Statnamic Load Test

Advantages: Relatively low Cost
             Free selection of test Piles

Disadvantages: Difficult to determine Bearing Capacity
                Difficult to distinguish between End Bearing and Shaft Friction

Application: Re-use of existing Piles
             Load-Settlement behaviour

Condition: \[ 10 \leq \frac{T_f}{L/c_p} \leq 1000 \]
            \( T_f \): Duration of rapid load
            \( L \): pile length
            \( c_p \): stress wave velocity test pile
**Interpretation**

\[ F_{stn} = \text{statnamic force, measured} \]
\[ F_{st} = \text{static resistance} \]
\[ u = \text{displacement, measured} \]
\[ v = \frac{du}{dt} \]
\[ a = \frac{d^2u}{dt^2} \]
\[ m = \text{pile mass} \]
\[ C = \text{damping coefficient} \]

\[
F_{stn}(t) = F_{st}(t) + m \cdot a(t) + C \cdot v(t)
\]
Interpretation

Load Cell Laser Sensor Accelerometer

Time [ms]

Load [MN]

Time [ms]

Displacement [mm]

Load Cell

Laser Sensor

Accelerometer
Interpretation

\[ F_{st}(t) = F_{stn}(t) - m \cdot a(t) - C \cdot v(t) \]

Estimated damping parameter C (hyperbolic curve)
Interpretation

Dynamic Analysis, PLAXIS

Simplified input of dynamics boundary conditions with Microsoft notepad
Interpretation

Dynamic Analysis, PLAXIS

Calibration model with static behaviour
Average damping parameter selected based on hyperbolic curve

Statnamic Test

Numerical Simulation PLAXIS
Interpretation

Extrapolation according to Middendorp and Bakker

Correction for “rate effects”:

Undrained behaviour
Interpretation
Guidelines

The Netherlands

- CUR-comittee H410 “Rapid load tests”
- goal: preparation European Codes
- Fugro is member (Maarten Profittlich)

European Codes

- Draft standard Rapid Load Testing procedure
- Working group 4 of TC 341
- (Testing of geotechnical structures; Testing of piles: rapid load testing (reference EN-ISO 22477-# version: 3.3, 23 April 2008)

- Guideline on the interpretation of Rapid Load test on piles
- 7 November 2008
Conclusion

Statnamic provides alternative in case

- Static load tests are not feasible
- Re-use of existing Piles
- Determine Load-Settlement behaviour
Thank You