Can an 18-Story Building Rise to 24 on Its Existing Foundation?

Load test of existing foundation consisting of driven precast concrete piles

Anna Lenart, DMT Poland
Rune Tranborg Tuxen, DMT Denmark

DMT

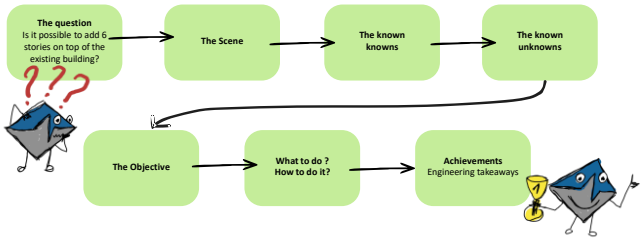
Short intro of DMT

We are a group of over **50 specialists** focused on pile testing and construction monitoring.

As engineers, we like to find solutions where others see problems, providing solutions perfectly tailored to every task.

Solving construction puzzles is our passion!!

The story



The Scene

Denmark, the city of Aarhus.

An 18-story high glass façade building from 2002.

The building is founded on driven precast piles.

The known knowns

Geotechnical information - Indicating fissured clay of high plasticity

Layout of the foundation and pile plan

Driving records for the installed precast piles

- Cross section 300 mm x 300 mm
- Embedded length approximately 12 m

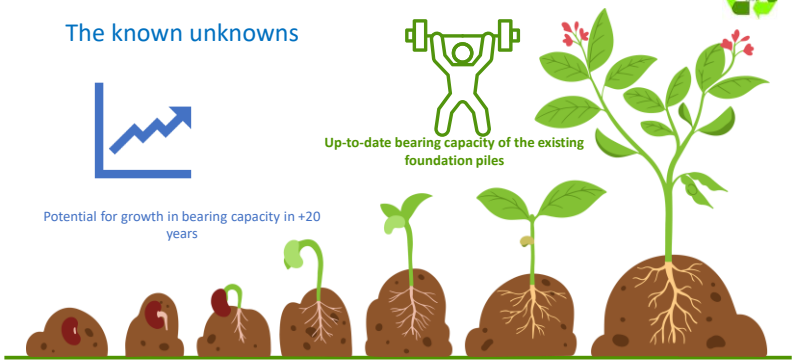
Capacity of foundation from installation

New ”demand” for capacity

The known unknowns

Potential for growth in bearing capacity in +20 years

Up-to-date bearing capacity of the existing foundation piles

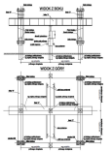


The Objective

Verify the bearing capacity of existing foundation piles.

Normally, we would make a static load test with steal beams and reaction piles.

But the conditions this time were different!



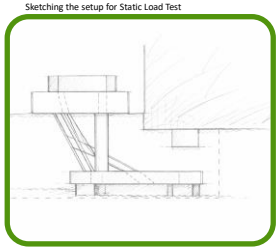
What to do? How to do it?

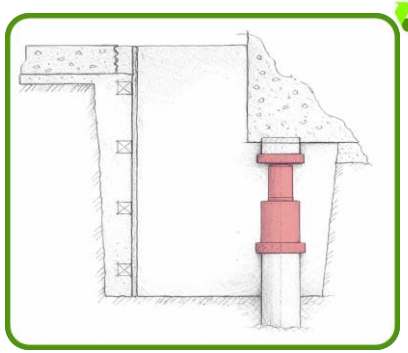
The scope – Static Load Test

- **4 load tests** - 2 outside, 2 inside
- Use existing building as reaction system

How to do it?

Sketching the setup for Static Load Test





How to do it?

On the outside – Not complicated

How to do it?

On the inside - a bit complicated

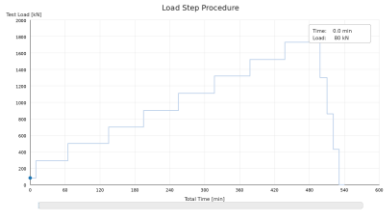
The load test

Load test in 9 steps

Preload and 8 load steps, each of 60 minutes duration

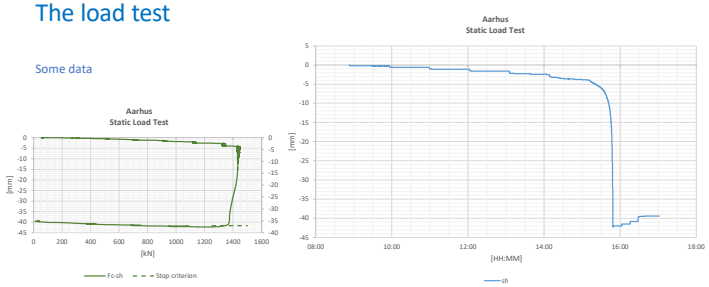
Unloading in 4 steps

Pile head movement surveyed in horizontal and vertical direction



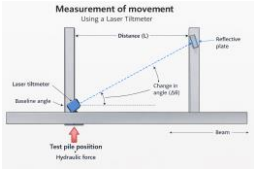
The load test

Some data

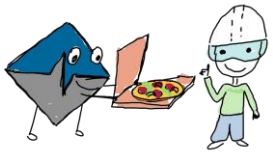


The load test

Surveying building movement



Achievements - Engineering Takeaways



The takeaways…

- Failure was reached before planned maximum force
- Test result indicate the bearing capacity was reached 4-8 weeks after installation
- Standard Geotechnical calculation does not apply to actual site conditions
- Additional bearing capacity is needed
- Monitoring of building show no movement during the Static Load Test
- Pile test is NEEDED to verify capacities and confirm calculation models and site/soil behavior
- Data from the past into the future?

The story continues…

- But only the planning is yet in place…

Thank you for your attention!

DMT