



Influence of grout composition on shaft friction

Simon van Dijk

1st phase program

- Scaled piles
- Reference = driven pile
- Effect screw tip
- No grout injection
- Static test in compression
- Strains measured with optical fibres (no loadcell pile tip)
- Final report October 2018



Participants 2nd phase program

(co-ordination NVAF)

Ballast Nedam

BAM Infra Funderingstechnieken

Franki Grondtechnieken

Funderingstechnieken Verstraeten

Heijmans Funderingstechnieken

Terracon Funderingstechniek

Van 't Hek Groep

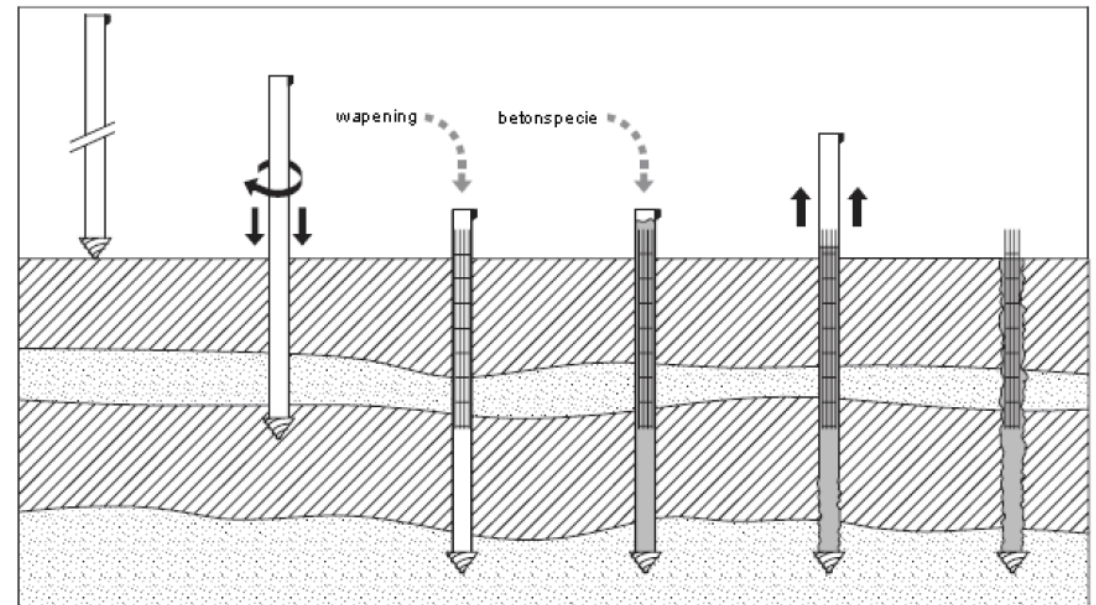
Volker Staal en Funderingen

Voorbij Funderingstechniek

Vroom Funderingstechnieken

2nd phase program

- Screw cast in place displacement pile (not scaled)
- Effect grout composition
 - w/d ratio
 - Constituents
- Effect grout flow
- Verification via shaft friction in tension

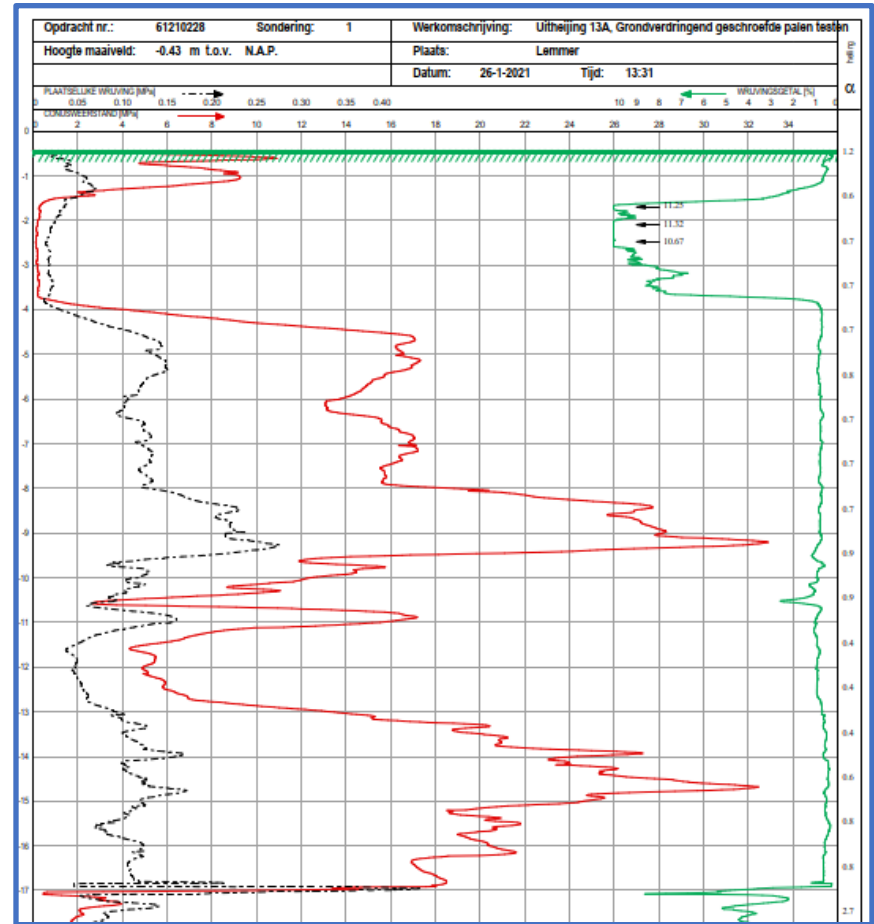
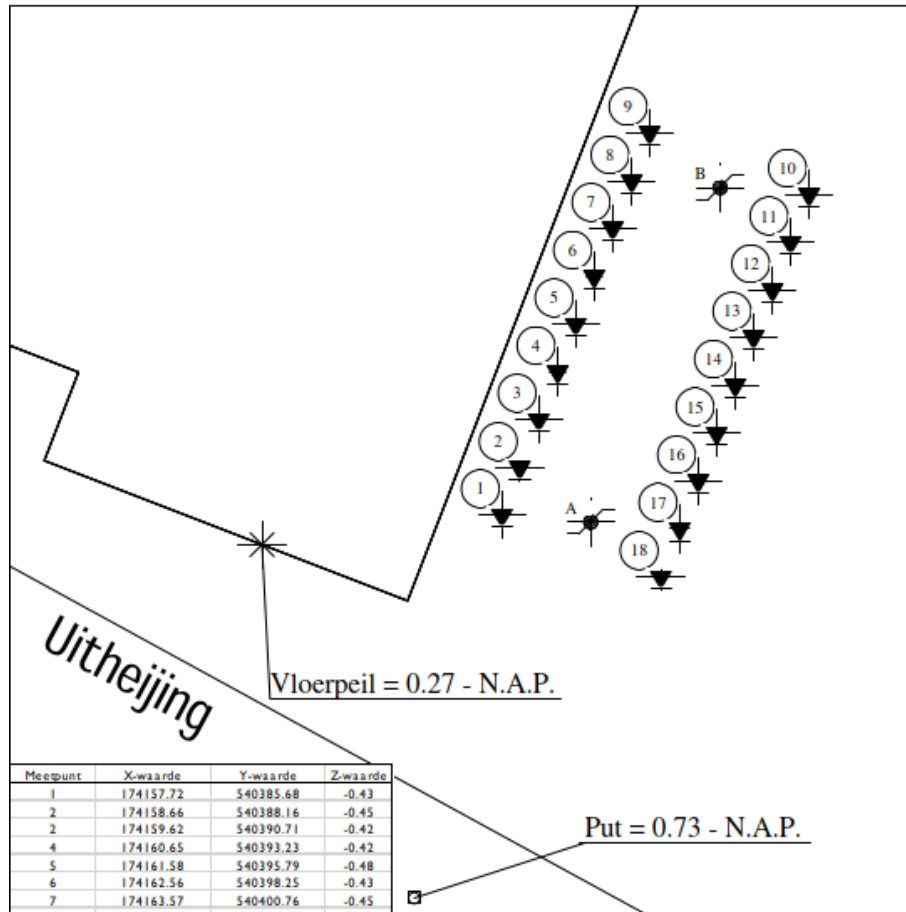


Lemmer test site - soil investigation

- January 2021
- CPT – (18)
- Boring (2)
- Ground water table (2)
- Sand classification (2)



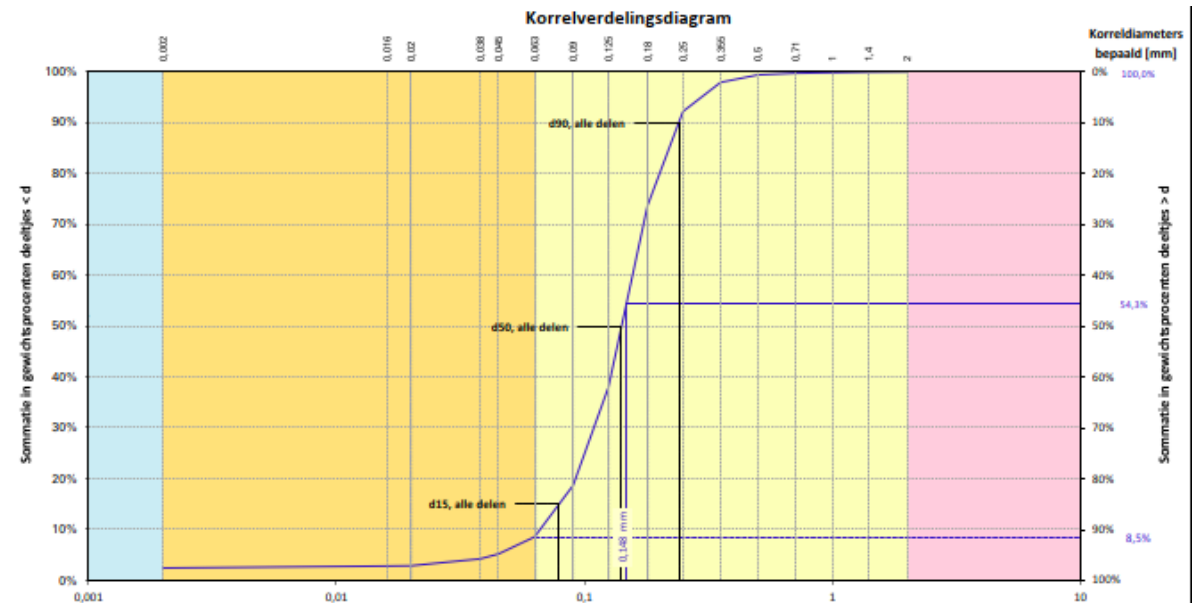
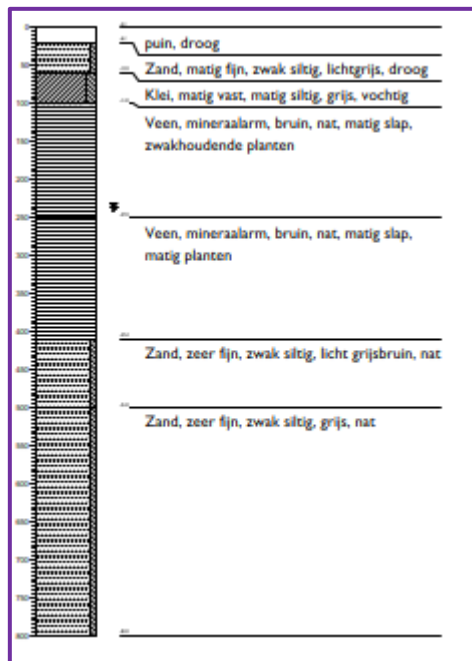
Top view test site – CPT plan



Boring & sample data

GWL = EG – 1.2 m

D₅₀ = 0.14 mm



Pile types

- \emptyset screw tip 470 mm
- \emptyset collar 380 mm
- \emptyset casing 355 mm
- Prediction $\alpha_t = 0,9 \%$
- Prediction $\alpha_t = 1,2 \%$

Sondering	Paal	PPN	WBF	Flow	$F_{t;\alpha = 0,9\%}$	$F_{t;\alpha = 1,2\%}$	Opmerking
[-]	[-]	[m NAP]	[-]	[l/min]	[kN]	[kN]	
1	D1	-9,93	2,5	115	1432	1909	2 x sisterbar op NAP - 5 m
2	E1	-9,95	2	75	1125	1500	webertec
3							
4	C1	-9,92	3,75	75	1532	2042	
5	E2	-9,98	2	75	1432	1909	webertec
6	C2	-9,93	3,75	75	1438	1918	
7	C3	-9,95	3,75	75	1485	1980	
8	D2	-9,99	2,5	115	1372	1829	2 x sisterbar op NAP - 5 m
9	A1	-9,97	1,25	75	972	1341	
10							
11	E3	-9,77	2	75	1225	1634	webertec
12	B1	-9,78	2,5	75	1159	1545	
13	B2	-9,75	2,5	75	1132	1509	
14	D3	-9,80	2,5	115	1432	1909	2 x sisterbar op NAP - 5 m
15	B3	-9,79	2,5	75	1219	1625	
16							
17	A2	-9,85	1,25	75	999	1332	
18	A3	-9,83	1,25	75	1132	1509	

Pile installation

- February 2021
- 5 pile types in 3 fold
- Central Gewi 63.5 TR rod
- Rebar cage
- Concrete C30/37



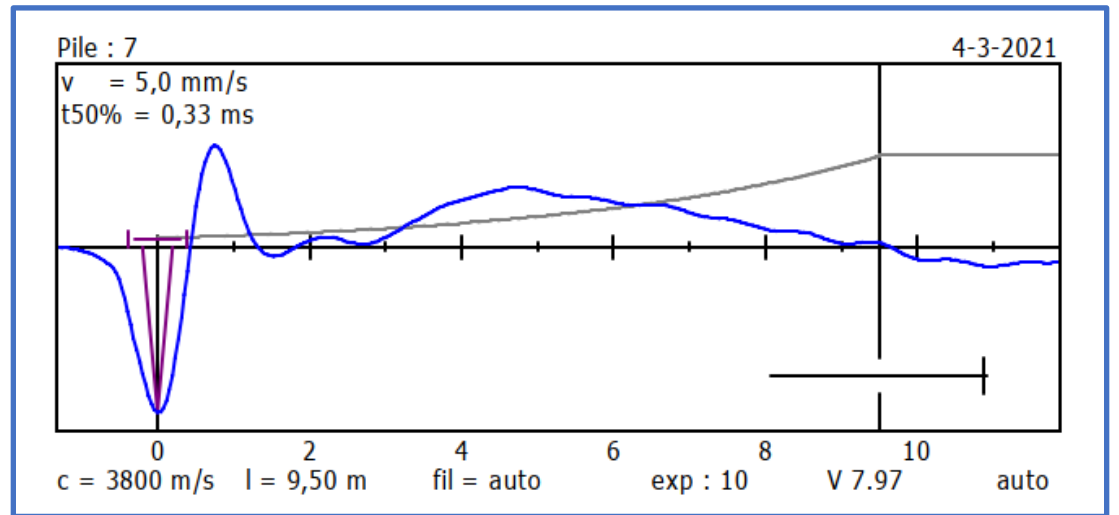
Grout sampling & testing

- Grout sampling
- Back flow grout sampling
- Casting of test specimens



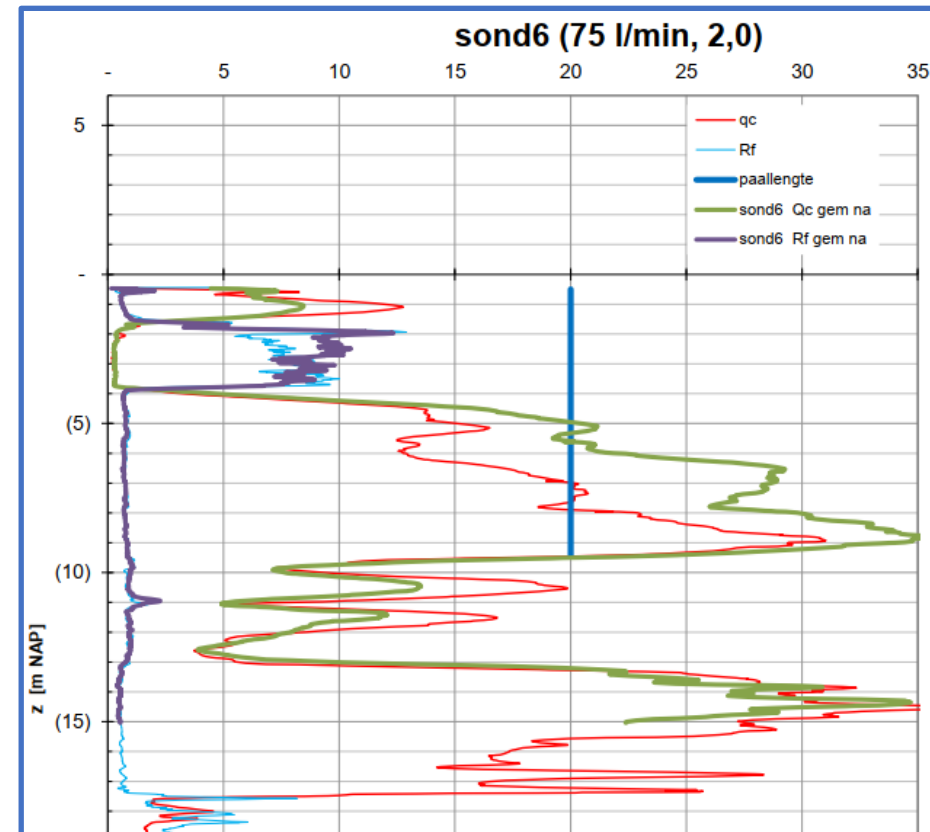
Integrity testing

- Pile length apr. 10 m
- March 2021



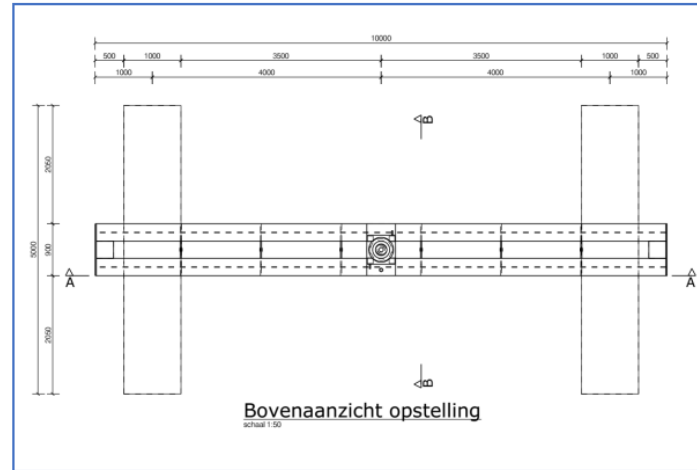
Post CPT testing

- March 2021
- Each pile 2 CPT's at 0.75 m
- Dummy CPT



Static load testing

- Test frame 10 m
- Capacity 2600 kN
- Crane mat support
- Free span 8 m
- No significant soil stress increase near test pile
- Hydraulic jack 3000 kN with 300 mm stroke



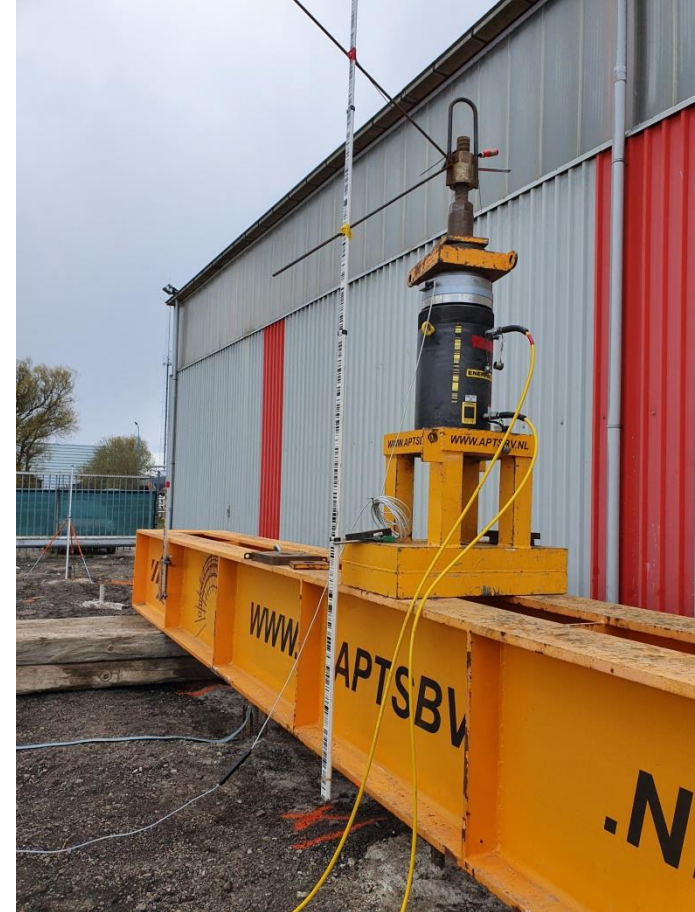
Static load testing

- Load cell 2500 kN 0,2 % FSO
- 2 Leica DNA levels
- Invar barcode
- Accuracy 0-0.1 mm
- Frequency 0.2 Hz



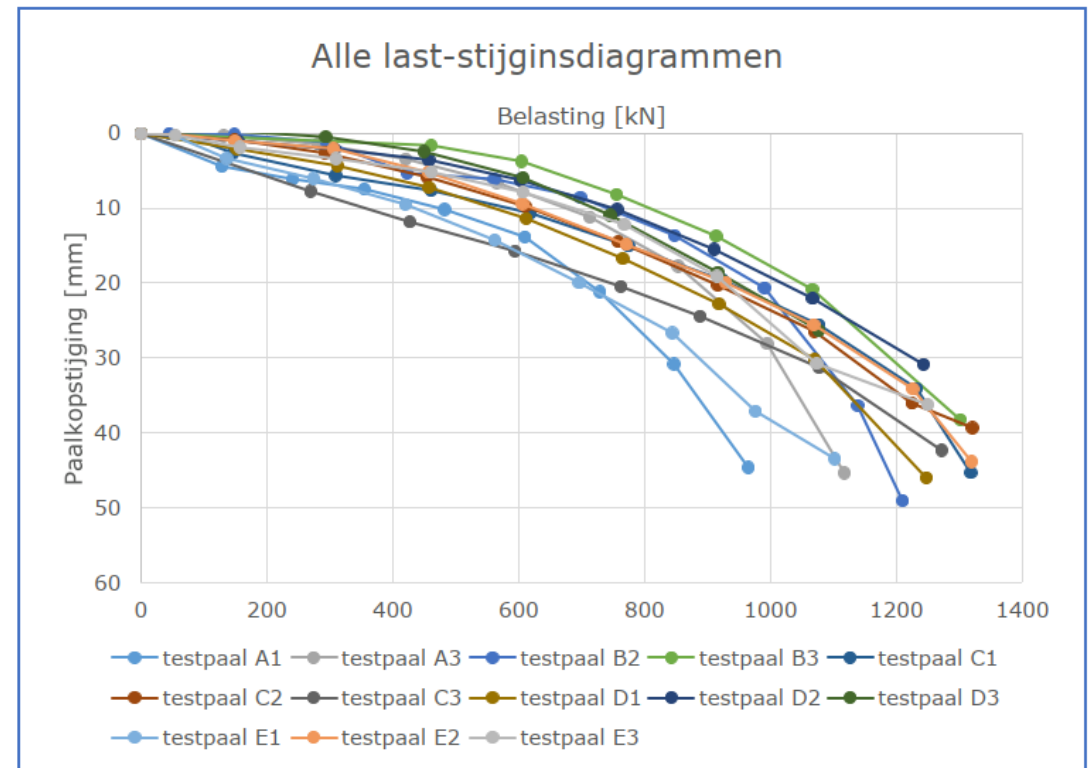
Static load testing

- Execution April 2021
- Pile position with DGPS-RTK
- (accuracy 0-20 mm)
- Test protocol NPR 7201
- 8 load steps
- Unloading after step 4



Test results

- Geotechnical pile diameter = base diameter = 470 mm
- Friction ratio 0.9 %
- No q_c limitation
- Failure loads 88 % - 105 % of predicted failure loads



Pile extraction

- Executed August 2021
- Oversized casing & vibrator
- 50 % piles extracted



Pile classification

- August 2021
- Surface cleaning using pressure washer
- Determination pile diameter as a function of depth



Sampling of pile annulus

- Executed September 2021
- Compressive strength grouted annulus (reference)
- Shear strength grouted annulus
- Test results expected November
- Final report in 2021



Questions?

