

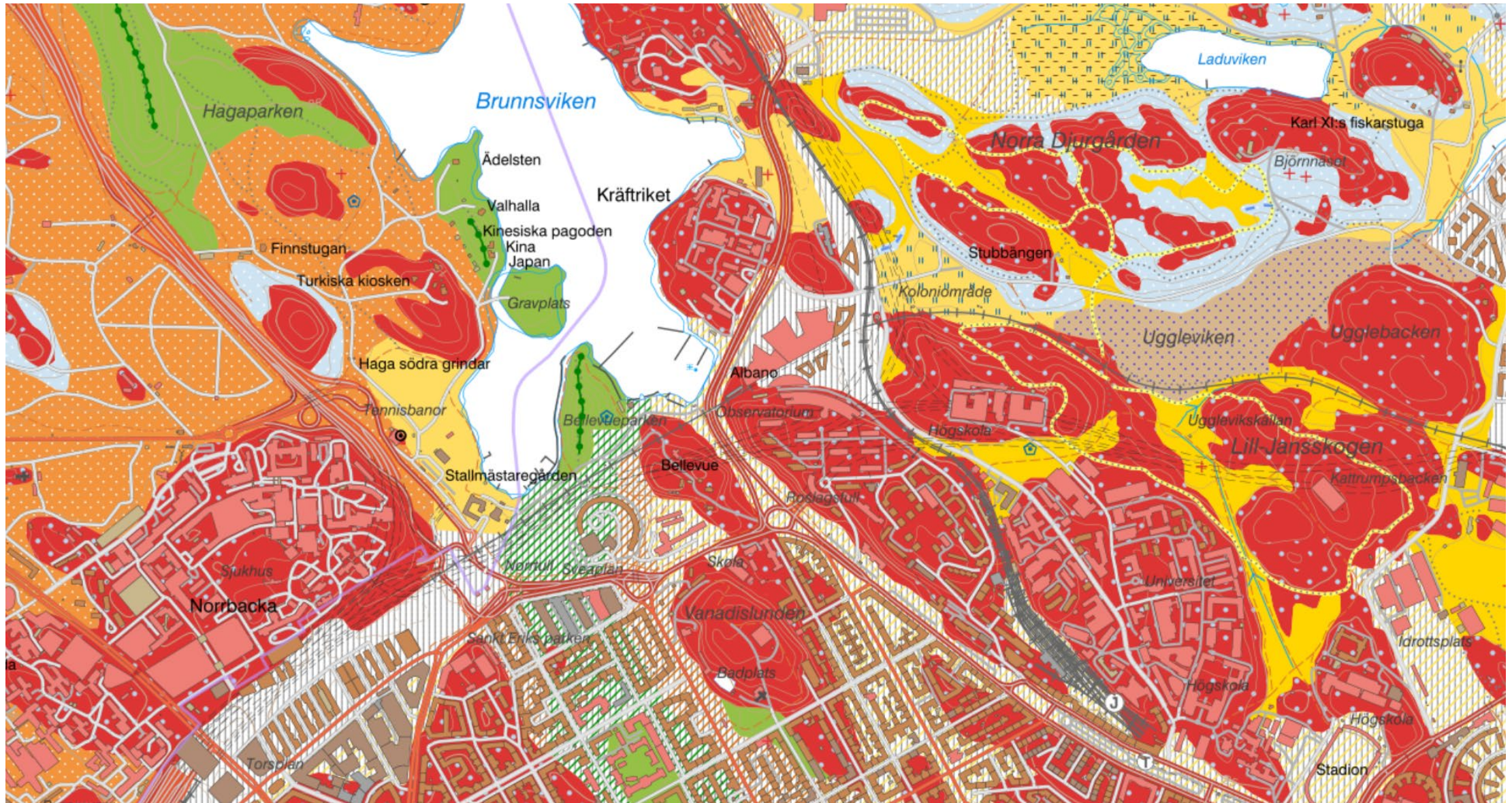
Block och taljor: Slagna pålar i blockig mark

Chiara Cannizzaro

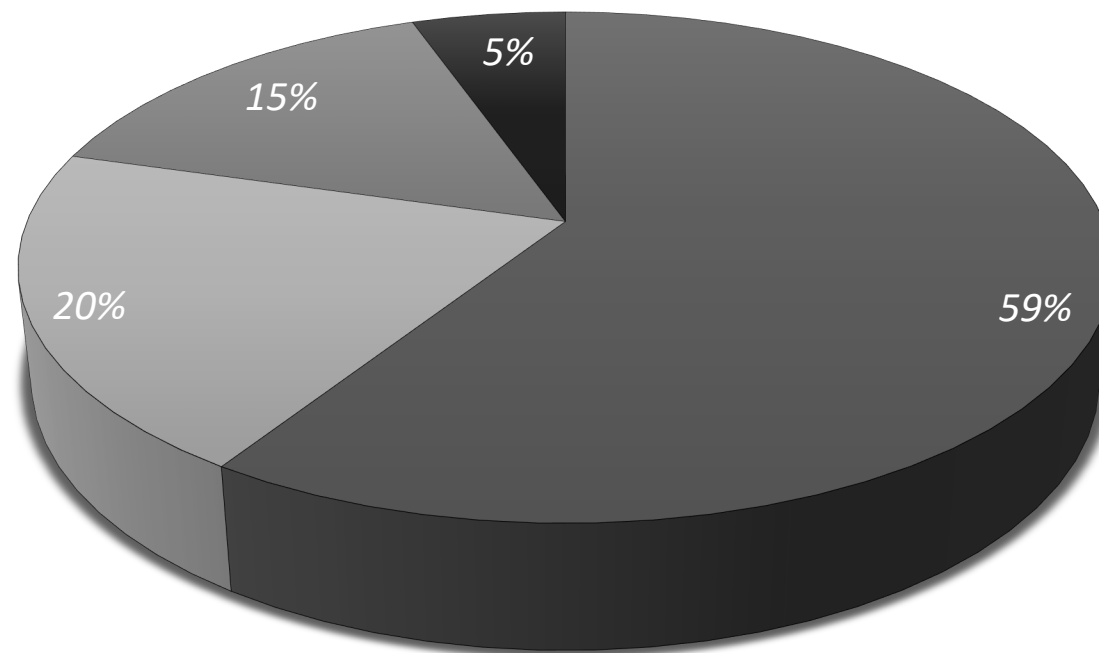
Påldagen 24, Göteborg | Maj 23, 2024

PÅLDAG 24

pålgrundläggning



Pålstatistik i Sverige (2022)



■ Slagna betongpålar

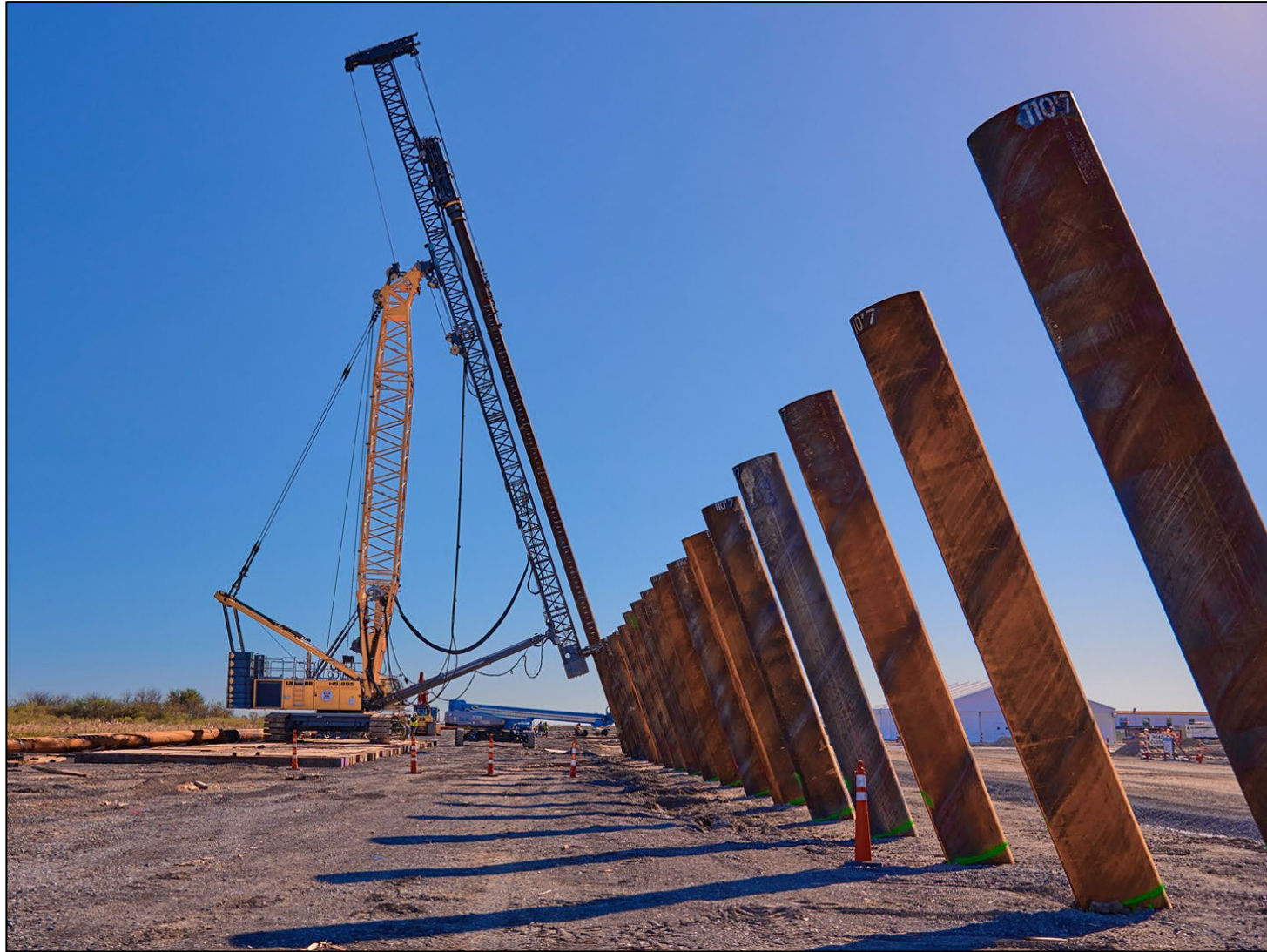
■ Slagna stålpålar

■ Borrade stålpålar

■ Övriga pålar (trä, ving, gräv, injekterade, ..)



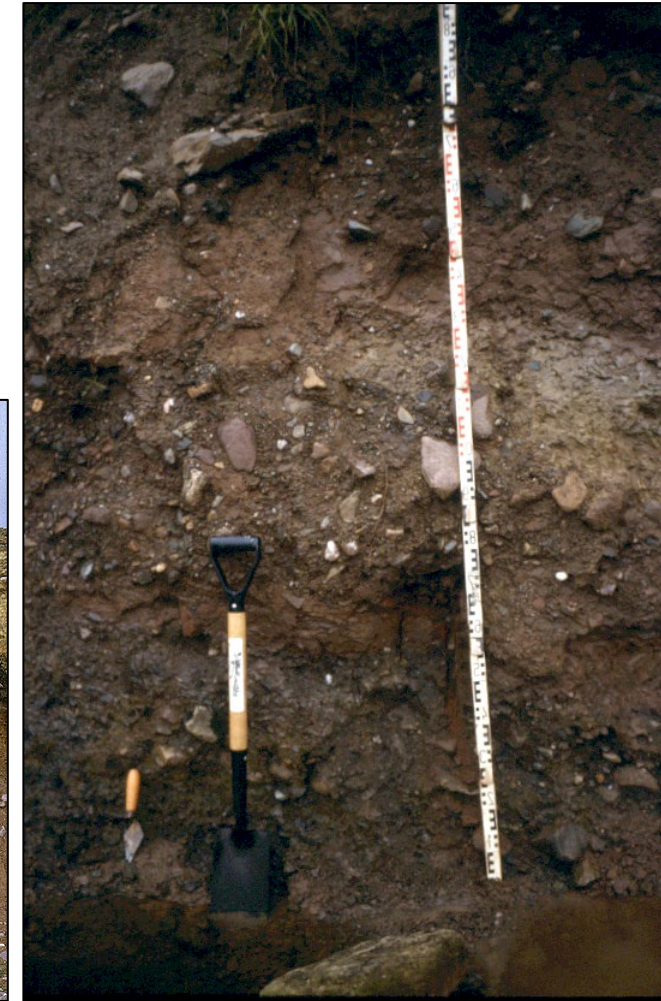
Betongpålar | Hercules



Piling rigs | Liebherr

Glaciala sediment: Morän (till)

- Morän är Sveriges vanligaste jordart.
- 85% av Sveriges land täcks av morän.
- Morän är osorterat glacialt sediment som transporterades av isen. Stor variation av jordens egenskaper förväntas både i sidled och vertikalt.
- Högt blockinnehåll kan hittas i morän.



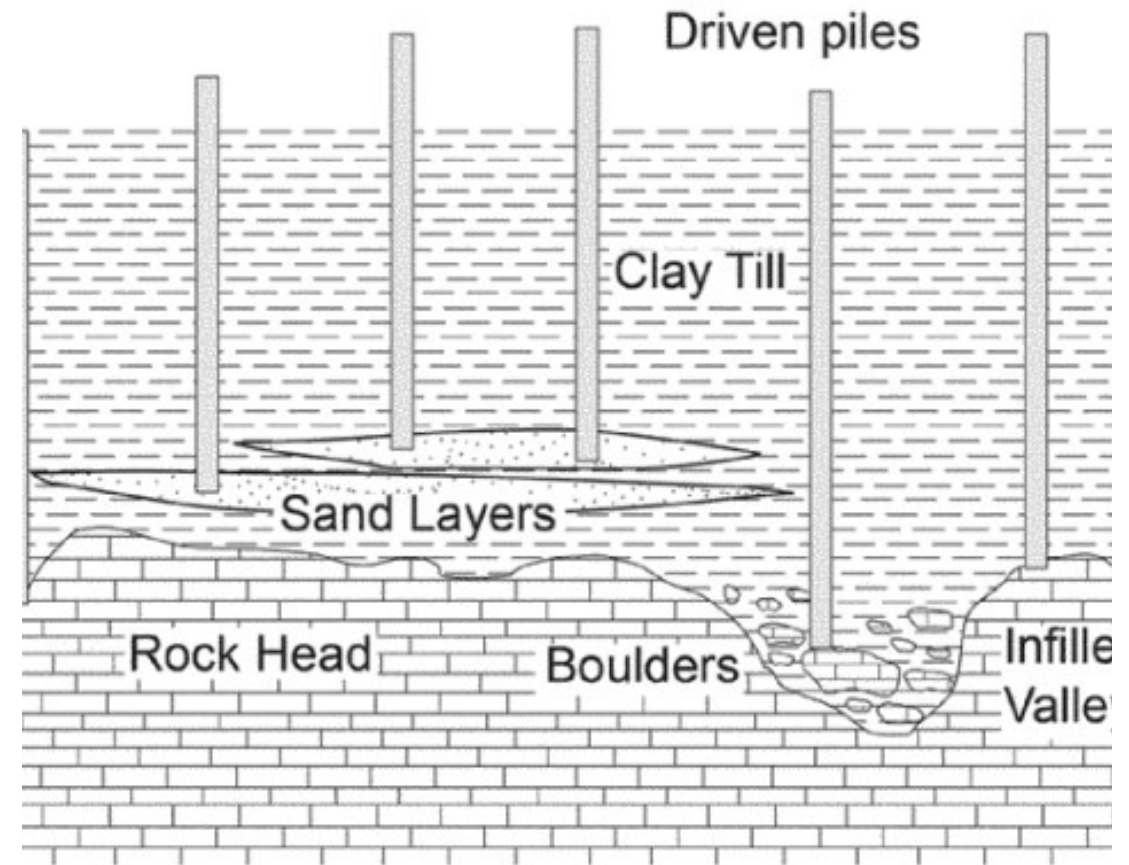
Bortslagning av pålar (Premature Pile Refusal)

Driven piles can encounter boulders in glacial till leading to:

- Damage of large proportion of piles
- Bending or buckling instability
- Laterally movement of the piles
- Large variations in pile length
- Doubtful load-bearing capacity or stiffness

Bortslagning av pålar:

- The structural integrity of the pile is compromised after encountering boulders while driving into till





Reinforced concrete piles damaged during driving at a site in California | R. Boulanger (University of California)



Reinforced concrete pile damaged due to hard driving conditions for a civil construction project in Sweden.



Steel pipe pile encountered an obstruction in the ground before its target elevation | R. Boulanger (University of California)



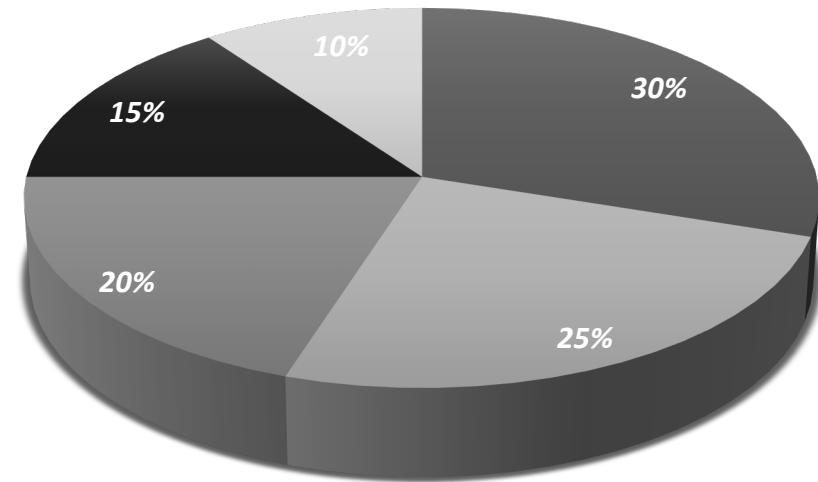
Steel tubular king piles toes heavily damaged during driving for an offshore construction project in Rotterdam.

Fältundersökningar



Borrsvagn | Geofound

Geotekniska Undersökningar i morän



■ Jb-sondering

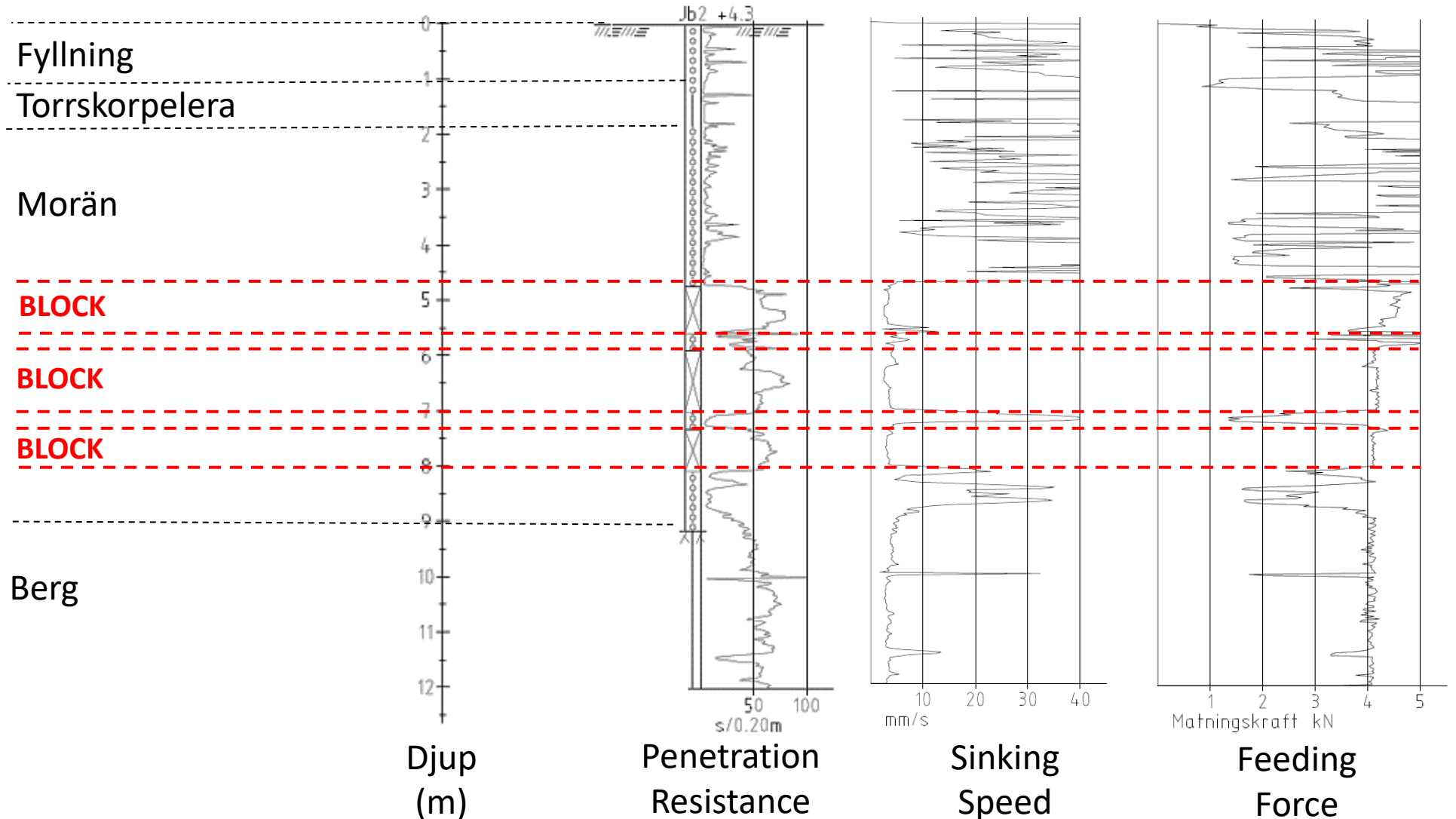
■ Slag-sondering

■ CPT-sondering

■ Jord-provtagning

■ Vikt-sondering

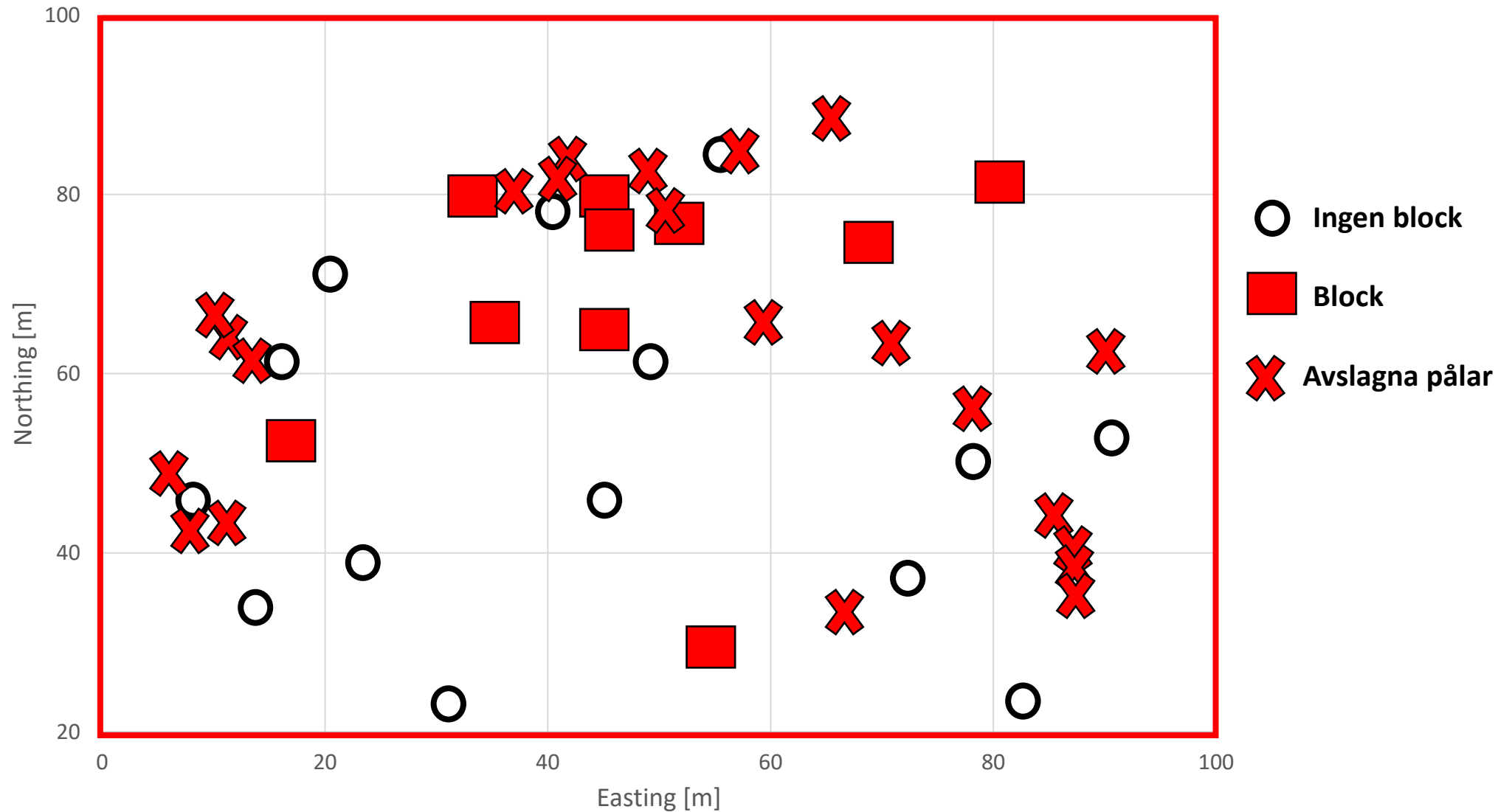
Jord-berg sonderingar



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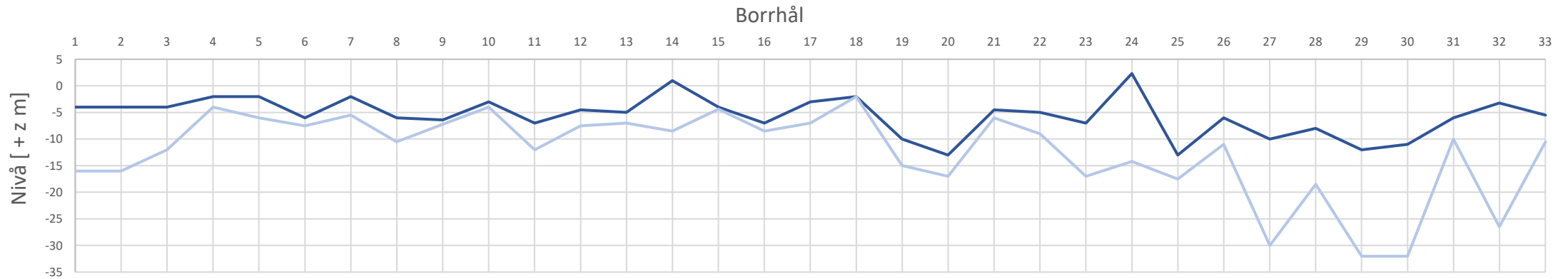
pålgrundläggning

Avslagna pålar

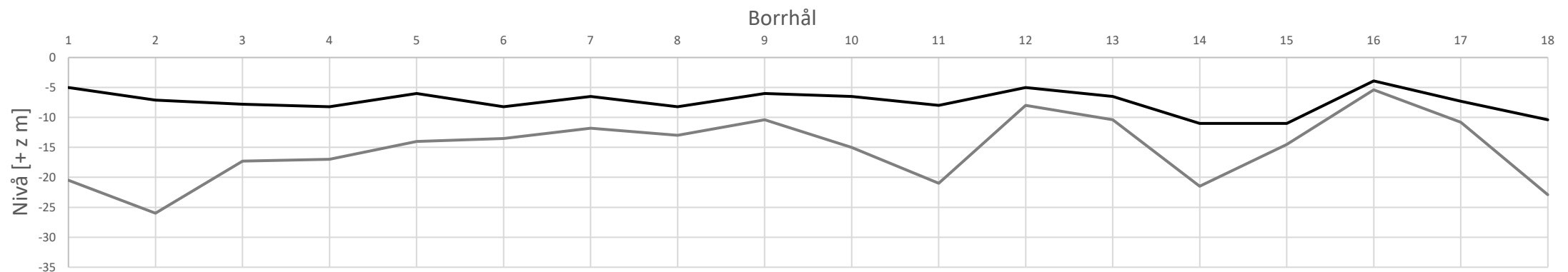


Moräns mäktighet

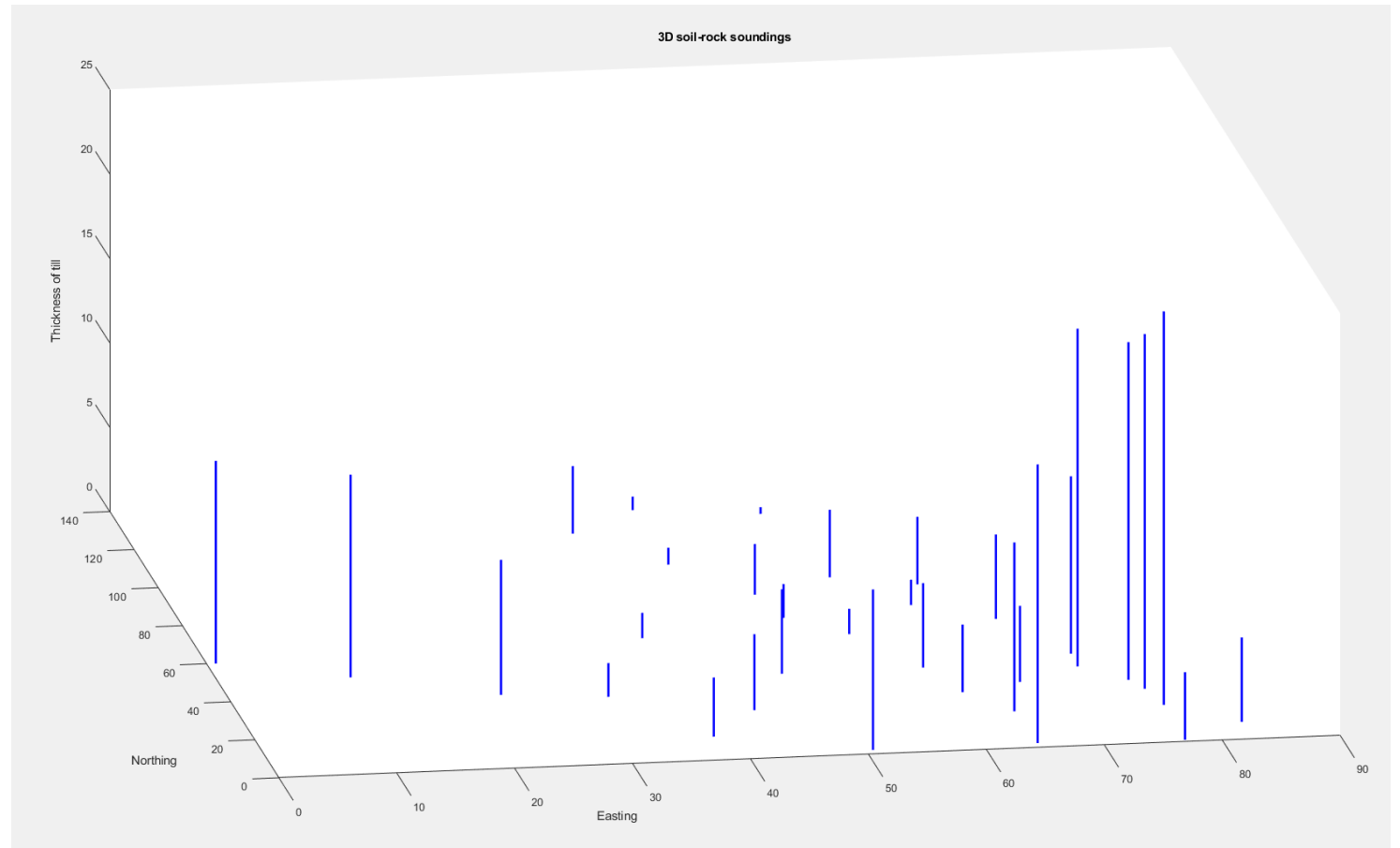
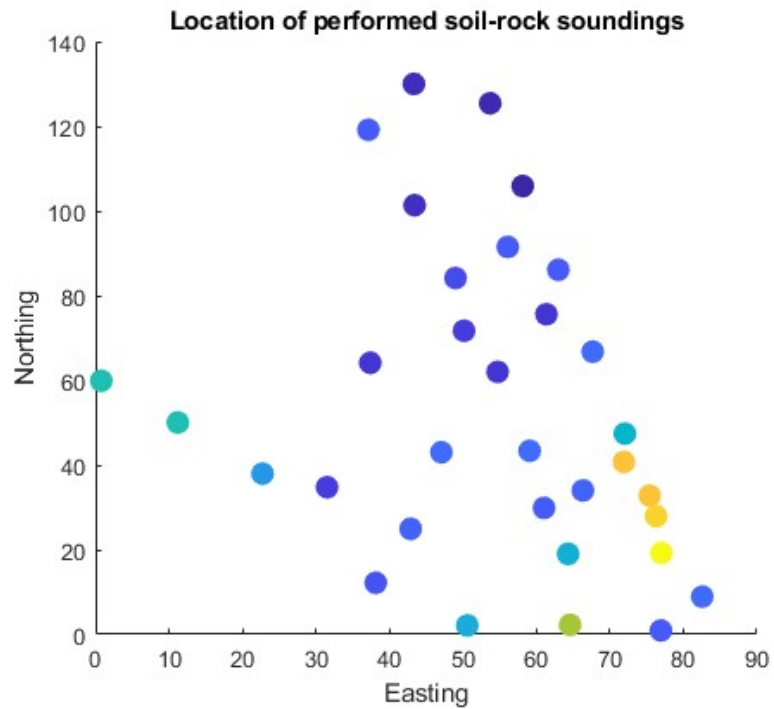
Moräns mäktighet – Projekt #1



Moräns mäktighet – Projekt #2



Moräns mäktighet



Pålkommissionen, R103

- Probability of encountering boulders and estimation of block density in the soil layer based on results of soil–rock sounding:

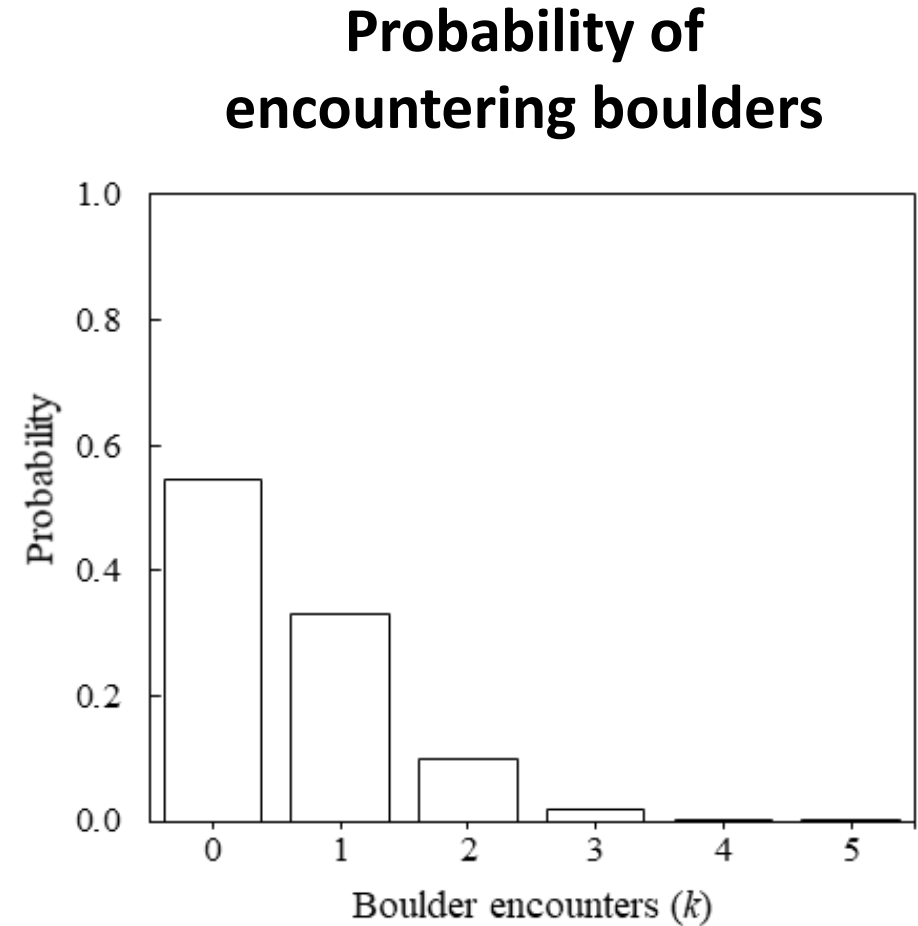
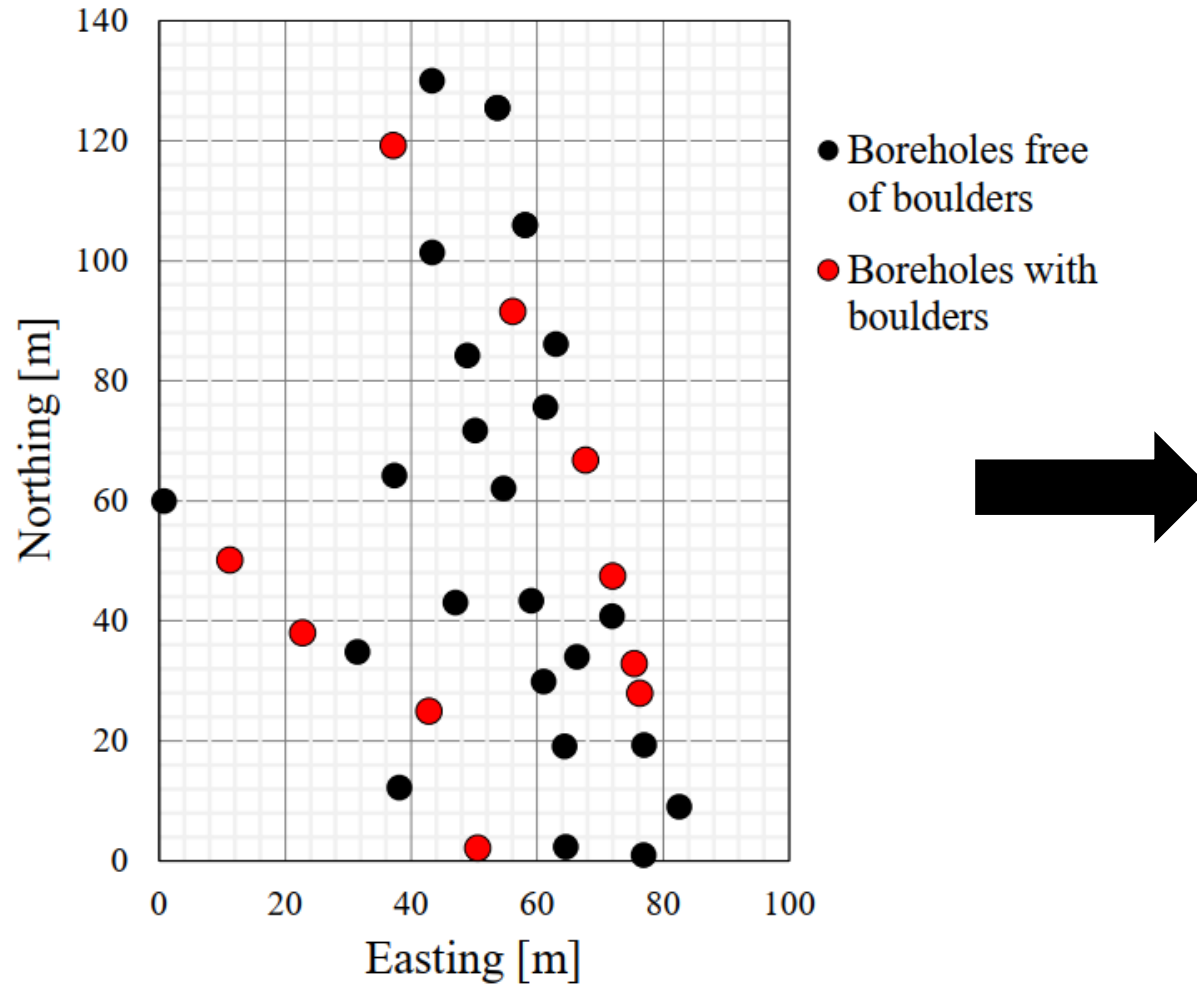
Boulder density	Number of boulders per soil meter
Very low	0 – 0.015
Low	0.015 – 0.05
Medium	0.05 – 0.15
High	0.15 – 0.3
Very high	> 0.3

Probability	Number of boulders per borehole ^a
Very low	< 0.02
Low	0.02 – 0.05
Medium	0.05 – 0.2
High	0.2 – 0.5
Very high	> 0.5

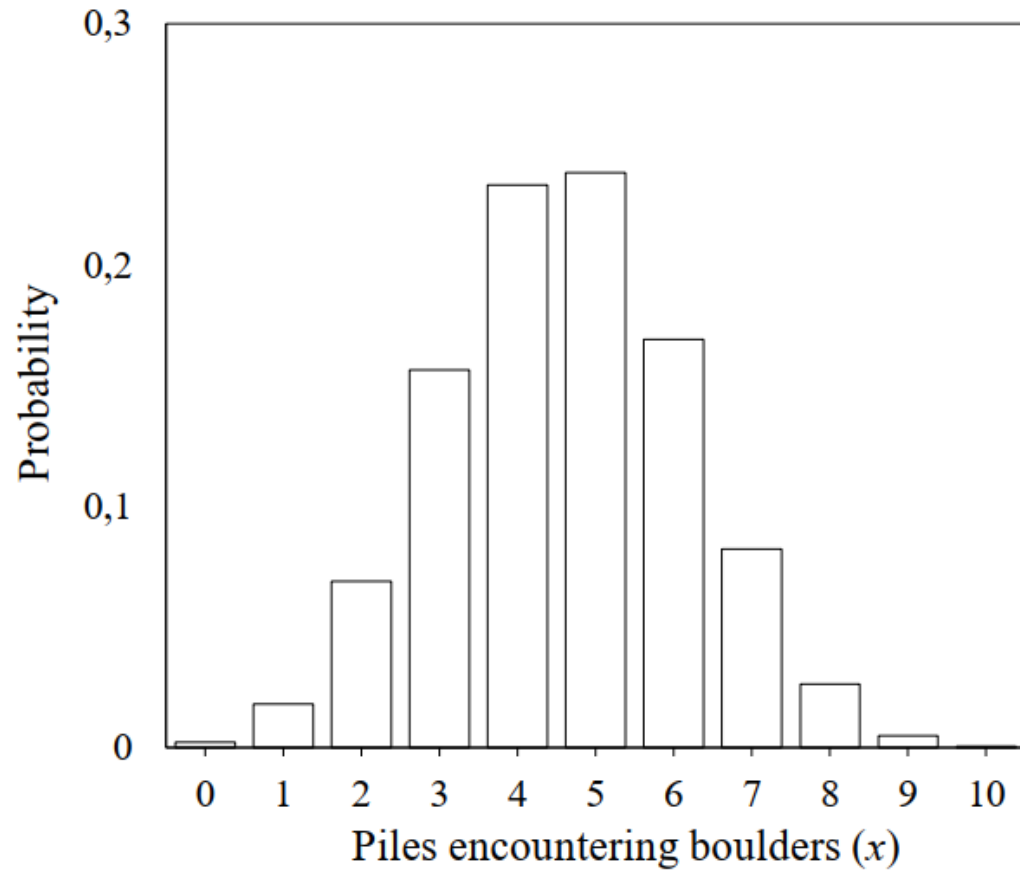
- Boulder content (%) based on an empirical relation between the boulder penetration length inside the borehole L_b and the total length of the boreholes L_{tot} :

$$BC [\%] = \frac{1.4}{0.4 + \frac{L_{tot}}{L_b}} \cdot 100$$

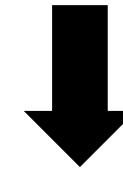
Probabilistic approach



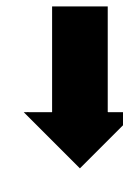
Probabilistic approach



**10 reinforced concrete piles
to be installed**

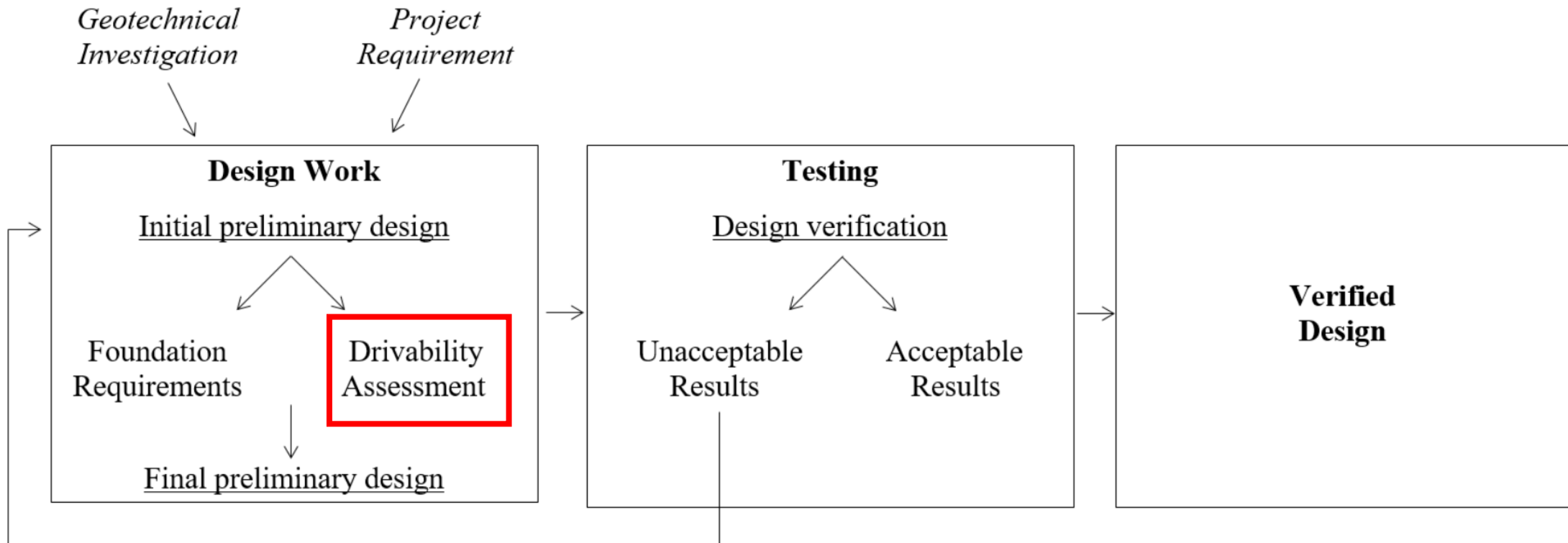


**Probability of 99 %
at least 1 pile encounters boulders**



**Probability of 70 %
5 piles encounter boulders**

Design decision for piles



Tack!

Thank you!

Grazie!