VAN ROSSUM RAADGEVENDE INGENIEURS

5.1.1.d

Project	**Duivendrechtsekade 50 te Amsterdam**
Ordernummer	11308
Opdrachtgever	Duivendrechtsekade C.V.
Rapportnummer	AO-001
Omschrijving	Constructieve omschrijving
Fase	Aanvraag omgevingsvergunning

Status	Datum	Omschrijving
Definitief	15-12-2023	Eerste uitgave

Opgesteld door:

ing. 5.1.1.d

5.1.1.d

Voor akkoord:

ing. 5.1.1.d

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VAN ROSSUM RAADGEVENDE INGENIEURS

Inhoudsopgave

VAN ROSSUM RAADGEVENDE INGENIEURS

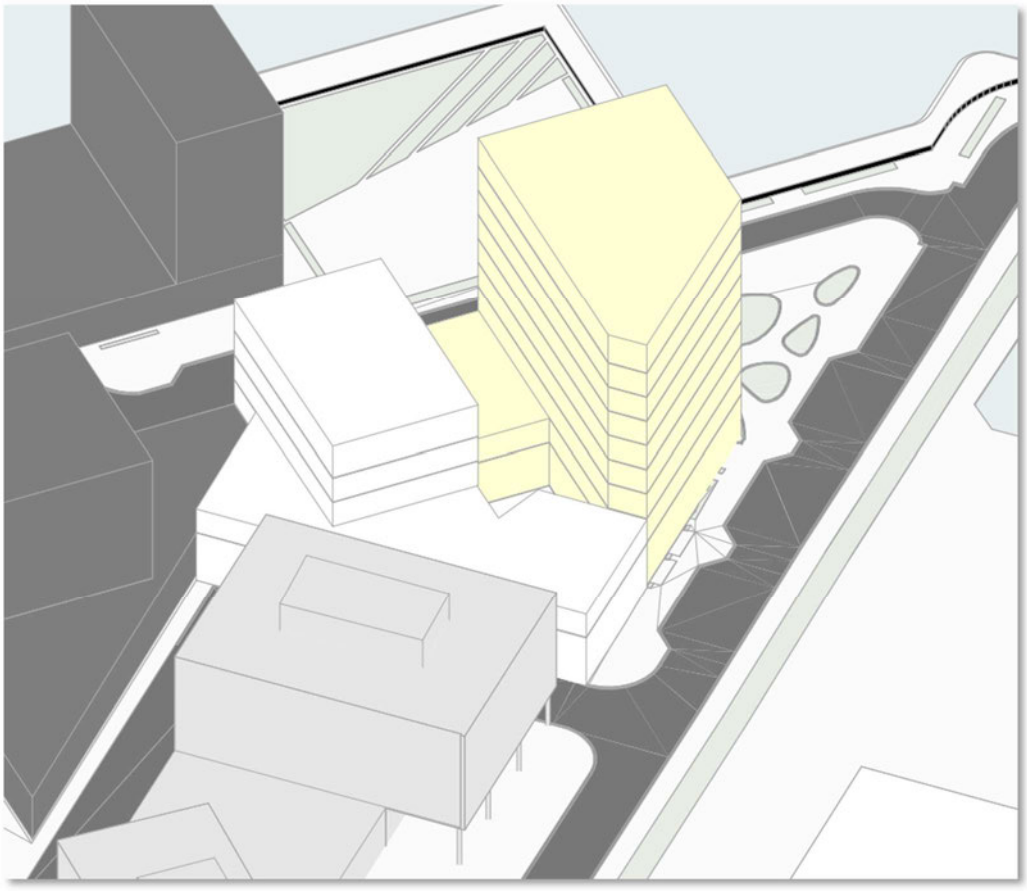
1. Inleiding

In opdracht van Duivendrechtsekade C.V. heeft Van Rossum Raadgevende Ingenieurs b.v. het constructieve tekenwerk en rekenwerk van het woningbouwproject “Duivendrechtsekade 50” te Amsterdam verzorgd voor de aanvraag omgevingsvergunning.

Op basis van de bouwkundige uitgangspunten en ontwerp van HFB + HFB Architectuur uit Rotterdam, heeft Van Rossum Raadgevende Ingenieurs de draagstructuur ontworpen.
Deze constructieve omschrijving is een toelichting op de constructieve uitgangspunten conform de Wabo en maakt een onderdeel uit van de aanvraag voor de omgevingsvergunning. Het is het basisdocument met constructieve uitgangspunten in hoofdlijnen voor de definitieve uitwerking.

Volgens de MOR artikel 2.7 wordt de detailuitwerking van de constructie op een later moment ingediend. Uiterlijk drie weken voor de start van de uitvoering van het in te dienen onderdeel.
Middels dit schrijven wordt hier tevens een verzoek toe gedaan.

In het stadsdeel Amsterdam Oost wordt aan de Duivendrechtsekade, op de locatie van een perceel met een enkele woning, een nieuw woongebouw ontwikkelt.
Het gebouw zal ruimte bieden aan circa 100 studio’s/ loften, met op de begane grond drie kantoorfuncties waarvan twee gecombineerd met wonen en een fietsenstalling.
Het betreft een rechthoekige toren van negen bouwlagen waarvan een kopzijde is afgeschuind. De onderste twee bouwlagen lopen verder door buiten de toren.



Een schematische weergave van het project door HFB + HFB Architectuur

2. Projectbeschrijving

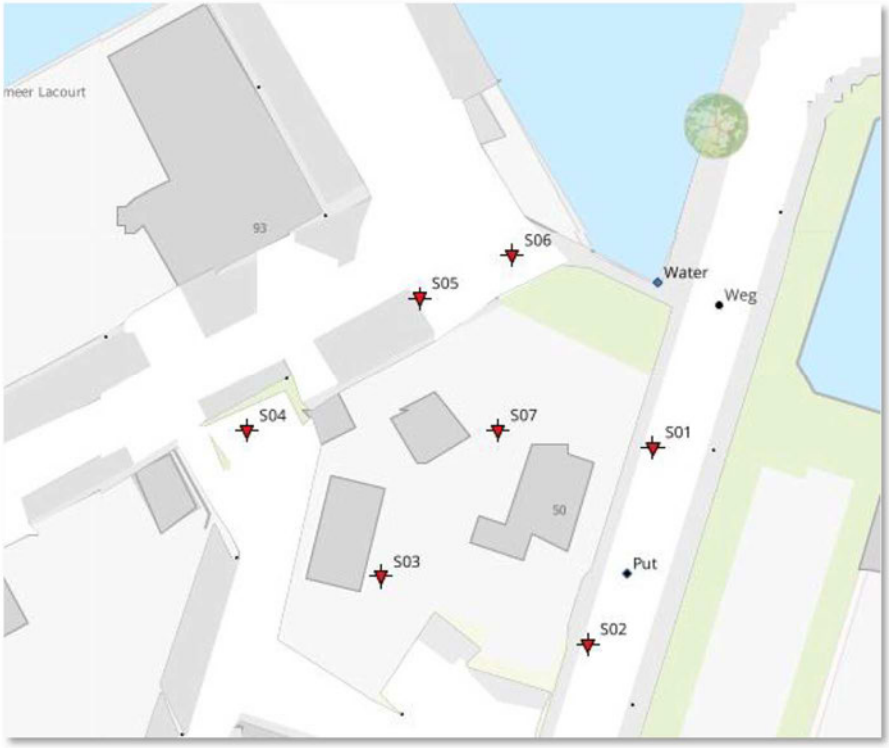
2.1 Bouwlocatie

Huidige projectlocatie project “Duivendrechtsekade 50 te Amsterdam” (bron Google Maps)

2.2 Fundering

Peil = 0 = 0,10 m + NAP

Het grondonderzoek en de sonderingen zijn uitgevoerd door BAM Infraconsult bv in opdracht van CRUX Engineering BV. Zij hebben 7 diepsonderingen gemaakt op 2 november 2023, waarmee de bodemopbouw tot maximaal circa 35,5 m - NAP is verkend. De sonderingen geven een consistent sordeerbeeld. Aan de hand hiervan is een funderingsadvies uitgebracht door CRUX Engineering BV volgens NEN 9997-1 met belastingtabellen van 1250 kN tot 3000 kN drukbelasting.
De sonderingen zijn in het funderingsadvies als bijlage A toegevoegd en tonen aan dat er een inheidiepte van 26,00 tot 26,50 meter - NAP wordt toegepast.



Sondeerlocaties (bron BAM Infraconsult BV)

Uitgangspunt voor dit project is een HEK-combipaal met een prefab betonnen paal. De schroefpalen worden in de grond gedraaid door middel van een stalen hulpbuis en verloren schroefpunt waarna een prefab betonnen kern wordt ingehangen en rondom aangegoten. Dit funderingssysteem kan als trillingsvrij en geluidsarm beschouwd worden en garandeert de kwaliteit van de uiteindelijke paal in de grond. Daarnaast betreft dit een grondverdringend paalsysteem welke vanaf maaiveld wordt aangebracht. Aangezien het project in de beschermzone ligt van de waterkering wordt hiermee voorkomen dat er een lekweg of kortsluiting zal optreden tussen watervoerende pakketen.

De verwachting is dat er geen noemenswaardige puinresten aanwezig zijn in de ondergrond. Wel zullen er funderingspalen achterblijven van de huidige woning op het perceel welke na sloop in kaart gebracht dienen te worden om onder de nieuwbouw te projecteren. Om conflicten te voorkomen zullen de nieuwe palen op voldoende afstand van de bestaande worden gehouden, wat in sommige gevallen tot grotere funderingen kan leiden. Voor eventuele conflicterende bestaande palen geldt dat deze in het werk opgegraven en ingemeten dienen te worden.

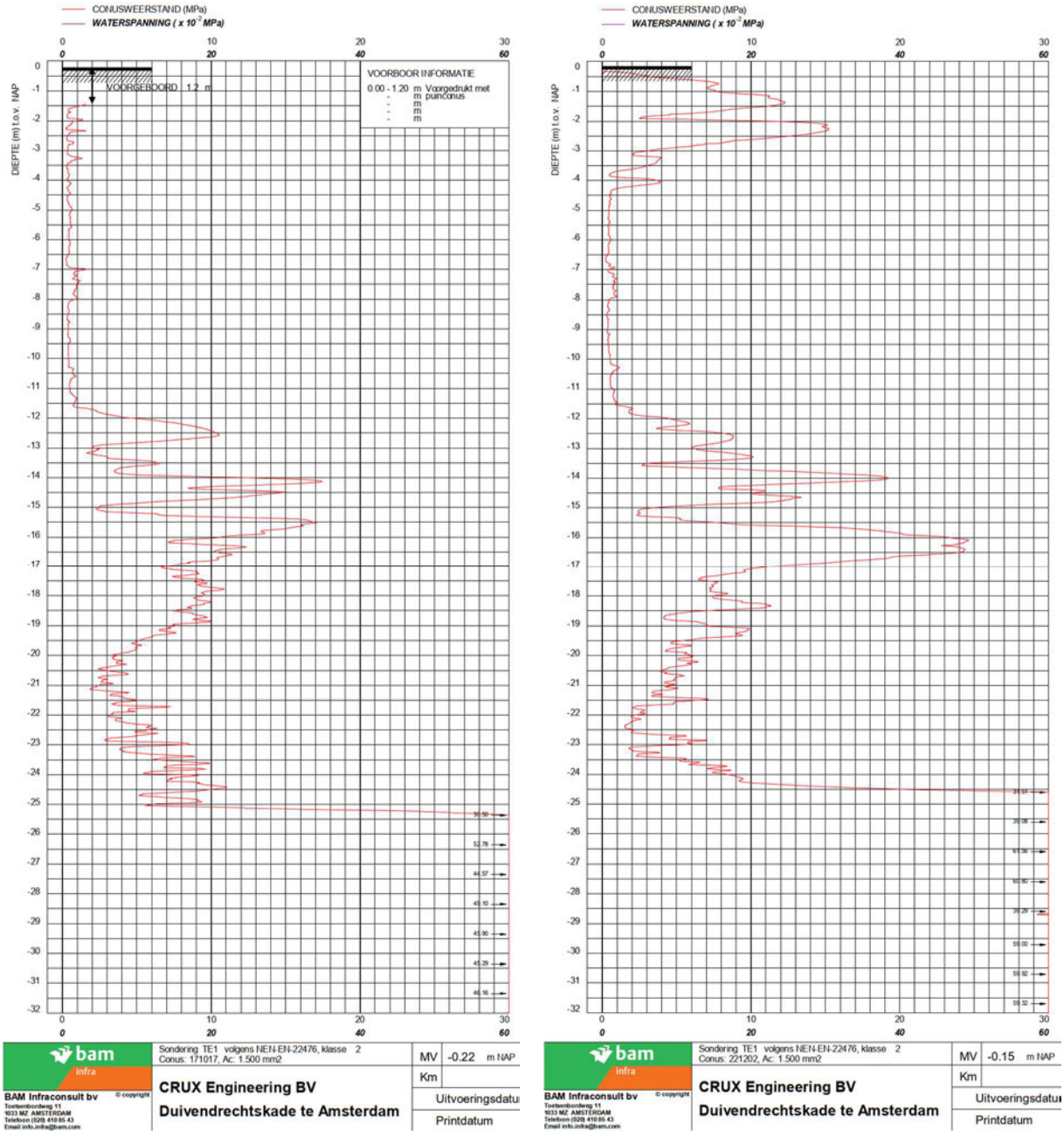
Uitgangspunt veerwaarden ten behoeve van invoer steunpunten verdere berekeningen:

$k_{;paal\ Ø410}$ = (E * A) / (1,5 * L) = (20.000 * π * 205²) / (1,5 * 25.500) = ± 69.000 N/mm

$k_{;paal\ Ø460}$ = (E * A) / (1,5 * L) = (20.000 * π * 230²) / (1,5 * 25.500) = ± 87.000 N/mm

$k_{;paal\ Ø540}$ = (E * A) / (1,5 * L) = (20.000 * π * 270²) / (1,5 * 25.000) = ± 122.000 N/mm

Op basis van deze gegevens zal de gewichtsberekening en het palenplan verder uitgewerkt worden. Op de palen wordt een in het werk gestorte fundering bestaande uit funderingsbalken en poeren toegepast.



Sondeerbeeld van sondering S01 en S04 (bron BAM Infraconsult BV)

2.3 Opbouw constructie

De fundering bestaat uit in het werk gestorte betonnen poeren onder de kolommen en gewapende funderingsbalken onder de betonwanden. Op de fundering komt een 250 mm dikke betonvloer ter plaatse van de technische ruimten en een 300 mm dikke betonvloer ter plaatse van de fietsenstalling. Bovenkant betonvloer fietsenstalling ligt op Peil = 0 en wordt door middel van een kleine hellingbaan richting de gevel in stramien 1 verbonden met het iets hoger liggende maaiveldniveau. Ter plaatse van de kantoren en woningen wordt de begane grond uitvoerd in een geïsoleerde kanaalplaatvloer h= 260.

De toren wordt opgetrokken uit een insitu betonskelet met betonwanden in een dikte van 250 mm. De gevels in stramien 1 en G zijn tevens dragend in de vorm van 250 mm dikke betonwanden met op de de begane grond en eerste verdieping grote openingen. Vanaf de tweede verdieping bevatten deze gevelwanden kleinere raamsparingen met onderliggende borstweringen. Om de (tussen)penanten vanaf de tweede verdieping op te kunnen vangen boven de grote openingen, dient de tweede verdiepingsvloer met onderliggende latei en bovenliggende borstwering als samengestelde wandligger uitgevoerd te worden. De overige gevels, met name in stramien E en C worden uitgevoerd in houtskeletbouw.

Met de eerste verdieping op 5,00 m + Peil bieden de ruimten op de begane grond, mogelijkheid voor het aanbrengen van mezzanine tussenvloeren in twee kantoren en vier woningen in de vorm van 200 mm of 250 mm dikke breedplaatbetonvloeren.

Vanaf de eerste verdieping tot en met dakvloer overspannen de vloeren van circa 7,80 m tot 8,10 m, uitgevoerd in 280 mm dikke breedplaatvloeren waarbinnen ruimte is voor het aanbrengen van installaties ten behoeve van de woningen.
De dakvloeren op de tweede verdieping tussen stramien A en C overspannen circa 5,00 m en worden ook uitgevoerd in 280 mm dikke breedplaatvloeren. Deze bieden ruimte voor dakterrassen en een gemeenschappelijke buitenruimte en verder voorzien van een nader te bepalen groendak.
De dakvloeren op de achtste verdieping bieden verder ruimte voor installaties en zonnepanelen.
De vloeren verzorgen tevens de schijfwerking voor het afdragen van de windbelasting vanuit de gevels naar de stabiliteitswanden.

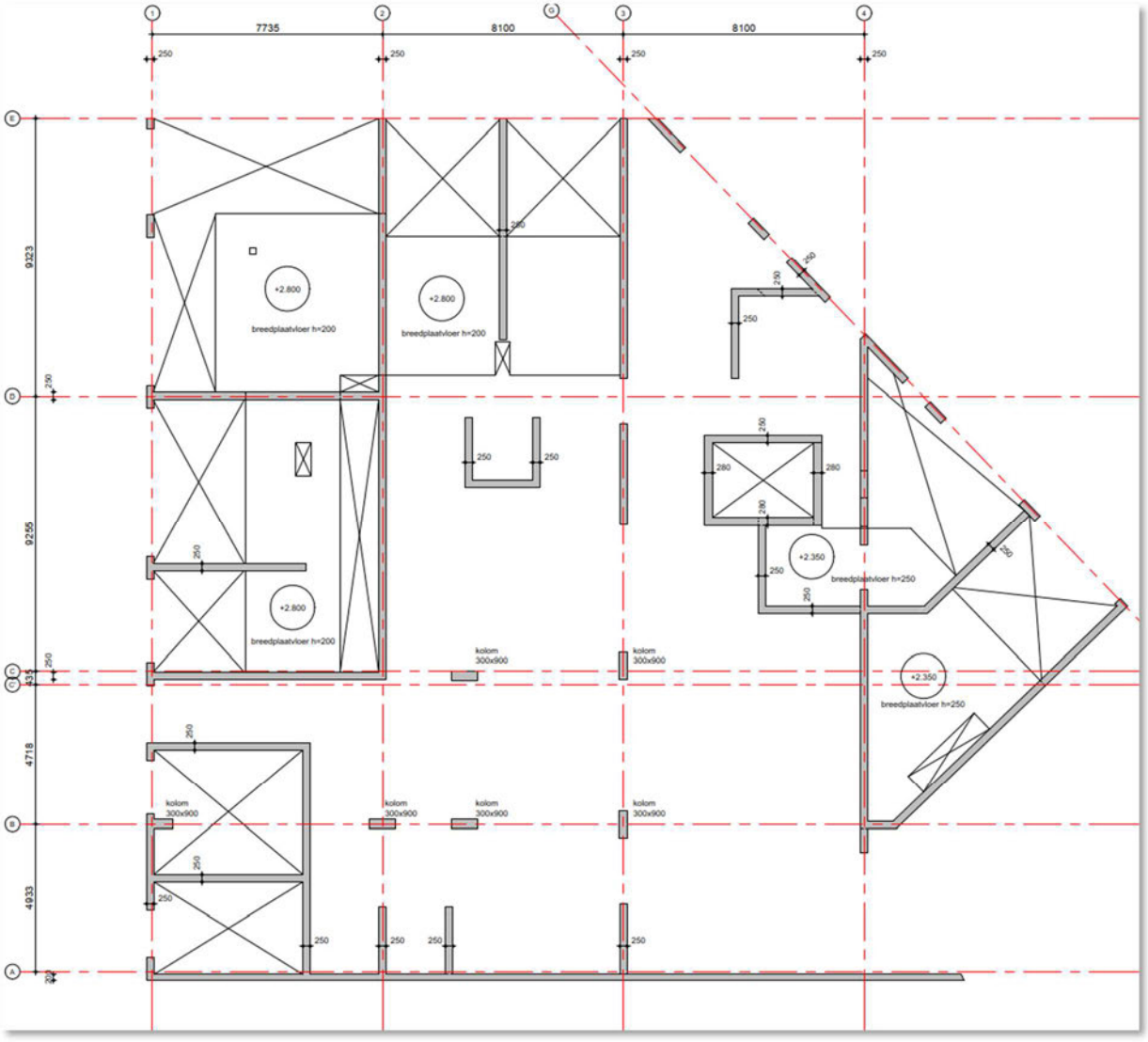
Naast de grote raampartijen bestaat de buitengevel tot de tweede verdieping uit metselwerk penanten welke afdragen op de fundering. Op de tweede verdieping komt een metselwerk band welke zal afdragen op de tweede verdiepingsvloer.

Het gebouw sluit aan op bestaande bebouwing maar wordt hier constructief volledig los van gehouden. Er zijn verder geen dillataties benodigd binnen het bouwwerk zelf.

2.4 Stabiliteit

Voor het gehele gebouw geldt dat de windbelasting van de gevels via schijfwerking van de vloeren wordt afgedragen naar de stabiliteitswanden.

Alle verdiepingen hebben diverse wanden in beide richtingen. De windbelasting op de schuine gevel in stramien G zal door de orthogonale wanden in zowel de cijfer- als letterassen worden opgenomen. Vanaf de tweede verdieing (toren) zal met name de liftkern en in mindere mate de wanden om de twee trappenhuizen de stabiliteit in de richting van de letterassen verzorgen.



Overzicht wandenstructuur op de begane grond

3. Van toepassing zijnde voorschriften

Van toepassing zijn de vigerende NEN-EN normen op de dag van de indiening van de bouwaanvraag.

NEN8700	Beoordeling constructieve veiligheid bestaand bouwwerken
NEN-EN 1990	Grondslagen van het constructieve ontwerp
NEN-EN 1991	Belastingen op constructies
NEN-EN 1992	Betonconstructies
NEN-EN 1993	Staalconstructies
NEN-EN 1994	Staal-betonconstructies
NEN-EN 1995	Houtconstructies
NEN-EN 1996	Metselwerkconstructies
NEN-EN 1997	Geotechnisch ontwerp
NEN-EN 1999	Aluminiumconstructies

4. Betrouwbaarheids- en gevolgklasse

De gevolgen van bezwijken voor dit project op basis van een woongebouw met 5 of meer bouwlagen kunnen ingedeeld worden conform NEN-EN 1991-1-7 Tabel NB.5 - A.1 in gevolgklasse CC2b.
Voor aanvullende richtlijnen met betrekking tot CC2b zie NEN-EN 1991-1-7 Bijlage A.4 c.

Ontwerplevensduur: 50 jaar.

Hierbij horen de volgende belastingfactoren:
γ_G = 1,35
γ_Q = 1,50
ξ_i = 0,89 (combinatiewaarde in formule 6.10b)

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5. Belastingen

De volgende belastingen worden aangehouden voor het nieuwbouwproject.

Belastingen (representatieve waarden)	**P_b**	/	**V_b**
Liftputvloer h= 300			
betonvloer h= 300	7,50	/	
nuttig (grove aanname)		/	50,00
totaal	7,50	/	50,00
Begane grondvloer h= 260 - Woning			
geïsoleerde kanaalplaatvloer h= 260, Rc-waarde = n.t.b.	4,00	/	
vloerafwerking h= 60	1,20	/	
nuttig (woonfunctie + 1,25 lichte scheidingswanden)		/	3,00
totaal	5,20	/	3,00
Begane grondvloer h= 260 - Kantoor			
geïsoleerde kanaalplaatvloer h= 260, Rc-waarde = n.t.b.	4,00	/	
vloerafwerking h= 60 (door huurder)	1,20	/	
nuttig (kantoorfunctie + 1,50 lichte scheidingswanden)		/	4,00
totaal	5,20	/	4,00
Betonvloer h= 300 - Fietsenstalling			
betonvloer h= 300	7,50	/	
nuttig (woonfunctie - gemeenschappelijke vloeren)		/	3,00
totaal	7,50	/	3,00
Betonvloer h= 250 - Techniek			
betonvloer h= 250	6,25	/	
nuttig (opslagfunctie)		/	10,00
totaal	6,25	/	10,00
Betonvloer h= 300 - Techniek			
betonvloer h= 300	7,50	/	
nuttig (opslagfunctie)		/	10,00
totaal	7,50	/	10,00

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Mezzaninevloer h= 200 - Woning			
betonvloer h= 200	5,00	/	
vloerafwerking h= 60	1,20	/	
plafond en installaties	0,50	/	
nuttig (woonfunctie)		/	1,75
totaal	6,70	/	1,75

Mezzaninevloer h= 250 - Woning			
betonvloer h= 250	6,25	/	
vloerafwerking h= 60	1,20	/	
plafond en installaties	0,50	/	
nuttig (woonfunctie)		/	1,75
totaal	7,95	/	1,75

Verdiepingsvloeren h= 280 - Woning			
betonvloer h= 280	7,00	/	
afwerking h= 60	1,20	/	
plafond en installaties	0,50	/	
nuttig (1,75 + 1,00 lichte scheidingswanden)		/	3,00
totaal	8,70	/	3,00

Dakvloer eerste + tweede verdieping h= 280 - Terras			
betonvloer h= 280	7,00	/	
dakbedekking + isolatie	0,30	/	
groendak / tegels h= 60 op tegeldragers	2,00	/	
plafond en installaties	0,50	/	
nuttig (woonfunctie - terras)		/	2,50
totaal	9,80	/	2,50

Dakvloer h= 280			
betonvloer h= 280	7,00	/	
dakbedekking + isolatie	0,30	/	
grind	0,70	/	
zonnepanelen	0,50	/	
plafond en installaties	0,50	/	
nuttig (dakvloer)		/	2,00
nuttig (opslagfunctie - techniek)		/	5,00
totaal	9,00	/	2,00 / 5,00

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Kopgevels	
betonwand d= 250	6,25
halfsteens metselwerk	2,00
totaal	8,25 kN/m²

Langsgevels	
binnenspouwblad	1,00
halfsteens metselwerk	2,00
totaal	3,00 kN/m²

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6. Windbelasting

Voor de windbelasting wordt uitgegaan van:
- windgebied II (Amsterdam)
- onbebouwd
- $h_{;max}$ = 31 m met $q_{p;max}$ = 1,21 kN/m²

Bouwfactor:
- $c_s c_d$ = 1,00

Wrijvingscoëfficiënt:
- c_{fr} = 0,04 (zeer ruw)

Gebouw:
- h / d = 31,00 m / 19,40 m = 1,60
- c_{pe} = + 0,80 (druk)
  – 0,53 (zuiging)
  = 1,33
- $c_{correlatie}$ = 0,85 Zie NEN-EN 1991-1-4 artikel 7.2.2 (4)

→ Er wordt gerekend met een totaalfactor van 1,15.

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7. Belastingcombinaties

De belastingcombinaties voor de uiterste grenstoestand worden bepaald conform NEN-EN 1990.

$1{,}35 \times G_k + \sum 1{,}50 \times Q_k \times \psi_0$ (eigen gewicht maatgevend)

$1{,}20 \times G_k + 1{,}50 \times Q_{k;1} + \sum 1{,}50 \times Q_k \times \psi_0$ (twee bouwlagen vol belast)

$0{,}90 \times G_k + 1{,}50 \times Q_{k;1} + \sum 1{,}50 \times Q_k \times \psi_0$ (trek, kantelen, opwaartse druk)

$1{,}00 \times G_k + 1{,}00 \times Q_{k;1} \times \psi_2 + \sum 1{,}00 \times Q_k \times \psi_2$ (bijzondere combinatie)

$1{,}00 \times G_k + 1{,}00 \times Q_{k;1} \times \psi_1 + \sum 1{,}00 \times Q_k \times \psi_2$ (als wind maatgevend is)

Voor de bruikbaarheidsgrenstoestand worden de volgende belastingcombinaties gehanteerd.

Karakteristieke combinatie:

$$1{,}00 \times G_k + 1{,}00 \times Q_{k;1} + \sum 1{,}00 \times Q_k \times \psi_0$$

Frequente combinatie:

$$1{,}00 \times G_k + 1{,}00 \times Q_{k;1} \times \psi_1 + \sum 1{,}00 \times Q_k \times \psi_2$$

Quasi-blijvende combinatie:

$$1{,}00 \times G_k + 1{,}00 \times Q_{k;1} \times \psi_2 + \sum 1{,}00 \times Q_k \times \psi_2$$

Voor de ψ-factoren worden de onderstaande waarden gehanteerd conform tabel A1.1 NEN-EN1990:

Tabel A1.1 — Waarden van de ψ-factoren voor gebouwen

Belasting	ψ_0	ψ_1	ψ_2
Voorgeschreven belastingen in gebouwen, categorie			
Categorie A: woon- en verblijfsruimtes	0,4	0,5	0,3
Categorie B: kantoorruimtes	0,5	0,5	0,3
Categorie C: bijeenkomstruimtes	0,25	0,7	0,6
Categorie D: winkelruimtes	0,4	0,7	0,6
Categorie E: opslagruimtes	1,0	0,9	0,8
Categorie F: verkeersruimte, voertuiggewicht ≤ 30 kN	0,7	0,7	0,6
Categorie G: verkeersruimte, 30 kN < voertuiggewicht ≤ 160 kN	0,7	0,5	0,3
Categorie H: daken	0	0	0
Sneeuwbelasting	0	0,2	0
Windbelasting	0	0,2	0
Temperatuur (geen brand)	0	0,5	0

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8. Brandwerendheid hoofddraagconstructie

Bepaling van de brandwerendheid zal geschieden volgens het Bouwbesluit.

Het gebouw bevat een woonfunctie waarvan vloeren hoger ligger dan 13 m boven het meetniveau.

Op basis van bovenstaande regel kan geconcludeerd worden dat de te hanteren brandwerendheid 120 minuten bedraagt. Deze brandwerendheidseis mag niet worden gereduceerd.

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9. Toe te passen materialen en sterkteklassen door Van Rossum R.I. b.v.

Onderstaande eigenschappen gelden in basis voor de constructie elementen, tenzij anders aangegeven op tekening.

Beton kwaliteit:

Poeren	C30/37
Vloeren en wanden	C30/37
Kolommen en schijven	C45/55
Prefab	volgens opgave leverancier maar minimaal C45/55
Giet- en ondersabelingsmortels	K70
Vloer- en wandwapening	B500A
Balk- en kolomwapening	B500B

Milieuklasse:

Constructie onderdeel		**Milieuklasse**
Betonconstructies onder maaiveld, onder grondwaterpeil, buiten		XC2
Betonconstructies onder maaiveld, boven grondwaterpeil, buiten		XC3, XF1
Betonconstructies boven maaiveld, buiten	Verticale elementen Horizontale elementen	XC4, XF1 XC4, XF3, XD3
Betonconstructies binnen		XC1
Beton in aanraking met dooizout		XF4

Staalsoort:

Flensprofielen	S235
Kokers en buizen	S355
Instort ankers	4.6
Instort ankers	8.8 voorzien van volgplaten
Lijmankers	8.8

RVS verankeringen in sterkteklasse 80

Bouten en moeren 8.8 gerolde draad

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10. Bijlage A - Funderingsadvies

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Projectnummer
23378

Ons kenmerk
NT23378a2

Versie
2

Datum
7 december 2023

Pagina's
10

Opgesteld
5.1.1.d

Gecontroleerd
5.1.1.d

Vrijgave
5.1.1.d

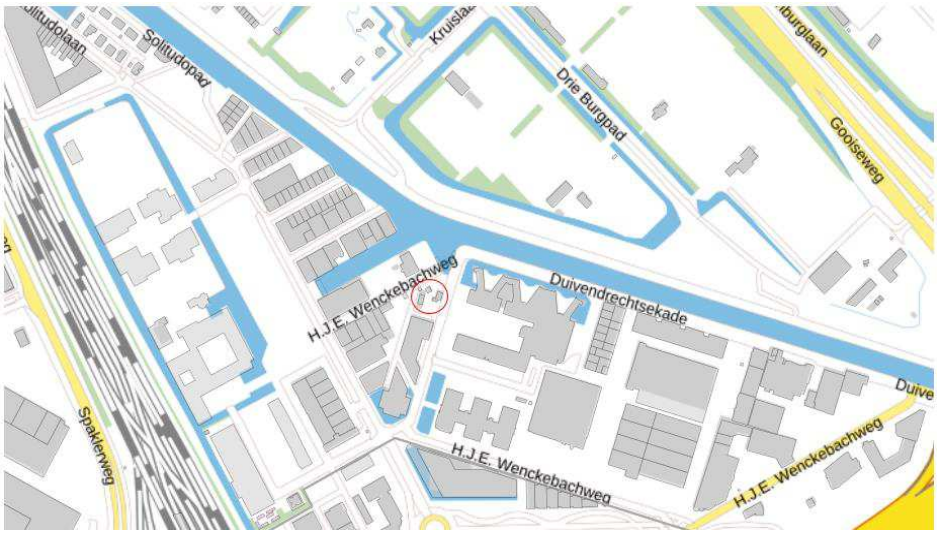
Bijlagen
Aantal bijlagen: 1

Formulier
NT-010

1 Inleiding

In opdracht van BLVG stelt CRUX Engineering BV een funderingsadvies op ten behoeve van de ontwikkeling van de kavel aan de Duivenrechtsekade 50 te Amsterdam. Deze notitie presenteert de uitgangspunten en resultaten van het funderingsadvies.

Figuur 1 illustreert de globale projectlocatie, aangeduid binnen een rode cirkel.



Figuur 1 Projectlocatie, bron: Bag Viewer

2 Uitgangspunten

2.1 Documenten

De volgende documenten zijn gehanteerd bij het opstellen van deze notitie:

[1] BAM Infraconsult BV; Geotechnisch bodemonderzoek Duivendrechtsekade 50 te Amsterdam; d.d. 10-11-2023;

[2] HFB Architectuur + HFB; ontwerptekeningen 2023 10 05 Duivenrechtsekade 50 - HFB A concept tekeningen; d.d. 10-11-2023;

[3] Van Rossum; e-mail *Duivendrechtsekade 50*; van Ewout Bruinsma; verzonden op 16 november 2023.

CRUX staat niet in voor de juistheid en/of volledigheid van de door derden verstrekte informatie en gegevens.

2.2 Programmatuur

De berekeningen van het paaldraagvermogen worden uitgevoerd met PileCore versie 0.19.00 van CEMS. Om tot een optimaal paalpuntniveau te komen zijn de resultaten van de berekeningen verwerkt middels de Grouper Tool waarin op basis van geautomatiseerde berekeningen een voorkeurs paalpuntniveau is bepaald.

De berekening van de zetting uit de diepe zandlaag wordt berekend met behulp van D-Settlement versie 21.2.

2.3 Uitgevoerd grondonderzoek en bodemopbouw

Het bepalen van de bodemopbouw vindt plaats op basis van het op locatie uitgevoerd grondonderzoek, referentie [1], bestaande uit 6 sonderingen. De globale bodemopbouw wordt weergegeven in Tabel 1. Het maaiveldniveau ligt in de huidige situatie op circa NAP -0,65 m.

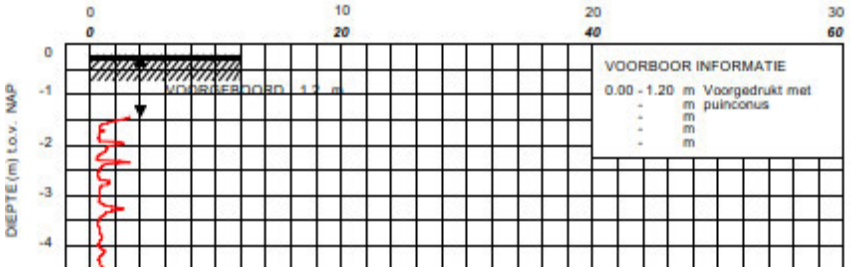
Tabel 1: Globale bodemopbouw

Grondlaag	Bovenkant laag [m NAP]
Zand, Schoon, Los	-0,7
Hollandveen	-4,5
Wadzand	-7,0
Hydrobiaklei	-8,4
Basisveen	-10,3
Eerste Zandlaag	-12,0
Allerød	-20,0
Tweede zandlaag	-24,0

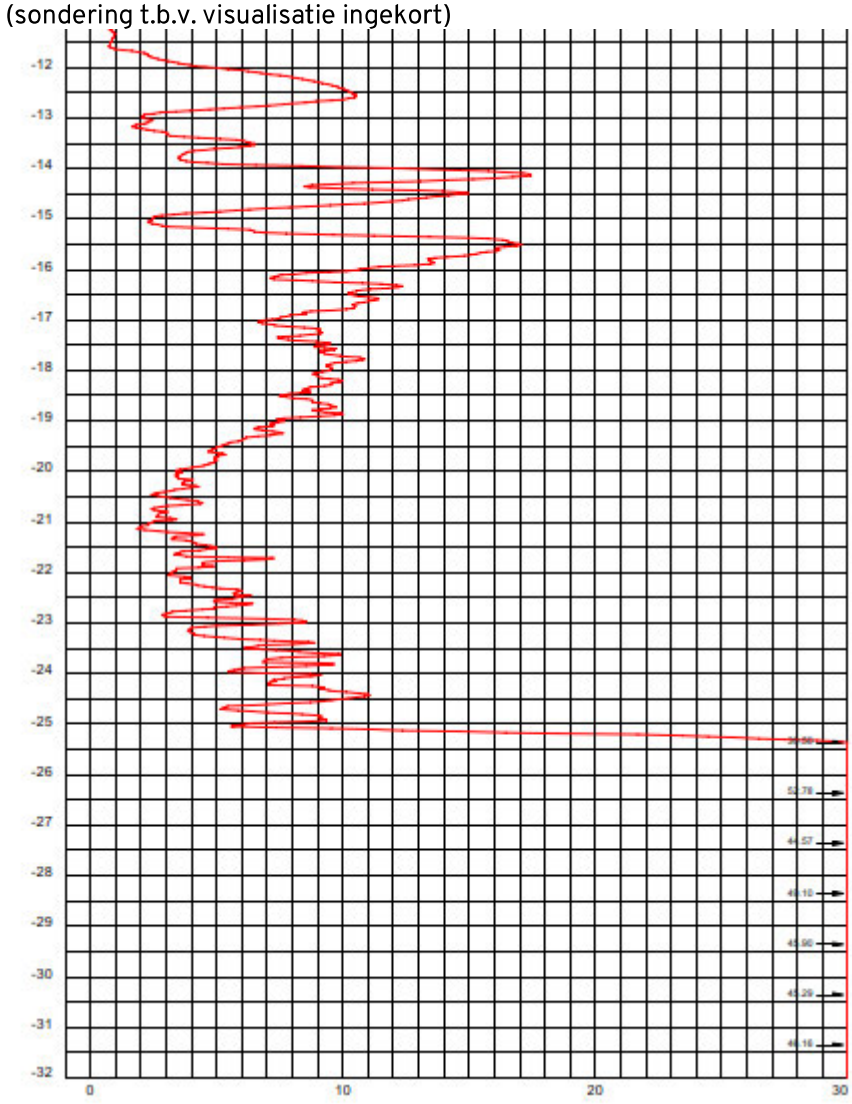
Opmerkingen bij tabel:

1 Grondprofiel is gebaseerd op sondering S03 uit referentie [1].

De pakking van het zand in de Eerste Zandlaag en het eerste deel van de Tweede Zandlaag is matig tot vast. Vanaf ongeveer NAP -25,5 m loopt de conusweerstand over een zeer kleine diepte op naar waarden van 35 MPa en hoger. Dit is een aandachtpunt voor de installeerbaarheid van de paalfundering. Het verloop van de conusweerstand is in de zandlagen is weergegeven in Figuur 2.



(sondering t.b.v. visualisatie ingekort)



Figuur 2 Verloop conusweerstand in Eerste en Tweede Zandlaag

De grondparameterset ten behoeve van de S2 zettingsberekeningen is gegeven in Tabel 2. Deze is bepaald aan de hand van Tabel 2.b uit NEN9997- 1+C2:2017 en maatgevende sondering S03 en alleen voor relevante grondlagen.

De locatie van de sonderingen wordt weergegeven in Figuur 3. Het grondonderzoek is bijgevoegd in Bijlage 1.

Tabel 2 Parameterset t.b.v. s2 zetting

Grondsoort	γ_{dr}/ γ_{sat}	CR	RR	Cα	OCR
	[kN/m^3]	[-]	[-]	[-]	[-]
Zandlaag	18/20	0,0035	0,0009	0	1,3

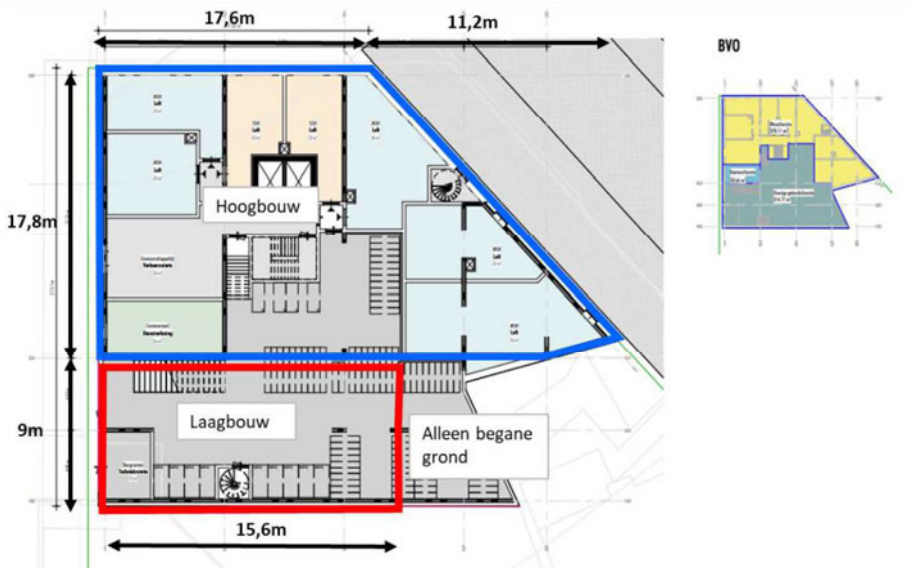
Figuur 3 Sondeerlocaties, bron: referentie [1]

2.4 Belastingen

De paalbelastingen bedragen 1.250 tot 3.000kN/paal. De gebouwbelastingen ten behoeve van de bepaling van de s2 zetting zijn in Tabel 3 gegeven. Alle belastingen zijn opgegeven door de constructeur, ref. [3]. Figuur 4 toont de contour van het gebouw op basis van de plattegrond van de begane grond met daarop de hoogbouw en de laagbouw aangegeven.

Tabel 3 Quasi permanente belasting t.b.v. bepaling s2 zetting, ref. [3]

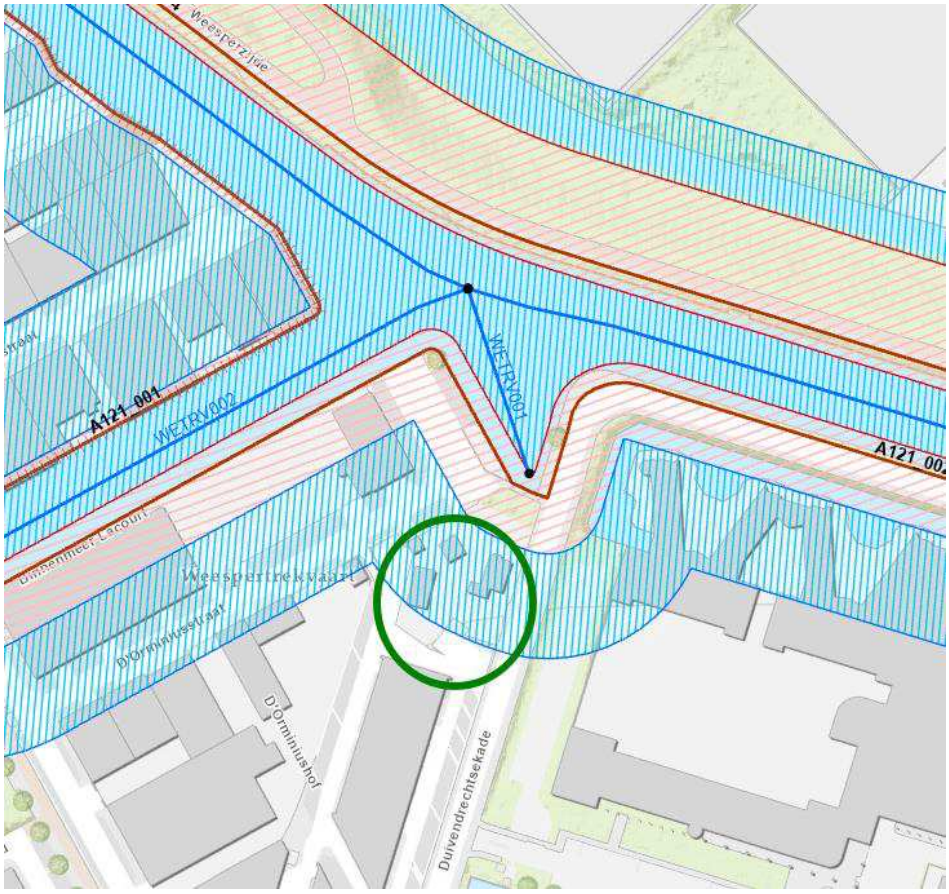
Bouwdeel, zie Figuur 4	Quasi permanente belasting
	[kN/m²]
Hoogbouw	123
Laagbouw	36
Alleen begane grond	Verwaarloosbaar tbv bepaling s2 zetting



Figuur 4 Plattegrond begane grond

2.5 Overige randvoorwaarden

De projectlocatie ligt gedeeltelijk in de beschermingszone van de waterkering langs de Duivendrechtse vaart. De ligging van de projectlocatie t.o.v. de waterkering is weergegeven in Figuur 5. De beschermingszone van de waterkering is daarin in blauw aangegeven.



Figuur 5: Projectlocatie t.o.v. waterkering

Ten aanzien van het werken in de waterking zijn in de Keur 2019 van Waternet eisen gesteld. Ten aanzien van het maken van palen in de beschermzone zijn anders dan dat er geen lekweg op mag treden of kortsluiting tussen watervoerende paketten mag ontstaan geen eisen gesteld. Met deze eisen is rekening gehouden door in het funderingsadvies uit te gaan van grondverdingende palen. Deze worden vanaf maaiveld en daarmee vanaf boven de geldende stijghoogte aangebracht.

3 Funderingsadvies

3.1 Algemeen

Dit hoofdstuk beschrijft de uitgangspunten en resultaten van de berekeningen van het geotechnisch paaldraagvermogen en -stijfheden.

3.2 Paalsysteem

Om risico op schade aan de belendingen in de nabije omgeving door trillingen te voorkomen wordt gekozen voor in de grondgevormd en geschroefde trillingsvrije paalsysteem met prefab kern. Tabel 4 vat de paalklasse factoren van dit paalsysteem samen.

Tabel 4 Paalspecificaties in de grondgevormd en geschroefde trillingsvrije paalsysteem met prefab kern

Paalsysteem	Afmetingen	Rekenwaarde paalbelasting	Inbreng-methode	LZ-gedrag	Paalfactoren
In de grond gevormde schroefpalen met prefab met behulp van een boorbuis waarbij de punt na het trekken van de paal achterblijft	Ø410/500mm Ø460/560mm Ø540/680mm	**DRUK:** 1.250 – 3.000kN/paal	Geschroefd met groutinjectie en prefab kern	Type 1	α_p = 0,63 α_s = 0,009 s = 1,0 β = 1,0

Gezien de aanwezige bodemgesteldheden raden we aan om van combinatiepalen uit te gaan om kwaliteitsproblemen van de betonnen paalschacht te voorkomen. De noodzaak van al dan niet toepassen van een prefabbeton kern (zgn. combinatiepaal) dient afsluitend door de uitvoerende aannemer te worden beoordeeld. Toepassen van een prefabbeton kern heeft geen invloed op het uitwendige geotechnisch draagvermogen van de paal.

3.3 Uitgangspunten

Voor de berekening van het verticaal draagvermogen van de palen worden de volgende uitgangspunten gehanteerd:

- Berekening volgens NEN9997-1+C2:2017 op basis van de in Bijlage 1 opgenomen sonderingen.
- Het ontgravingsniveau wordt gelijk gesteld aan het maaiveldniveau.
- De positieve schachtwrijving wordt ontleend vanaf de Eerste zandlaag laag op circa NAP -12 m.
- Negatieve kleef wordt in rekening gebracht van paalkopniveau tot NAP -12 m.
- De stijfheid van de constructie van de bovenbouw bepaalt mede de waarde van de factoren ξ (ksi) die de onzekerheid in het grondonderzoek en de mogelijkheid van herverdeling van belasting over meerdere palen in rekening brengt. In het ontwerp van de fundering is voor de hele constructie uitgegaan van een ‘niet-stijf’ bouwwerk.
- De conform NEN 9997-1 aangehouden factoren ξ (ksi) en veiligheidsfactoren zijn:
    - ξ_3 = 1,27 en ξ_4 = 1,01
    - De factor ξ is mede afhankelijk van het aantal sonderingen dat als groep bij elkaar genomen kan worden. De draagkracht is op twee manieren berekend: het gemiddelde van de sonderingen waarbij de factor ξ_3 van toepassing is, en de slechtste van de groep sonderingen waarbij ξ_4 van toepassing is. De laagste draagkracht is maatgevend. Hierbij moet wel gelden dat de variatiecoëfficiënt ≤ 12% is anders is gerekend met een ξ factor voor een enkele sondering.
    - γ_b, γ_s = 1,2.

3.4 Veerstijfheid paalfundering

3.4.1 Vervormingen paalfundering (druk)

De paalkopzakking (s) van een paalfundering is opgebouwd uit :

s = $s_1 + s_2$, waarbij

s_1 = rekenwaarde van de zakking van de bovenzijde van de paal, opgebouwd uit de zakking van de paalpunt (s_b) en de elastische verkorting van de paal (s_{el}).

s_2 = de zakking door samendrukking van de onder het paalpuntniveau gelegen lagen.

3.4.2 Veerstijfheid statische belasting (s1)

De bepaling van de veerstijfheid bij statische belasting is op basis op het eigen gewicht van het bouwwerk en het permanent aanwezige deel van de veranderlijke belasting (Quasi permanente belasting). De paalkopverplaatsing bestaat uit een gedeelte paalverplaatsing ten gevolge van mobiliseren grondweerstand (s_b) en een gedeelte elastische verkorting (s_{el}) van de paal. Het last-zakkingsgedrag van de palen voor de bruikbaarheidsgrenstoestand (SLS) wordt bepaald met de rekenregels gegeven in NEN 9997-1.

De statische belasting is door CRUX gelijk gesteld aan 70% van het netto draagvermogen.

Aan de hand van de berekende puntverplaatsing onder invloed van de opgelegde karakteristieke paalbelasting is de puntveerstijfheid bepaald volgens vergelijking 1:

$$k_{v;punt}=F_{s;tot;k}/s_b \qquad (1)$$

Wanneer ook de elastische verkorting van de paal meegenomen wordt, dan wordt de veerstijfheid van de paalkop met vergelijking 2 bepaald:

$$k_{v;1}=F_{s;tot;k}/(s_b+s_{el}) \qquad (2)$$

Opgemerkt wordt dat de puntverplaatsing t.g.v. mobilisatie van de grondweerstand niet lineair verloopt. Bij toenemende belasting neemt de zakking meer dan evenredig toe en de veerstijfheid neemt dus af. Op basis van de definitieve paalbelastingen moet een controle van de gehanteerde veerstijfheid worden uitgevoerd.

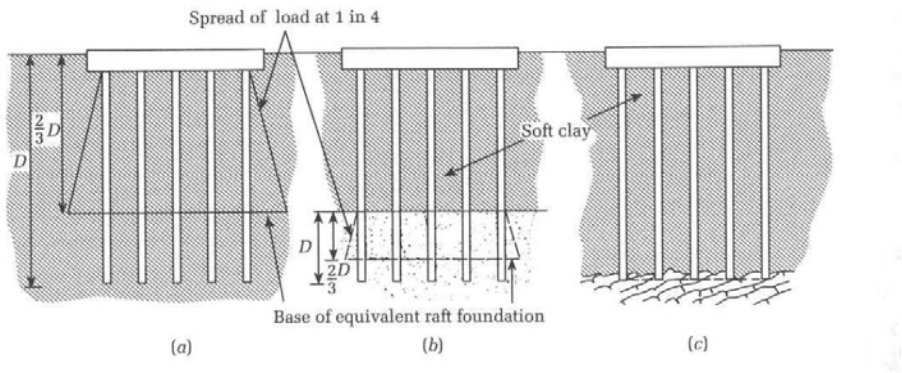
De aangehouden elasticiteitsmodulus van de paal voor de berekening van de elastische verkorting is E_{beton} = 20.000 N/mm^2. Door de constructeur dient de gehanteerde elasticiteitsmodulus gecontroleerd te worden.

De resultaten betreffen representatieve waarden. Voor een boven- en ondergrenswaarde dient de waarde gedeeld of vermenigvuldigd te worden met een factor $\sqrt{2}$.

3.4.3 Zetting uit diepe ondergrond (S2)

De bepaling van de zetting uit de diep ondergrond vindt op basis van de theorie van Tomlinson plaats. De zetting wordt berekend ten gevolge van de opgegeven belastingen op 4D beneden paalpuntniveau (NAP-28,25m).

De palen zijn niet afzonderlijk gemodelleerd maar als belasting op diepte waarbij het belastingoppervlak en de bijbehorende belasting (na spreiding) zijn bepaald met de methode volgens Tomlinson (b), zie ook Figuur 6.



Figuur 6 Overzicht belastingoverdracht bij paalgroepen, volgens "Foundation Design, Tomlinson"

De samendrukking van de diepe grondlaag wordt berekend tot een korrelspanningstoename van 20%. Dit komt op de maatgevende locatie overeen met NAP-35,5m. De zetting in de zandlaag van 4Deq beneden het paalpuntniveau (NAP-21,3m) tot NAP-35,5m wordt berekend met behulp van D-Settlement.

Bij de beoordeling van de berekende zettingen dient rekening gehouden te worden met onzekerheid op de zettingsparameters, belastingaannames, belasting verdeling en modelleringseffecten. Om deze effecten in rekening te brengen dient een bandbreedte van 30% op de berekende waarden aangehouden te worden.

3.4.4 Veerstijfheid kortdurende belasting

De veerstijfheid bij kortdurende belasting heeft betrekking op het windaandeel van de belasting op de stabiliteitsconstructie met uitzondering van piekbelastingen door zeer korte windvlagen.

Bij de bepaling van de veerstijfheid voor kortdurende belastingen worden de volgende uitgangspunten conform bovengenoemde richtlijnen gehanteerd:

- de stijfheid wordt afgeleid uit het last-zakkingsdiagram in BGT;
- de veerstijfheid wordt met een factor 1,5 vergroot i.v.m. het kortdurende karakter;
- vanwege het kortdurende effect hoeft s_2 niet meegenomen te worden in de bepaling van de veerstijfheid.

Bij de bepaling van deze veerstijfheid bij kortdurende belastingen dient er rekening mee gehouden te worden dat deze kortdurende belasting optreedt aanvullend op de statische belasting. Deze veerstijfheid geldt dus voor de aanvullende kortdurende belasting. De bepaling van de veerstijfheid is in vergelijking 3 weergegeven.

$$k_{v;kort} = 1{,}5 * F_{rep;stat} / s_{F;stat} = 1{,}5 * k_{v;1} \qquad (3)$$

3.5 Resultaten draagvermogen en veerstijfheid (druk)

Tabel 5 geeft de resultaten van het geotechnisch draagvermogen en de stijfheid voor op druk belaste palen. Geadviseerd wordt om op een niveau van NAP-26m of NAP-26,5m te funderen en daarbij afhankelijk van de belasting voor de volgende paalafmetingen te kiezen:

- Ø410/500mmm voor een paalbelasting 1250 – 1700kN
- Ø460/560mm voor een paalbelasting 1700 - 2150kN
- Ø540/680mm voor een paalbelasting 2150 - 3000kN

Aanbevolen wordt om de haalbaarheid van de installatie inclusief trekken van de boorbuis door een funderingsaannemer te laten beoordelen voor paalpuntniveaus vanaf NAP-27m.

De uitvoer van de berekeningen van het paaldraagvermogen middels PileCore is opgenomen in Bijlage 2 t/m Bijlage 4.

Tabel 5 Rekenkundig draagvermogen/veerwaarden

PPN	Ø410/500mm			Ø460/560mm			Ø540/680mm		
[m NAP]	$R_{c;net;d}$ [kN]	$k_{v;punt}$ [MN/m]	$k_{v;l}$ [MN/m]	$R_{c;net;d}$ [kN]	$k_{v;punt}$ [MN/m]	$k_{v;l}$ [MN/m]	$R_{c;net;d}$ [kN]	$k_{v;punt}$ [MN/m]	$k_{v;l}$ [MN/m]
-25,5	358	84	67	581	79	77	1187	125	100
-26,0	1553	198	126	1979	216	143	3013	253	176
-26,5	1640	217	131	2164	241	150	4403	485	209
-27,0	1727	237	136	2261	263	156	4507	508	211
-27,5	1815	258	140	2359	263	156	4601	532	213
-28,0	1902	280	144	3348	287	162	4696	557	215

3.6 Resultaten S2 zettingen

De berekende S2 zetting uit de diepe zandlaag beneden paalpuntniveau is maximaal 1 à 2cm en derhalve verwaarloosbaar gering.

4 Conclusies

In opdracht van BLVG heeft CRUX Engineering BV een funderingsadvies opgesteld ten behoeve van de ontwikkeling van de kavel aan de Duivenrechtsekade 50 te Amsterdam.

Het funderingsadvies omvat het geotechnische draagvermogen inclusief veerstijfheden voor in de grondgevormd en geschroefde trillingsvrije paalsysteem met prefab kern met de volgende afmetingen:

- Ø410/500mm
- Ø460/560mm
- Ø540/680mm

In het ontwerp van de fundering is voor de hele constructie uitgegaan van een 'niet-stijf' bouwwerk.

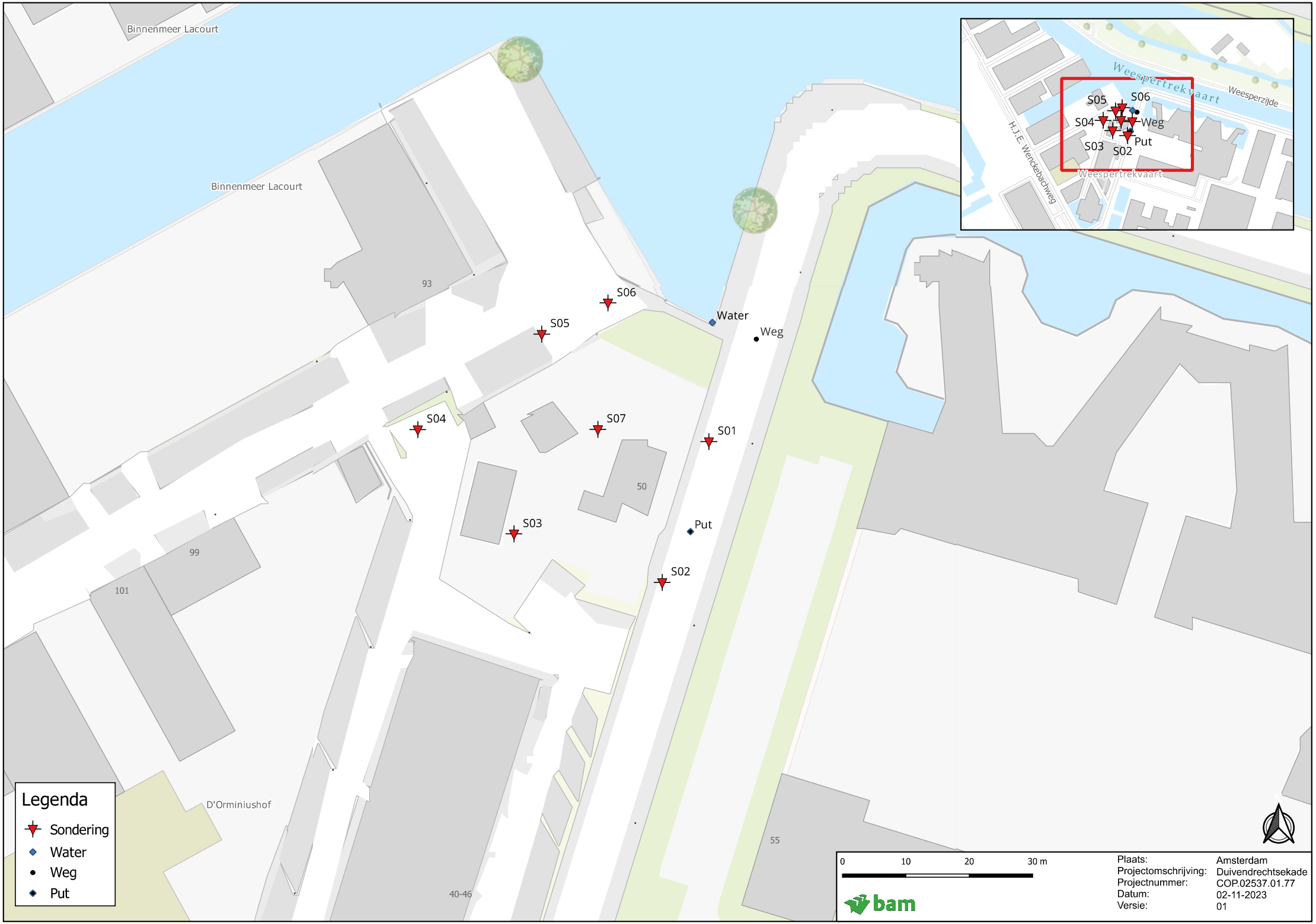
Het berekende paaldraagvermogen per paalafmeting met bijbehorende paalveerstijfheden zijn in Tabel 4 gegeven. De berekende S2 zetting uit de diepe zandlaag beneden paalpuntniveau is verwaarloosbaar klein.

Geadviseerd wordt om op een niveau van NAP-26m of NAP-26,5m te funderen en daarbij afhankelijk van de belasting voor de volgende paalafmetingen te kiezen:

- Ø410/500mmm voor een paalbelasting 1250 – 1700kN
- Ø460/560mm voor een paalbelasting 1700 - 2150kN
- Ø540/680mm voor een paalbelasting 2150 - 3000kN

Vanwege de sterk oplopende conusweerstand (waarden > 35 MPa) vanaf NAP- 25,5m wordt aanbevolen om de haalbaarheid van de installatie inclusief trekken van de boorbuis door een funderingsaannemer te laten beoordelen voor paalpuntniveaus vanaf NAP-27m.

Bijlage 1 Grondonderzoek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Binnenmeer Lacourt
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Sondering
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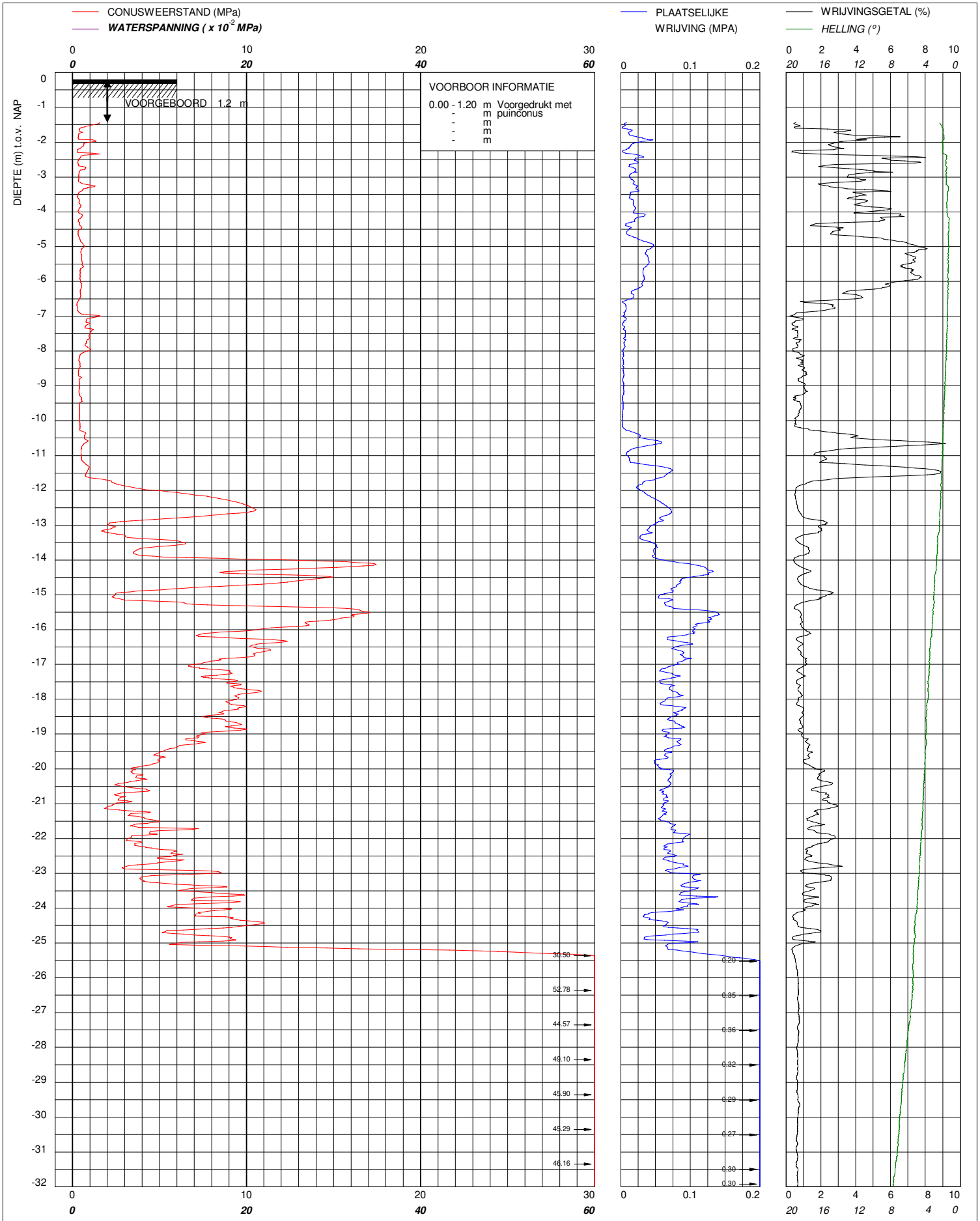
Projectomschrijving: Duivendrechtsekade
Projectnummer: COP.02537.01.77
Datum: 02-11-2023
Versie: 01



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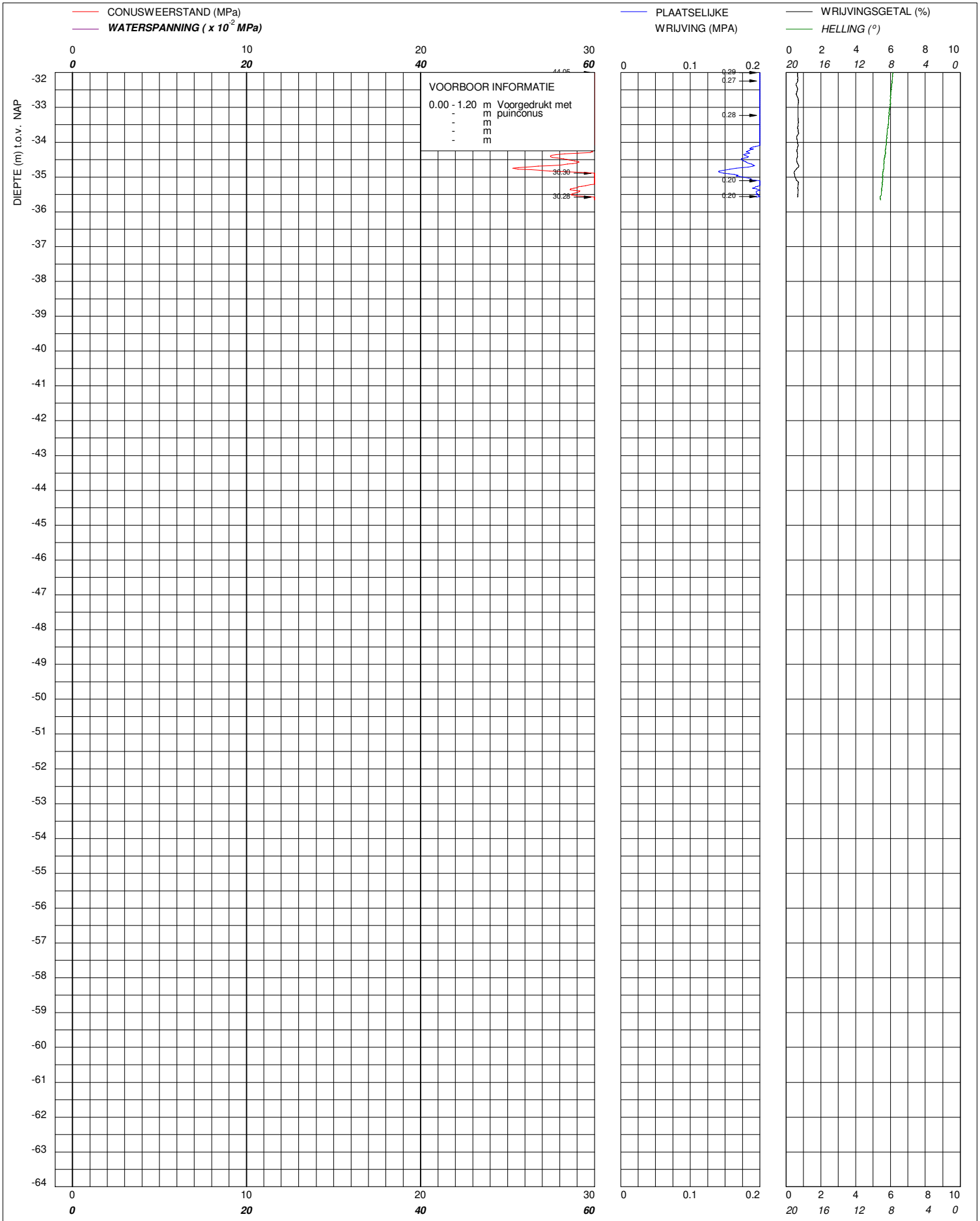
		Printdatum		2-11-2023		S01



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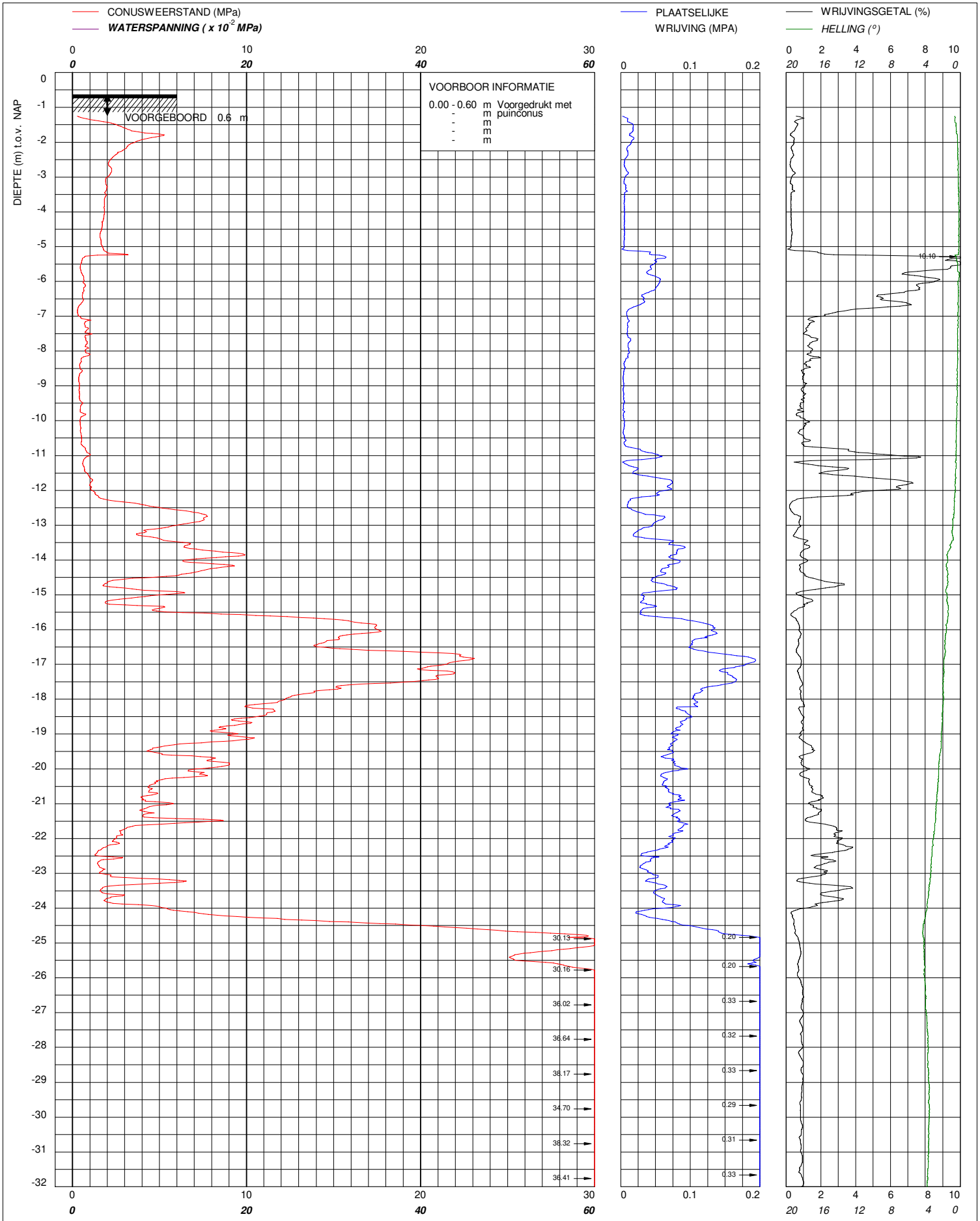

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		Uitvoeringsdatum		2-11-2023	Locatiecode :
		Printdatum		3-11-2023	S02

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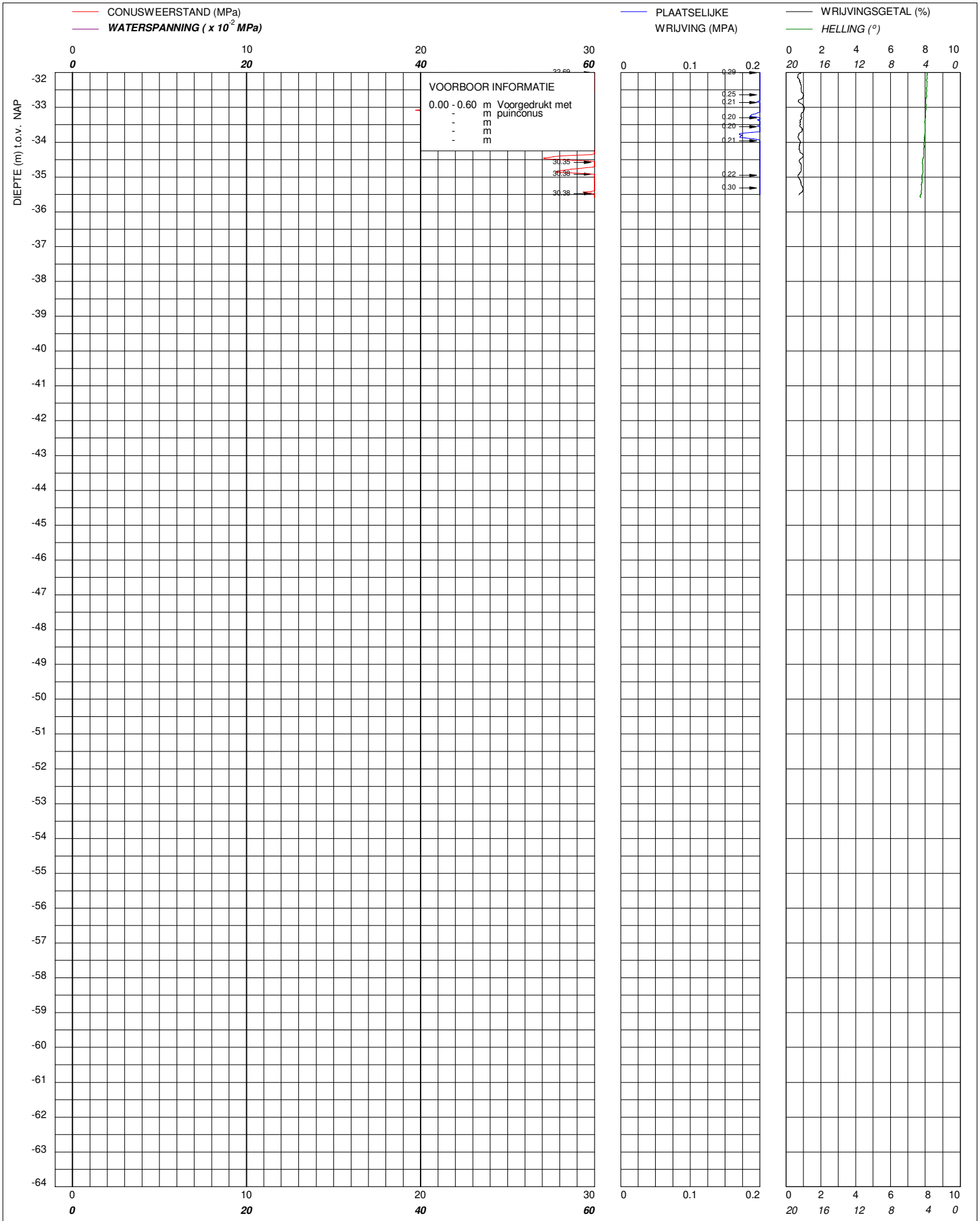

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CRUX Engineering BV **Duivendrechtskade te Amsterdam**	Km	Y	483441	02537.01.77
	Uitvoeringsdatum	2-11-2023		Locatiecode :
	Printdatum	3-11-2023		S02

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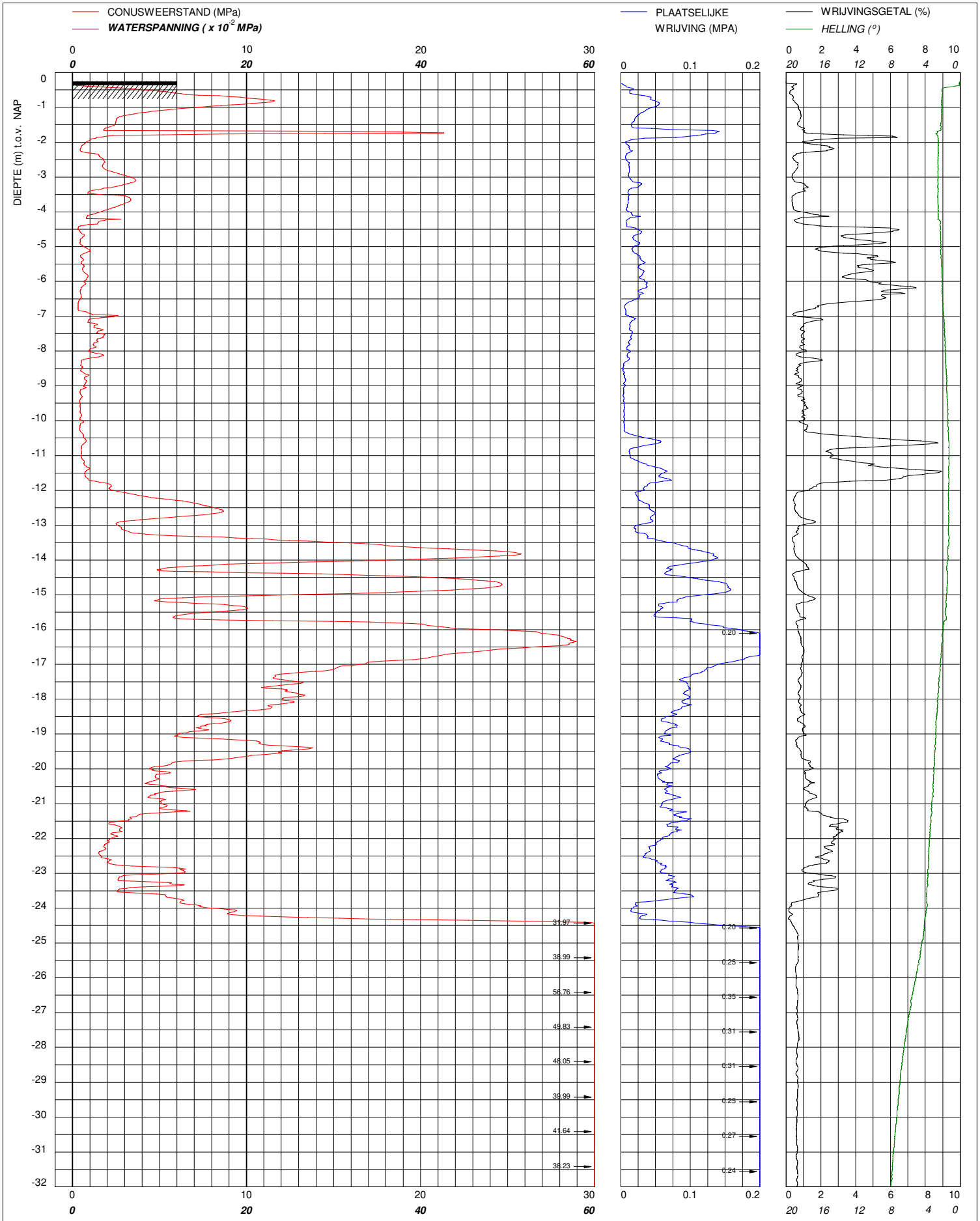

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Sondering TE1 volgens NEN-EN-22476, klasse 2
Conus: 171017, Ac: 1.500 mm2

CRUX Engineering BV

Duivendrechtskade te Amsterdam

5.1.1.d	-0.25 m NAP	X	123774	Opdrachtnummer :
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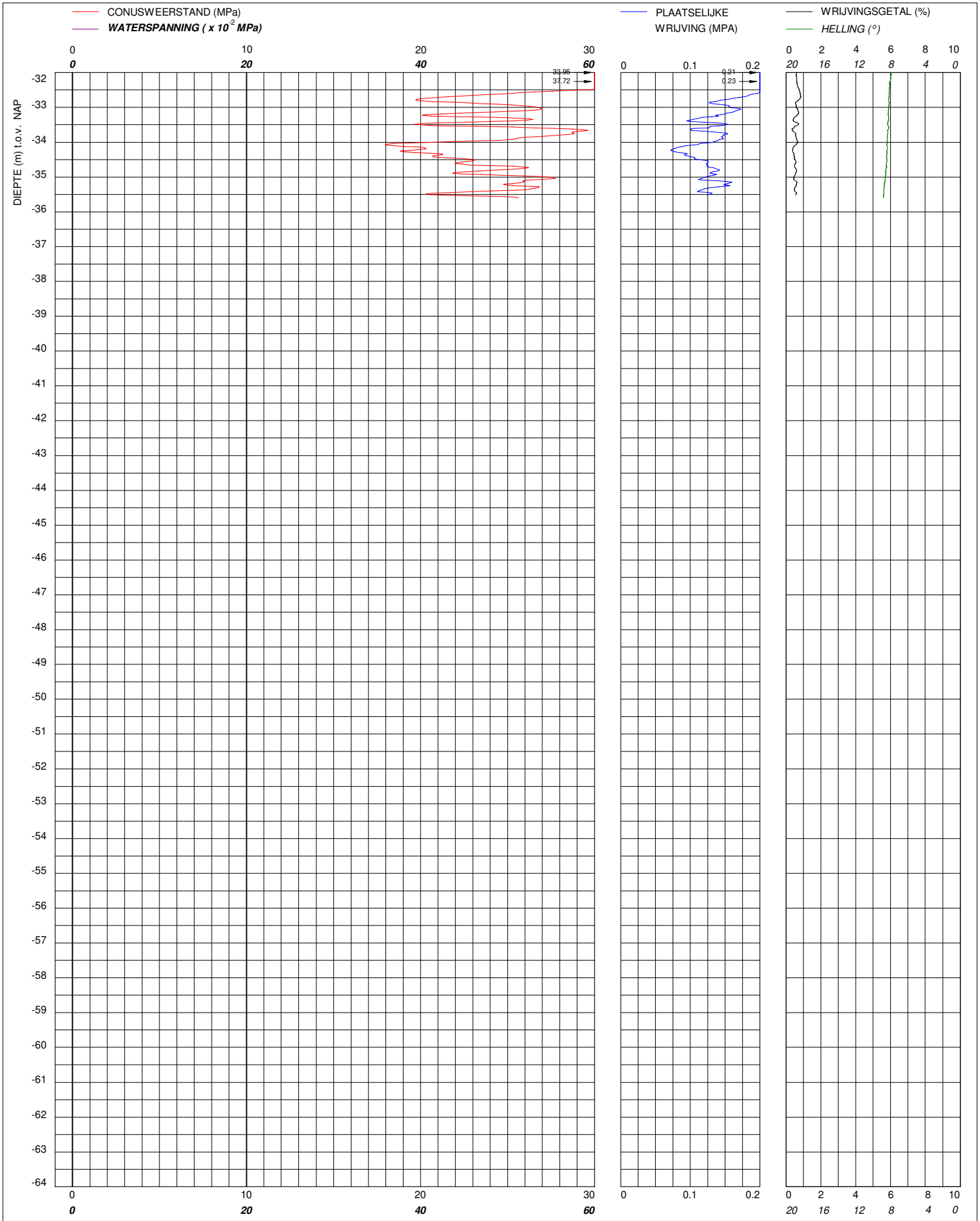

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		Km	Y 483449	02537.01.77
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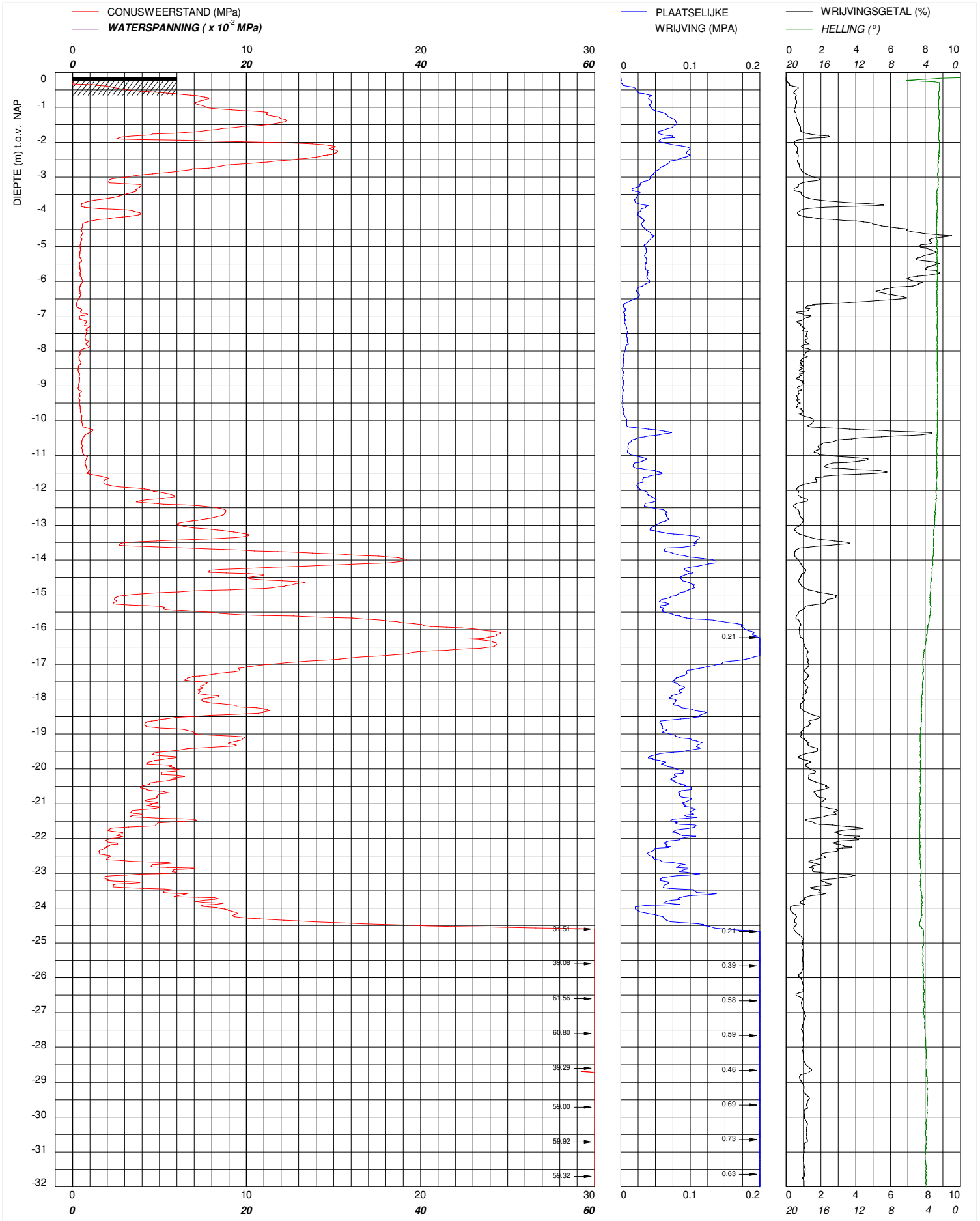
		Printdatum	2-11-2023	S03



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Sondering TE1 volgens NEN-EN-22476, klasse 2
Conus: 221202, Ac: 1.500 mm2

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Duivendrechtskade te Amsterdam

5.1.1.d	-0.15 m NAP	X	123759	Opdrachtnummer :
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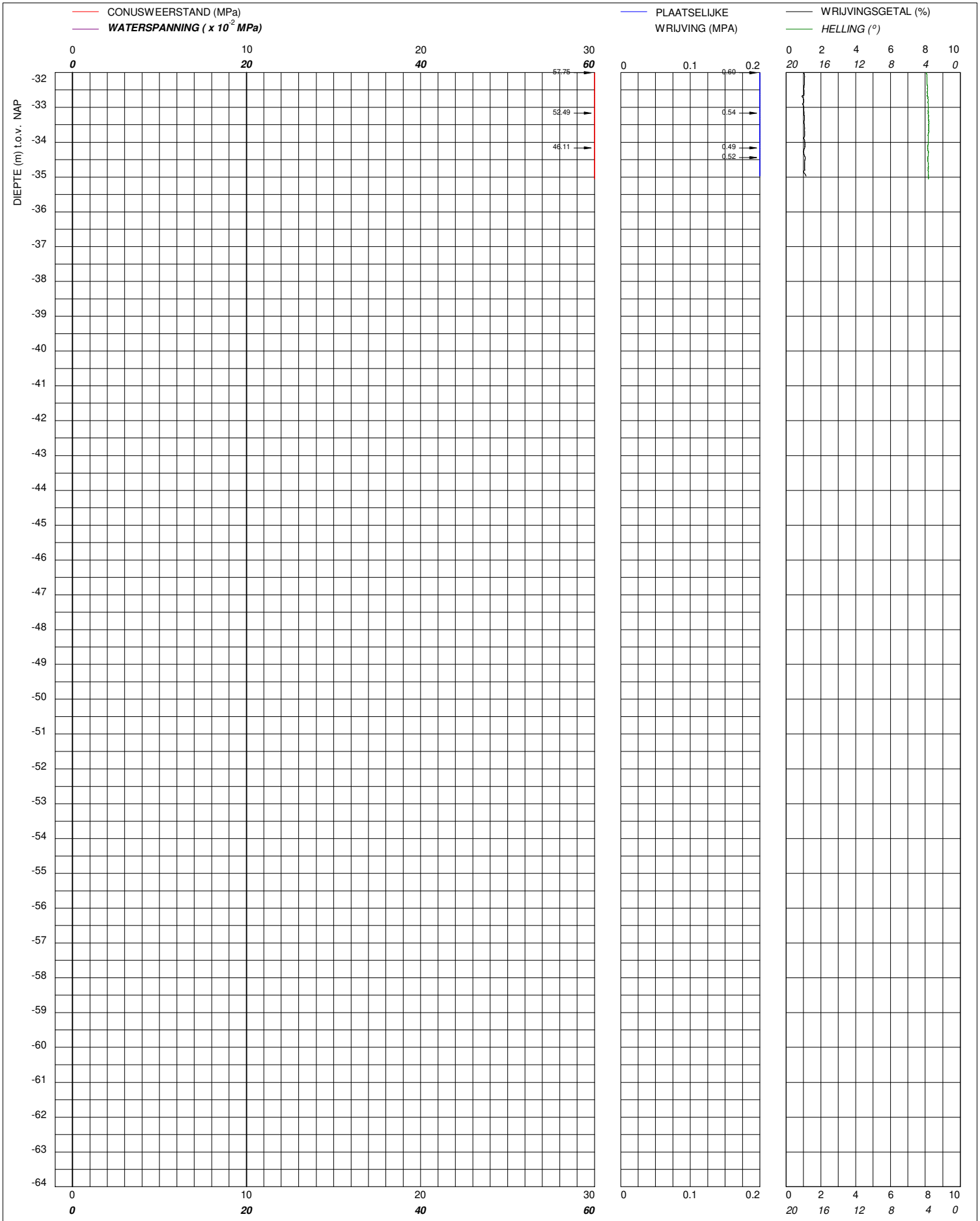

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CRUX Engineering BV **Duivendrechtskade te Amsterdam**		Km	Y 483465	
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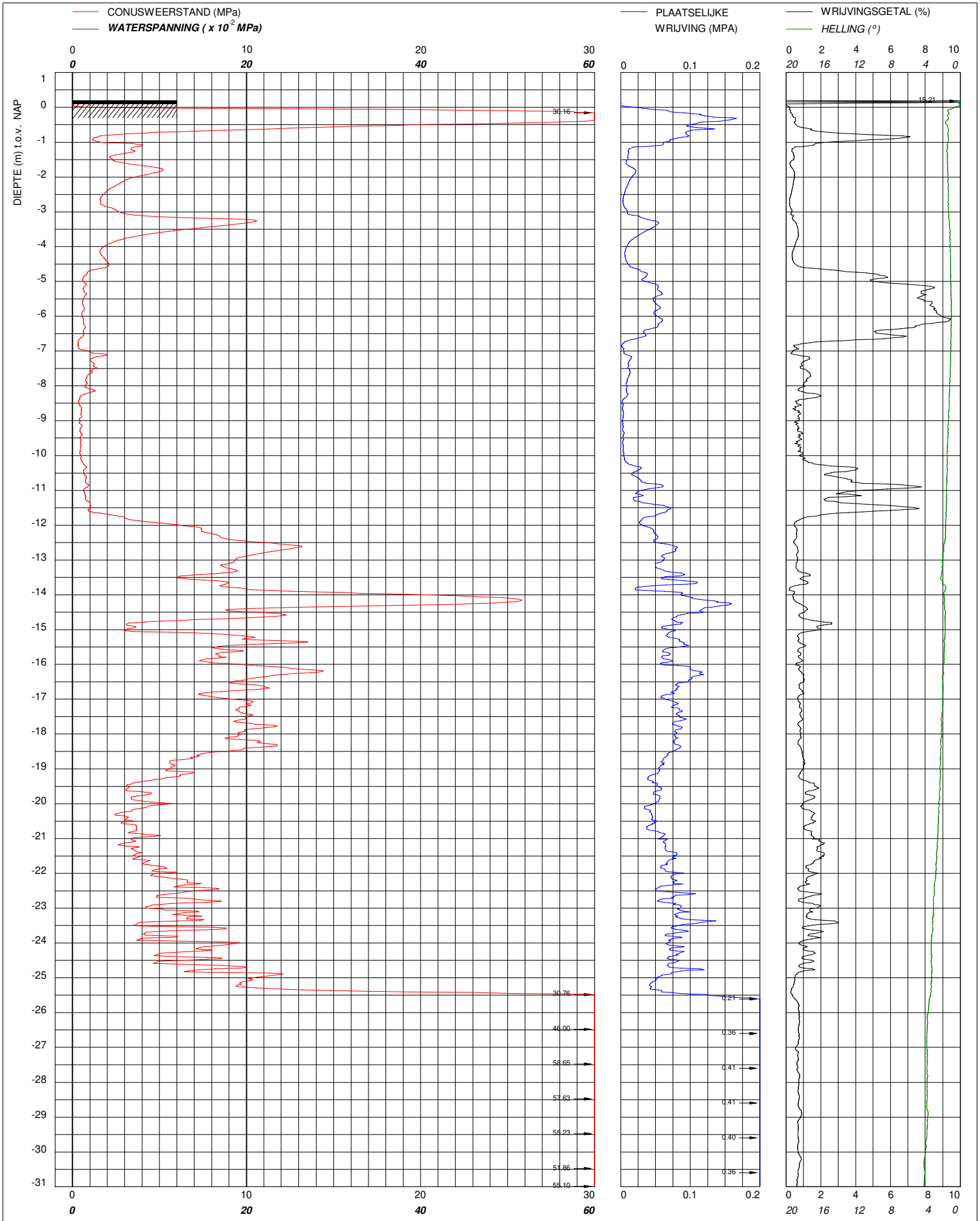

Sondering TE1 volgens NEN-EN-22476, klasse 2 Conus: 171017, Ac: 1.500 mm2	5.1.1.d	0.2 m NAP	X	123778	Opdrachtnummer :
CRUX Engineering BV **Duivendrechtskade te Amsterdam**	Km		Y	483481	02537.01.77
	Uitvoeringsdatum		2-11-2023		Locatiecode :
	Printdatum		2-11-2023		S05

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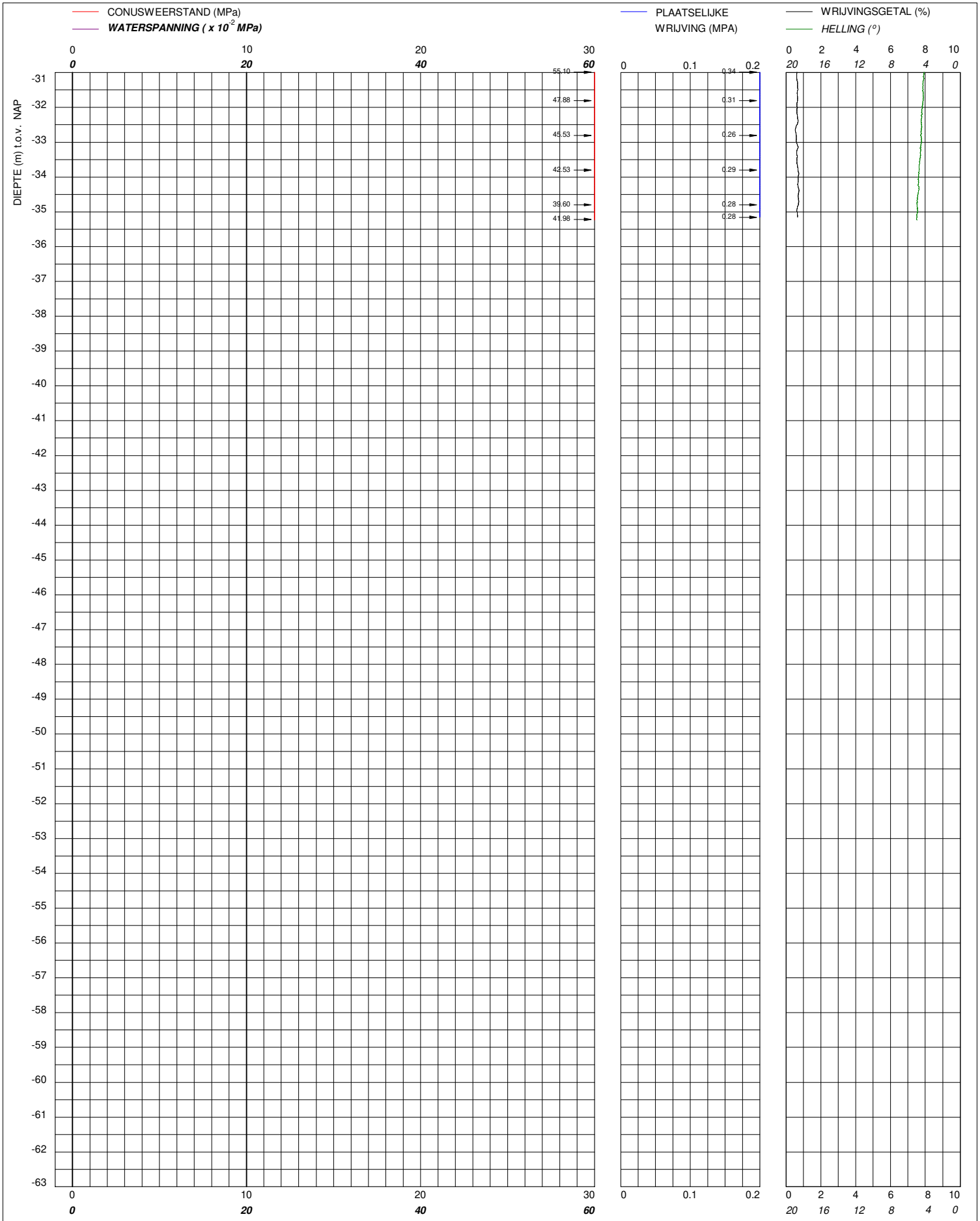

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Sondering TE1 volgens NEN-EN-22476, klasse 2
Conus: 171017, Ac: 1.500 mm2

CRUX Engineering BV

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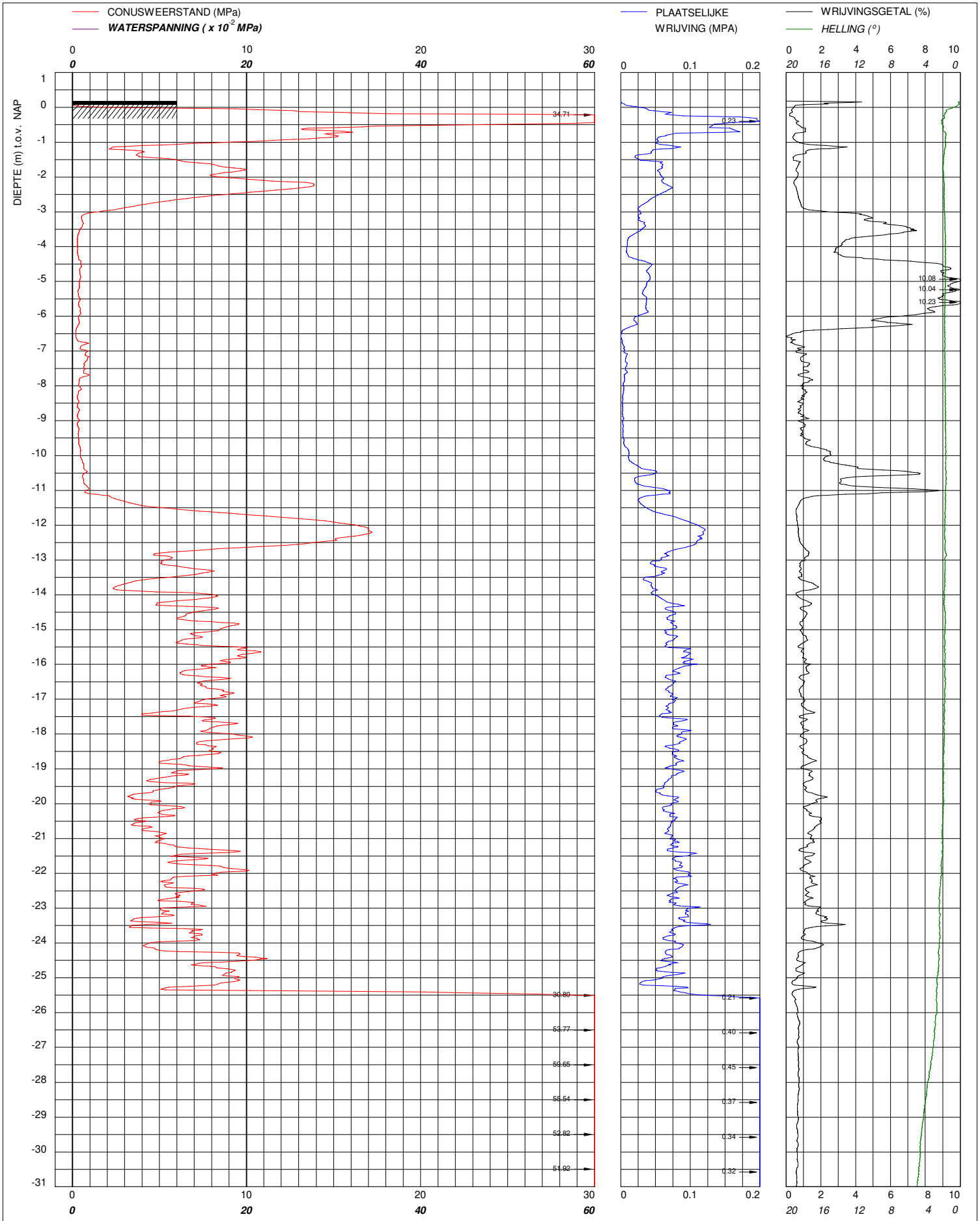
5.1.1.d	0.2	m NAP	X	123778	Opdrachtnummer :
Km			Y	483481	02537.01.77
Uitvoeringsdatum			2-11-2023		Locatiecode :
Printdatum			2-11-2023		S05



Sondering TE1 volgens NEN-EN-22476, klasse 2 Conus: 171017, Ac: 1.500 mm2	5.1.1.d	0.18 m NAP	X	123789	Opdrachtnummer :
CRUX Engineering BV **Duivendrechtskade te Amsterdam**	Km		Y	483485	02537.01.77
	Uitvoeringsdatum		2-11-2023		Locatiecode :
	Printdatum		2-11-2023		S06

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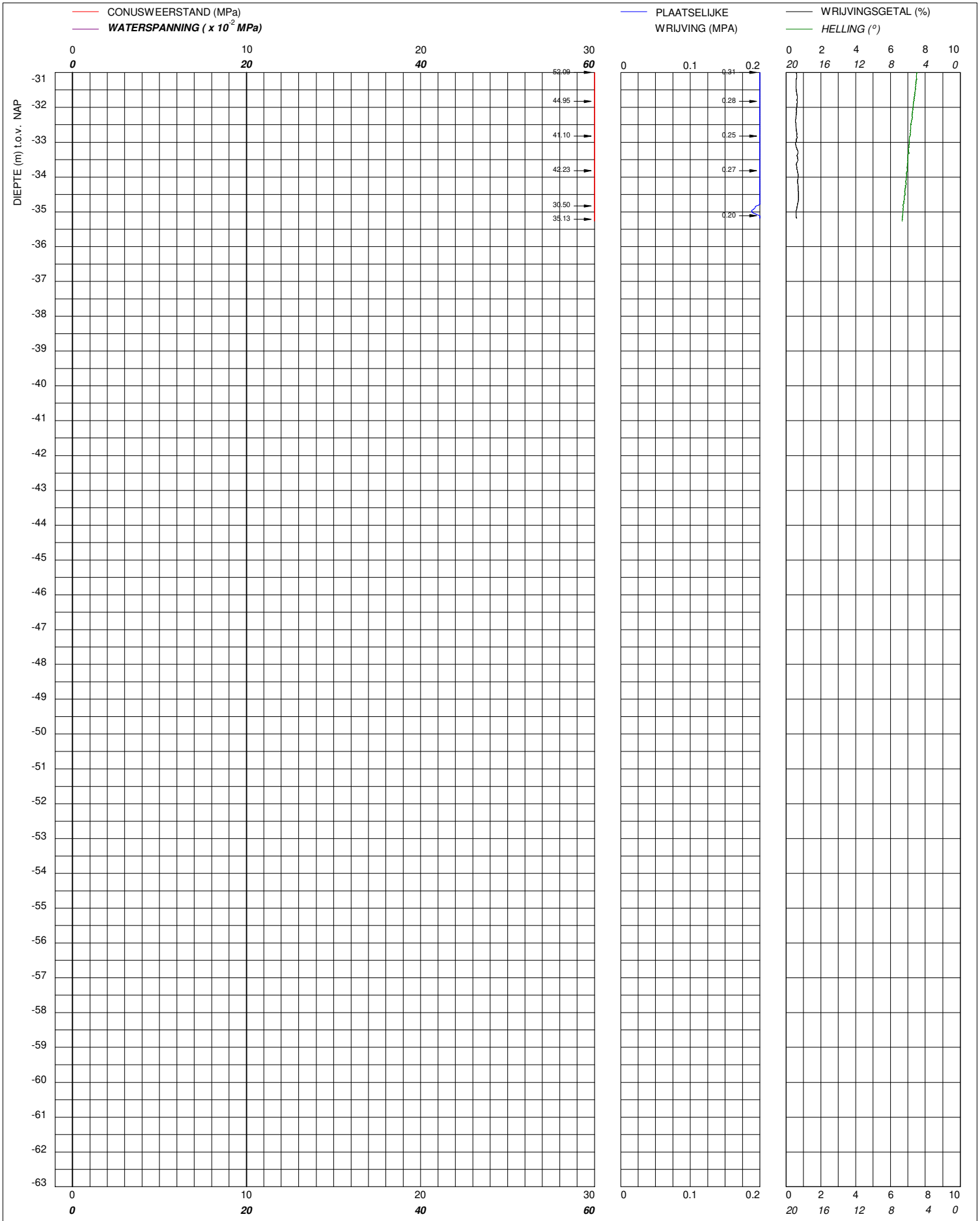

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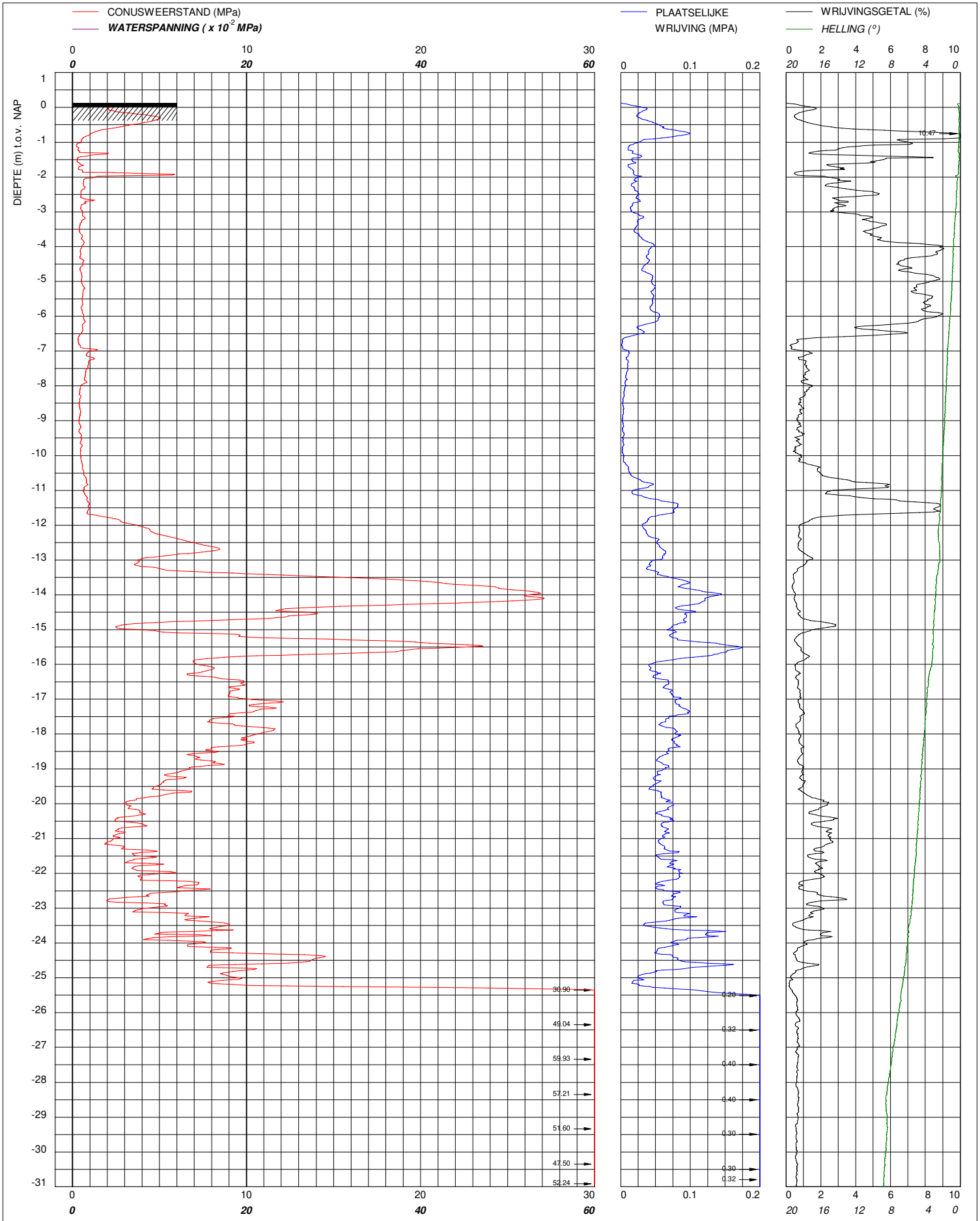
Sondering TE1 volgens NEN-EN-22476, klasse 2
Conus: 171017, Ac: 1.500 mm2

CRUX Engineering BV

Duivendrechtskade te Amsterdam

5.1.1.d	0.18 m NAP	X	123789	Opdrachtnummer :	
Km		Y	483485	02537.01.77	
Uitvoeringsdatum		2-11-2023		Locatiecode :	
Printdatum		2-11-2023		S06	



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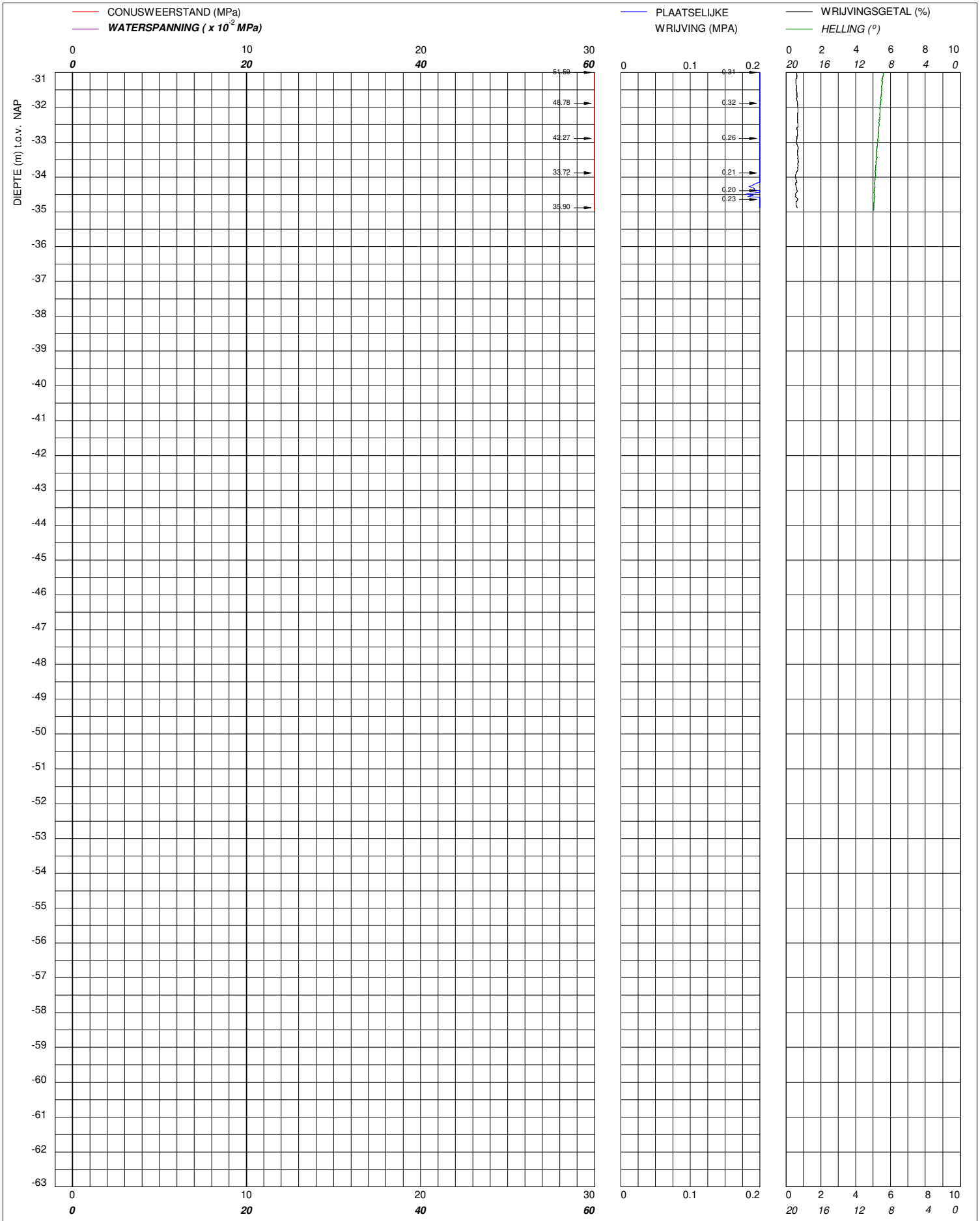
Sondering TE1 volgens NEN-EN-22476, klasse 2
Conus: 171017, Ac: 1.500 mm2

CRUX Engineering BV

Duivendrechtskade te Amsterdam

5.1.1.d	0.12 m NAP	X	123787	Opdrachtnummer :
Km		Y	483465	02537.01.77
Uitvoeringsdatum		2-11-2023		Locatiecode :
Printdatum		2-11-2023		S07



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Sondering TE1 volgens NEN-EN-22476, klasse 2
Conus: 171017, Ac: 1.500 mm2

CRUX Engineering BV

Duivendrechtskade te Amsterdam

5.1.1.d	0.12 m NAP	X	123787	Opdrachtnummer :	
Km		Y	483465	02537.01.77	
Uitvoeringsdatum		2-11-2023		Locatiecode :	
Printdatum		2-11-2023		S07	

Bijlage 2 Uitvoer PileCore Ø410/500mm

PileCore results			CEMS 5.1.1.d
Project:	Duivendrechtsekade 50	Author:	
Number:	23378	Date:	29-11-23
PileCore Version:	2.6.5		

Pile properties:

Name:		Reference NEN9997-1
Type:	betonpaal	Table 7.c
Description:	In de grond gevormd met een gladde mantelbuis op een schroefpunt, waarbij het beton direct tegen de grond drukt	Table 7.c
Installation:	Geschroefd; bij het trekken van de mantelbuis blijft de schroefpunt in de grond achter	Table 7.c
Shaft size:	rond 500 mm	
Base size:	rond 500 mm	
Height pile base [mm]:	0.0	Figure 7.h
$E_{pile;nom}[GPa]$:	20.0	

Pile factors:		Reference NEN9997-1	Safety factors:		Reference NEN9997-1
α_p:	0.63	Table 7.c	$\gamma_{F;nk}$:	1.0	7.3.2.2(7)(b)
$\alpha_{s;sand}$:	0.009	Table 7.c	$\gamma_{R;b}$:	1.2	A.3.3.2
$\alpha_{s;clay}$:	0.009	Table 7.d	$\gamma_{R;s}$:	1.2	A.3.3.2
β_p:	1.0	7.6.2.3. (10)(g)			
Pile factor s:	1.0	7.6.2.3. (10)(h)			
Settlement curve:	1	Table 7.c			
$\delta_{j;k}$:	1.0 $\varphi'_{j;k}$	7.3.2.2 (7)(d)			

Result Summary

CPT	Pile Tip Level	Bearing capacity		Spring stiffness		
		$F_{nk;d}$	$R_{c;net;d}$	$F_{c;k;tot}$	$K_b^{1)}$	$K_1^{2)}$
[-]	[m NAP]	[kN]	[kN]	[kN]	[kN/mm]	[kN/mm]
S07	-24.0	308	825	886	231	118
S07	-24.5	308	903	940	246	120
S07	-25.0	308	1160	1121	268	120
S07	-25.5	308	2318	1931	347	121
S07	-26.0	308	2381	1975	366	122
S07	-26.5	308	2445	2020	385	123
S07	-27.0	308	2508	2064	405	123
S07	-27.5	308	2573	2109	426	123
S07	-28.0	308	2635	2153	445	124
S07	-28.5	308	2700	2198	466	124
S07	-29.0	308	2762	2242	486	124
S06	-24.0	304	776	847	233	119
S06	-24.5	304	841	893	245	121
S06	-25.0	304	877	918	258	122
S06	-25.5	304	2305	1917	342	121
S06	-26.0	304	2368	1962	361	121
S06	-26.5	304	2432	2006	380	122
S06	-27.0	304	2495	2051	400	122
S06	-27.5	304	2559	2095	420	123
S06	-28.0	304	2622	2140	440	123
S06	-28.5	304	2686	2184	460	123
S06	-29.0	304	2750	2229	481	123
S02	-24.0	1204	0	1204	1	1
S02	-24.5	1204	0	1204	36	33
S02	-25.0	1204	88	1265	60	52
S02	-25.5	1204	358	1454	84	67
S02	-26.0	1204	799	1763	125	85
S02	-26.5	1204	863	1807	136	89
S02	-27.0	1204	926	1852	148	92
S02	-27.5	1204	990	1896	163	96
S02	-28.0	1204	1053	1941	178	100
S02	-28.5	1204	1118	1986	194	103
S02	-29.0	1204	1181	2030	210	106
S04	-24.0	347	844	937	234	121
S04	-24.5	347	1866	1653	300	121
S04	-25.0	347	2220	1900	339	124
S04	-25.5	347	2340	1984	361	125
S04	-26.0	347	2403	2029	380	125
S04	-26.5	347	2468	2074	400	126
S04	-27.0	347	2531	2118	420	126
S04	-27.5	347	2594	2163	441	127
S04	-28.0	347	2658	2207	461	127
S04	-28.5	347	2721	2252	481	127
S04	-29.0	347	2785	2296	501	127
S03	-24.0	0	1485	1039	369	144
S03	-24.5	0	2642	1849	421	137
S03	-25.0	0	2847	1993	449	137
S03	-25.5	0	2919	2043	471	137
S03	-26.0	0	2982	2088	493	137
S03	-26.5	0	3046	2132	515	137
S03	-27.0	0	3110	2177	538	137

S03	-27.5	0	3173	2221	560	137
S03	-28.0	0	3237	2266	582	136
S03	-28.5	0	3300	2310	604	136
S03	-29.0	0	3364	2355	627	136
S01	-24.0	301	773	842	224	117
S01	-24.5	301	815	872	238	120
S01	-25.0	301	1273	1192	264	118
S01	-25.5	301	2300	1911	340	121
S01	-26.0	301	2363	1955	359	122
S01	-26.5	301	2428	2000	378	123
S01	-27.0	301	2491	2044	398	123
S01	-27.5	301	2554	2089	418	124
S01	-28.0	301	2617	2133	438	124
S01	-28.5	301	2682	2178	459	124
S01	-29.0	301	2745	2222	479	124
S05	-24.0	391	699	880	227	121
S05	-24.5	391	772	932	239	122
S05	-25.0	391	959	1062	256	122
S05	-25.5	391	2208	1936	340	122
S05	-26.0	391	2309	2008	361	123
S05	-26.5	391	2373	2052	380	124
S05	-27.0	391	2436	2096	400	124
S05	-27.5	391	2501	2142	420	124
S05	-28.0	391	2564	2186	441	125
S05	-28.5	391	2628	2231	461	125
S05	-29.0	391	2691	2275	481	125

1) Spring stiffness not taking elastic deformation of the pile into account
2) Spring stiffness including elastic deformation of the pile

PileCore CPT results for S07			CEMS
X coordinate* [m]:	123787.0	Excavation level [m NAP]:	N.A.
Y coordinate* [m]:	483465.0	$\rho_{sur;rep}$ $[kN/m^2]$	0.0
Groundwater level [m NAP]:	-0.4	ξ [-]	1.39
Surface level [m NAP]:	0.12	qc-reduction:	N.A.

* The x and y coordinates of the CPT need to be in a Cartesian metric coordinate system.

Soil classification:

Soil code	Bottom	Thickness	γ_{unsat}	γ_{sat}	Φ'
[-]	[m NAP]	[m]	$[kN/m^3]$	$[kN/m^3]$	[°]
Zs1	0.04	0.08	19.0	21.0	32.5
Zs1	-0.58	0.62	19.0	21.0	32.5
Kv2s1	-1.08	0.5	16.0	16.0	15.0
Ks2z2	-2.98	1.9	21.0	21.0	27.5
Ks1	-3.78	0.8	21.0	21.0	27.5
Kv4s1	-6.08	2.3	16.0	16.0	15.0
Ks1v1	-6.48	0.4	21.0	21.0	27.5
Zk8s2	-10.48	4.0	19.0	21.0	30.0
Ks2	-11.18	0.7	18.0	18.0	22.5
Kv4s1	-11.68	0.5	15.0	15.0	15.0
Zs1	-13.38	1.7	18.0	20.0	27.0
Zs1	-14.27	0.9	18.0	20.0	27.0
Zs1	-19.66	5.39	18.0	20.0	27.0
Zs2k1	-23.15	3.49	18.0	20.0	27.0
Zs1	-25.24	2.09	18.0	20.0	27.0
Zs1	-26.53	1.29	18.0	20.0	27.0
Zs1	-28.7	2.18	18.0	20.0	27.0
Zs1	-32.56	3.85	18.0	20.0	27.0
Zs1	-34.77	2.21	18.0	20.0	27.0

Friction range:

Pile tip level	Negative friction range [m NAP]		Positive friction range [m NAP]	
[m NAP]	Top	Bottom	Top	Bottom
-24.0	0.12	-11.68	-11.68	-24.0
-24.5	0.12	-11.68	-11.68	-24.5
-25.0	0.12	-11.68	-11.68	-25.0
-25.5	0.12	-11.68	-11.68	-25.49
-26.0	0.12	-11.68	-11.68	-25.99
-26.5	0.12	-11.68	-11.68	-26.51
-27.0	0.12	-11.68	-11.68	-27.0
-27.5	0.12	-11.68	-11.68	-27.5
-28.0	0.12	-11.68	-11.68	-27.99
-28.5	0.12	-11.68	-11.68	-28.51
-29.0	0.12	-11.68	-11.68	-29.0

Negative skin friction[1)] :

Soil code	Bottom	Thickness	Average circum. [2]	$\sigma'_{v;rep}$	δ_k	$K_{0;k}$ [3]	$F_{nk;d}$
[-]	[m NAP]	[m]	[m]	$[kN/m^2]$	[°]	[-]	[kN]
Zs1	0.04	0.08	1.57	0.8	32.5	0.5	0
Zs1	-0.58	0.62	1.57	7.4	32.5	0.5	2
Kv2s1	-1.08	0.5	1.57	13.5	15.0	0.7	3
Ks2z2	-2.98	1.9	1.57	25.5	27.5	0.5	21
Ks1	-3.78	0.8	1.57	40.7	27.5	0.5	14
Kv4s1	-6.08	2.3	1.57	52.3	15.0	0.7	47
Ks1v1	-6.48	0.4	1.57	61.6	27.5	0.5	11
Zk8s2	-10.48	4.0	1.57	86.2	30.0	0.5	157
Ks2	-11.18	0.7	1.57	111.5	22.5	0.6	31
Kv4s1	-11.68	0.5	1.57	115.7	15.0	0.7	22

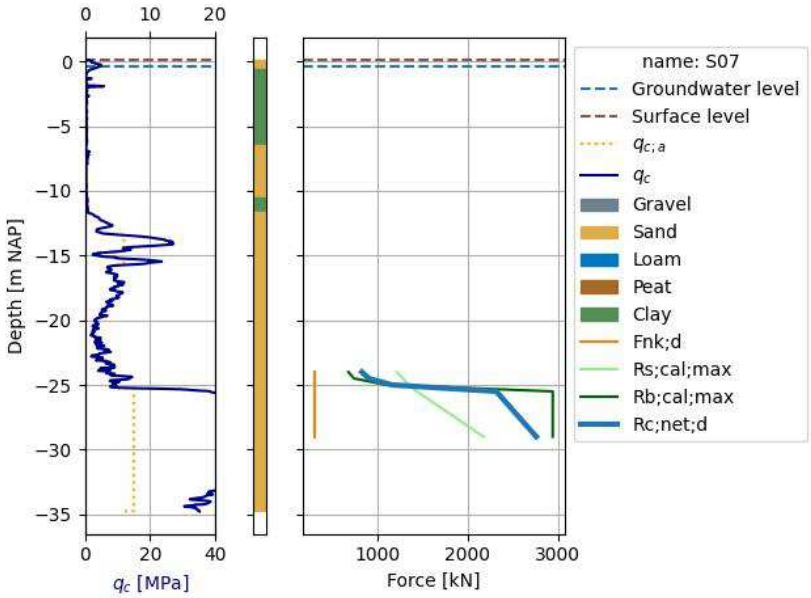
1) The results in this table are presented for the specific case when the pile-tip level is at -29.0 m NAP.
2) The average circumference of the pile per soil layer.
3) A minimum value of 0.25 for the product $K_{0;k}\tan(\delta_{j;k})$ is applied in the calculations (7.3.2.2(7)(d)).

Pile bearing capacity (ULS):

Pile tip level	Base resistance					Shaft resistance		Pile resistance			
	$q_{c;I;gem}$	$q_{c;II;gem}$	$q_{c;III;gem}$	$q_{b;max}$	$R_{b;cal;max}$	$q_{s;max;av}$ [4]	$R_{s;cal;max}$	$R_{c;k}$	$R_{c;d}$	$F_{nk;d}$	$R_{c;net;d}$
[m NAP]	[MPa]	[MPa]	[MPa]	[MPa]	[kN]	[kPa]	[kN]	[kN]	[kN]	[kN]	[kN]
-24.0	8.5	8.2	2.6	3.4	676	62.76	1215	1361	1134	308	825
-24.5	9.6	7.8	3.3	3.8	738	63.68	1282	1453	1211	308	903
-25.0	14.0	13.6	4.0	5.6	1099	64.51	1351	1763	1469	308	1160
-25.5	42.9	42.9	6.2	15.0	2945	66.13	1435	3152	2626	308	2318
-26.0	52.3	48.1	11.5	15.0	2945	68.52	1541	3227	2689	308	2381
-26.5	55.8	55.6	17.3	15.0	2945	70.84	1648	3304	2754	308	2445
-27.0	59.8	53.7	23.7	15.0	2945	72.93	1753	3380	2817	308	2508
-27.5	57.6	49.4	28.8	15.0	2945	74.88	1860	3457	2881	308	2573
-28.0	54.7	49.1	34.3	15.0	2945	76.71	1965	3533	2944	308	2635
-28.5	51.8	45.2	36.9	15.0	2945	78.5	2072	3610	3008	308	2700
-29.0	50.7	45.1	41.5	15.0	2945	80.12	2177	3685	3071	308	2762

4)The average maximum shaft friction in the positive friction zone.

CPT and bearing capacity



Pile settlement (SLS):

Pile tip level	SLS loads			Distributed capacity		Pile settlement/ spring stiffness				
	$F_{c;k}$	$F_{nk;k}$	$F_{c;k;tot}$	$R_{b;k}$	$R_{s;k}$	S_{el}	S_b	S_1	K_b	K_1
[m NAP]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm]	[mm]	[mm]	[kN/mm]	[kN/mm]
-24.0	578	308	886	486	874	3.7	3.8	7.5	231	118
-24.5	632	308	940	531	922	4.0	3.8	7.8	246	120
-25.0	812	308	1121	791	972	5.2	4.2	9.3	268	120
-25.5	1623	308	1931	2119	1033	10.4	5.6	15.9	347	121
-26.0	1667	308	1975	2119	1108	10.8	5.4	16.2	366	122
-26.5	1712	308	2020	2119	1186	11.2	5.2	16.5	385	123
-27.0	1756	308	2064	2119	1261	11.7	5.1	16.8	405	123
-27.5	1801	308	2109	2119	1338	12.1	5.0	17.1	426	123
-28.0	1845	308	2153	2119	1414	12.6	4.8	17.4	445	124
-28.5	1890	308	2198	2119	1491	13.0	4.7	17.8	466	124
-29.0	1934	308	2242	2119	1566	13.5	4.6	18.1	486	124

PileCore CPT results for S06			CEMS
X coordinate* [m]:	123789.0	Excavation level [m NAP]:	N.A.
Y coordinate* [m]:	483485.0	$\rho_{sur;rep}$ $[kN/m^2]$	0.0
Groundwater level [m NAP]:	-0.4	ξ [-]	1.39
Surface level [m NAP]:	0.18	qc-reduction:	N.A.

* The x and y coordinates of the CPT need to be in a Cartesian metric coordinate system.

Soil classification:

Soil code	Bottom	Thickness	γ_{unsat}	γ_{sat}	Φ'
[-]	[m NAP]	[m]	$[kN/m^3]$	$[kN/m^3]$	[°]
Zs1	0.1	0.08	19.0	21.0	32.5
Zs1	-2.82	2.92	19.0	21.0	32.5
Kv4s1	-6.22	3.4	16.0	16.0	15.0
Kz5s2	-11.52	5.3	20.0	20.0	32.5
Zs1	-12.51	1.0	18.0	20.0	27.0
Zs1	-25.41	12.89	18.0	20.0	27.0
Zs1	-29.0	3.59	18.0	20.0	27.0
Zs1	-32.49	3.49	18.0	20.0	27.0
Zs1	-34.48	1.99	18.0	20.0	27.0
Zs1	-35.07	0.6	18.0	20.0	27.0

Friction range:

Pile tip level	Negative friction range [m NAP]		Positive friction range [m NAP]	
[m NAP]	Top	Bottom	Top	Bottom
-24.0	0.18	-11.52	-11.52	-24.01
-24.5	0.18	-11.52	-11.52	-24.51
-25.0	0.18	-11.52	-11.52	-25.01
-25.5	0.18	-11.52	-11.52	-25.51
-26.0	0.18	-11.52	-11.52	-26.0
-26.5	0.18	-11.52	-11.52	-26.5
-27.0	0.18	-11.52	-11.52	-27.0
-27.5	0.18	-11.52	-11.52	-27.5
-28.0	0.18	-11.52	-11.52	-28.0
-28.5	0.18	-11.52	-11.52	-28.5
-29.0	0.18	-11.52	-11.52	-29.0

Negative skin friction[1] :

Soil code	Bottom	Thickness	Average circum. [2]	$\sigma'_{v;rep}$	δ_k	$K_{0;k}$ [3]	$F_{nk;d}$
[-]	[m NAP]	[m]	[m]	$[kN/m^2]$	[°]	[-]	[kN]
Zs1	0.1	0.08	1.57	0.8	32.5	0.5	0
Zs1	-2.82	2.92	1.57	21.4	32.5	0.5	29
Kv4s1	-6.22	3.4	1.57	48.6	15.0	0.7	65
Kz5s2	-11.52	5.3	1.57	86.0	32.5	0.5	210

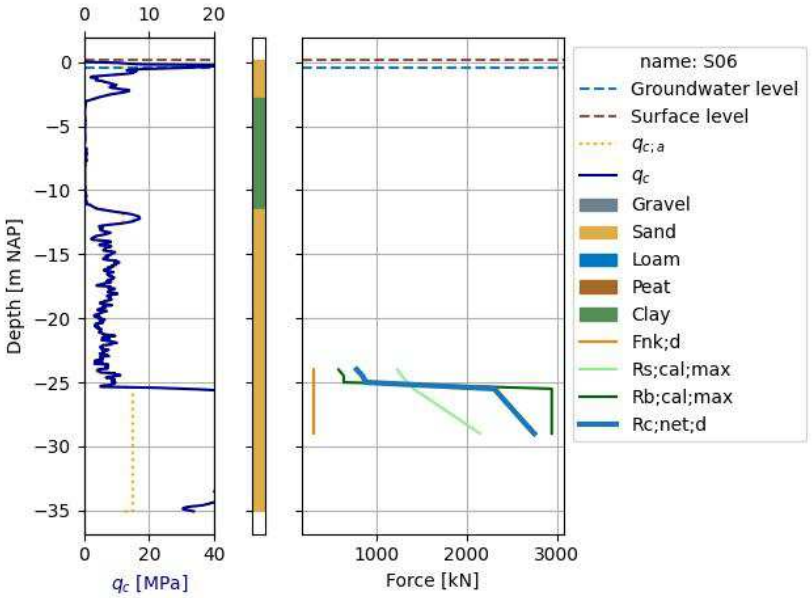
1) The results in this table are presented for the specific case when the pile-tip level is at -29.0 m NAP.
2) The average circumference of the pile per soil layer.
3) A minimum value of 0.25 for the product $K_{0;k} \tan(\delta_{j;k})$ is applied in the calculations (7.3.2.2(7)(d)).

Pile bearing capacity (ULS):

Pile tip level	Base resistance					Shaft resistance		Pile resistance			
	$q_{c;I;gem}$	$q_{c;II;gem}$	$q_{c;III;gem}$	$q_{b;max}$	$R_{b;cal;max}$	$q_{s;max;av}$ [4)]	$R_{s;cal;max}$	$R_{c;k}$	$R_{c;d}$	$F_{nk;d}$	$R_{c;net;d}$
[m NAP]	[MPa]	[MPa]	[MPa]	[MPa]	[kN]	[kPa]	[kN]	[kN]	[kN]	[kN]	[kN]
-24.0	5.9	5.9	3.4	2.9	574	62.55	1227	1296	1080	304	776
-24.5	8.2	5.1	3.6	3.2	632	62.71	1278	1374	1145	304	841
-25.0	7.8	5.1	3.8	3.2	631	63.24	1339	1417	1181	304	877
-25.5	43.7	43.6	4.7	15.0	2945	64.14	1407	3131	2609	304	2305
-26.0	56.6	52.6	10.1	15.0	2945	66.58	1512	3207	2672	304	2368
-26.5	56.1	55.8	16.2	15.0	2945	68.86	1618	3283	2736	304	2432
-27.0	57.9	54.2	22.5	15.0	2945	70.99	1724	3359	2799	304	2495
-27.5	56.5	52.5	28.4	15.0	2945	72.99	1830	3435	2863	304	2559
-28.0	54.0	49.1	32.6	15.0	2945	74.86	1936	3512	2926	304	2622
-28.5	53.0	49.2	38.1	15.0	2945	76.63	2042	3588	2990	304	2686
-29.0	52.2	49.3	43.6	15.0	2945	78.29	2150	3665	3054	304	2750

4)The average maximum shaft friction in the positive friction zone.

CPT and bearing capacity



Pile settlement (SLS):

Pile tip level	SLS loads			Distributed capacity		Pile settlement/ spring stiffness				
	$F_{c;k}$	$F_{nk;k}$	$F_{c;k;tot}$	$R_{b;k}$	$R_{s;k}$	S_{el}	S_b	S_1	K_b	K_1
[m NAP]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm]	[mm]	[mm]	[kN/mm]	[kN/mm]
-24.0	543	304	847	413	883	3.5	3.6	7.1	233	119
-24.5	589	304	893	455	920	3.8	3.6	7.4	245	121
-25.0	614	304	918	454	963	4.0	3.6	7.5	258	122
-25.5	1613	304	1917	2119	1012	10.3	5.6	15.9	342	121
-26.0	1658	304	1962	2119	1088	10.7	5.4	16.2	361	121
-26.5	1702	304	2006	2119	1164	11.2	5.3	16.5	380	122
-27.0	1747	304	2051	2119	1240	11.6	5.1	16.8	400	122
-27.5	1791	304	2095	2119	1317	12.1	5.0	17.1	420	123
-28.0	1836	304	2140	2119	1393	12.5	4.9	17.4	440	123
-28.5	1880	304	2184	2119	1469	13.0	4.7	17.7	460	123
-29.0	1925	304	2229	2119	1546	13.5	4.6	18.1	481	123

PileCore CPT results for S02			CEMS
X coordinate* [m]:	123797.0	Excavation level [m NAP]:	N.A.
Y coordinate* [m]:	483441.0	$\rho_{sur;rep}$ $[kN/m^2]$	0.0
Groundwater level [m NAP]:	-0.4	ξ [-]	1.39
Surface level [m NAP]:	-0.63	qc-reduction:	N.A.

* The x and y coordinates of the CPT need to be in a Cartesian metric coordinate system.

Soil classification:

Soil code	Bottom	Thickness	γ_{unsat}	γ_{sat}	Φ'
[-]	[m NAP]	[m]	$[kN/m^3]$	$[kN/m^3]$	[°]
Zs1	-1.31	0.68	19.0	21.0	32.5
Zs1	-5.13	3.82	19.0	21.0	32.5
Kv6z1	-6.23	1.1	16.0	16.0	15.0
Ks1v1	-6.73	0.5	21.0	21.0	27.5
Kz3s2	-10.73	4.0	20.0	20.0	32.5
Ks2	-12.13	1.4	18.0	18.0	22.5
Zs1	-15.53	3.4	18.0	20.0	27.0
Zs1	-16.53	1.0	18.0	20.0	27.0
Zs1	-17.53	1.0	18.0	20.0	27.0
Zs1	-19.23	1.7	18.0	20.0	27.0
Zs1	-21.53	2.3	18.0	20.0	27.0
Kz7s3	-23.92	2.4	18.0	18.0	27.5
Zs1	-24.42	0.5	18.0	20.0	27.0
Zs1	-25.82	1.4	18.0	20.0	27.0
Zs1	-32.5	6.69	18.0	20.0	27.0
Zs1	-34.0	1.5	18.0	20.0	27.0
Zs1	-35.39	1.4	18.0	20.0	27.0

Friction range:

Pile tip level	Negative friction range [m NAP]		Positive friction range [m NAP]	
[m NAP]	Top	Bottom	Top	Bottom
-24.0	-0.63	-23.92	-23.92	-24.0
-24.5	-0.63	-23.92	-23.92	-24.5
-25.0	-0.63	-23.92	-23.92	-25.0
-25.5	-0.63	-23.92	-23.92	-25.5
-26.0	-0.63	-23.92	-23.92	-25.99
-26.5	-0.63	-23.92	-23.92	-26.49
-27.0	-0.63	-23.92	-23.92	-26.99
-27.5	-0.63	-23.92	-23.92	-27.49
-28.0	-0.63	-23.92	-23.92	-27.99
-28.5	-0.63	-23.92	-23.92	-28.51
-29.0	-0.63	-23.92	-23.92	-29.01

Negative skin friction[1)] :

Soil code	Bottom	Thickness	Average circum. [2]	$\sigma'_{v;rep}$	δ_k	$K_{0;k}$ [3]	$F_{nk;d}$
[-]	[m NAP]	[m]	[m]	$[kN/m^2]$	[°]	[-]	[kN]
Zs1	-1.31	0.68	1.57	3.8	32.5	0.5	1
Zs1	-5.13	3.82	1.57	29.0	32.5	0.5	51
Kv6z1	-6.23	1.1	1.57	53.7	15.0	0.7	23
Ks1v1	-6.73	0.5	1.57	59.9	27.5	0.5	13
Kz3s2	-10.73	4.0	1.57	83.0	32.5	0.5	154
Ks2	-12.13	1.4	1.57	109.2	22.5	0.6	62
Zs1	-15.53	3.4	1.57	132.3	27.0	0.5	198
Zs1	-16.53	1.0	1.57	154.8	27.0	0.5	68
Zs1	-17.53	1.0	1.57	164.8	27.0	0.5	72
Zs1	-19.23	1.7	1.57	178.6	27.0	0.5	133
Zs1	-21.53	2.3	1.57	199.0	27.0	0.5	202
Kz7s3	-23.92	2.4	1.57	220.5	27.5	0.5	231

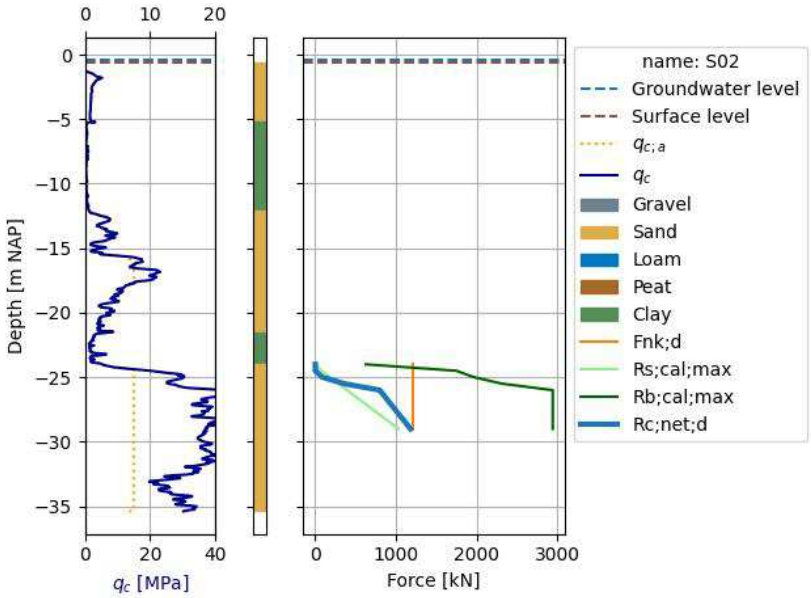
1) The results in this table are presented for the specific case when the pile-tip level is at -29.0 m NAP.
2) The average circumference of the pile per soil layer.
3) A minimum value of 0.25 for the product $K_{0;k}\tan(\delta_{j;k})$ is applied in the calculations (7.3.2.2(7)(d)).

Pile bearing capacity (ULS):

Pile tip level	Base resistance					Shaft resistance		Pile resistance			
	$q_{c;I;gem}$	$q_{c;II;gem}$	$q_{c;III;gem}$	$q_{b;max}$	$R_{b;cal;max}$	$q_{s;max;av}$ [4]	$R_{s;cal;max}$	$R_{c;k}$	$R_{c;d}$	$F_{nk;d}$	$R_{c;net;d}$
[m NAP]	[MPa]	[MPa]	[MPa]	[MPa]	[kN]	[kPa]	[kN]	[kN]	[kN]	[kN]	[kN]
-24.0	8.6	8.6	1.5	3.2	625	44.77	6	454	378	1204	0
-24.5	25.6	25.4	2.8	8.9	1750	86.18	78	1315	1096	1204	0
-25.0	27.3	25.2	5.6	10.0	1969	108.37	184	1549	1291	1204	88
-25.5	28.8	28.8	8.6	11.8	2315	116.69	290	1874	1562	1204	358
-26.0	38.0	33.2	12.2	15.0	2945	121.05	395	2403	2003	1204	799
-26.5	36.2	32.9	16.1	15.0	2945	123.73	501	2479	2066	1204	863
-27.0	36.0	32.7	20.0	15.0	2945	125.55	607	2556	2130	1204	926
-27.5	36.0	32.8	23.8	15.0	2945	126.86	713	2632	2193	1204	990
-28.0	37.2	34.5	27.6	15.0	2945	127.86	819	2708	2257	1204	1053
-28.5	36.7	34.6	30.6	15.0	2945	128.66	927	2786	2321	1204	1118
-29.0	36.0	34.6	31.8	15.0	2945	129.28	1032	2862	2385	1204	1181

4)The average maximum shaft friction in the positive friction zone.

CPT and bearing capacity



Pile settlement (SLS):

Pile tip level	SLS loads			Distributed capacity		Pile settlement/ spring stiffness				
	$F_{c;k}$	$F_{nk;k}$	$F_{c;k;tot}$	$R_{b;k}$	$R_{s;k}$	S_{el}	S_b	S_1	K_b	K_1
[m NAP]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm]	[mm]	[mm]	[kN/mm]	[kN/mm]
-24.0	0	1204	1204	450	4	2.4	1000.0	1002.4	1	1
-24.5	0	1204	1204	1259	56	2.6	33.3	35.9	36	33
-25.0	61	1204	1265	1417	132	3.1	21.2	24.3	60	52
-25.5	251	1204	1454	1665	208	4.5	17.3	21.8	84	67
-26.0	559	1204	1763	2119	284	6.6	14.1	20.7	125	85
-26.5	604	1204	1807	2119	361	7.1	13.3	20.4	136	89
-27.0	648	1204	1852	2119	437	7.6	12.5	20.0	148	92
-27.5	693	1204	1896	2119	513	8.0	11.7	19.7	163	96
-28.0	737	1204	1941	2119	589	8.5	10.9	19.4	178	100
-28.5	782	1204	1986	2119	667	9.0	10.2	19.2	194	103
-29.0	827	1204	2030	2119	743	9.5	9.7	19.2	210	106

PileCore CPT results for S04			CEMS
X coordinate* [m]:	123759.0	Excavation level [m NAP]:	N.A.
Y coordinate* [m]:	483465.0	$\rho_{sur;rep}$ $[kN/m^2]$	0.0
Groundwater level [m NAP]:	-0.4	ξ [-]	1.39
Surface level [m NAP]:	-0.15	qc-reduction:	N.A.

* The x and y coordinates of the CPT need to be in a Cartesian metric coordinate system.

Soil classification:

Soil code	Bottom	Thickness	γ_{unsat}	γ_{sat}	Φ'
[-]	[m NAP]	[m]	$[kN/m^3]$	$[kN/m^3]$	[°]
Vk3	-0.23	0.08	12.0	12.0	15.0
Vk3	-0.25	0.02	12.0	12.0	15.0
Zs1	-2.85	2.6	19.0	21.0	32.5
Kz5s2	-11.94	9.09	20.0	20.0	32.5
Zs1	-15.63	3.69	18.0	20.0	27.0
Zs1	-16.83	1.2	18.0	20.0	27.0
Zs2k1	-24.41	7.58	18.0	20.0	27.0
Zs1	-25.8	1.4	18.0	20.0	27.0
Zs1	-32.69	6.88	18.0	20.0	27.0
Zs1	-34.86	2.17	18.0	20.0	27.0

Friction range:

Pile tip level	Negative friction range [m NAP]		Positive friction range [m NAP]	
[m NAP]	Top	Bottom	Top	Bottom
-24.0	-0.15	-11.94	-11.94	-24.01
-24.5	-0.15	-11.94	-11.94	-24.51
-25.0	-0.15	-11.94	-11.94	-25.0
-25.5	-0.15	-11.94	-11.94	-25.5
-26.0	-0.15	-11.94	-11.94	-26.0
-26.5	-0.15	-11.94	-11.94	-26.5
-27.0	-0.15	-11.94	-11.94	-27.0
-27.5	-0.15	-11.94	-11.94	-27.5
-28.0	-0.15	-11.94	-11.94	-28.0
-28.5	-0.15	-11.94	-11.94	-28.49
-29.0	-0.15	-11.94	-11.94	-28.99

Negative skin friction[1] :

Soil code	Bottom	Thickness	Average circum. [2]	$\sigma'_{v;rep}$	δ_k	$K_{0;k}$ [3]	$F_{nk;d}$
[-]	[m NAP]	[m]	[m]	$[kN/m^2]$	[°]	[-]	[kN]
Vk3	-0.23	0.08	1.57	0.4	15.0	0.7	0
Vk3	-0.25	0.02	1.57	1.0	15.0	0.7	0
Zs1	-2.85	2.6	1.57	16.8	32.5	0.5	20
Kz5s2	-11.94	9.09	1.57	77.8	32.5	0.5	326

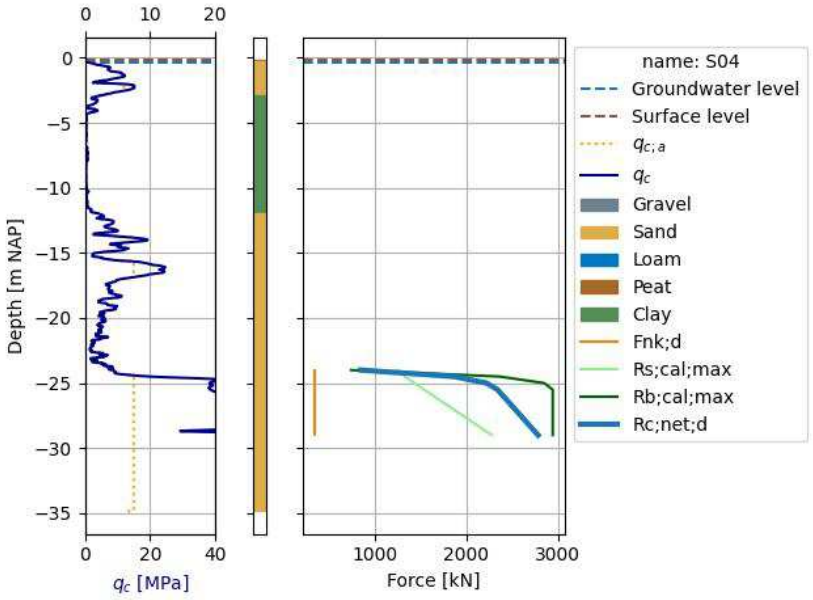
1) The results in this table are presented for the specific case when the pile-tip level is at -29.0 m NAP.
2) The average circumference of the pile per soil layer.
3) A minimum value of 0.25 for the product $K_{0;k}\tan(\delta_{j;k})$ is applied in the calculations (7.3.2.2(7)(d)).

Pile bearing capacity (ULS):

Pile tip level	Base resistance					Shaft resistance		Pile resistance			
	$q_{c;I;gem}$	$q_{c;II;gem}$	$q_{c;III;gem}$	$q_{b;max}$	$R_{b;cal;max}$	$q_{s;max;av}$ [4)]	$R_{s;cal;max}$	$R_{c;k}$	$R_{c;d}$	$F_{nk;d}$	$R_{c;net;d}$
[m NAP]	[MPa]	[MPa]	[MPa]	[MPa]	[kN]	[kPa]	[kN]	[kN]	[kN]	[kN]	[kN]
-24.0	9.6	9.6	2.4	3.8	739	65.79	1247	1429	1190	347	844
-24.5	34.7	34.5	3.6	12.1	2366	67.18	1324	2655	2212	347	1866
-25.0	38.5	38.0	7.8	14.5	2851	69.77	1430	3080	2566	347	2220
-25.5	40.3	40.3	12.4	15.0	2945	72.16	1535	3224	2686	347	2340
-26.0	59.4	59.4	17.6	15.0	2945	74.39	1641	3299	2750	347	2403
-26.5	61.8	48.0	23.2	15.0	2945	76.46	1749	3377	2814	347	2468
-27.0	56.8	29.5	20.8	15.0	2945	78.4	1855	3453	2878	347	2531
-27.5	54.0	29.6	24.1	15.0	2945	80.21	1960	3529	2941	347	2594
-28.0	50.1	29.6	26.9	15.0	2945	81.91	2066	3605	3004	347	2658
-28.5	40.0	34.6	29.1	15.0	2945	83.5	2172	3682	3068	347	2721
-29.0	57.5	56.0	30.5	15.0	2945	85.01	2278	3758	3131	347	2785

4)The average maximum shaft friction in the positive friction zone.

CPT and bearing capacity



Pile settlement (SLS):

Pile tip level	SLS loads			Distributed capacity		Pile settlement/ spring stiffness				
	$F_{c;k}$	$F_{nk;k}$	$F_{c;k;tot}$	$R_{b;k}$	$R_{s;k}$	S_{el}	S_b	S_1	K_b	K_1
[m NAP]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm]	[mm]	[mm]	[kN/mm]	[kN/mm]
-24.0	591	347	937	532	897	3.8	4.0	7.8	234	121
-24.5	1306	347	1653	1702	953	8.1	5.5	13.6	300	121
-25.0	1554	347	1900	2051	1029	9.8	5.6	15.4	339	124
-25.5	1638	347	1984	2119	1105	10.4	5.5	15.9	361	125
-26.0	1682	347	2029	2119	1181	10.9	5.3	16.2	380	125
-26.5	1727	347	2074	2119	1258	11.3	5.2	16.5	400	126
-27.0	1772	347	2118	2119	1334	11.7	5.0	16.8	420	126
-27.5	1816	347	2163	2119	1410	12.2	4.9	17.1	441	127
-28.0	1861	347	2207	2119	1486	12.6	4.8	17.4	461	127
-28.5	1905	347	2252	2119	1563	13.1	4.7	17.8	481	127
-29.0	1949	347	2296	2119	1639	13.6	4.6	18.1	501	127

PileCore CPT results for S03			CEMS
X coordinate* [m]:	123774.0	Excavation level [m NAP]:	N.A.
Y coordinate* [m]:	483449.0	$\rho_{sur;rep}$ $[kN/m^2]$	0.0
Groundwater level [m NAP]:	-0.4	ξ [-]	1.39
Surface level [m NAP]:	-0.25	qc-reduction:	N.A.

* The x and y coordinates of the CPT need to be in a Cartesian metric coordinate system.

Soil classification:

Soil code	Bottom	Thickness	γ_{unsat}	γ_{sat}	Φ'
[-]	[m NAP]	[m]	$[kN/m^3]$	$[kN/m^3]$	[°]
Zk7s1	-0.33	0.08	19.0	21.0	30.0
Zk7s1	-13.34	13.01	19.0	21.0	30.0
Zs1	-14.94	1.6	18.0	20.0	27.0
Zs1	-15.74	0.8	18.0	20.0	27.0
Zs1	-16.84	1.1	18.0	20.0	27.0
Zs1	-19.64	2.8	18.0	20.0	27.0
Zk3s2	-24.33	4.69	18.0	20.0	25.0
Zs1	-25.73	1.4	18.0	20.0	27.0
Zs1	-27.32	1.59	18.0	20.0	27.0
Zs1	-28.91	1.59	18.0	20.0	27.0
Zs1	-32.38	3.47	18.0	20.0	27.0
Zs1	-35.41	3.03	18.0	20.0	27.0

Friction range:

Pile tip level	Negative friction range [m NAP]		Positive friction range [m NAP]	
[m NAP]	Top	Bottom	Top	Bottom
-24.0	-0.25	-0.25	-0.25	-23.99
-24.5	-0.25	-0.25	-0.25	-24.51
-25.0	-0.25	-0.25	-0.25	-25.01
-25.5	-0.25	-0.25	-0.25	-25.51
-26.0	-0.25	-0.25	-0.25	-26.0
-26.5	-0.25	-0.25	-0.25	-26.5
-27.0	-0.25	-0.25	-0.25	-27.0
-27.5	-0.25	-0.25	-0.25	-27.5
-28.0	-0.25	-0.25	-0.25	-27.99
-28.5	-0.25	-0.25	-0.25	-28.49
-29.0	-0.25	-0.25	-0.25	-29.01

Negative skin friction[1)] :

Soil code	Bottom	Thickness	Average circum. [2]	$\sigma'_{v;rep}$	δ_k	$K_{0;k}$ [3]	$F_{nk;d}$
[-]	[m NAP]	[m]	[m]	$[kN/m^2]$	[°]	[-]	[kN]

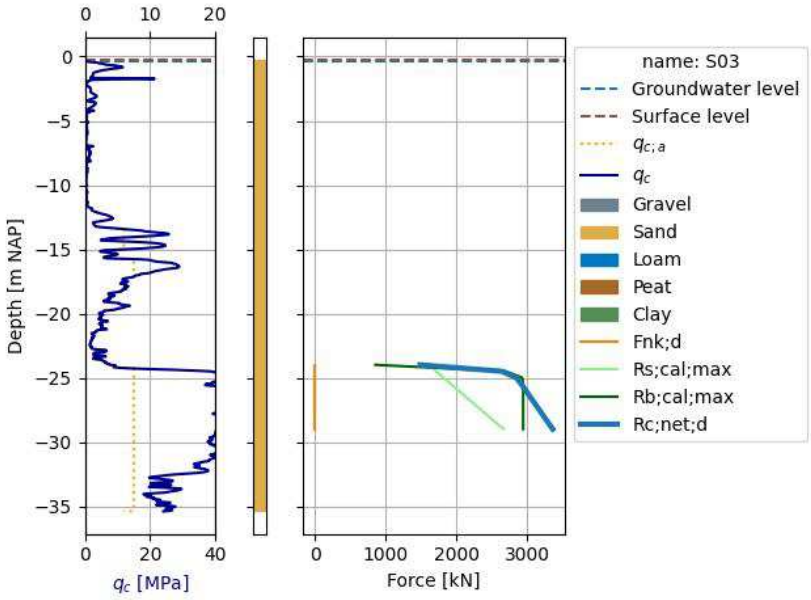
1) The results in this table are presented for the specific case when the pile-tip level is at -29.0 m NAP.
2) The average circumference of the pile per soil layer.
3) A minimum value of 0.25 for the product $K_{0;k}\tan(\delta_{j;k})$ is applied in the calculations (7.3.2.2(7)(d)).

Pile bearing capacity (ULS):

Pile tip level	Base resistance					Shaft resistance		Pile resistance			
	$q_{c;I;gem}$	$q_{c;II;gem}$	$q_{c;III;gem}$	$q_{b;max}$	$R_{b;cal;max}$	$q_{s;max;av}$ [4]	$R_{s;cal;max}$	$R_{c;k}$	$R_{c;d}$	$F_{nk;d}$	$R_{c;net;d}$
[m NAP]	[MPa]	[MPa]	[MPa]	[MPa]	[kN]	[kPa]	[kN]	[kN]	[kN]	[kN]	[kN]
-24.0	11.5	11.4	2.3	4.3	851	43.6	1626	1782	1485	0	1485
-24.5	41.5	36.9	4.4	13.7	2694	45.01	1712	3170	2642	0	2642
-25.0	40.4	36.9	8.7	14.9	2931	46.83	1818	3417	2847	0	2847
-25.5	43.9	43.8	13.1	15.0	2945	48.57	1924	3503	2919	0	2919
-26.0	52.2	39.4	17.7	15.0	2945	50.24	2029	3579	2982	0	2982
-26.5	49.1	39.5	22.4	15.0	2945	51.85	2135	3655	3046	0	3046
-27.0	47.6	39.5	27.0	15.0	2945	53.41	2243	3732	3110	0	3110
-27.5	42.5	39.2	31.5	15.0	2945	54.9	2348	3808	3173	0	3173
-28.0	42.7	37.6	34.7	15.0	2945	56.34	2453	3884	3237	0	3237
-28.5	41.1	37.7	37.4	15.0	2945	57.73	2559	3960	3300	0	3300
-29.0	39.3	37.7	37.5	15.0	2945	59.13	2666	4037	3364	0	3364

4)The average maximum shaft friction in the positive friction zone.

CPT and bearing capacity



Pile settlement (SLS):

Pile tip level	SLS loads			Distributed capacity		Pile settlement/ spring stiffness				
	$F_{c;k}$	$F_{nk;k}$	$F_{c;k;tot}$	$R_{b;k}$	$R_{s;k}$	S_{el}	S_b	S_1	K_b	K_1
[m NAP]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm]	[mm]	[mm]	[kN/mm]	[kN/mm]
-24.0	1039	0	1039	612	1170	4.4	2.8	7.2	369	144
-24.5	1849	0	1849	1938	1232	9.1	4.4	13.5	421	137
-25.0	1993	0	1993	2109	1308	10.1	4.4	14.5	449	137
-25.5	2043	0	2043	2119	1384	10.6	4.3	14.9	471	137
-26.0	2088	0	2088	2119	1460	11.0	4.2	15.2	493	137
-26.5	2132	0	2132	2119	1536	11.4	4.1	15.5	515	137
-27.0	2177	0	2177	2119	1613	11.8	4.0	15.9	538	137
-27.5	2221	0	2221	2119	1689	12.3	4.0	16.2	560	137
-28.0	2266	0	2266	2119	1765	12.7	3.9	16.6	582	136
-28.5	2310	0	2310	2119	1841	13.2	3.8	17.0	604	136
-29.0	2355	0	2355	2119	1918	13.6	3.8	17.4	627	136

PileCore CPT results for S01			CEMS
X coordinate* [m]:	123805.0	Excavation level [m NAP]:	N.A.
Y coordinate* [m]:	483464.0	$\rho_{sur;rep}$ $[kN/m^2]$	0.0
Groundwater level [m NAP]:	-0.4	ξ [-]	1.39
Surface level [m NAP]:	-0.22	qc-reduction:	N.A.

* The x and y coordinates of the CPT need to be in a Cartesian metric coordinate system.

Soil classification:

Soil code	Bottom	Thickness	γ_{unsat}	γ_{sat}	Φ'
[-]	[m NAP]	[m]	$[kN/m^3]$	$[kN/m^3]$	[°]
Ks2	-1.5	1.28	21.0	21.0	27.5
Ks2	-4.72	3.22	21.0	21.0	27.5
Kv2s1	-6.12	1.4	16.0	16.0	15.0
Ks1	-6.82	0.7	21.0	21.0	27.5
Zk6s2	-10.22	3.4	19.0	21.0	30.0
Ks2	-11.22	1.0	18.0	18.0	22.5
Kv4s1	-11.62	0.4	15.0	15.0	15.0
Zs1k1	-13.91	2.3	18.0	20.0	27.0
Zs1	-19.2	5.29	18.0	20.0	27.0
Zs2	-23.29	4.09	18.0	20.0	27.0
Zs1	-25.08	1.79	18.0	20.0	27.0
Zs1	-25.58	0.5	18.0	20.0	27.0
Zs1	-28.47	2.88	18.0	20.0	27.0
Zs1	-33.53	5.06	18.0	20.0	27.0
Zs1	-35.46	1.94	18.0	20.0	27.0

Friction range:

Pile tip level	Negative friction range [m NAP]		Positive friction range [m NAP]	
[m NAP]	Top	Bottom	Top	Bottom
-24.0	-0.22	-11.62	-11.62	-24.01
-24.5	-0.22	-11.62	-11.62	-24.51
-25.0	-0.22	-11.62	-11.62	-25.0
-25.5	-0.22	-11.62	-11.62	-25.5
-26.0	-0.22	-11.62	-11.62	-26.0
-26.5	-0.22	-11.62	-11.62	-26.5
-27.0	-0.22	-11.62	-11.62	-27.0
-27.5	-0.22	-11.62	-11.62	-27.49
-28.0	-0.22	-11.62	-11.62	-27.99
-28.5	-0.22	-11.62	-11.62	-28.51
-29.0	-0.22	-11.62	-11.62	-29.0

Negative skin friction[1)] :

Soil code	Bottom	Thickness	Average circum. [2]	$\sigma'_{v;rep}$	δ_k	$K_{0;k}$ [3]	$F_{nk;d}$
[-]	[m NAP]	[m]	[m]	$[kN/m^2]$	[°]	[-]	[kN]
Ks2	-1.5	1.28	1.57	8.7	27.5	0.5	5
Ks2	-4.72	3.22	1.57	34.0	27.5	0.5	48
Kv2s1	-6.12	1.4	1.57	56.4	15.0	0.7	31
Ks1	-6.82	0.7	1.57	64.6	27.5	0.5	20
Zk6s2	-10.22	3.4	1.57	87.5	30.0	0.5	135
Ks2	-11.22	1.0	1.57	110.6	22.5	0.6	45
Kv4s1	-11.62	0.4	1.57	115.8	15.0	0.7	17

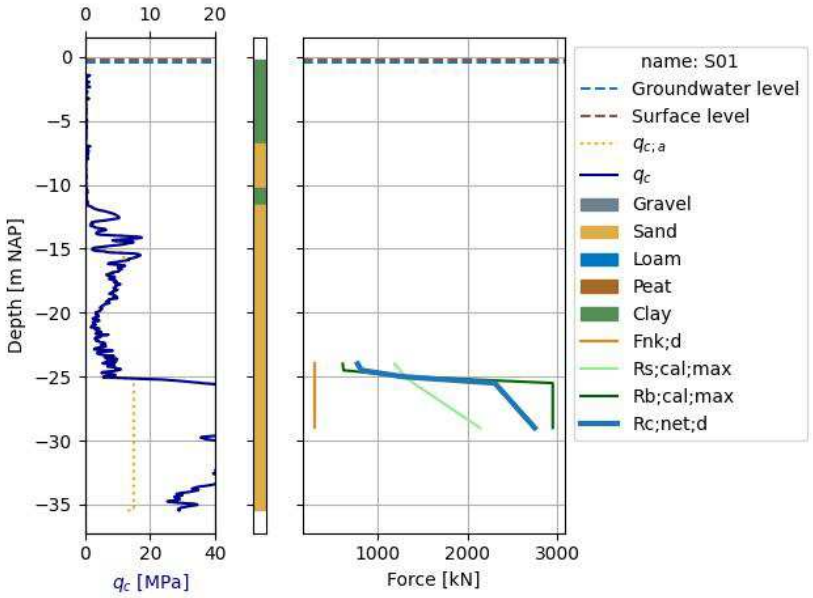
1) The results in this table are presented for the specific case when the pile-tip level is at -29.0 m NAP.
2) The average circumference of the pile per soil layer.
3) A minimum value of 0.25 for the product $K_{0;k}\tan(\delta_{j;k})$ is applied in the calculations (7.3.2.2(7)(d)).

Pile bearing capacity (ULS):

Pile tip level	Base resistance					Shaft resistance		Pile resistance			
	$q_{c;I;gem}$	$q_{c;II;gem}$	$q_{c;III;gem}$	$q_{b;max}$	$R_{b;cal;max}$	$q_{s;max;av}$ [4]	$R_{s;cal;max}$	$R_{c;k}$	$R_{c;d}$	$F_{nk;d}$	$R_{c;net;d}$
[m NAP]	[MPa]	[MPa]	[MPa]	[MPa]	[kN]	[kPa]	[kN]	[kN]	[kN]	[kN]	[kN]
-24.0	8.2	5.3	3.1	3.1	607	60.83	1184	1288	1074	301	773
-24.5	7.5	5.4	3.5	3.1	615	61.59	1246	1339	1116	301	815
-25.0	17.5	17.5	3.9	6.7	1324	61.82	1300	1888	1574	301	1273
-25.5	45.8	45.8	6.5	15.0	2945	63.95	1393	3121	2601	301	2300
-26.0	50.9	44.6	11.5	15.0	2945	66.41	1498	3197	2664	301	2363
-26.5	49.0	44.6	16.6	15.0	2945	68.7	1606	3274	2728	301	2428
-27.0	46.4	44.6	21.8	15.0	2945	70.85	1711	3350	2792	301	2491
-27.5	48.7	43.2	26.1	15.0	2945	72.86	1817	3426	2855	301	2554
-28.0	45.7	35.8	26.3	15.0	2945	74.75	1922	3502	2918	301	2617
-28.5	43.9	35.8	30.1	15.0	2945	76.6	2030	3579	2983	301	2682
-29.0	42.3	35.9	33.8	15.0	2945	78.27	2135	3655	3046	301	2745

4)The average maximum shaft friction in the positive friction zone.

CPT and bearing capacity



Pile settlement (SLS):

Pile tip level	SLS loads			Distributed capacity		Pile settlement/ spring stiffness				
	$F_{c;k}$	$F_{nk;k}$	$F_{c;k;tot}$	$R_{b;k}$	$R_{s;k}$	S_{el}	S_b	S_1	K_b	K_1
[m NAP]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm]	[mm]	[mm]	[kN/mm]	[kN/mm]
-24.0	541	301	842	437	852	3.4	3.8	7.2	224	117
-24.5	571	301	872	443	897	3.6	3.7	7.3	238	120
-25.0	891	301	1192	953	936	5.6	4.5	10.1	264	118
-25.5	1610	301	1911	2119	1002	10.2	5.6	15.8	340	121
-26.0	1654	301	1955	2119	1078	10.6	5.4	16.0	359	122
-26.5	1699	301	2000	2119	1155	11.0	5.3	16.3	378	123
-27.0	1743	301	2044	2119	1231	11.5	5.1	16.6	398	123
-27.5	1788	301	2089	2119	1307	11.9	5.0	16.9	418	124
-28.0	1832	301	2133	2119	1383	12.4	4.9	17.2	438	124
-28.5	1877	301	2178	2119	1460	12.8	4.8	17.6	459	124
-29.0	1921	301	2222	2119	1536	13.3	4.6	17.9	479	124

PileCore CPT results for S05			CEMS
X coordinate* [m]:	123778.0	Excavation level [m NAP]:	N.A.
Y coordinate* [m]:	483481.0	$\rho_{sur;rep}$ $[kN/m^2]$	0.0
Groundwater level [m NAP]:	-0.4	ξ [-]	1.39
Surface level [m NAP]:	0.2	qc-reduction:	N.A.

* The x and y coordinates of the CPT need to be in a Cartesian metric coordinate system.

Soil classification:

Soil code	Bottom	Thickness	γ_{unsat}	γ_{sat}	Φ'
[-]	[m NAP]	[m]	$[kN/m^3]$	$[kN/m^3]$	[°]
Zs1k1	0.12	0.08	19.0	21.0	32.5
Zs1k1	-0.5	0.62	19.0	21.0	32.5
Zs1	-4.6	4.1	19.0	21.0	32.5
Kz5s2	-11.9	7.3	20.0	20.0	32.5
Zs1	-18.49	6.6	18.0	20.0	27.0
Zs1	-25.39	6.89	18.0	20.0	27.0
Zs1	-26.78	1.4	18.0	20.0	27.0
Zs1	-31.27	4.49	18.0	20.0	27.0
Zs1	-32.77	1.5	18.0	20.0	27.0
Zs1	-35.04	2.27	18.0	20.0	27.0

Friction range:

Pile tip level	Negative friction range [m NAP]		Positive friction range [m NAP]	
[m NAP]	Top	Bottom	Top	Bottom
-24.0	0.2	-11.9	-11.9	-24.01
-24.5	0.2	-11.9	-11.9	-24.51
-25.0	0.2	-11.9	-11.9	-25.0
-25.5	0.2	-11.9	-11.9	-25.5
-26.0	0.2	-11.9	-11.9	-26.0
-26.5	0.2	-11.9	-11.9	-26.5
-27.0	0.2	-11.9	-11.9	-27.0
-27.5	0.2	-11.9	-11.9	-27.5
-28.0	0.2	-11.9	-11.9	-28.0
-28.5	0.2	-11.9	-11.9	-28.5
-29.0	0.2	-11.9	-11.9	-29.0

Negative skin friction[1] :

Soil code	Bottom	Thickness	Average circum. [2]	$\sigma'_{v;rep}$	δ_k	$K_{0;k}$ [3]	$F_{nk;d}$
[-]	[m NAP]	[m]	[m]	$[kN/m^2]$	[°]	[-]	[kN]
Zs1k1	0.12	0.08	1.57	0.6	32.5	0.5	0
Zs1k1	-0.5	0.62	1.57	7.2	32.5	0.5	2
Zs1	-4.6	4.1	1.57	35.3	32.5	0.5	67
Kz5s2	-11.9	7.3	1.57	95.7	32.5	0.5	321

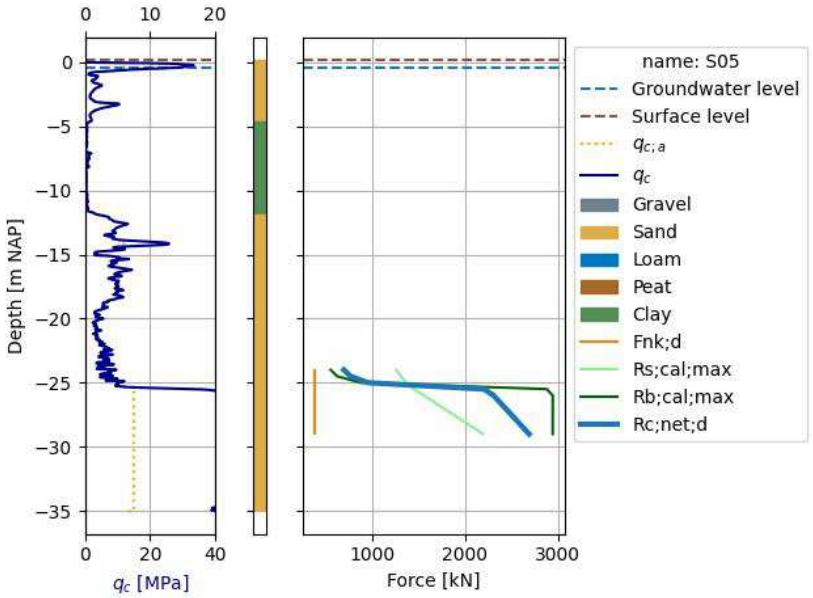
1) The results in this table are presented for the specific case when the pile-tip level is at -29.0 m NAP.
2) The average circumference of the pile per soil layer.
3) A minimum value of 0.25 for the product $K_{0;k}\tan(\delta_{j;k})$ is applied in the calculations (7.3.2.2(7)(d)).

Pile bearing capacity (ULS):

Pile tip level	Base resistance					Shaft resistance		Pile resistance			
	$q_{c;I;gem}$	$q_{c;II;gem}$	$q_{c;III;gem}$	$q_{b;max}$	$R_{b;cal;max}$	$q_{s;max;av}$ [4)]	$R_{s;cal;max}$	$R_{c;k}$	$R_{c;d}$	$F_{nk;d}$	$R_{c;net;d}$
[m NAP]	[MPa]	[MPa]	[MPa]	[MPa]	[kN]	[kPa]	[kN]	[kN]	[kN]	[kN]	[kN]
-24.0	6.8	4.7	3.3	2.8	556	66.43	1262	1308	1090	391	699
-24.5	7.2	6.0	3.5	3.2	627	66.28	1313	1396	1163	391	772
-25.0	10.3	10.0	4.1	4.5	880	66.68	1372	1620	1350	391	959
-25.5	41.1	41.0	5.5	14.7	2881	68.12	1453	3118	2599	391	2208
-26.0	43.2	42.5	10.2	15.0	2945	70.49	1559	3241	2701	391	2309
-26.5	48.5	48.5	15.1	15.0	2945	72.69	1665	3317	2764	391	2373
-27.0	60.0	56.2	21.0	15.0	2945	74.75	1771	3393	2827	391	2436
-27.5	58.4	54.9	27.3	15.0	2945	76.68	1879	3470	2892	391	2501
-28.0	57.3	54.9	33.7	15.0	2945	78.48	1985	3547	2955	391	2564
-28.5	56.5	51.3	38.5	15.0	2945	80.18	2090	3623	3019	391	2628
-29.0	55.2	51.5	44.0	15.0	2945	81.78	2196	3699	3082	391	2691

4)The average maximum shaft friction in the positive friction zone.

CPT and bearing capacity



Pile settlement (SLS):

Pile tip level	SLS loads			Distributed capacity		Pile settlement/ spring stiffness				
	$F_{c;k}$	$F_{nk;k}$	$F_{c;k;tot}$	$R_{b;k}$	$R_{s;k}$	S_{el}	S_b	S_1	K_b	K_1
[m NAP]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm]	[mm]	[mm]	[kN/mm]	[kN/mm]
-24.0	489	391	880	400	908	3.4	3.9	7.3	227	121
-24.5	540	391	932	451	944	3.7	3.9	7.6	239	122
-25.0	671	391	1062	633	987	4.6	4.1	8.7	256	122
-25.5	1545	391	1936	2073	1046	10.2	5.7	15.9	340	122
-26.0	1617	391	2008	2119	1122	10.8	5.6	16.3	361	123
-26.5	1661	391	2052	2119	1198	11.2	5.4	16.6	380	124
-27.0	1705	391	2096	2119	1274	11.7	5.2	16.9	400	124
-27.5	1751	391	2142	2119	1352	12.1	5.1	17.2	420	124
-28.0	1795	391	2186	2119	1428	12.6	5.0	17.5	441	125
-28.5	1839	391	2231	2119	1504	13.0	4.8	17.9	461	125
-29.0	1884	391	2275	2119	1580	13.5	4.7	18.2	481	125

PileCore results for user defined CPT Group

CPT[1)]	X coordinate[2)]	Y coordinate[2)]	Surface level	Groundwater level	Excavation level	$\rho_{sur;rep}$
	[m]	[m]	[m NAP]	[m NAP]	[m NAP]	[kN/m^2]
S07	123787.00	483465.00	0.12	-0.4	0.12	0
S06	123789.00	483485.00	0.18	-0.4	0.18	0
S02	123797.00	483441.00	-0.63	-0.4	-0.63	0
S04	123759.00	483465.00	-0.15	-0.4	-0.15	0
S03	123774.00	483449.00	-0.25	-0.4	-0.25	0
S01	123805.00	483464.00	-0.22	-0.4	-0.22	0
S05	123778.00	483481.00	0.2	-0.4	0.2	0

1) Other input parameters that are used to calculate the bearing capacity (e.g. positive skin friction trajectory) can be found in the individual CPT results report.
2) The x and y coordinates of the CPT need to be in a Cartesian metric coordinate system.

Pile Tip Level	$R_{c;cal;mean}$	$R_{c;cal;min}$	Factor	Var. co-eff	Nominal CPT	$R_{c;k}$	$R_{c;d}$	$F_{nk;d}$[3)]	$R_{c;net;d}$	ξ[4)]
[m NAP]	[kN]	[kN]	[-]	[%]	[-]	[kN]	[kN]	[kN]	[kN]	[-]
-24.0	1771	631	4	31.5	S02	454	378	1204	0	1.39
-24.5	2522	1828	4	42.2	S02	1315	1096	1204	0	1.39
-25.0	2926	1970	4	38.1	S06	1417	1181	304	877	1.39
-25.5	4194	2605	4	17.3	S02	1874	1562	1204	358	1.39
-26.0	4399	3341	4	11.4	S02	3308	2756	1204	1553	1.01
-26.5	4506	3446	4	11.1	S02	3412	2844	1204	1640	1.01
-27.0	4611	3552	4	10.9	S02	3517	2931	1204	1727	1.01
-27.5	4718	3658	4	10.6	S02	3622	3018	1204	1815	1.01
-28.0	4823	3764	4	10.4	S02	3727	3106	1204	1902	1.01
-28.5	4930	3872	4	10.2	S02	3834	3195	1204	1991	1.01
-29.0	5036	3978	4	10.0	S02	3938	3282	1204	2078	1.01

3) The design negative friction force is based on the Nominal CPT. If the 3 factor is applied, the friction force is the group average.
4) The values are related to the net pile bearing capacity (NEN9997-1 7.6.2.3). Based on the lowest outcome of Rc;net;d, this can either be a 3 or 4 value (based on the nominal CPT). In case the variation coefficient is above 12

Pile settlement (SLS):

Pile tip level	SLS loads			Distributed capacity		Pile settlement/ spring stiffness				
	$F_{c;k}$	$F_{nk;k}$	$F_{c;k;tot}$	$R_{b;k}$	$R_{s;k}$	S_{el}	S_b	S_1	K_b	K_1
[m NAP]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm]	[mm]	[mm]	[kN/mm]	[kN/mm]
-24.0	0	1204	1204	450	4	2.4	1000.0	1002.4	1	1
-24.5	0	1204	1204	1259	56	2.6	33.3	35.9	36	33
-25.0	614	304	918	454	963	4.0	3.6	7.5	258	122
-25.5	251	1204	1454	1665	208	4.5	17.3	21.8	84	67
-26.0	1087	1204	2290	2916	391	6.6	11.6	18.2	198	126
-26.5	1148	1204	2352	2916	496	7.1	10.9	17.9	217	131
-27.0	1209	1204	2413	2916	601	7.6	10.2	17.7	237	136
-27.5	1270	1204	2474	2916	706	8.0	9.6	17.6	258	140
-28.0	1331	1204	2535	2916	811	8.5	9.1	17.6	280	144
-28.5	1394	1204	2597	2916	917	9.0	8.7	17.7	300	147
-29.0	1455	1204	2658	2916	1022	9.5	8.3	17.8	321	149

Bijlage 3 Uitvoer PileCore Ø460/556mm

PileCore results			CEMS
Project:	Duivendrechtsekade 50	Author:	5.1.1.d
Number:	23378	Date:	29-11-23
PileCore Version:	2.6.5		

Pile properties:

Name:		Reference NEN9997-1
Type:	betonpaal	Table 7.c
Description:	In de grond gevormd met een gladde mantelbuis op een schroefpunt, waarbij het beton direct tegen de grond drukt	Table 7.c
Installation:	Geschroefd; bij het trekken van de mantelbuis blijft de schroefpunt in de grond achter	Table 7.c
Shaft size:	rond 560 mm	
Base size:	rond 560 mm	
Height pile base [mm]:	0.0	Figure 7.h
$E_{pile;nom}[GPa]$:	20.0	

Pile factors:		Reference NEN9997-1	Safety factors:		Reference NEN9997-1
α_p:	0.63	Table 7.c	$\gamma_{F;nk}$:	1.0	7.3.2.2(7)(b)
$\alpha_{s;sand}$:	0.009	Table 7.c	$\gamma_{R;b}$:	1.2	A.3.3.2
$\alpha_{s;clay}$:	0.009	Table 7.d	$\gamma_{R;s}$:	1.2	A.3.3.2
β_p:	1.0	7.6.2.3. (10)(g)			
Pile factor s:	1.0	7.6.2.3. (10)(h)			
Settlement curve:	1	Table 7.c			
$\delta_{j;k}$:	1.0 $\varphi'_{j;k}$	7.3.2.2 (7)(d)			

Result Summary

CPT	Pile Tip Level	Bearing capacity		Spring stiffness		
		$F_{nk;d}$	$R_{c;net;d}$	$F_{c;k;tot}$	$K_b^{1)}$	$K_1^{2)}$
[-]	[m NAP]	[kN]	[kN]	[kN]	[kN/mm]	[kN/mm]
S07	-24.0	345	992	1040	252	137
S07	-24.5	345	1063	1090	268	140
S07	-25.0	345	1459	1367	291	139
S07	-25.5	345	2833	2329	375	143
S07	-26.0	345	2904	2378	394	144
S07	-26.5	345	2976	2429	414	145
S07	-27.0	345	3047	2478	434	146
S07	-27.5	345	3119	2528	456	147
S07	-28.0	345	3189	2578	477	147
S07	-28.5	345	3261	2628	500	148
S07	-29.0	345	3331	2677	523	148
S06	-24.0	341	932	993	254	138
S06	-24.5	341	992	1035	266	140
S06	-25.0	341	1062	1084	281	142
S06	-25.5	341	2819	2314	370	142
S06	-26.0	341	2890	2363	389	143
S06	-26.5	341	2961	2413	409	144
S06	-27.0	341	3032	2463	429	145
S06	-27.5	341	3103	2513	450	146
S06	-28.0	341	3174	2562	472	146
S06	-28.5	341	3245	2612	494	147
S06	-29.0	341	3318	2663	517	147
S02	-24.0	1348	0	1348	1	1
S02	-24.5	1348	28	1368	53	48
S02	-25.0	1348	235	1513	69	60
S02	-25.5	1348	581	1755	97	77
S02	-26.0	1348	1070	2097	137	96
S02	-26.5	1348	1204	2190	154	102
S02	-27.0	1348	1275	2240	167	106
S02	-27.5	1348	1346	2290	181	111
S02	-28.0	1348	1417	2340	196	114
S02	-28.5	1348	1489	2390	213	118
S02	-29.0	1348	1560	2440	232	122
S04	-24.0	388	1018	1101	253	139
S04	-24.5	388	2283	1987	324	142
S04	-25.0	388	2685	2267	364	145
S04	-25.5	388	2858	2389	390	147
S04	-26.0	388	2929	2438	409	148
S04	-26.5	388	3001	2489	430	149
S04	-27.0	388	3072	2539	451	150
S04	-27.5	388	3143	2588	472	150
S04	-28.0	388	3214	2638	494	151
S04	-28.5	388	3285	2688	517	151
S04	-29.0	388	3356	2738	540	151
S03	-24.0	0	1795	1256	403	169
S03	-24.5	0	3162	2213	452	162
S03	-25.0	0	3389	2372	481	163
S03	-25.5	0	3507	2455	506	163
S03	-26.0	0	3577	2504	528	163
S03	-26.5	0	3648	2554	551	164
S03	-27.0	0	3721	2605	575	164

S03	-27.5	0	3791	2654	599	164
S03	-28.0	0	3862	2704	623	164
S03	-28.5	0	3933	2753	648	163
S03	-29.0	0	4005	2804	674	163
S01	-24.0	337	908	973	244	136
S01	-24.5	337	954	1005	259	139
S01	-25.0	337	1584	1446	287	137
S01	-25.5	337	2813	2306	368	143
S01	-26.0	337	2884	2356	387	144
S01	-26.5	337	2956	2406	407	145
S01	-27.0	337	3027	2456	427	146
S01	-27.5	337	3098	2506	448	146
S01	-28.0	337	3169	2555	469	147
S01	-28.5	337	3241	2606	492	148
S01	-29.0	337	3312	2655	514	148
S05	-24.0	438	824	1015	249	140
S05	-24.5	438	934	1092	261	141
S05	-25.0	438	1165	1253	278	141
S05	-25.5	438	2704	2331	368	144
S05	-26.0	438	2824	2415	390	145
S05	-26.5	438	2895	2464	410	146
S05	-27.0	438	2966	2514	430	147
S05	-27.5	438	3038	2565	451	147
S05	-28.0	438	3109	2615	472	148
S05	-28.5	438	3180	2664	494	149
S05	-29.0	438	3251	2714	516	149

1) Spring stiffness not taking elastic deformation of the pile into account
2) Spring stiffness including elastic deformation of the pile

PileCore CPT results for S07			CEMS
X coordinate* [m]:	123787.0	Excavation level [m NAP]:	N.A.
Y coordinate* [m]:	483465.0	$\rho_{sur;rep}$ $[kN/m^2]$	0.0
Groundwater level [m NAP]:	-0.4	ξ [-]	1.39
Surface level [m NAP]:	0.12	qc-reduction:	N.A.

* The x and y coordinates of the CPT need to be in a Cartesian metric coordinate system.

Soil classification:

Soil code	Bottom	Thickness	γ_{unsat}	γ_{sat}	Φ'
[-]	[m NAP]	[m]	$[kN/m^3]$	$[kN/m^3]$	[°]
Zs1	0.04	0.08	19.0	21.0	32.5
Zs1	-0.58	0.62	19.0	21.0	32.5
Kv2s1	-1.08	0.5	16.0	16.0	15.0
Ks2z2	-2.98	1.9	21.0	21.0	27.5
Ks1	-3.78	0.8	21.0	21.0	27.5
Kv4s1	-6.08	2.3	16.0	16.0	15.0
Ks1v1	-6.48	0.4	21.0	21.0	27.5
Zk8s2	-10.48	4.0	19.0	21.0	30.0
Ks2	-11.18	0.7	18.0	18.0	22.5
Kv4s1	-11.68	0.5	15.0	15.0	15.0
Zs1	-13.38	1.7	18.0	20.0	27.0
Zs1	-14.27	0.9	18.0	20.0	27.0
Zs1	-19.66	5.39	18.0	20.0	27.0
Zs2k1	-23.15	3.49	18.0	20.0	27.0
Zs1	-25.24	2.09	18.0	20.0	27.0
Zs1	-26.53	1.29	18.0	20.0	27.0
Zs1	-28.7	2.18	18.0	20.0	27.0
Zs1	-32.56	3.85	18.0	20.0	27.0
Zs1	-34.77	2.21	18.0	20.0	27.0

Friction range:

Pile tip level	Negative friction range [m NAP]		Positive friction range [m NAP]	
[m NAP]	Top	Bottom	Top	Bottom
-24.0	0.12	-11.68	-11.68	-24.0
-24.5	0.12	-11.68	-11.68	-24.5
-25.0	0.12	-11.68	-11.68	-25.0
-25.5	0.12	-11.68	-11.68	-25.49
-26.0	0.12	-11.68	-11.68	-25.99
-26.5	0.12	-11.68	-11.68	-26.51
-27.0	0.12	-11.68	-11.68	-27.0
-27.5	0.12	-11.68	-11.68	-27.5
-28.0	0.12	-11.68	-11.68	-27.99
-28.5	0.12	-11.68	-11.68	-28.51
-29.0	0.12	-11.68	-11.68	-29.0

Negative skin friction[1)] :

Soil code	Bottom	Thickness	Average circum. [2]	$\sigma'_{v;rep}$	δ_k	$K_{0;k}$ [3]	$F_{nk;d}$
[-]	[m NAP]	[m]	[m]	$[kN/m^2]$	[°]	[-]	[kN]
Zs1	0.04	0.08	1.76	0.8	32.5	0.5	0
Zs1	-0.58	0.62	1.76	7.4	32.5	0.5	2
Kv2s1	-1.08	0.5	1.76	13.5	15.0	0.7	3
Ks2z2	-2.98	1.9	1.76	25.5	27.5	0.5	24
Ks1	-3.78	0.8	1.76	40.7	27.5	0.5	16
Kv4s1	-6.08	2.3	1.76	52.3	15.0	0.7	53
Ks1v1	-6.48	0.4	1.76	61.6	27.5	0.5	12
Zk8s2	-10.48	4.0	1.76	86.2	30.0	0.5	175
Ks2	-11.18	0.7	1.76	111.5	22.5	0.6	35
Kv4s1	-11.68	0.5	1.76	115.7	15.0	0.7	24

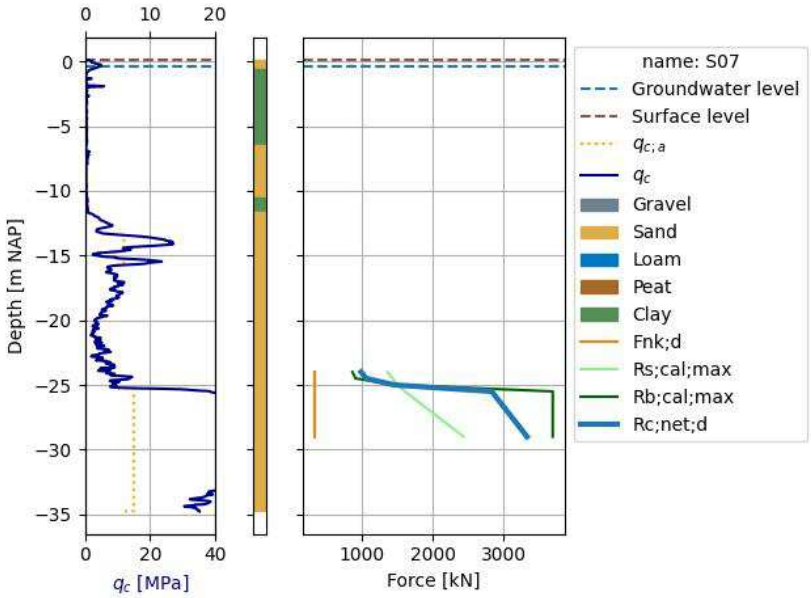
1) The results in this table are presented for the specific case when the pile-tip level is at -29.0 m NAP.
2) The average circumference of the pile per soil layer.
3) A minimum value of 0.25 for the product $K_{0;k}\tan(\delta_{j;k})$ is applied in the calculations (7.3.2.2(7)(d)).

Pile bearing capacity (ULS):

Pile tip level	Base resistance					Shaft resistance		Pile resistance			
	$q_{c;I;gem}$	$q_{c;II;gem}$	$q_{c;III;gem}$	$q_{b;max}$	$R_{b;cal;max}$	$q_{s;max;av}$ [4]	$R_{s;cal;max}$	$R_{c;k}$	$R_{c;d}$	$F_{nk;d}$	$R_{c;net;d}$
[m NAP]	[MPa]	[MPa]	[MPa]	[MPa]	[kN]	[kPa]	[kN]	[kN]	[kN]	[kN]	[kN]
-24.0	9.8	7.7	2.5	3.5	869	62.76	1361	1605	1337	345	992
-24.5	9.6	7.8	3.1	3.7	914	63.68	1435	1691	1409	345	1063
-25.0	15.7	15.3	3.8	6.1	1497	64.51	1513	2165	1804	345	1459
-25.5	43.6	43.6	5.8	15.0	3695	66.13	1608	3815	3179	345	2833
-26.0	52.3	48.1	10.4	15.0	3695	68.52	1725	3899	3249	345	2904
-26.5	56.3	56.1	15.7	15.0	3695	70.84	1846	3986	3321	345	2976
-27.0	59.1	49.1	20.9	15.0	3695	72.93	1963	4070	3392	345	3047
-27.5	56.9	49.3	26.1	15.0	3695	74.88	2083	4157	3464	345	3119
-28.0	54.1	48.0	30.7	15.0	3695	76.71	2201	4241	3534	345	3189
-28.5	51.7	45.2	33.8	15.0	3695	78.5	2321	4328	3606	345	3261
-29.0	50.7	45.1	37.9	15.0	3695	80.12	2438	4412	3677	345	3331

4)The average maximum shaft friction in the positive friction zone.

CPT and bearing capacity



Pile settlement (SLS):

Pile tip level	SLS loads			Distributed capacity		Pile settlement/ spring stiffness				
	$F_{c;k}$	$F_{nk;k}$	$F_{c;k;tot}$	$R_{b;k}$	$R_{s;k}$	S_{el}	S_b	S_1	K_b	K_1
[m NAP]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm]	[mm]	[mm]	[kN/mm]	[kN/mm]
-24.0	694	345	1040	625	979	3.5	4.1	7.6	252	137
-24.5	744	345	1090	658	1033	3.7	4.1	7.8	268	140
-25.0	1021	345	1367	1077	1088	5.1	4.7	9.8	291	139
-25.5	1983	345	2329	2658	1157	10.1	6.2	16.3	375	143
-26.0	2033	345	2378	2658	1241	10.5	6.0	16.5	394	144
-26.5	2083	345	2429	2658	1328	10.9	5.9	16.7	414	145
-27.0	2133	345	2478	2658	1413	11.3	5.7	17.0	434	146
-27.5	2183	345	2528	2658	1499	11.7	5.5	17.3	456	147
-28.0	2232	345	2578	2658	1583	12.1	5.4	17.5	477	147
-28.5	2283	345	2628	2658	1670	12.5	5.3	17.8	500	148
-29.0	2332	345	2677	2658	1754	13.0	5.1	18.1	523	148

PileCore CPT results for S06			
X coordinate* [m]:	123789.0	Excavation level [m NAP]:	N.A.
Y coordinate* [m]:	483485.0	$\rho_{sur;rep}$ $[kN/m^2]$	0.0
Groundwater level [m NAP]:	-0.4	ξ [-]	1.39
Surface level [m NAP]:	0.18	qc-reduction:	N.A.

* The x and y coordinates of the CPT need to be in a Cartesian metric coordinate system.

Soil classification:

Soil code	Bottom	Thickness	γ_{unsat}	γ_{sat}	Φ'
[-]	[m NAP]	[m]	$[kN/m^3]$	$[kN/m^3]$	[°]
Zs1	0.1	0.08	19.0	21.0	32.5
Zs1	-2.82	2.92	19.0	21.0	32.5
Kv4s1	-6.22	3.4	16.0	16.0	15.0
Kz5s2	-11.52	5.3	20.0	20.0	32.5
Zs1	-12.51	1.0	18.0	20.0	27.0
Zs1	-25.41	12.89	18.0	20.0	27.0
Zs1	-29.0	3.59	18.0	20.0	27.0
Zs1	-32.49	3.49	18.0	20.0	27.0
Zs1	-34.48	1.99	18.0	20.0	27.0
Zs1	-35.07	0.6	18.0	20.0	27.0

Friction range:

Pile tip level	Negative friction range [m NAP]		Positive friction range [m NAP]	
[m NAP]	Top	Bottom	Top	Bottom
-24.0	0.18	-11.52	-11.52	-24.01
-24.5	0.18	-11.52	-11.52	-24.51
-25.0	0.18	-11.52	-11.52	-25.01
-25.5	0.18	-11.52	-11.52	-25.51
-26.0	0.18	-11.52	-11.52	-26.0
-26.5	0.18	-11.52	-11.52	-26.5
-27.0	0.18	-11.52	-11.52	-27.0
-27.5	0.18	-11.52	-11.52	-27.5
-28.0	0.18	-11.52	-11.52	-28.0
-28.5	0.18	-11.52	-11.52	-28.5
-29.0	0.18	-11.52	-11.52	-29.0

Negative skin friction[1] :

Soil code	Bottom	Thickness	Average circum. [2]	$\sigma'_{v;rep}$	δ_k	$K_{0;k}$ [3]	$F_{nk;d}$
[-]	[m NAP]	[m]	[m]	$[kN/m^2]$	[°]	[-]	[kN]
Zs1	0.1	0.08	1.76	0.8	32.5	0.5	0
Zs1	-2.82	2.92	1.76	21.4	32.5	0.5	32
Kv4s1	-6.22	3.4	1.76	48.6	15.0	0.7	72
Kz5s2	-11.52	5.3	1.76	86.0	32.5	0.5	235

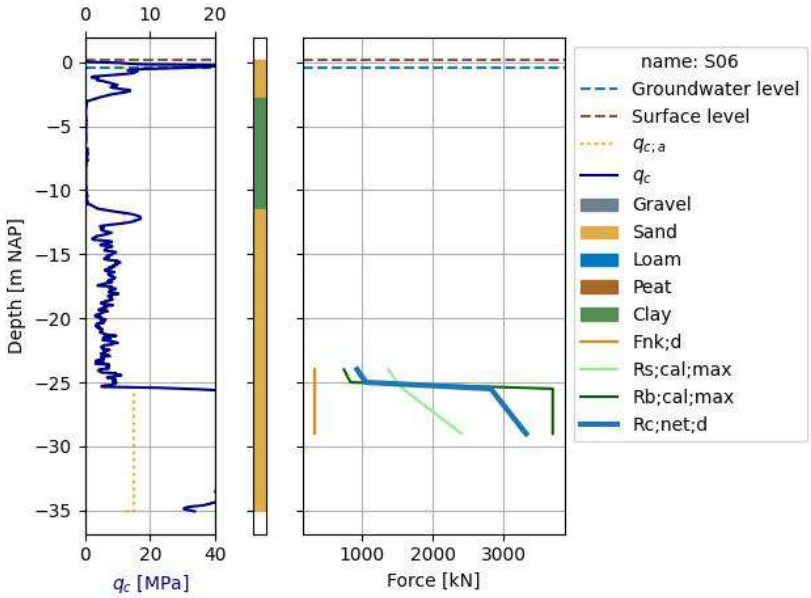
1) The results in this table are presented for the specific case when the pile-tip level is at -29.0 m NAP.
2) The average circumference of the pile per soil layer.
3) A minimum value of 0.25 for the product $K_{0;k} \tan(\delta_{j;k})$ is applied in the calculations (7.3.2.2(7)(d)).

Pile bearing capacity (ULS):

Pile tip level	Base resistance					Shaft resistance		Pile resistance			
	$q_{c;I;gem}$	$q_{c;II;gem}$	$q_{c;III;gem}$	$q_{b;max}$	$R_{b;cal;max}$	$q_{s;max;av}$ [4)]	$R_{s;cal;max}$	$R_{c;k}$	$R_{c;d}$	$F_{nk;d}$	$R_{c;net;d}$
[m NAP]	[MPa]	[MPa]	[MPa]	[MPa]	[kN]	[kPa]	[kN]	[kN]	[kN]	[kN]	[kN]
-24.0	6.3	6.3	3.3	3.0	747	62.55	1375	1527	1272	341	932
-24.5	8.2	5.1	3.5	3.2	790	62.71	1432	1599	1332	341	992
-25.0	8.3	5.9	3.7	3.4	840	63.24	1499	1683	1402	341	1062
-25.5	45.3	45.1	4.5	15.0	3695	64.14	1575	3791	3159	341	2819
-26.0	56.6	52.6	9.4	15.0	3695	66.58	1694	3876	3230	341	2890
-26.5	58.1	54.2	14.8	15.0	3695	68.86	1813	3962	3302	341	2961
-27.0	57.4	52.5	20.3	15.0	3695	70.99	1931	4047	3373	341	3032
-27.5	56.0	51.0	25.2	15.0	3695	72.99	2050	4132	3444	341	3103
-28.0	53.7	49.2	29.5	15.0	3695	74.86	2168	4218	3515	341	3174
-28.5	53.0	49.2	34.6	15.0	3695	76.63	2287	4303	3586	341	3245
-29.0	52.2	49.3	39.5	15.0	3695	78.29	2408	4390	3658	341	3318

4)The average maximum shaft friction in the positive friction zone.

CPT and bearing capacity



Pile settlement (SLS):

Pile tip level	SLS loads			Distributed capacity		Pile settlement/ spring stiffness				
	$F_{c;k}$	$F_{nk;k}$	$F_{c;k;tot}$	$R_{b;k}$	$R_{s;k}$	S_{el}	S_b	S_1	K_b	K_1
[m NAP]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm]	[mm]	[mm]	[kN/mm]	[kN/mm]
-24.0	652	341	993	538	989	3.3	3.9	7.2	254	138
-24.5	694	341	1035	569	1030	3.5	3.9	7.4	266	140
-25.0	743	341	1084	604	1079	3.8	3.9	7.6	281	142
-25.5	1973	341	2314	2658	1133	10.0	6.3	16.3	370	142
-26.0	2023	341	2363	2658	1219	10.4	6.1	16.5	389	143
-26.5	2073	341	2413	2658	1304	10.8	5.9	16.7	409	144
-27.0	2123	341	2463	2658	1389	11.2	5.7	17.0	429	145
-27.5	2172	341	2513	2658	1475	11.7	5.6	17.2	450	146
-28.0	2222	341	2562	2658	1560	12.1	5.4	17.5	472	146
-28.5	2272	341	2612	2658	1645	12.5	5.3	17.8	494	147
-29.0	2322	341	2663	2658	1732	12.9	5.1	18.1	517	147

PileCore CPT results for S02			CEMS
X coordinate* [m]:	123797.0	Excavation level [m NAP]:	N.A.
Y coordinate* [m]:	483441.0	$\rho_{sur;rep}$ $[kN/m^2]$	0.0
Groundwater level [m NAP]:	-0.4	ξ [-]	1.39
Surface level [m NAP]:	-0.63	qc-reduction:	N.A.

* The x and y coordinates of the CPT need to be in a Cartesian metric coordinate system.

Soil classification:

Soil code	Bottom	Thickness	γ_{unsat}	γ_{sat}	Φ'
[-]	[m NAP]	[m]	$[kN/m^3]$	$[kN/m^3]$	[°]
Zs1	-1.31	0.68	19.0	21.0	32.5
Zs1	-5.13	3.82	19.0	21.0	32.5
Kv6z1	-6.23	1.1	16.0	16.0	15.0
Ks1v1	-6.73	0.5	21.0	21.0	27.5
Kz3s2	-10.73	4.0	20.0	20.0	32.5
Ks2	-12.13	1.4	18.0	18.0	22.5
Zs1	-15.53	3.4	18.0	20.0	27.0
Zs1	-16.53	1.0	18.0	20.0	27.0
Zs1	-17.53	1.0	18.0	20.0	27.0
Zs1	-19.23	1.7	18.0	20.0	27.0
Zs1	-21.53	2.3	18.0	20.0	27.0
Kz7s3	-23.92	2.4	18.0	18.0	27.5
Zs1	-24.42	0.5	18.0	20.0	27.0
Zs1	-25.82	1.4	18.0	20.0	27.0
Zs1	-32.5	6.69	18.0	20.0	27.0
Zs1	-34.0	1.5	18.0	20.0	27.0
Zs1	-35.39	1.4	18.0	20.0	27.0

Friction range:

Pile tip level	Negative friction range [m NAP]		Positive friction range [m NAP]	
[m NAP]	Top	Bottom	Top	Bottom
-24.0	-0.63	-23.92	-23.92	-24.0
-24.5	-0.63	-23.92	-23.92	-24.5
-25.0	-0.63	-23.92	-23.92	-25.0
-25.5	-0.63	-23.92	-23.92	-25.5
-26.0	-0.63	-23.92	-23.92	-25.99
-26.5	-0.63	-23.92	-23.92	-26.49
-27.0	-0.63	-23.92	-23.92	-26.99
-27.5	-0.63	-23.92	-23.92	-27.49
-28.0	-0.63	-23.92	-23.92	-27.99
-28.5	-0.63	-23.92	-23.92	-28.51
-29.0	-0.63	-23.92	-23.92	-29.01

Negative skin friction[1)] :

Soil code	Bottom	Thickness	Average circum. [2]	$\sigma'_{v;rep}$	δ_k	$K_{0;k}$ [3]	$F_{nk;d}$
[-]	[m NAP]	[m]	[m]	$[kN/m^2]$	[°]	[-]	[kN]
Zs1	-1.31	0.68	1.76	3.8	32.5	0.5	1
Zs1	-5.13	3.82	1.76	29.0	32.5	0.5	57
Kv6z1	-6.23	1.1	1.76	53.7	15.0	0.7	26
Ks1v1	-6.73	0.5	1.76	59.9	27.5	0.5	15
Kz3s2	-10.73	4.0	1.76	83.0	32.5	0.5	172
Ks2	-12.13	1.4	1.76	109.2	22.5	0.6	69
Zs1	-15.53	3.4	1.76	132.3	27.0	0.5	222
Zs1	-16.53	1.0	1.76	154.8	27.0	0.5	76
Zs1	-17.53	1.0	1.76	164.8	27.0	0.5	81
Zs1	-19.23	1.7	1.76	178.6	27.0	0.5	149
Zs1	-21.53	2.3	1.76	199.0	27.0	0.5	226
Kz7s3	-23.92	2.4	1.76	220.5	27.5	0.5	258

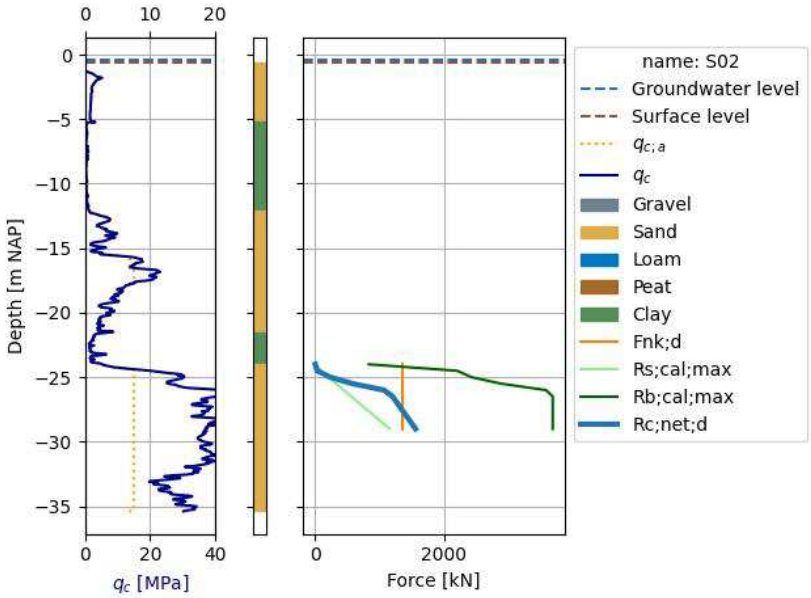
1) The results in this table are presented for the specific case when the pile-tip level is at -29.0 m NAP.
2) The average circumference of the pile per soil layer.
3) A minimum value of 0.25 for the product $K_{0;k}\tan(\delta_{j;k})$ is applied in the calculations (7.3.2.2(7)(d)).

Pile bearing capacity (ULS):

Pile tip level	Base resistance					Shaft resistance		Pile resistance			
	$q_{c;I;gem}$	$q_{c;II;gem}$	$q_{c;III;gem}$	$q_{b;max}$	$R_{b;cal;max}$	$q_{s;max;av}$ [4]	$R_{s;cal;max}$	$R_{c;k}$	$R_{c;d}$	$F_{nk;d}$	$R_{c;net;d}$
[m NAP]	[MPa]	[MPa]	[MPa]	[MPa]	[kN]	[kPa]	[kN]	[kN]	[kN]	[kN]	[kN]
-24.0	9.2	9.2	1.5	3.4	832	44.77	6	603	503	1348	0
-24.5	27.1	24.7	2.6	9.0	2208	86.18	88	1652	1376	1348	28
-25.0	27.3	25.2	5.2	9.9	2435	108.37	206	1900	1583	1348	235
-25.5	29.5	29.5	7.8	11.7	2894	116.69	325	2315	1929	1348	581
-26.0	37.8	32.8	11.0	14.6	3590	121.05	443	2901	2418	1348	1070
-26.5	36.2	32.9	14.5	15.0	3695	123.73	561	3062	2551	1348	1204
-27.0	36.0	32.7	18.0	15.0	3695	125.55	680	3147	2623	1348	1275
-27.5	36.0	32.8	21.5	15.0	3695	126.86	798	3232	2694	1348	1346
-28.0	37.2	34.5	24.9	15.0	3695	127.86	917	3318	2765	1348	1417
-28.5	36.7	34.6	28.5	15.0	3695	128.66	1038	3405	2837	1348	1489
-29.0	36.0	34.6	31.1	15.0	3695	129.28	1156	3490	2908	1348	1560

4)The average maximum shaft friction in the positive friction zone.

CPT and bearing capacity



Pile settlement (SLS):

Pile tip level	SLS loads			Distributed capacity		Pile settlement/ spring stiffness				
	$F_{c;k}$	$F_{nk;k}$	$F_{c;k;tot}$	$R_{b;k}$	$R_{s;k}$	S_{el}	S_b	S_1	K_b	K_1
[m NAP]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm]	[mm]	[mm]	[kN/mm]	[kN/mm]
-24.0	0	1348	1348	599	4	2.2	1000.0	1002.2	1	1
-24.5	20	1348	1368	1589	63	2.4	25.9	28.3	53	48
-25.0	165	1348	1513	1752	148	3.3	22.0	25.3	69	60
-25.5	407	1348	1755	2082	234	4.6	18.2	22.8	97	77
-26.0	749	1348	2097	2583	319	6.5	15.3	21.8	137	96
-26.5	842	1348	2190	2658	404	7.2	14.2	21.4	154	102
-27.0	892	1348	2240	2658	489	7.6	13.4	21.1	167	106
-27.5	942	1348	2290	2658	574	8.1	12.6	20.7	181	111
-28.0	992	1348	2340	2658	660	8.5	11.9	20.5	196	114
-28.5	1042	1348	2390	2658	747	9.0	11.2	20.2	213	118
-29.0	1092	1348	2440	2658	832	9.4	10.5	19.9	232	122

PileCore CPT results for S04			CEMS
X coordinate* [m]:	123759.0	Excavation level [m NAP]:	N.A.
Y coordinate* [m]:	483465.0	$\rho_{sur;rep}$ $[kN/m^2]$	0.0
Groundwater level [m NAP]:	-0.4	ξ [-]	1.39
Surface level [m NAP]:	-0.15	qc-reduction:	N.A.

* The x and y coordinates of the CPT need to be in a Cartesian metric coordinate system.

Soil classification:

Soil code	Bottom	Thickness	γ_{unsat}	γ_{sat}	Φ'
[-]	[m NAP]	[m]	$[kN/m^3]$	$[kN/m^3]$	[°]
Vk3	-0.23	0.08	12.0	12.0	15.0
Vk3	-0.25	0.02	12.0	12.0	15.0
Zs1	-2.85	2.6	19.0	21.0	32.5
Kz5s2	-11.94	9.09	20.0	20.0	32.5
Zs1	-15.63	3.69	18.0	20.0	27.0
Zs1	-16.83	1.2	18.0	20.0	27.0
Zs2k1	-24.41	7.58	18.0	20.0	27.0
Zs1	-25.8	1.4	18.0	20.0	27.0
Zs1	-32.69	6.88	18.0	20.0	27.0
Zs1	-34.86	2.17	18.0	20.0	27.0

Friction range:

Pile tip level	Negative friction range [m NAP]		Positive friction range [m NAP]	
[m NAP]	Top	Bottom	Top	Bottom
-24.0	-0.15	-11.94	-11.94	-24.01
-24.5	-0.15	-11.94	-11.94	-24.51
-25.0	-0.15	-11.94	-11.94	-25.0
-25.5	-0.15	-11.94	-11.94	-25.5
-26.0	-0.15	-11.94	-11.94	-26.0
-26.5	-0.15	-11.94	-11.94	-26.5
-27.0	-0.15	-11.94	-11.94	-27.0
-27.5	-0.15	-11.94	-11.94	-27.5
-28.0	-0.15	-11.94	-11.94	-28.0
-28.5	-0.15	-11.94	-11.94	-28.49
-29.0	-0.15	-11.94	-11.94	-28.99

Negative skin friction[1] :

Soil code	Bottom	Thickness	Average circum. [2]	$\sigma'_{v;rep}$	δ_k	$K_{0;k}$ [3]	$F_{nk;d}$
[-]	[m NAP]	[m]	[m]	$[kN/m^2]$	[°]	[-]	[kN]
Vk3	-0.23	0.08	1.76	0.4	15.0	0.7	0
Vk3	-0.25	0.02	1.76	1.0	15.0	0.7	0
Zs1	-2.85	2.6	1.76	16.8	32.5	0.5	23
Kz5s2	-11.94	9.09	1.76	77.8	32.5	0.5	365

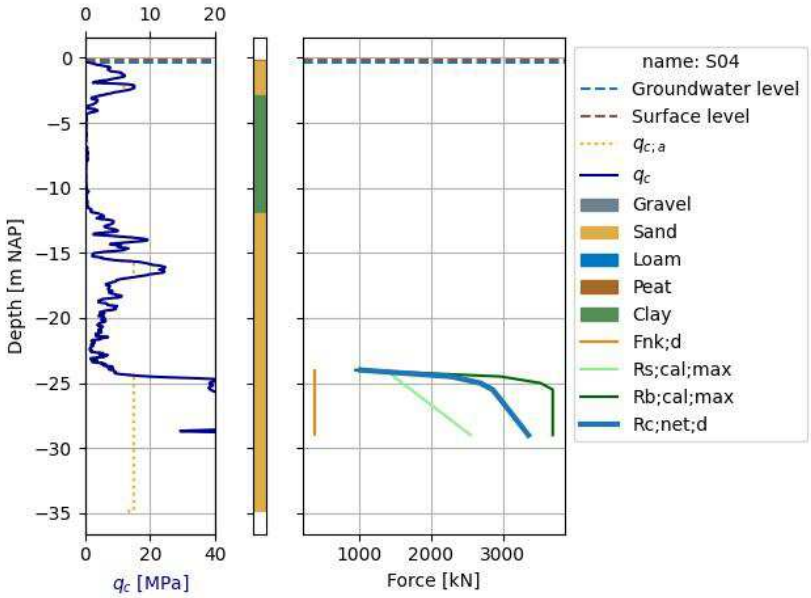
1) The results in this table are presented for the specific case when the pile-tip level is at -29.0 m NAP.
2) The average circumference of the pile per soil layer.
3) A minimum value of 0.25 for the product $K_{0;k}\tan(\delta_{j;k})$ is applied in the calculations (7.3.2.2(7)(d)).

Pile bearing capacity (ULS):

Pile tip level	Base resistance					Shaft resistance		Pile resistance			
	$q_{c;I;gem}$	$q_{c;II;gem}$	$q_{c;III;gem}$	$q_{b;max}$	$R_{b;cal;max}$	$q_{s;max;av}$ [4)]	$R_{s;cal;max}$	$R_{c;k}$	$R_{c;d}$	$F_{nk;d}$	$R_{c;net;d}$
[m NAP]	[MPa]	[MPa]	[MPa]	[MPa]	[kN]	[kPa]	[kN]	[kN]	[kN]	[kN]	[kN]
-24.0	10.0	9.9	2.3	3.9	950	65.79	1396	1688	1406	388	1018
-24.5	35.2	34.6	3.4	12.1	2973	67.18	1483	3206	2672	388	2283
-25.0	38.5	38.0	7.2	14.3	3524	69.77	1601	3687	3073	388	2685
-25.5	41.5	41.5	11.2	15.0	3695	72.16	1720	3895	3246	388	2858
-26.0	60.5	58.6	15.9	15.0	3695	74.39	1838	3980	3317	388	2929
-26.5	59.1	29.3	15.6	15.0	3695	76.46	1959	4067	3389	388	3001
-27.0	56.8	29.5	18.7	15.0	3695	78.4	2077	4152	3460	388	3072
-27.5	54.0	29.6	21.8	15.0	3695	80.21	2196	4238	3531	388	3143
-28.0	50.1	29.6	24.7	15.0	3695	81.91	2314	4323	3602	388	3214
-28.5	41.1	36.2	27.2	15.0	3695	83.5	2433	4408	3673	388	3285
-29.0	57.5	56.0	30.3	15.0	3695	85.01	2551	4493	3744	388	3356

4)The average maximum shaft friction in the positive friction zone.

CPT and bearing capacity



Pile settlement (SLS):

Pile tip level	SLS loads			Distributed capacity		Pile settlement/ spring stiffness				
	$F_{c;k}$	$F_{nk;k}$	$F_{c;k;tot}$	$R_{b;k}$	$R_{s;k}$	S_{el}	S_b	S_1	K_b	K_1
[m NAP]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm]	[mm]	[mm]	[kN/mm]	[kN/mm]
-24.0	713	388	1101	683	1005	3.6	4.3	7.9	253	139
-24.5	1598	388	1987	2139	1067	7.9	6.1	14.0	324	142
-25.0	1879	388	2267	2535	1152	9.4	6.2	15.6	364	145
-25.5	2000	388	2389	2658	1237	10.1	6.1	16.3	390	147
-26.0	2050	388	2438	2658	1322	10.5	6.0	16.5	409	148
-26.5	2101	388	2489	2658	1409	10.9	5.8	16.7	430	149
-27.0	2151	388	2539	2658	1495	11.3	5.6	17.0	451	150
-27.5	2200	388	2588	2658	1580	11.7	5.5	17.2	472	150
-28.0	2250	388	2638	2658	1665	12.2	5.3	17.5	494	151
-28.5	2300	388	2688	2658	1750	12.6	5.2	17.8	517	151
-29.0	2349	388	2738	2658	1835	13.0	5.1	18.1	540	151

PileCore CPT results for S03			CEMS
X coordinate* [m]:	123774.0	Excavation level [m NAP]:	N.A.
Y coordinate* [m]:	483449.0	$\rho_{sur;rep}$ $[kN/m^2]$	0.0
Groundwater level [m NAP]:	-0.4	ξ [-]	1.39
Surface level [m NAP]:	-0.25	qc-reduction:	N.A.

* The x and y coordinates of the CPT need to be in a Cartesian metric coordinate system.

Soil classification:

Soil code	Bottom	Thickness	γ_{unsat}	γ_{sat}	Φ'
[-]	[m NAP]	[m]	$[kN/m^3]$	$[kN/m^3]$	[°]
Zk7s1	-0.33	0.08	19.0	21.0	30.0
Zk7s1	-13.34	13.01	19.0	21.0	30.0
Zs1	-14.94	1.6	18.0	20.0	27.0
Zs1	-15.74	0.8	18.0	20.0	27.0
Zs1	-16.84	1.1	18.0	20.0	27.0
Zs1	-19.64	2.8	18.0	20.0	27.0
Zk3s2	-24.33	4.69	18.0	20.0	25.0
Zs1	-25.73	1.4	18.0	20.0	27.0
Zs1	-27.32	1.59	18.0	20.0	27.0
Zs1	-28.91	1.59	18.0	20.0	27.0
Zs1	-32.38	3.47	18.0	20.0	27.0
Zs1	-35.41	3.03	18.0	20.0	27.0

Friction range:

Pile tip level	Negative friction range [m NAP]		Positive friction range [m NAP]	
[m NAP]	Top	Bottom	Top	Bottom
-24.0	-0.25	-0.25	-0.25	-23.99
-24.5	-0.25	-0.25	-0.25	-24.51
-25.0	-0.25	-0.25	-0.25	-25.01
-25.5	-0.25	-0.25	-0.25	-25.51
-26.0	-0.25	-0.25	-0.25	-26.0
-26.5	-0.25	-0.25	-0.25	-26.5
-27.0	-0.25	-0.25	-0.25	-27.0
-27.5	-0.25	-0.25	-0.25	-27.5
-28.0	-0.25	-0.25	-0.25	-27.99
-28.5	-0.25	-0.25	-0.25	-28.49
-29.0	-0.25	-0.25	-0.25	-29.01

Negative skin friction[1)] :

Soil code	Bottom	Thickness	Average circum. [2]	$\sigma'_{v;rep}$	δ_k	$K_{0;k}$ [3]	$F_{nk;d}$
[-]	[m NAP]	[m]	[m]	$[kN/m^2]$	[°]	[-]	[kN]

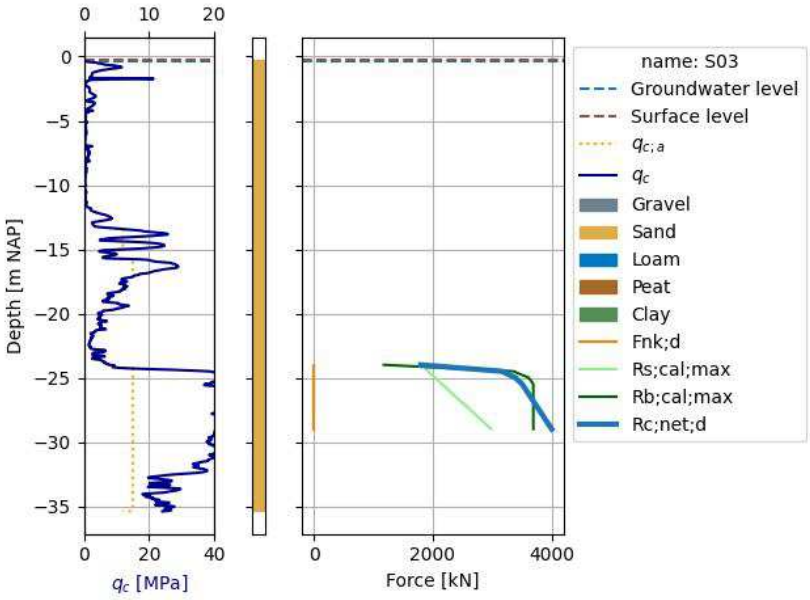
1) The results in this table are presented for the specific case when the pile-tip level is at -29.0 m NAP.
2) The average circumference of the pile per soil layer.
3) A minimum value of 0.25 for the product $K_{0;k}\tan(\delta_{j;k})$ is applied in the calculations (7.3.2.2(7)(d)).

Pile bearing capacity (ULS):

Pile tip level	Base resistance					Shaft resistance		Pile resistance			
	$q_{c;I;gem}$	$q_{c;II;gem}$	$q_{c;III;gem}$	$q_{b;max}$	$R_{b;cal;max}$	$q_{s;max;av}$ [4]	$R_{s;cal;max}$	$R_{c;k}$	$R_{c;d}$	$F_{nk;d}$	$R_{c;net;d}$
[m NAP]	[MPa]	[MPa]	[MPa]	[MPa]	[kN]	[kPa]	[kN]	[kN]	[kN]	[kN]	[kN]
-24.0	13.0	12.9	2.2	4.8	1173	43.6	1821	2154	1795	0	1795
-24.5	41.5	36.9	4.1	13.6	3356	45.01	1918	3794	3162	0	3162
-25.0	40.4	36.9	8.0	14.7	3617	46.83	2036	4067	3389	0	3389
-25.5	45.5	45.4	11.9	15.0	3695	48.57	2154	4208	3507	0	3507
-26.0	51.5	40.0	16.0	15.0	3695	50.24	2273	4293	3577	0	3577
-26.5	49.1	39.5	20.2	15.0	3695	51.85	2391	4378	3648	0	3648
-27.0	45.9	39.7	24.3	15.0	3695	53.41	2512	4465	3721	0	3721
-27.5	43.1	38.3	28.0	15.0	3695	54.9	2630	4550	3791	0	3791
-28.0	42.2	37.7	31.6	15.0	3695	56.34	2748	4635	3862	0	3862
-28.5	41.1	37.7	35.2	15.0	3695	57.73	2866	4719	3933	0	3933
-29.0	39.3	37.7	37.4	15.0	3695	59.13	2986	4806	4005	0	4005

4)The average maximum shaft friction in the positive friction zone.

CPT and bearing capacity



Pile settlement (SLS):

Pile tip level	SLS loads			Distributed capacity		Pile settlement/ spring stiffness				
	$F_{c;k}$	$F_{nk;k}$	$F_{c;k;tot}$	$R_{b;k}$	$R_{s;k}$	S_{el}	S_b	S_1	K_b	K_1
[m NAP]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm]	[mm]	[mm]	[kN/mm]	[kN/mm]
-24.0	1256	0	1256	844	1310	4.3	3.1	7.4	403	169
-24.5	2213	0	2213	2415	1380	8.8	4.9	13.7	452	162
-25.0	2372	0	2372	2602	1465	9.7	4.9	14.6	481	163
-25.5	2455	0	2455	2658	1550	10.2	4.9	15.1	506	163
-26.0	2504	0	2504	2658	1635	10.6	4.7	15.3	528	163
-26.5	2554	0	2554	2658	1720	11.0	4.6	15.6	551	164
-27.0	2605	0	2605	2658	1807	11.4	4.5	15.9	575	164
-27.5	2654	0	2654	2658	1892	11.8	4.4	16.2	599	164
-28.0	2704	0	2704	2658	1977	12.2	4.3	16.5	623	164
-28.5	2753	0	2753	2658	2062	12.6	4.2	16.8	648	163
-29.0	2804	0	2804	2658	2148	13.0	4.2	17.2	674	163

PileCore CPT results for S01			CEMS
X coordinate* [m]:	123805.0	Excavation level [m NAP]:	N.A.
Y coordinate* [m]:	483464.0	$\rho_{sur;rep}$ $[kN/m^2]$	0.0
Groundwater level [m NAP]:	-0.4	ξ [-]	1.39
Surface level [m NAP]:	-0.22	qc-reduction:	N.A.

* The x and y coordinates of the CPT need to be in a Cartesian metric coordinate system.

Soil classification:

Soil code	Bottom	Thickness	γ_{unsat}	γ_{sat}	Φ'
[-]	[m NAP]	[m]	$[kN/m^3]$	$[kN/m^3]$	[°]
Ks2	-1.5	1.28	21.0	21.0	27.5
Ks2	-4.72	3.22	21.0	21.0	27.5
Kv2s1	-6.12	1.4	16.0	16.0	15.0
Ks1	-6.82	0.7	21.0	21.0	27.5
Zk6s2	-10.22	3.4	19.0	21.0	30.0
Ks2	-11.22	1.0	18.0	18.0	22.5
Kv4s1	-11.62	0.4	15.0	15.0	15.0
Zs1k1	-13.91	2.3	18.0	20.0	27.0
Zs1	-19.2	5.29	18.0	20.0	27.0
Zs2	-23.29	4.09	18.0	20.0	27.0
Zs1	-25.08	1.79	18.0	20.0	27.0
Zs1	-25.58	0.5	18.0	20.0	27.0
Zs1	-28.47	2.88	18.0	20.0	27.0
Zs1	-33.53	5.06	18.0	20.0	27.0
Zs1	-35.46	1.94	18.0	20.0	27.0

Friction range:

Pile tip level	Negative friction range [m NAP]		Positive friction range [m NAP]	
[m NAP]	Top	Bottom	Top	Bottom
-24.0	-0.22	-11.62	-11.62	-24.01
-24.5	-0.22	-11.62	-11.62	-24.51
-25.0	-0.22	-11.62	-11.62	-25.0
-25.5	-0.22	-11.62	-11.62	-25.5
-26.0	-0.22	-11.62	-11.62	-26.0
-26.5	-0.22	-11.62	-11.62	-26.5
-27.0	-0.22	-11.62	-11.62	-27.0
-27.5	-0.22	-11.62	-11.62	-27.49
-28.0	-0.22	-11.62	-11.62	-27.99
-28.5	-0.22	-11.62	-11.62	-28.51
-29.0	-0.22	-11.62	-11.62	-29.0

Negative skin friction[1)] :

Soil code	Bottom	Thickness	Average circum. [2]	$\sigma'_{v;rep}$	δ_k	$K_{0;k}$ [3]	$F_{nk;d}$
[-]	[m NAP]	[m]	[m]	$[kN/m^2]$	[°]	[-]	[kN]
Ks2	-1.5	1.28	1.76	8.7	27.5	0.5	6
Ks2	-4.72	3.22	1.76	34.0	27.5	0.5	54
Kv2s1	-6.12	1.4	1.76	56.4	15.0	0.7	35
Ks1	-6.82	0.7	1.76	64.6	27.5	0.5	22
Zk6s2	-10.22	3.4	1.76	87.5	30.0	0.5	151
Ks2	-11.22	1.0	1.76	110.6	22.5	0.6	50
Kv4s1	-11.62	0.4	1.76	115.8	15.0	0.7	19

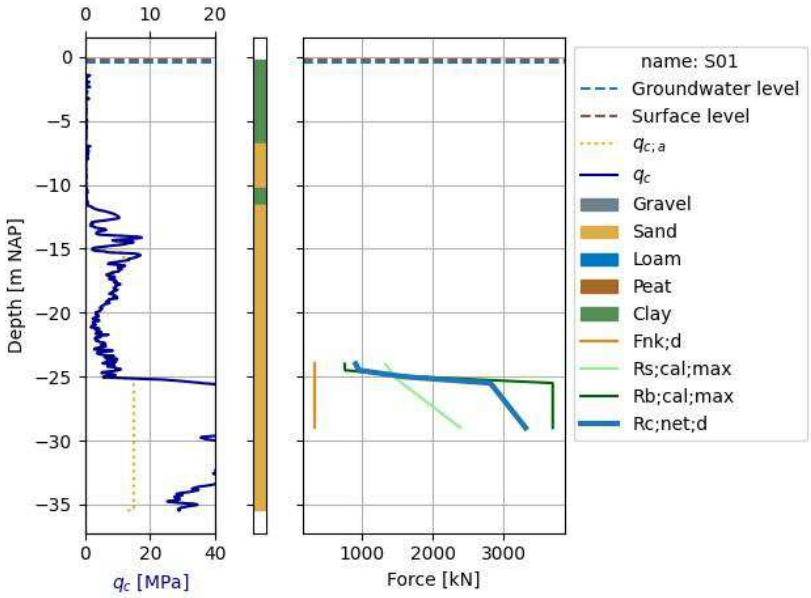
1) The results in this table are presented for the specific case when the pile-tip level is at -29.0 m NAP.
2) The average circumference of the pile per soil layer.
3) A minimum value of 0.25 for the product $K_{0;k}\tan(\delta_{j;k})$ is applied in the calculations (7.3.2.2(7)(d)).

Pile bearing capacity (ULS):

Pile tip level	Base resistance					Shaft resistance		Pile resistance			
	$q_{c;I;gem}$	$q_{c;II;gem}$	$q_{c;III;gem}$	$q_{b;max}$	$R_{b;cal;max}$	$q_{s;max;av}$ [4]	$R_{s;cal;max}$	$R_{c;k}$	$R_{c;d}$	$F_{nk;d}$	$R_{c;net;d}$
[m NAP]	[MPa]	[MPa]	[MPa]	[MPa]	[kN]	[kPa]	[kN]	[kN]	[kN]	[kN]	[kN]
-24.0	8.2	5.3	3.0	3.0	751	60.83	1326	1494	1245	337	908
-24.5	7.5	5.4	3.3	3.1	758	61.59	1396	1550	1291	337	954
-25.0	18.8	18.8	3.7	7.1	1748	61.82	1456	2305	1921	337	1584
-25.5	50.4	44.1	6.1	15.0	3695	63.95	1560	3780	3150	337	2813
-26.0	50.9	44.6	10.5	15.0	3695	66.41	1678	3865	3221	337	2884
-26.5	49.0	44.6	15.2	15.0	3695	68.7	1799	3952	3293	337	2956
-27.0	46.4	44.6	19.8	15.0	3695	70.85	1917	4037	3364	337	3027
-27.5	47.8	35.6	20.6	15.0	3695	72.86	2035	4122	3435	337	3098
-28.0	45.7	35.8	24.0	15.0	3695	74.75	2153	4207	3506	337	3169
-28.5	43.9	35.8	27.4	15.0	3695	76.6	2273	4293	3578	337	3241
-29.0	42.3	35.9	30.8	15.0	3695	78.27	2391	4378	3649	337	3312

4)The average maximum shaft friction in the positive friction zone.

CPT and bearing capacity



Pile settlement (SLS):

Pile tip level	SLS loads			Distributed capacity		Pile settlement/ spring stiffness				
	$F_{c;k}$	$F_{nk;k}$	$F_{c;k;tot}$	$R_{b;k}$	$R_{s;k}$	S_{el}	S_b	S_1	K_b	K_1
[m NAP]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm]	[mm]	[mm]	[kN/mm]	[kN/mm]
-24.0	636	337	973	540	954	3.2	4.0	7.2	244	136
-24.5	668	337	1005	546	1004	3.4	3.9	7.2	259	139
-25.0	1109	337	1446	1257	1048	5.5	5.0	10.5	287	137
-25.5	1969	337	2306	2658	1122	9.9	6.3	16.2	368	143
-26.0	2019	337	2356	2658	1207	10.3	6.1	16.4	387	144
-26.5	2069	337	2406	2658	1294	10.7	5.9	16.6	407	145
-27.0	2119	337	2456	2658	1379	11.1	5.8	16.9	427	146
-27.5	2168	337	2506	2658	1464	11.5	5.6	17.1	448	146
-28.0	2218	337	2555	2658	1549	11.9	5.4	17.4	469	147
-28.5	2269	337	2606	2658	1635	12.4	5.3	17.6	492	148
-29.0	2318	337	2655	2658	1720	12.8	5.2	17.9	514	148

PileCore CPT results for S05			CEMS
X coordinate* [m]:	123778.0	Excavation level [m NAP]:	N.A.
Y coordinate* [m]:	483481.0	$\rho_{sur;rep}$ $[kN/m^2]$	0.0
Groundwater level [m NAP]:	-0.4	ξ [-]	1.39
Surface level [m NAP]:	0.2	qc-reduction:	N.A.

* The x and y coordinates of the CPT need to be in a Cartesian metric coordinate system.

Soil classification:

Soil code	Bottom	Thickness	γ_{unsat}	γ_{sat}	Φ'
[-]	[m NAP]	[m]	$[kN/m^3]$	$[kN/m^3]$	[°]
Zs1k1	0.12	0.08	19.0	21.0	32.5
Zs1k1	-0.5	0.62	19.0	21.0	32.5
Zs1	-4.6	4.1	19.0	21.0	32.5
Kz5s2	-11.9	7.3	20.0	20.0	32.5
Zs1	-18.49	6.6	18.0	20.0	27.0
Zs1	-25.39	6.89	18.0	20.0	27.0
Zs1	-26.78	1.4	18.0	20.0	27.0
Zs1	-31.27	4.49	18.0	20.0	27.0
Zs1	-32.77	1.5	18.0	20.0	27.0
Zs1	-35.04	2.27	18.0	20.0	27.0

Friction range:

Pile tip level	Negative friction range [m NAP]		Positive friction range [m NAP]	
[m NAP]	Top	Bottom	Top	Bottom
-24.0	0.2	-11.9	-11.9	-24.01
-24.5	0.2	-11.9	-11.9	-24.51
-25.0	0.2	-11.9	-11.9	-25.0
-25.5	0.2	-11.9	-11.9	-25.5
-26.0	0.2	-11.9	-11.9	-26.0
-26.5	0.2	-11.9	-11.9	-26.5
-27.0	0.2	-11.9	-11.9	-27.0
-27.5	0.2	-11.9	-11.9	-27.5
-28.0	0.2	-11.9	-11.9	-28.0
-28.5	0.2	-11.9	-11.9	-28.5
-29.0	0.2	-11.9	-11.9	-29.0

Negative skin friction[1)] :

Soil code	Bottom	Thickness	Average circum. [2)]	$\sigma'_{v;rep}$	δ_k	$K_{0;k}$[3)]	$F_{nk;d}$
[-]	[m NAP]	[m]	[m]	$[kN/m^2]$	[°]	[-]	[kN]
Zs1k1	0.12	0.08	1.76	0.6	32.5	0.5	0
Zs1k1	-0.5	0.62	1.76	7.2	32.5	0.5	2
Zs1	-4.6	4.1	1.76	35.3	32.5	0.5	75
Kz5s2	-11.9	7.3	1.76	95.7	32.5	0.5	360

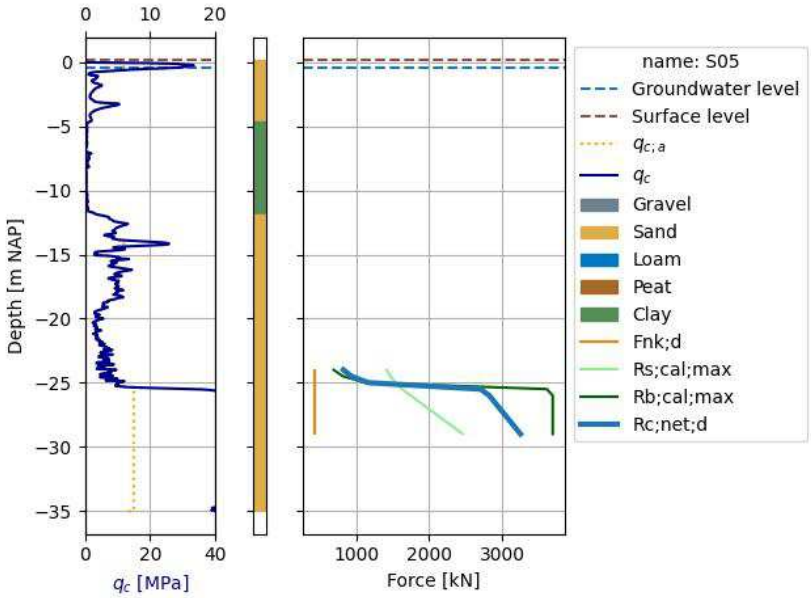
1) The results in this table are presented for the specific case when the pile-tip level is at -29.0 m NAP.
2) The average circumference of the pile per soil layer.
3) A minimum value of 0.25 for the product $K_{0;k} \tan(\delta_{j;k})$ is applied in the calculations (7.3.2.2(7)(d)).

Pile bearing capacity (ULS):

Pile tip level	Base resistance					Shaft resistance		Pile resistance			
	$q_{c;I;gem}$	$q_{c;II;gem}$	$q_{c;III;gem}$	$q_{b;max}$	$R_{b;cal;max}$	$q_{s;max;av}$ [4)]	$R_{s;cal;max}$	$R_{c;k}$	$R_{c;d}$	$F_{nk;d}$	$R_{c;net;d}$
[m NAP]	[MPa]	[MPa]	[MPa]	[MPa]	[kN]	[kPa]	[kN]	[kN]	[kN]	[kN]	[kN]
-24.0	6.8	4.7	3.2	2.8	690	66.43	1414	1514	1262	438	824
-24.5	7.6	6.6	3.4	3.3	818	66.28	1470	1646	1372	438	934
-25.0	10.8	10.6	4.0	4.6	1137	66.68	1536	1923	1603	438	1165
-25.5	41.5	41.1	5.3	14.7	3614	68.12	1628	3771	3142	438	2704
-26.0	43.2	42.6	9.5	15.0	3695	70.49	1746	3914	3262	438	2824
-26.5	49.1	49.1	13.9	15.0	3695	72.69	1865	3999	3333	438	2895
-27.0	59.6	54.9	19.1	15.0	3695	74.75	1983	4085	3404	438	2966
-27.5	58.1	54.8	24.8	15.0	3695	76.68	2104	4172	3476	438	3038
-28.0	57.3	54.9	30.5	15.0	3695	78.48	2223	4257	3547	438	3109
-28.5	56.1	51.4	34.9	15.0	3695	80.18	2341	4342	3619	438	3180
-29.0	55.2	51.5	40.1	15.0	3695	81.78	2460	4427	3690	438	3251

4)The average maximum shaft friction in the positive friction zone.

CPT and bearing capacity



Pile settlement (SLS):

Pile tip level	SLS loads			Distributed capacity		Pile settlement/ spring stiffness				
	$F_{c;k}$	$F_{nk;k}$	$F_{c;k;tot}$	$R_{b;k}$	$R_{s;k}$	S_{el}	S_b	S_1	K_b	K_1
[m NAP]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm]	[mm]	[mm]	[kN/mm]	[kN/mm]
-24.0	576	438	1015	497	1017	3.1	4.1	7.2	249	140
-24.5	654	438	1092	588	1058	3.5	4.2	7.7	261	141
-25.0	815	438	1253	818	1105	4.4	4.5	8.9	278	141
-25.5	1893	438	2331	2600	1171	9.9	6.3	16.2	368	144
-26.0	1977	438	2415	2658	1256	10.5	6.2	16.6	390	145
-26.5	2026	438	2464	2658	1342	10.9	6.0	16.9	410	146
-27.0	2076	438	2514	2658	1427	11.3	5.9	17.1	430	147
-27.5	2127	438	2565	2658	1514	11.7	5.7	17.4	451	147
-28.0	2177	438	2615	2658	1599	12.1	5.5	17.7	472	148
-28.5	2226	438	2664	2658	1684	12.5	5.4	17.9	494	149
-29.0	2276	438	2714	2658	1770	13.0	5.3	18.2	516	149

PileCore results for user defined CPT Group

CPT[1)]	X coordinate[2)]	Y coordinate[2)]	Surface level	Groundwater level	Excavation level	$\rho_{sur;rep}$
	[m]	[m]	[m NAP]	[m NAP]	[m NAP]	[kN/m^2]
S07	123787.00	483465.00	0.12	-0.4	0.12	0
S06	123789.00	483485.00	0.18	-0.4	0.18	0
S02	123797.00	483441.00	-0.63	-0.4	-0.63	0
S04	123759.00	483465.00	-0.15	-0.4	-0.15	0
S03	123774.00	483449.00	-0.25	-0.4	-0.25	0
S01	123805.00	483464.00	-0.22	-0.4	-0.22	0
S05	123778.00	483481.00	0.2	-0.4	0.2	0

1) Other input parameters that are used to calculate the bearing capacity (e.g. positive skin friction trajectory) can be found in the individual CPT results report.
2) The x and y coordinates of the CPT need to be in a Cartesian metric coordinate system.

Pile Tip Level	$R_{c;cal;mean}$	$R_{c;cal;min}$	Factor	Var. co-eff	Nominal CPT	$R_{c;k}$	$R_{c;d}$	$F_{nk;d}$[3)]	$R_{c;net;d}$	ξ[4)]
[m NAP]	[kN]	[kN]	[-]	[%]	[-]	[kN]	[kN]	[kN]	[kN]	[-]
-24.0	2102	839	4	30.5	S02	603	503	1348	0	1.39
-24.5	3006	2154	4	43.0	S01	1550	1291	337	954	1.39
-25.0	3521	2339	4	37.3	S06	1683	1402	341	1062	1.39
-25.5	5078	3218	4	16.7	S02	2315	1929	1348	581	1.39
-26.0	5308	4033	4	11.3	S02	3993	3327	1348	1979	1.01
-26.5	5442	4256	4	10.3	S02	4214	3511	1348	2164	1.01
-27.0	5561	4374	4	10.1	S02	4331	3609	1348	2261	1.01
-27.5	5680	4493	4	9.9	S02	4448	3707	1348	2359	1.01
-28.0	5798	4611	3	9.7	Group av.	4565	3804	457	3348	1.27
-28.5	5917	4732	3	9.5	Group av.	4659	3883	457	3426	1.27
-29.0	6036	4851	3	9.3	Group av.	4753	3961	457	3504	1.27

3) The design negative friction force is based on the Nominal CPT. If the 3 factor is applied, the friction force is the group average.
4) The values are related to the net pile bearing capacity (NEN9997-1 7.6.2.3). Based on the lowest outcome of Rc;net;d, this can either be a 3 or 4 value (based on the nominal CPT). In case the variation coefficient is above 12

Pile settlement (SLS):

Pile tip level	SLS loads			Distributed capacity		Pile settlement/ spring stiffness				
	$F_{c;k}$	$F_{nk;k}$	$F_{c;k;tot}$	$R_{b;k}$	$R_{s;k}$	S_{el}	S_b	S_1	K_b	K_1
[m NAP]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm]	[mm]	[mm]	[kN/mm]	[kN/mm]
-24.0	0	1348	1348	599	4	2.2	1000.0	1002.2	1	1
-24.5	668	337	1005	546	1004	3.4	3.9	7.2	259	139
-25.0	743	341	1084	604	1079	3.8	3.9	7.6	281	142
-25.5	407	1348	1755	2082	234	4.6	18.2	22.8	97	77
-26.0	1385	1348	2733	3554	438	6.5	12.7	19.2	216	143
-26.5	1514	1348	2862	3658	556	7.2	11.9	19.1	241	150
-27.0	1583	1348	2931	3658	673	7.6	11.2	18.8	263	156
-27.5	1651	1348	2999	3658	791	8.1	10.5	18.5	287	162

-28.0	2343	457	2800	2909	1656	11.6	5.7	17.2	495	162
-28.5	2398	457	2855	2909	1750	12.0	5.5	17.5	519	163
-29.0	2453	457	2909	2909	1844	12.4	5.4	17.8	543	163

PileCore results			
Project:	Duivendrechtsekade 50	Author:	5.1.1.d
Number:	23378	Date:	29-11-23
PileCore Version:	2.6.5		

Pile properties:

Name:		Reference NEN9997-1
Type:	betonpaal	Table 7.c
Description:	In de grond gevormd met een gladde mantelbuis op een schroefpunt, waarbij het beton direct tegen de grond drukt	Table 7.c
Installation:	Geschroefd; bij het trekken van de mantelbuis blijft de schroefpunt in de grond achter	Table 7.c
Shaft size:	rond 680 mm	
Base size:	rond 680 mm	
Height pile base [mm]:	0.0	Figure 7.h
$E_{pile;nom}[GPa]$:	20.0	

Pile factors:		Reference NEN9997-1	Safety factors:		Reference NEN9997-1
α_p:	0.63	Table 7.c	$\gamma_{F;nk}$:	1.0	7.3.2.2(7)(b)
$\alpha_{s;sand}$:	0.009	Table 7.c	$\gamma_{R;b}$:	1.2	A.3.3.2
$\alpha_{s;clay}$:	0.009	Table 7.d	$\gamma_{R;s}$:	1.2	A.3.3.2
β_p:	1.0	7.6.2.3. (10)(g)			
Pile factor s:	1.0	7.6.2.3. (10)(h)			
Settlement curve:	1	Table 7.c			
$\delta_{j;k}$:	1.0 $\varphi'_{j;k}$	7.3.2.2 (7)(d)			

Result Summary

CPT	Pile Tip Level	Bearing capacity		Spring stiffness		
		$F_{nk;d}$	$R_{c;net;d}$	$F_{c;k;tot}$	$K_b^{1)}$	$K_1^{2)}$
[-]	[m NAP]	[kN]	[kN]	[kN]	[kN/mm]	[kN/mm]
S07	-24.0	419	1332	1352	286	172
S07	-24.5	419	1419	1413	304	177
S07	-25.0	419	2201	1960	332	176
S07	-25.5	419	4017	3231	424	187
S07	-26.0	419	4103	3291	445	189
S07	-26.5	419	4190	3352	467	191
S07	-27.0	419	4276	3413	489	193
S07	-27.5	419	4363	3474	512	194
S07	-28.0	419	4449	3534	535	196
S07	-28.5	419	4536	3595	560	197
S07	-29.0	419	4621	3654	585	198
S06	-24.0	413	1255	1292	290	174
S06	-24.5	413	1324	1340	304	178
S06	-25.0	413	1602	1535	322	179
S06	-25.5	413	3999	3213	419	186
S06	-26.0	413	4086	3273	440	188
S06	-26.5	413	4172	3334	461	190
S06	-27.0	413	4258	3394	483	191
S06	-27.5	413	4345	3455	506	193
S06	-28.0	413	4431	3515	529	195
S06	-28.5	413	4517	3575	554	196
S06	-29.0	413	4605	3637	579	197
S02	-24.0	1637	0	1637	2	2
S02	-24.5	1637	363	1891	70	64
S02	-25.0	1637	619	2070	88	77
S02	-25.5	1637	1187	2468	125	100
S02	-26.0	1637	1742	2856	164	120
S02	-26.5	1637	1978	3021	186	129
S02	-27.0	1637	2124	3124	203	135
S02	-27.5	1637	2210	3184	217	140
S02	-28.0	1637	2297	3244	233	144
S02	-28.5	1637	2385	3306	250	149
S02	-29.0	1637	2471	3366	269	154
S04	-24.0	471	1469	1500	289	174
S04	-24.5	471	3247	2744	367	183
S04	-25.0	471	3742	3091	409	189
S04	-25.5	471	4047	3304	441	192
S04	-26.0	471	4133	3364	462	194
S04	-26.5	471	4221	3426	484	196
S04	-27.0	471	4307	3486	507	198
S04	-27.5	471	4393	3546	530	199
S04	-28.0	471	4479	3607	554	201
S04	-28.5	471	4566	3667	579	202
S04	-29.0	471	4652	3728	604	203
S03	-24.0	0	2571	1800	455	218
S03	-24.5	0	4332	3033	502	212
S03	-25.0	0	4602	3221	533	214
S03	-25.5	0	4834	3384	563	215
S03	-26.0	0	4920	3444	587	217
S03	-26.5	0	5007	3505	613	218
S03	-27.0	0	5094	3566	640	219

S03	-27.5	0	5180	3626	667	220
S03	-28.0	0	5266	3686	694	220
S03	-28.5	0	5352	3746	723	221
S03	-29.0	0	5440	3808	753	221
S01	-24.0	409	1207	1254	278	171
S01	-24.5	409	1259	1291	296	176
S01	-25.0	409	2377	2073	327	174
S01	-25.5	409	3992	3204	417	187
S01	-26.0	409	4078	3264	437	189
S01	-26.5	409	4166	3325	459	191
S01	-27.0	409	4252	3386	481	192
S01	-27.5	409	4338	3446	503	194
S01	-28.0	409	4424	3506	527	195
S01	-28.5	409	4512	3567	551	197
S01	-29.0	409	4598	3628	576	198
S05	-24.0	532	1099	1301	285	177
S05	-24.5	532	1299	1441	299	178
S05	-25.0	532	1775	1774	318	178
S05	-25.5	532	3832	3215	417	187
S05	-26.0	532	4005	3336	441	190
S05	-26.5	532	4091	3396	462	192
S05	-27.0	532	4178	3456	484	193
S05	-27.5	532	4266	3518	507	195
S05	-28.0	532	4352	3578	530	196
S05	-28.5	532	4438	3639	554	198
S05	-29.0	532	4525	3699	579	199

1) Spring stiffness not taking elastic deformation of the pile into account
2) Spring stiffness including elastic deformation of the pile

PileCore CPT results for S07			CEMS
X coordinate* [m]:	123787.0	Excavation level [m NAP]:	N.A.
Y coordinate* [m]:	483465.0	$\rho_{sur;rep}$ $[kN/m^2]$	0.0
Groundwater level [m NAP]:	-0.4	ξ [-]	1.39
Surface level [m NAP]:	0.12	qc-reduction:	N.A.

* The x and y coordinates of the CPT need to be in a Cartesian metric coordinate system.

Soil classification:

Soil code	Bottom	Thickness	γ_{unsat}	γ_{sat}	Φ'
[-]	[m NAP]	[m]	$[kN/m^3]$	$[kN/m^3]$	[°]
Zs1	0.04	0.08	19.0	21.0	32.5
Zs1	-0.58	0.62	19.0	21.0	32.5
Kv2s1	-1.08	0.5	16.0	16.0	15.0
Ks2z2	-2.98	1.9	21.0	21.0	27.5
Ks1	-3.78	0.8	21.0	21.0	27.5
Kv4s1	-6.08	2.3	16.0	16.0	15.0
Ks1v1	-6.48	0.4	21.0	21.0	27.5
Zk8s2	-10.48	4.0	19.0	21.0	30.0
Ks2	-11.18	0.7	18.0	18.0	22.5
Kv4s1	-11.68	0.5	15.0	15.0	15.0
Zs1	-13.38	1.7	18.0	20.0	27.0
Zs1	-14.27	0.9	18.0	20.0	27.0
Zs1	-19.66	5.39	18.0	20.0	27.0
Zs2k1	-23.15	3.49	18.0	20.0	27.0
Zs1	-25.24	2.09	18.0	20.0	27.0
Zs1	-26.53	1.29	18.0	20.0	27.0
Zs1	-28.7	2.18	18.0	20.0	27.0
Zs1	-32.56	3.85	18.0	20.0	27.0
Zs1	-34.77	2.21	18.0	20.0	27.0

Friction range:

Pile tip level	Negative friction range [m NAP]		Positive friction range [m NAP]	
[m NAP]	Top	Bottom	Top	Bottom
-24.0	0.12	-11.68	-11.68	-24.0
-24.5	0.12	-11.68	-11.68	-24.5
-25.0	0.12	-11.68	-11.68	-25.0
-25.5	0.12	-11.68	-11.68	-25.49
-26.0	0.12	-11.68	-11.68	-25.99
-26.5	0.12	-11.68	-11.68	-26.51
-27.0	0.12	-11.68	-11.68	-27.0
-27.5	0.12	-11.68	-11.68	-27.5
-28.0	0.12	-11.68	-11.68	-27.99
-28.5	0.12	-11.68	-11.68	-28.51
-29.0	0.12	-11.68	-11.68	-29.0

Negative skin friction[1)] :

Soil code	Bottom	Thickness	Average circum. [2]	$\sigma'_{v;rep}$	δ_k	$K_{0;k}$ [3]	$F_{nk;d}$
[-]	[m NAP]	[m]	[m]	$[kN/m^2]$	[°]	[-]	[kN]
Zs1	0.04	0.08	2.14	0.8	32.5	0.5	0
Zs1	-0.58	0.62	2.14	7.4	32.5	0.5	3
Kv2s1	-1.08	0.5	2.14	13.5	15.0	0.7	4
Ks2z2	-2.98	1.9	2.14	25.5	27.5	0.5	29
Ks1	-3.78	0.8	2.14	40.7	27.5	0.5	20
Kv4s1	-6.08	2.3	2.14	52.3	15.0	0.7	64
Ks1v1	-6.48	0.4	2.14	61.6	27.5	0.5	15
Zk8s2	-10.48	4.0	2.14	86.2	30.0	0.5	213
Ks2	-11.18	0.7	2.14	111.5	22.5	0.6	43
Kv4s1	-11.68	0.5	2.14	115.7	15.0	0.7	30

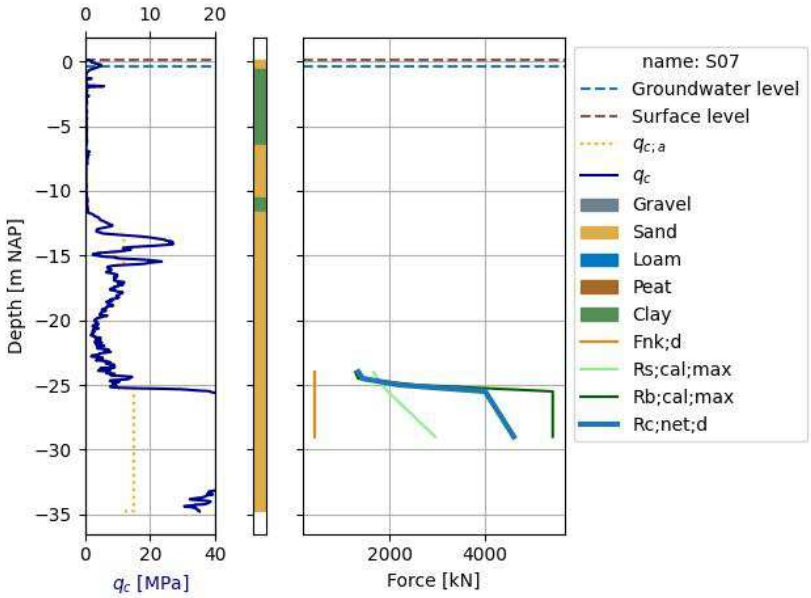
1) The results in this table are presented for the specific case when the pile-tip level is at -29.0 m NAP.
2) The average circumference of the pile per soil layer.
3) A minimum value of 0.25 for the product $K_{0;k}\tan(\delta_{j;k})$ is applied in the calculations (7.3.2.2(7)(d)).

Pile bearing capacity (ULS):

Pile tip level	Base resistance					Shaft resistance		Pile resistance			
	$q_{c;I;gem}$	$q_{c;II;gem}$	$q_{c;III;gem}$	$q_{b;max}$	$R_{b;cal;max}$	$q_{s;max;av}$ [4]	$R_{s;cal;max}$	$R_{c;k}$	$R_{c;d}$	$F_{nk;d}$	$R_{c;net;d}$
[m NAP]	[MPa]	[MPa]	[MPa]	[MPa]	[kN]	[kPa]	[kN]	[kN]	[kN]	[kN]	[kN]
-24.0	9.8	7.7	2.4	3.5	1269	62.76	1653	2102	1752	419	1332
-24.5	9.6	7.8	2.9	3.6	1323	63.68	1743	2206	1838	419	1419
-25.0	18.9	18.6	3.4	7.0	2534	64.51	1837	3145	2620	419	2201
-25.5	45.1	45.1	5.1	15.0	5448	66.13	1952	5324	4436	419	4017
-26.0	52.3	48.1	8.9	15.0	5448	68.52	2095	5426	4522	419	4103
-26.5	58.8	51.3	13.3	15.0	5448	70.84	2241	5531	4610	419	4190
-27.0	57.8	49.3	17.6	15.0	5448	72.93	2384	5634	4695	419	4276
-27.5	55.6	48.0	21.6	15.0	5448	74.88	2530	5739	4783	419	4363
-28.0	53.3	45.3	24.6	15.0	5448	76.71	2673	5842	4868	419	4449
-28.5	51.7	45.2	28.7	15.0	5448	78.5	2818	5946	4955	419	4536
-29.0	50.7	45.1	32.4	15.0	5448	80.12	2961	6049	5041	419	4621

4)The average maximum shaft friction in the positive friction zone.

CPT and bearing capacity



Pile settlement (SLS):

Pile tip level	SLS loads			Distributed capacity		Pile settlement/ spring stiffness				
	$F_{c;k}$	$F_{nk;k}$	$F_{c;k;tot}$	$R_{b;k}$	$R_{s;k}$	S_{el}	S_b	S_1	K_b	K_1
[m NAP]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm]	[mm]	[mm]	[kN/mm]	[kN/mm]
-24.0	933	419	1352	913	1189	3.1	4.7	7.8	286	172
-24.5	993	419	1413	952	1254	3.4	4.6	8.0	304	177
-25.0	1541	419	1960	1823	1322	5.2	5.9	11.1	332	176
-25.5	2812	419	3231	3919	1404	9.7	7.6	17.3	424	187
-26.0	2872	419	3291	3919	1507	10.0	7.4	17.4	445	189
-26.5	2933	419	3352	3919	1612	10.4	7.2	17.6	467	191
-27.0	2993	419	3413	3919	1715	10.7	7.0	17.7	489	193
-27.5	3054	419	3474	3919	1820	11.1	6.8	17.9	512	194
-28.0	3114	419	3534	3919	1923	11.5	6.6	18.1	535	196
-28.5	3175	419	3595	3919	2027	11.8	6.4	18.2	560	197
-29.0	3235	419	3654	3919	2130	12.2	6.2	18.4	585	198

PileCore CPT results for S06			
X coordinate* [m]:	123789.0	Excavation level [m NAP]:	N.A.
Y coordinate* [m]:	483485.0	$\rho_{sur;rep}$ $[kN/m^2]$	0.0
Groundwater level [m NAP]:	-0.4	ξ [-]	1.39
Surface level [m NAP]:	0.18	qc-reduction:	N.A.

* The x and y coordinates of the CPT need to be in a Cartesian metric coordinate system.

Soil classification:

Soil code	Bottom	Thickness	γ_{unsat}	γ_{sat}	Φ'
[-]	[m NAP]	[m]	$[kN/m^3]$	$[kN/m^3]$	[°]
Zs1	0.1	0.08	19.0	21.0	32.5
Zs1	-2.82	2.92	19.0	21.0	32.5
Kv4s1	-6.22	3.4	16.0	16.0	15.0
Kz5s2	-11.52	5.3	20.0	20.0	32.5
Zs1	-12.51	1.0	18.0	20.0	27.0
Zs1	-25.41	12.89	18.0	20.0	27.0
Zs1	-29.0	3.59	18.0	20.0	27.0
Zs1	-32.49	3.49	18.0	20.0	27.0
Zs1	-34.48	1.99	18.0	20.0	27.0
Zs1	-35.07	0.6	18.0	20.0	27.0

Friction range:

Pile tip level	Negative friction range [m NAP]		Positive friction range [m NAP]	
[m NAP]	Top	Bottom	Top	Bottom
-24.0	0.18	-11.52	-11.52	-24.01
-24.5	0.18	-11.52	-11.52	-24.51
-25.0	0.18	-11.52	-11.52	-25.01
-25.5	0.18	-11.52	-11.52	-25.51
-26.0	0.18	-11.52	-11.52	-26.0
-26.5	0.18	-11.52	-11.52	-26.5
-27.0	0.18	-11.52	-11.52	-27.0
-27.5	0.18	-11.52	-11.52	-27.5
-28.0	0.18	-11.52	-11.52	-28.0
-28.5	0.18	-11.52	-11.52	-28.5
-29.0	0.18	-11.52	-11.52	-29.0

Negative skin friction[1] :

Soil code	Bottom	Thickness	Average circum. [2]	$\sigma'_{v;rep}$	δ_k	$K_{0;k}$ [3]	$F_{nk;d}$
[-]	[m NAP]	[m]	[m]	$[kN/m^2]$	[°]	[-]	[kN]
Zs1	0.1	0.08	2.14	0.8	32.5	0.5	0
Zs1	-2.82	2.92	2.14	21.4	32.5	0.5	39
Kv4s1	-6.22	3.4	2.14	48.6	15.0	0.7	88
Kz5s2	-11.52	5.3	2.14	86.0	32.5	0.5	286

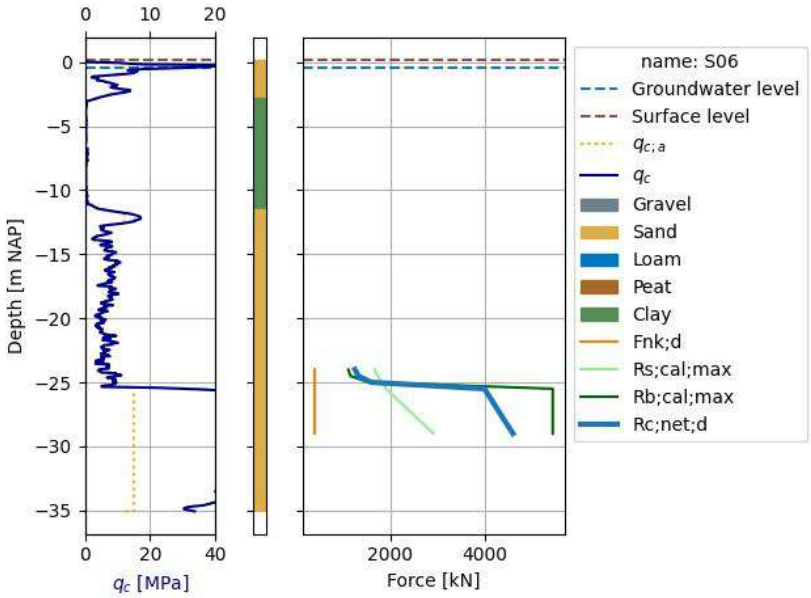
1) The results in this table are presented for the specific case when the pile-tip level is at -29.0 m NAP.
2) The average circumference of the pile per soil layer.
3) A minimum value of 0.25 for the product $K_{0;k}\tan(\delta_{j;k})$ is applied in the calculations (7.3.2.2(7)(d)).

Pile bearing capacity (ULS):

Pile tip level	Base resistance					Shaft resistance		Pile resistance			
	$q_{c;I;gem}$	$q_{c;II;gem}$	$q_{c;III;gem}$	$q_{b;max}$	$R_{b;cal;max}$	$q_{s;max;av}$ [4)]	$R_{s;cal;max}$	$R_{c;k}$	$R_{c;d}$	$F_{nk;d}$	$R_{c;net;d}$
[m NAP]	[MPa]	[MPa]	[MPa]	[MPa]	[kN]	[kPa]	[kN]	[kN]	[kN]	[kN]	[kN]
-24.0	7.9	5.0	3.3	3.1	1113	62.55	1669	2002	1668	413	1255
-24.5	8.2	5.1	3.5	3.2	1159	62.71	1738	2084	1737	413	1324
-25.0	10.8	8.8	3.6	4.2	1541	63.24	1821	2418	2015	413	1602
-25.5	48.6	48.5	4.3	15.0	5448	64.14	1913	5295	4413	413	3999
-26.0	56.6	52.6	8.3	15.0	5448	66.58	2057	5399	4499	413	4086
-26.5	57.4	52.5	12.7	15.0	5448	68.86	2201	5503	4585	413	4172
-27.0	56.6	50.9	17.0	15.0	5448	70.99	2345	5606	4672	413	4258
-27.5	55.0	49.2	20.7	15.0	5448	72.99	2489	5710	4758	413	4345
-28.0	53.7	49.2	24.9	15.0	5448	74.86	2633	5813	4844	413	4431
-28.5	53.0	49.2	29.1	15.0	5448	76.63	2777	5917	4931	413	4517
-29.0	52.1	46.5	31.8	15.0	5448	78.29	2923	6022	5019	413	4605

4)The average maximum shaft friction in the positive friction zone.

CPT and bearing capacity



Pile settlement (SLS):

Pile tip level	SLS loads			Distributed capacity		Pile settlement/ spring stiffness				
	$F_{c;k}$	$F_{nk;k}$	$F_{c;k;tot}$	$R_{b;k}$	$R_{s;k}$	S_{el}	S_b	S_1	K_b	K_1
[m NAP]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm]	[mm]	[mm]	[kN/mm]	[kN/mm]
-24.0	878	413	1292	801	1201	2.9	4.5	7.4	290	174
-24.5	926	413	1340	834	1251	3.1	4.4	7.5	304	178
-25.0	1121	413	1535	1109	1310	3.8	4.8	8.6	322	179
-25.5	2799	413	3213	3919	1376	9.6	7.7	17.3	419	186
-26.0	2860	413	3273	3919	1480	10.0	7.4	17.4	440	188
-26.5	2920	413	3334	3919	1583	10.3	7.2	17.6	461	190
-27.0	2981	413	3394	3919	1687	10.7	7.0	17.7	483	191
-27.5	3041	413	3455	3919	1790	11.1	6.8	17.9	506	193
-28.0	3102	413	3515	3919	1894	11.4	6.6	18.1	529	195
-28.5	3162	413	3575	3919	1998	11.8	6.5	18.3	554	196
-29.0	3224	413	3637	3919	2103	12.2	6.3	18.5	579	197

PileCore CPT results for S02			CEMS
X coordinate* [m]:	123797.0	Excavation level [m NAP]:	N.A.
Y coordinate* [m]:	483441.0	$\rho_{sur;rep}$ $[kN/m^2]$	0.0
Groundwater level [m NAP]:	-0.4	ξ [-]	1.39
Surface level [m NAP]:	-0.63	qc-reduction:	N.A.

* The x and y coordinates of the CPT need to be in a Cartesian metric coordinate system.

Soil classification:

Soil code	Bottom	Thickness	γ_{unsat}	γ_{sat}	Φ'
[-]	[m NAP]	[m]	$[kN/m^3]$	$[kN/m^3]$	[°]
Zs1	-1.31	0.68	19.0	21.0	32.5
Zs1	-5.13	3.82	19.0	21.0	32.5
Kv6z1	-6.23	1.1	16.0	16.0	15.0
Ks1v1	-6.73	0.5	21.0	21.0	27.5
Kz3s2	-10.73	4.0	20.0	20.0	32.5
Ks2	-12.13	1.4	18.0	18.0	22.5
Zs1	-15.53	3.4	18.0	20.0	27.0
Zs1	-16.53	1.0	18.0	20.0	27.0
Zs1	-17.53	1.0	18.0	20.0	27.0
Zs1	-19.23	1.7	18.0	20.0	27.0
Zs1	-21.53	2.3	18.0	20.0	27.0
Kz7s3	-23.92	2.4	18.0	18.0	27.5
Zs1	-24.42	0.5	18.0	20.0	27.0
Zs1	-25.82	1.4	18.0	20.0	27.0
Zs1	-32.5	6.69	18.0	20.0	27.0
Zs1	-34.0	1.5	18.0	20.0	27.0
Zs1	-35.39	1.4	18.0	20.0	27.0

Friction range:

Pile tip level	Negative friction range [m NAP]		Positive friction range [m NAP]	
[m NAP]	Top	Bottom	Top	Bottom
-24.0	-0.63	-23.92	-23.92	-24.0
-24.5	-0.63	-23.92	-23.92	-24.5
-25.0	-0.63	-23.92	-23.92	-25.0
-25.5	-0.63	-23.92	-23.92	-25.5
-26.0	-0.63	-23.92	-23.92	-25.99
-26.5	-0.63	-23.92	-23.92	-26.49
-27.0	-0.63	-23.92	-23.92	-26.99
-27.5	-0.63	-23.92	-23.92	-27.49
-28.0	-0.63	-23.92	-23.92	-27.99
-28.5	-0.63	-23.92	-23.92	-28.51
-29.0	-0.63	-23.92	-23.92	-29.01

Negative skin friction[1)] :

Soil code	Bottom	Thickness	Average circum. [2]	$\sigma'_{v;rep}$	δ_k	$K_{0;k}$ [3]	$F_{nk;d}$
[-]	[m NAP]	[m]	[m]	$[kN/m^2]$	[°]	[-]	[kN]
Zs1	-1.31	0.68	2.14	3.8	32.5	0.5	2
Zs1	-5.13	3.82	2.14	29.0	32.5	0.5	70
Kv6z1	-6.23	1.1	2.14	53.7	15.0	0.7	32
Ks1v1	-6.73	0.5	2.14	59.9	27.5	0.5	18
Kz3s2	-10.73	4.0	2.14	83.0	32.5	0.5	209
Ks2	-12.13	1.4	2.14	109.2	22.5	0.6	84
Zs1	-15.53	3.4	2.14	132.3	27.0	0.5	269
Zs1	-16.53	1.0	2.14	154.8	27.0	0.5	92
Zs1	-17.53	1.0	2.14	164.8	27.0	0.5	98
Zs1	-19.23	1.7	2.14	178.6	27.0	0.5	180
Zs1	-21.53	2.3	2.14	199.0	27.0	0.5	274
Kz7s3	-23.92	2.4	2.14	220.5	27.5	0.5	314

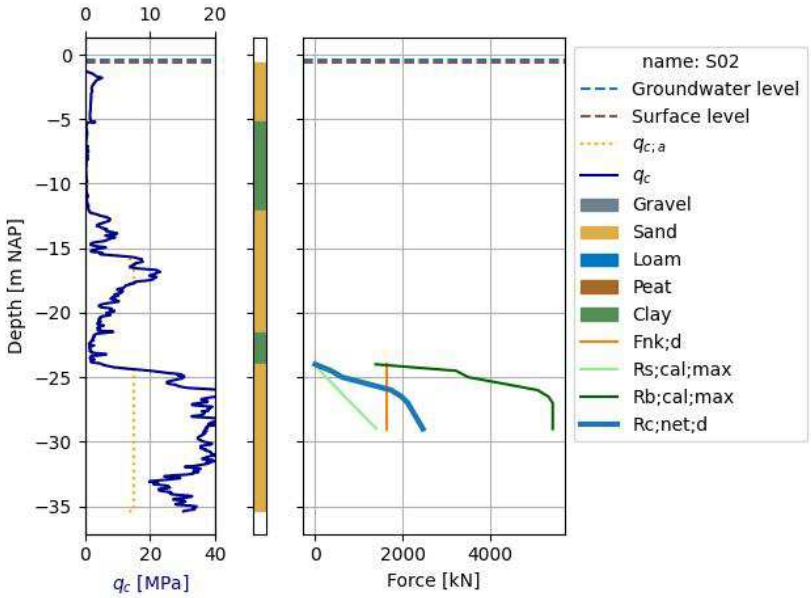
1) The results in this table are presented for the specific case when the pile-tip level is at -29.0 m NAP.
2) The average circumference of the pile per soil layer.
3) A minimum value of 0.25 for the product $K_{0;k}\tan(\delta_{j;k})$ is applied in the calculations (7.3.2.2(7)(d)).

Pile bearing capacity (ULS):

Pile tip level	Base resistance					Shaft resistance		Pile resistance			
	$q_{c;I;gem}$	$q_{c;II;gem}$	$q_{c;III;gem}$	$q_{b;max}$	$R_{b;cal;max}$	$q_{s;max;av}$ [4]	$R_{s;cal;max}$	$R_{c;k}$	$R_{c;d}$	$F_{nk;d}$	$R_{c;net;d}$
[m NAP]	[MPa]	[MPa]	[MPa]	[MPa]	[kN]	[kPa]	[kN]	[kN]	[kN]	[kN]	[kN]
-24.0	10.7	10.7	1.5	3.8	1386	44.77	8	1003	836	1637	0
-24.5	27.1	24.7	2.4	8.9	3230	86.18	106	2400	2000	1637	363
-25.0	27.3	25.2	4.5	9.7	3512	108.37	250	2707	2256	1637	619
-25.5	31.1	31.1	6.7	11.9	4316	116.69	394	3389	2824	1637	1187
-26.0	37.8	32.8	9.3	14.0	5098	121.05	538	4054	3378	1637	1742
-26.5	36.2	32.9	12.2	14.7	5347	123.73	682	4337	3615	1637	1978
-27.0	36.0	32.7	15.1	15.0	5448	125.55	826	4513	3761	1637	2124
-27.5	36.0	32.8	17.9	15.0	5448	126.86	969	4617	3847	1637	2210
-28.0	37.2	34.5	20.8	15.0	5448	127.86	1113	4720	3933	1637	2297
-28.5	36.7	34.6	23.9	15.0	5448	128.66	1260	4826	4021	1637	2385
-29.0	36.0	34.6	26.9	15.0	5448	129.28	1404	4929	4108	1637	2471

4)The average maximum shaft friction in the positive friction zone.

CPT and bearing capacity



Pile settlement (SLS):

Pile tip level	SLS loads			Distributed capacity		Pile settlement/ spring stiffness				
	$F_{c;k}$	$F_{nk;k}$	$F_{c;k;tot}$	$R_{b;k}$	$R_{s;k}$	S_{el}	S_b	S_1	K_b	K_1
[m NAP]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm]	[mm]	[mm]	[kN/mm]	[kN/mm]
-24.0	0	1637	1637	997	5	1.8	1000.0	1001.8	2	2
-24.5	254	1637	1891	2323	76	2.7	26.9	29.7	70	64
-25.0	433	1637	2070	2527	180	3.5	23.6	27.0	88	77
-25.5	831	1637	2468	3105	284	5.0	19.7	24.6	125	100
-26.0	1219	1637	2856	3667	387	6.5	17.4	23.8	164	120
-26.5	1384	1637	3021	3847	490	7.2	16.2	23.4	186	129
-27.0	1487	1637	3124	3919	594	7.8	15.4	23.1	203	135
-27.5	1547	1637	3184	3919	697	8.1	14.6	22.8	217	140
-28.0	1608	1637	3244	3919	801	8.5	13.9	22.5	233	144
-28.5	1669	1637	3306	3919	907	8.9	13.2	22.2	250	149
-29.0	1730	1637	3366	3919	1010	9.3	12.5	21.9	269	154

PileCore CPT results for S04			CEMS
X coordinate* [m]:	123759.0	Excavation level [m NAP]:	N.A.
Y coordinate* [m]:	483465.0	$\rho_{sur;rep}$ $[kN/m^2]$	0.0
Groundwater level [m NAP]:	-0.4	ξ [-]	1.39
Surface level [m NAP]:	-0.15	qc-reduction:	N.A.

* The x and y coordinates of the CPT need to be in a Cartesian metric coordinate system.

Soil classification:

Soil code	Bottom	Thickness	γ_{unsat}	γ_{sat}	Φ'
[-]	[m NAP]	[m]	$[kN/m^3]$	$[kN/m^3]$	[°]
Vk3	-0.23	0.08	12.0	12.0	15.0
Vk3	-0.25	0.02	12.0	12.0	15.0
Zs1	-2.85	2.6	19.0	21.0	32.5
Kz5s2	-11.94	9.09	20.0	20.0	32.5
Zs1	-15.63	3.69	18.0	20.0	27.0
Zs1	-16.83	1.2	18.0	20.0	27.0
Zs2k1	-24.41	7.58	18.0	20.0	27.0
Zs1	-25.8	1.4	18.0	20.0	27.0
Zs1	-32.69	6.88	18.0	20.0	27.0
Zs1	-34.86	2.17	18.0	20.0	27.0

Friction range:

Pile tip level	Negative friction range [m NAP]		Positive friction range [m NAP]	
[m NAP]	Top	Bottom	Top	Bottom
-24.0	-0.15	-11.94	-11.94	-24.01
-24.5	-0.15	-11.94	-11.94	-24.51
-25.0	-0.15	-11.94	-11.94	-25.0
-25.5	-0.15	-11.94	-11.94	-25.5
-26.0	-0.15	-11.94	-11.94	-26.0
-26.5	-0.15	-11.94	-11.94	-26.5
-27.0	-0.15	-11.94	-11.94	-27.0
-27.5	-0.15	-11.94	-11.94	-27.5
-28.0	-0.15	-11.94	-11.94	-28.0
-28.5	-0.15	-11.94	-11.94	-28.49
-29.0	-0.15	-11.94	-11.94	-28.99

Negative skin friction[1] :

Soil code	Bottom	Thickness	Average circum. [2]	$\sigma'_{v;rep}$	δ_k	$K_{0;k}$ [3]	$F_{nk;d}$
[-]	[m NAP]	[m]	[m]	$[kN/m^2]$	[°]	[-]	[kN]
Vk3	-0.23	0.08	2.14	0.4	15.0	0.7	0
Vk3	-0.25	0.02	2.14	1.0	15.0	0.7	0
Zs1	-2.85	2.6	2.14	16.8	32.5	0.5	28
Kz5s2	-11.94	9.09	2.14	77.8	32.5	0.5	443

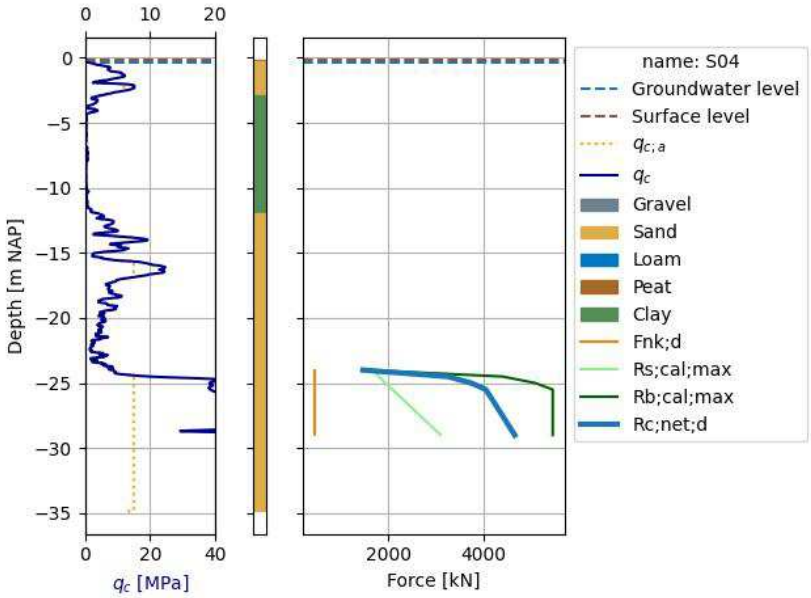
1) The results in this table are presented for the specific case when the pile-tip level is at -29.0 m NAP.
2) The average circumference of the pile per soil layer.
3) A minimum value of 0.25 for the product $K_{0;k}\tan(\delta_{j;k})$ is applied in the calculations (7.3.2.2(7)(d)).

Pile bearing capacity (ULS):

Pile tip level	Base resistance					Shaft resistance		Pile resistance			
	$q_{c;I;gem}$	$q_{c;II;gem}$	$q_{c;III;gem}$	$q_{b;max}$	$R_{b;cal;max}$	$q_{s;max;av}$ [4)]	$R_{s;cal;max}$	$R_{c;k}$	$R_{c;d}$	$F_{nk;d}$	$R_{c;net;d}$
[m NAP]	[MPa]	[MPa]	[MPa]	[MPa]	[kN]	[kPa]	[kN]	[kN]	[kN]	[kN]	[kN]
-24.0	11.3	11.3	2.2	4.2	1541	65.79	1696	2329	1940	471	1469
-24.5	35.9	34.9	3.1	12.1	4402	67.18	1801	4462	3718	471	3247
-25.0	38.5	38.0	6.2	14.0	5084	69.77	1944	5056	4214	471	3742
-25.5	43.4	43.4	9.5	15.0	5448	72.16	2088	5421	4518	471	4047
-26.0	59.6	29.2	10.6	15.0	5448	74.39	2232	5525	4604	471	4133
-26.5	58.8	29.5	13.1	15.0	5448	76.46	2379	5630	4692	471	4221
-27.0	56.8	29.5	15.7	15.0	5448	78.4	2523	5734	4778	471	4307
-27.5	54.0	29.6	18.2	15.0	5448	80.21	2666	5837	4864	471	4393
-28.0	50.1	29.6	20.7	15.0	5448	81.91	2810	5941	4951	471	4479
-28.5	42.9	38.7	23.2	15.0	5448	83.5	2954	6044	5037	471	4566
-29.0	57.5	56.0	26.7	15.0	5448	85.01	3098	6148	5123	471	4652

4)The average maximum shaft friction in the positive friction zone.

CPT and bearing capacity



Pile settlement (SLS):

Pile tip level	SLS loads			Distributed capacity		Pile settlement/ spring stiffness				
	$F_{c;k}$	$F_{nk;k}$	$F_{c;k;tot}$	$R_{b;k}$	$R_{s;k}$	S_{el}	S_b	S_1	K_b	K_1
[m NAP]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm]	[mm]	[mm]	[kN/mm]	[kN/mm]
-24.0	1028	471	1500	1109	1220	3.4	5.2	8.6	289	174
-24.5	2273	471	2744	3167	1295	7.5	7.5	15.0	367	183
-25.0	2620	471	3091	3657	1399	8.8	7.6	16.4	409	189
-25.5	2833	471	3304	3919	1502	9.7	7.5	17.2	441	192
-26.0	2893	471	3364	3919	1606	10.0	7.3	17.3	462	194
-26.5	2954	471	3426	3919	1711	10.4	7.1	17.5	484	196
-27.0	3015	471	3486	3919	1815	10.8	6.9	17.6	507	198
-27.5	3075	471	3546	3919	1918	11.1	6.7	17.8	530	199
-28.0	3135	471	3607	3919	2022	11.5	6.5	18.0	554	201
-28.5	3196	471	3667	3919	2125	11.8	6.3	18.2	579	202
-29.0	3256	471	3728	3919	2229	12.2	6.2	18.4	604	203

PileCore CPT results for S03			CEMS
X coordinate* [m]:	123774.0	Excavation level [m NAP]:	N.A.
Y coordinate* [m]:	483449.0	$\rho_{sur;rep}$ $[kN/m^2]$	0.0
Groundwater level [m NAP]:	-0.4	ξ [-]	1.39
Surface level [m NAP]:	-0.25	qc-reduction:	N.A.

* The x and y coordinates of the CPT need to be in a Cartesian metric coordinate system.

Soil classification:

Soil code	Bottom	Thickness	γ_{unsat}	γ_{sat}	Φ'
[-]	[m NAP]	[m]	$[kN/m^3]$	$[kN/m^3]$	[°]
Zk7s1	-0.33	0.08	19.0	21.0	30.0
Zk7s1	-13.34	13.01	19.0	21.0	30.0
Zs1	-14.94	1.6	18.0	20.0	27.0
Zs1	-15.74	0.8	18.0	20.0	27.0
Zs1	-16.84	1.1	18.0	20.0	27.0
Zs1	-19.64	2.8	18.0	20.0	27.0
Zk3s2	-24.33	4.69	18.0	20.0	25.0
Zs1	-25.73	1.4	18.0	20.0	27.0
Zs1	-27.32	1.59	18.0	20.0	27.0
Zs1	-28.91	1.59	18.0	20.0	27.0
Zs1	-32.38	3.47	18.0	20.0	27.0
Zs1	-35.41	3.03	18.0	20.0	27.0

Friction range:

Pile tip level	Negative friction range [m NAP]		Positive friction range [m NAP]	
[m NAP]	Top	Bottom	Top	Bottom
-24.0	-0.25	-0.25	-0.25	-23.99
-24.5	-0.25	-0.25	-0.25	-24.51
-25.0	-0.25	-0.25	-0.25	-25.01
-25.5	-0.25	-0.25	-0.25	-25.51
-26.0	-0.25	-0.25	-0.25	-26.0
-26.5	-0.25	-0.25	-0.25	-26.5
-27.0	-0.25	-0.25	-0.25	-27.0
-27.5	-0.25	-0.25	-0.25	-27.5
-28.0	-0.25	-0.25	-0.25	-27.99
-28.5	-0.25	-0.25	-0.25	-28.49
-29.0	-0.25	-0.25	-0.25	-29.01

Negative skin friction[1)] :

Soil code	Bottom	Thickness	Average circum. [2]	$\sigma'_{v;rep}$	δ_k	$K_{0;k}$ [3]	$F_{nk;d}$
[-]	[m NAP]	[m]	[m]	$[kN/m^2]$	[°]	[-]	[kN]

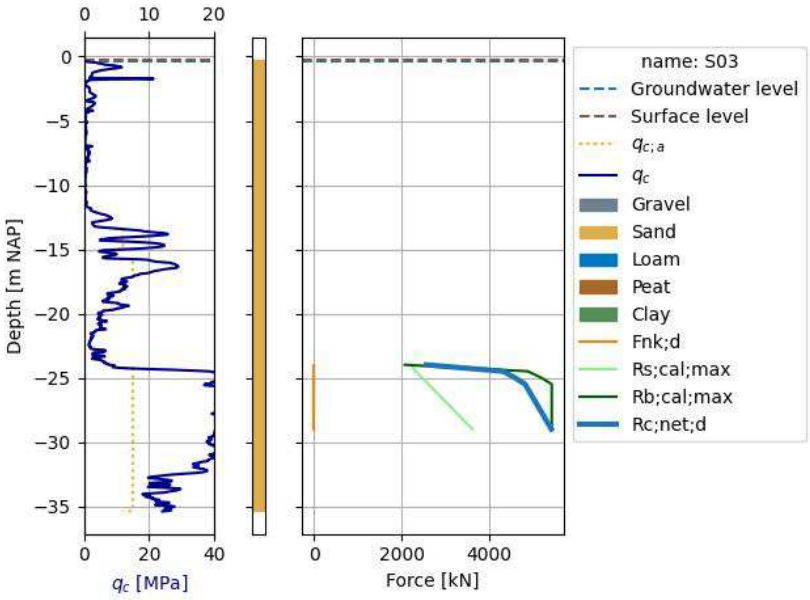
1) The results in this table are presented for the specific case when the pile-tip level is at -29.0 m NAP.
2) The average circumference of the pile per soil layer.
3) A minimum value of 0.25 for the product $K_{0;k}\tan(\delta_{j;k})$ is applied in the calculations (7.3.2.2(7)(d)).

Pile bearing capacity (ULS):

Pile tip level	Base resistance					Shaft resistance		Pile resistance			
	$q_{c;I;gem}$	$q_{c;II;gem}$	$q_{c;III;gem}$	$q_{b;max}$	$R_{b;cal;max}$	$q_{s;max;av}$ [4]	$R_{s;cal;max}$	$R_{c;k}$	$R_{c;d}$	$F_{nk;d}$	$R_{c;net;d}$
[m NAP]	[MPa]	[MPa]	[MPa]	[MPa]	[kN]	[kPa]	[kN]	[kN]	[kN]	[kN]	[kN]
-24.0	16.1	16.1	2.1	5.7	2077	43.6	2211	3085	2571	0	2571
-24.5	41.5	36.9	3.6	13.5	4898	45.01	2329	5199	4332	0	4332
-25.0	40.4	36.9	6.8	14.3	5204	46.83	2472	5522	4602	0	4602
-25.5	51.4	39.4	10.1	15.0	5448	48.57	2616	5801	4834	0	4834
-26.0	50.6	40.8	13.5	15.0	5448	50.24	2760	5905	4920	0	4920
-26.5	47.2	39.6	16.9	15.0	5448	51.85	2903	6008	5007	0	5007
-27.0	44.8	38.3	20.1	15.0	5448	53.41	3050	6113	5094	0	5094
-27.5	42.3	37.7	23.2	15.0	5448	54.9	3193	6216	5180	0	5180
-28.0	42.2	37.8	26.5	15.0	5448	56.34	3337	6319	5266	0	5266
-28.5	41.1	37.7	29.8	15.0	5448	57.73	3480	6422	5352	0	5352
-29.0	39.7	33.4	29.6	15.0	5448	59.13	3626	6528	5440	0	5440

4)The average maximum shaft friction in the positive friction zone.

CPT and bearing capacity



Pile settlement (SLS):

Pile tip level	SLS loads			Distributed capacity		Pile settlement/ spring stiffness				
	$F_{c;k}$	$F_{nk;k}$	$F_{c;k;tot}$	$R_{b;k}$	$R_{s;k}$	S_{el}	S_b	S_1	K_b	K_1
[m NAP]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm]	[mm]	[mm]	[kN/mm]	[kN/mm]
-24.0	1800	0	1800	1495	1591	4.3	4.0	8.3	455	218
-24.5	3033	0	3033	3523	1675	8.3	6.0	14.3	502	212
-25.0	3221	0	3221	3744	1779	9.0	6.0	15.1	533	214
-25.5	3384	0	3384	3919	1882	9.7	6.0	15.7	563	215
-26.0	3444	0	3444	3919	1985	10.0	5.9	15.9	587	217
-26.5	3505	0	3505	3919	2089	10.4	5.7	16.1	613	218
-27.0	3566	0	3566	3919	2194	10.7	5.6	16.3	640	219
-27.5	3626	0	3626	3919	2297	11.1	5.4	16.5	667	220
-28.0	3686	0	3686	3919	2400	11.4	5.3	16.7	694	220
-28.5	3746	0	3746	3919	2503	11.8	5.2	17.0	723	221
-29.0	3808	0	3808	3919	2608	12.2	5.1	17.2	753	221

PileCore CPT results for S01			CEMS
X coordinate* [m]:	123805.0	Excavation level [m NAP]:	N.A.
Y coordinate* [m]:	483464.0	$\rho_{sur;rep}$ $[kN/m^2]$	0.0
Groundwater level [m NAP]:	-0.4	ξ [-]	1.39
Surface level [m NAP]:	-0.22	qc-reduction:	N.A.

* The x and y coordinates of the CPT need to be in a Cartesian metric coordinate system.

Soil classification:

Soil code	Bottom	Thickness	γ_{unsat}	γ_{sat}	Φ'
[-]	[m NAP]	[m]	$[kN/m^3]$	$[kN/m^3]$	[°]
Ks2	-1.5	1.28	21.0	21.0	27.5
Ks2	-4.72	3.22	21.0	21.0	27.5
Kv2s1	-6.12	1.4	16.0	16.0	15.0
Ks1	-6.82	0.7	21.0	21.0	27.5
Zk6s2	-10.22	3.4	19.0	21.0	30.0
Ks2	-11.22	1.0	18.0	18.0	22.5
Kv4s1	-11.62	0.4	15.0	15.0	15.0
Zs1k1	-13.91	2.3	18.0	20.0	27.0
Zs1	-19.2	5.29	18.0	20.0	27.0
Zs2	-23.29	4.09	18.0	20.0	27.0
Zs1	-25.08	1.79	18.0	20.0	27.0
Zs1	-25.58	0.5	18.0	20.0	27.0
Zs1	-28.47	2.88	18.0	20.0	27.0
Zs1	-33.53	5.06	18.0	20.0	27.0
Zs1	-35.46	1.94	18.0	20.0	27.0

Friction range:

Pile tip level	Negative friction range [m NAP]		Positive friction range [m NAP]	
[m NAP]	Top	Bottom	Top	Bottom
-24.0	-0.22	-11.62	-11.62	-24.01
-24.5	-0.22	-11.62	-11.62	-24.51
-25.0	-0.22	-11.62	-11.62	-25.0
-25.5	-0.22	-11.62	-11.62	-25.5
-26.0	-0.22	-11.62	-11.62	-26.0
-26.5	-0.22	-11.62	-11.62	-26.5
-27.0	-0.22	-11.62	-11.62	-27.0
-27.5	-0.22	-11.62	-11.62	-27.49
-28.0	-0.22	-11.62	-11.62	-27.99
-28.5	-0.22	-11.62	-11.62	-28.51
-29.0	-0.22	-11.62	-11.62	-29.0

Negative skin friction[1)] :

Soil code	Bottom	Thickness	Average circum. [2]	$\sigma'_{v;rep}$	δ_k	$K_{0;k}$ [3]	$F_{nk;d}$
[-]	[m NAP]	[m]	[m]	$[kN/m^2]$	[°]	[-]	[kN]
Ks2	-1.5	1.28	2.14	8.7	27.5	0.5	7
Ks2	-4.72	3.22	2.14	34.0	27.5	0.5	66
Kv2s1	-6.12	1.4	2.14	56.4	15.0	0.7	42
Ks1	-6.82	0.7	2.14	64.6	27.5	0.5	27
Zk6s2	-10.22	3.4	2.14	87.5	30.0	0.5	184
Ks2	-11.22	1.0	2.14	110.6	22.5	0.6	61
Kv4s1	-11.62	0.4	2.14	115.8	15.0	0.7	23

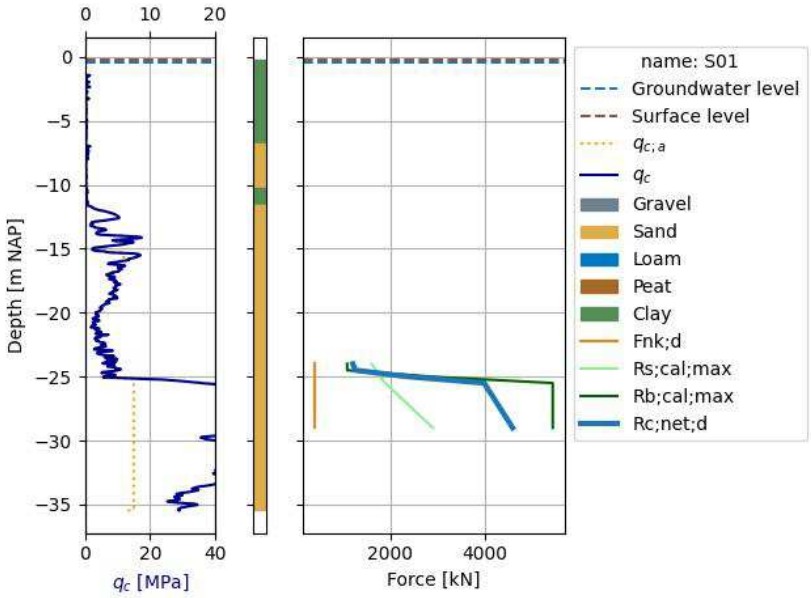
1) The results in this table are presented for the specific case when the pile-tip level is at -29.0 m NAP.
2) The average circumference of the pile per soil layer.
3) A minimum value of 0.25 for the product $K_{0;k}\tan(\delta_{j;k})$ is applied in the calculations (7.3.2.2(7)(d)).

Pile bearing capacity (ULS):

Pile tip level	Base resistance					Shaft resistance		Pile resistance			
	$q_{c;I;gem}$	$q_{c;II;gem}$	$q_{c;III;gem}$	$q_{b;max}$	$R_{b;cal;max}$	$q_{s;max;av}$ [4]	$R_{s;cal;max}$	$R_{c;k}$	$R_{c;d}$	$F_{nk;d}$	$R_{c;net;d}$
[m NAP]	[MPa]	[MPa]	[MPa]	[MPa]	[kN]	[kPa]	[kN]	[kN]	[kN]	[kN]	[kN]
-24.0	8.2	5.3	2.8	3.0	1085	60.83	1610	1939	1616	409	1207
-24.5	7.5	5.4	3.1	3.0	1088	61.59	1695	2003	1669	409	1259
-25.0	21.8	21.8	3.4	7.9	2879	61.82	1769	3343	2786	409	2377
-25.5	50.4	44.1	5.3	15.0	5448	63.95	1894	5282	4401	409	3992
-26.0	50.9	44.6	9.1	15.0	5448	66.41	2037	5385	4487	409	4078
-26.5	49.0	44.6	13.0	15.0	5448	68.7	2184	5490	4575	409	4166
-27.0	47.7	35.8	14.5	15.0	5448	70.85	2327	5593	4661	409	4252
-27.5	46.7	35.8	17.4	15.0	5448	72.86	2471	5697	4747	409	4338
-28.0	45.7	35.8	20.4	15.0	5448	74.75	2614	5800	4833	409	4424
-28.5	43.9	35.8	23.4	15.0	5448	76.6	2760	5905	4921	409	4512
-29.0	42.3	35.9	26.2	15.0	5448	78.27	2904	6008	5007	409	4598

4)The average maximum shaft friction in the positive friction zone.

CPT and bearing capacity



Pile settlement (SLS):

Pile tip level	SLS loads			Distributed capacity		Pile settlement/ spring stiffness				
	$F_{c;k}$	$F_{nk;k}$	$F_{c;k;tot}$	$R_{b;k}$	$R_{s;k}$	S_{el}	S_b	S_1	K_b	K_1
[m NAP]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm]	[mm]	[mm]	[kN/mm]	[kN/mm]
-24.0	845	409	1254	781	1158	2.8	4.5	7.3	278	171
-24.5	882	409	1291	783	1219	3.0	4.4	7.3	296	176
-25.0	1664	409	2073	2071	1272	5.6	6.3	11.9	327	174
-25.5	2794	409	3204	3919	1362	9.5	7.7	17.2	417	187
-26.0	2855	409	3264	3919	1466	9.8	7.5	17.3	437	189
-26.5	2916	409	3325	3919	1571	10.2	7.2	17.5	459	191
-27.0	2976	409	3386	3919	1674	10.6	7.0	17.6	481	192
-27.5	3037	409	3446	3919	1778	10.9	6.8	17.8	503	194
-28.0	3097	409	3506	3919	1881	11.3	6.7	17.9	527	195
-28.5	3158	409	3567	3919	1986	11.7	6.5	18.1	551	197
-29.0	3218	409	3628	3919	2089	12.0	6.3	18.3	576	198

PileCore CPT results for S05			CEMS
X coordinate* [m]:	123778.0	Excavation level [m NAP]:	N.A.
Y coordinate* [m]:	483481.0	$\rho_{sur;rep}$ $[kN/m^2]$	0.0
Groundwater level [m NAP]:	-0.4	ξ [-]	1.39
Surface level [m NAP]:	0.2	qc-reduction:	N.A.

* The x and y coordinates of the CPT need to be in a Cartesian metric coordinate system.

Soil classification:

Soil code	Bottom	Thickness	γ_{unsat}	γ_{sat}	Φ'
[-]	[m NAP]	[m]	$[kN/m^3]$	$[kN/m^3]$	[°]
Zs1k1	0.12	0.08	19.0	21.0	32.5
Zs1k1	-0.5	0.62	19.0	21.0	32.5
Zs1	-4.6	4.1	19.0	21.0	32.5
Kz5s2	-11.9	7.3	20.0	20.0	32.5
Zs1	-18.49	6.6	18.0	20.0	27.0
Zs1	-25.39	6.89	18.0	20.0	27.0
Zs1	-26.78	1.4	18.0	20.0	27.0
Zs1	-31.27	4.49	18.0	20.0	27.0
Zs1	-32.77	1.5	18.0	20.0	27.0
Zs1	-35.04	2.27	18.0	20.0	27.0

Friction range:

Pile tip level	Negative friction range [m NAP]		Positive friction range [m NAP]	
[m NAP]	Top	Bottom	Top	Bottom
-24.0	0.2	-11.9	-11.9	-24.01
-24.5	0.2	-11.9	-11.9	-24.51
-25.0	0.2	-11.9	-11.9	-25.0
-25.5	0.2	-11.9	-11.9	-25.5
-26.0	0.2	-11.9	-11.9	-26.0
-26.5	0.2	-11.9	-11.9	-26.5
-27.0	0.2	-11.9	-11.9	-27.0
-27.5	0.2	-11.9	-11.9	-27.5
-28.0	0.2	-11.9	-11.9	-28.0
-28.5	0.2	-11.9	-11.9	-28.5
-29.0	0.2	-11.9	-11.9	-29.0

Negative skin friction[1] :

Soil code	Bottom	Thickness	Average circum. [2]	$\sigma'_{v;rep}$	δ_k	$K_{0;k}$[3]	$F_{nk;d}$
[-]	[m NAP]	[m]	[m]	$[kN/m^2]$	[°]	[-]	[kN]
Zs1k1	0.12	0.08	2.14	0.6	32.5	0.5	0
Zs1k1	-0.5	0.62	2.14	7.2	32.5	0.5	3
Zs1	-4.6	4.1	2.14	35.3	32.5	0.5	92
Kz5s2	-11.9	7.3	2.14	95.7	32.5	0.5	437

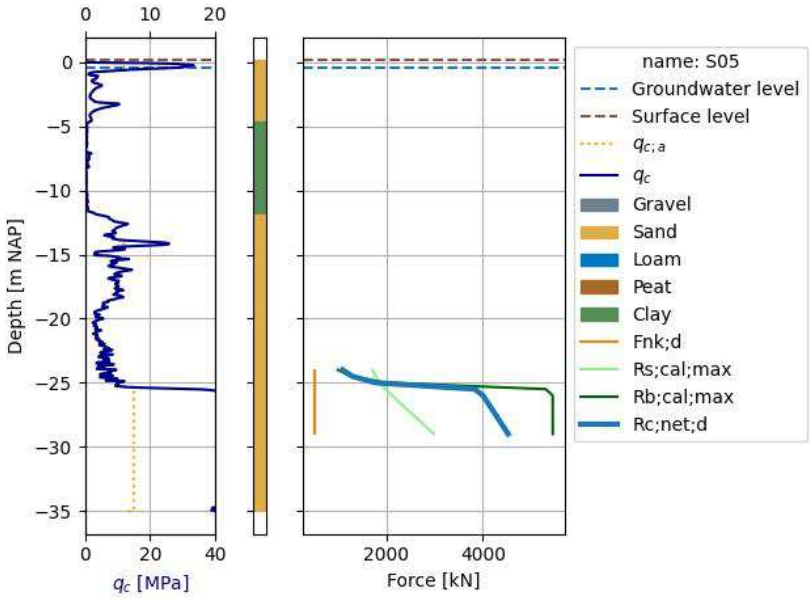
1) The results in this table are presented for the specific case when the pile-tip level is at -29.0 m NAP.
2) The average circumference of the pile per soil layer.
3) A minimum value of 0.25 for the product $K_{0;k} \tan(\delta_{j;k})$ is applied in the calculations (7.3.2.2(7)(d)).

Pile bearing capacity (ULS):

Pile tip level	Base resistance					Shaft resistance		Pile resistance			
	$q_{c;I;gem}$	$q_{c;II;gem}$	$q_{c;III;gem}$	$q_{b;max}$	$R_{b;cal;max}$	$q_{s;max;av}$ [4)]	$R_{s;cal;max}$	$R_{c;k}$	$R_{c;d}$	$F_{nk;d}$	$R_{c;net;d}$
[m NAP]	[MPa]	[MPa]	[MPa]	[MPa]	[kN]	[kPa]	[kN]	[kN]	[kN]	[kN]	[kN]
-24.0	6.8	4.7	3.1	2.8	1003	66.43	1717	1957	1631	532	1099
-24.5	8.4	7.3	3.3	3.5	1268	66.28	1785	2197	1831	532	1299
-25.0	13.8	13.5	3.7	5.5	1982	66.68	1865	2768	2307	532	1775
-25.5	41.8	41.4	4.8	14.6	5303	68.12	1977	5237	4364	532	3832
-26.0	43.5	43.0	8.3	15.0	5448	70.49	2121	5445	4537	532	4005
-26.5	50.2	50.2	12.0	15.0	5448	72.69	2264	5548	4623	532	4091
-27.0	58.9	54.9	16.3	15.0	5448	74.75	2408	5652	4710	532	4178
-27.5	58.0	54.9	21.0	15.0	5448	76.68	2555	5757	4798	532	4266
-28.0	56.5	51.4	25.0	15.0	5448	78.48	2699	5861	4884	532	4352
-28.5	55.8	51.5	29.4	15.0	5448	80.18	2843	5964	4970	532	4438
-29.0	54.4	48.6	32.7	15.0	5448	81.78	2987	6068	5057	532	4525

4)The average maximum shaft friction in the positive friction zone.

CPT and bearing capacity



Pile settlement (SLS):

Pile tip level	SLS loads			Distributed capacity		Pile settlement/ spring stiffness				
	$F_{c;k}$	$F_{nk;k}$	$F_{c;k;tot}$	$R_{b;k}$	$R_{s;k}$	S_{el}	S_b	S_1	K_b	K_1
[m NAP]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm]	[mm]	[mm]	[kN/mm]	[kN/mm]
-24.0	769	532	1301	721	1235	2.8	4.6	7.4	285	177
-24.5	909	532	1441	913	1284	3.3	4.8	8.1	299	178
-25.0	1242	532	1774	1426	1342	4.4	5.6	10.0	318	178
-25.5	2683	532	3215	3815	1422	9.4	7.7	17.2	417	187
-26.0	2804	532	3336	3919	1526	10.0	7.6	17.6	441	190
-26.5	2864	532	3396	3919	1629	10.4	7.3	17.7	462	192
-27.0	2924	532	3456	3919	1733	10.7	7.1	17.9	484	193
-27.5	2986	532	3518	3919	1838	11.1	6.9	18.0	507	195
-28.0	3046	532	3578	3919	1942	11.5	6.7	18.2	530	196
-28.5	3107	532	3639	3919	2045	11.8	6.6	18.4	554	198
-29.0	3167	532	3699	3919	2149	12.2	6.4	18.6	579	199

PileCore results for user defined CPT Group

CPT[1)]	X coordinate[2)]	Y coordinate[2)]	Surface level	Groundwater level	Excavation level	$\rho_{sur;rep}$
	[m]	[m]	[m NAP]	[m NAP]	[m NAP]	[kN/m^2]
S07	123787.00	483465.00	0.12	-0.4	0.12	0
S06	123789.00	483485.00	0.18	-0.4	0.18	0
S02	123797.00	483441.00	-0.63	-0.4	-0.63	0
S04	123759.00	483465.00	-0.15	-0.4	-0.15	0
S03	123774.00	483449.00	-0.25	-0.4	-0.25	0
S01	123805.00	483464.00	-0.22	-0.4	-0.22	0
S05	123778.00	483481.00	0.2	-0.4	0.2	0

1) Other input parameters that are used to calculate the bearing capacity (e.g. positive skin friction trajectory) can be found in the individual CPT results report.
2) The x and y coordinates of the CPT need to be in a Cartesian metric coordinate system.

Pile Tip Level	$R_{c;cal;mean}$	$R_{c;cal;min}$	Factor	Var. co-eff	Nominal CPT	$R_{c;k}$	$R_{c;d}$	$F_{nk;d}$[3)]	$R_{c;net;d}$	ξ[4)]
[m NAP]	[kN]	[kN]	[-]	[%]	[-]	[kN]	[kN]	[kN]	[kN]	[-]
-24.0	2863	1394	4	29.9	S02	1003	836	1637	0	1.39
-24.5	4081	2783	4	44.9	S01	2003	1669	409	1259	1.39
-25.0	4956	3362	4	34.3	S06	2418	2015	413	1602	1.39
-25.5	7099	4710	4	15.3	S02	3389	2824	1637	1187	1.39
-26.0	7375	5635	4	10.9	S02	5579	4650	1637	3013	1.01
-26.5	7555	6029	3	9.5	Group av.	5949	4957	555	4403	1.27
-27.0	7714	6273	3	8.9	Group av.	6074	5061	555	4507	1.27
-27.5	7858	6417	3	8.7	Group av.	6187	5156	555	4602	1.27
-28.0	8002	6561	3	8.5	Group av.	6300	5250	555	4696	1.27
-28.5	8146	6708	3	8.4	Group av.	6414	5345	555	4791	1.27
-29.0	8291	6852	3	8.2	Group av.	6528	5440	555	4886	1.27

3) The design negative friction force is based on the Nominal CPT. If the 3 factor is applied, the friction force is the group average.
4) The values are related to the net pile bearing capacity (NEN9997-1 7.6.2.3). Based on the lowest outcome of Rc;net;d, this can either be a 3 or 4 value (based on the nominal CPT). In case the variation coefficient is above 12

Pile settlement (SLS):

Pile tip level	SLS loads			Distributed capacity		Pile settlement/ spring stiffness				
	$F_{c;k}$	$F_{nk;k}$	$F_{c;k;tot}$	$R_{b;k}$	$R_{s;k}$	S_{el}	S_b	S_1	K_b	K_1
[m NAP]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm]	[mm]	[mm]	[kN/mm]	[kN/mm]
-24.0	0	1637	1637	997	5	1.8	1000.0	1001.8	2	2
-24.5	882	409	1291	783	1219	3.0	4.4	7.3	296	176
-25.0	1121	413	1535	1109	1310	3.8	4.8	8.6	322	179
-25.5	831	1637	2468	3105	284	5.0	19.7	24.6	125	100
-26.0	2109	1637	3746	5047	532	6.5	14.8	21.2	253	176

-26.5	3082	555	3637	4278	1671	9.9	7.5	17.4	485	209
-27.0	3155	555	3709	4289	1784	10.3	7.3	17.6	508	211
-27.5	3221	555	3776	4289	1898	10.6	7.1	17.7	532	213
-28.0	3287	555	3842	4289	2011	11.0	6.9	17.9	557	215
-28.5	3354	555	3908	4289	2125	11.4	6.7	18.1	583	216
-29.0	3420	555	3974	4289	2239	11.8	6.5	18.3	609	217

Bijlage 4 Uitvoer PileCore Ø540/680mm

PileCore results			CEMS 5.1.1.d
Project:	Duivendrechtsekade 50	Author:	
Number:	23378	Date:	29-11-23
PileCore Version:	2.6.5		

Pile properties:

Name:		Reference NEN9997-1
Type:	betonpaal	Table 7.c
Description:	In de grond gevormd met een gladde mantelbuis op een schroefpunt, waarbij het beton direct tegen de grond drukt	Table 7.c
Installation:	Geschroefd; bij het trekken van de mantelbuis blijft de schroefpunt in de grond achter	Table 7.c
Shaft size:	rond 680 mm	
Base size:	rond 680 mm	
Height pile base [mm]:	0.0	Figure 7.h
$E_{pile;nom}[GPa]$:	20.0	

Pile factors:		Reference NEN9997-1	Safety factors:		Reference NEN9997-1
α_p:	0.63	Table 7.c	$\gamma_{F;nk}$:	1.0	7.3.2.2(7)(b)
$\alpha_{s;sand}$:	0.009	Table 7.c	$\gamma_{R;b}$:	1.2	A.3.3.2
$\alpha_{s;clay}$:	0.009	Table 7.d	$\gamma_{R;s}$:	1.2	A.3.3.2
β_p:	1.0	7.6.2.3. (10)(g)			
Pile factor s:	1.0	7.6.2.3. (10)(h)			
Settlement curve:	1	Table 7.c			
$\delta_{j;k}$:	1.0 $\varphi'_{j;k}$	7.3.2.2 (7)(d)			

Result Summary

CPT	Pile Tip Level	Bearing capacity		Spring stiffness		
		$F_{nk;d}$	$R_{c;net;d}$	$F_{c;k;tot}$	$K_b^{1)}$	$K_1^{2)}$
[-]	[m NAP]	[kN]	[kN]	[kN]	[kN/mm]	[kN/mm]
S07	-24.0	419	1332	1352	286	172
S07	-24.5	419	1419	1413	304	177
S07	-25.0	419	2201	1960	332	176
S07	-25.5	419	4017	3231	424	187
S07	-26.0	419	4103	3291	445	189
S07	-26.5	419	4190	3352	467	191
S07	-27.0	419	4276	3413	489	193
S07	-27.5	419	4363	3474	512	194
S07	-28.0	419	4449	3534	535	196
S07	-28.5	419	4536	3595	560	197
S07	-29.0	419	4621	3654	585	198
S06	-24.0	413	1255	1292	290	174
S06	-24.5	413	1324	1340	304	178
S06	-25.0	413	1602	1535	322	179
S06	-25.5	413	3999	3213	419	186
S06	-26.0	413	4086	3273	440	188
S06	-26.5	413	4172	3334	461	190
S06	-27.0	413	4258	3394	483	191
S06	-27.5	413	4345	3455	506	193
S06	-28.0	413	4431	3515	529	195
S06	-28.5	413	4517	3575	554	196
S06	-29.0	413	4605	3637	579	197
S02	-24.0	1637	0	1637	2	2
S02	-24.5	1637	363	1891	70	64
S02	-25.0	1637	619	2070	88	77
S02	-25.5	1637	1187	2468	125	100
S02	-26.0	1637	1742	2856	164	120
S02	-26.5	1637	1978	3021	186	129
S02	-27.0	1637	2124	3124	203	135
S02	-27.5	1637	2210	3184	217	140
S02	-28.0	1637	2297	3244	233	144
S02	-28.5	1637	2385	3306	250	149
S02	-29.0	1637	2471	3366	269	154
S04	-24.0	471	1469	1500	289	174
S04	-24.5	471	3247	2744	367	183
S04	-25.0	471	3742	3091	409	189
S04	-25.5	471	4047	3304	441	192
S04	-26.0	471	4133	3364	462	194
S04	-26.5	471	4221	3426	484	196
S04	-27.0	471	4307	3486	507	198
S04	-27.5	471	4393	3546	530	199
S04	-28.0	471	4479	3607	554	201
S04	-28.5	471	4566	3667	579	202
S04	-29.0	471	4652	3728	604	203
S03	-24.0	0	2571	1800	455	218
S03	-24.5	0	4332	3033	502	212
S03	-25.0	0	4602	3221	533	214
S03	-25.5	0	4834	3384	563	215
S03	-26.0	0	4920	3444	587	217
S03	-26.5	0	5007	3505	613	218
S03	-27.0	0	5094	3566	640	219

S03	-27.5	0	5180	3626	667	220
S03	-28.0	0	5266	3686	694	220
S03	-28.5	0	5352	3746	723	221
S03	-29.0	0	5440	3808	753	221
S01	-24.0	409	1207	1254	278	171
S01	-24.5	409	1259	1291	296	176
S01	-25.0	409	2377	2073	327	174
S01	-25.5	409	3992	3204	417	187
S01	-26.0	409	4078	3264	437	189
S01	-26.5	409	4166	3325	459	191
S01	-27.0	409	4252	3386	481	192
S01	-27.5	409	4338	3446	503	194
S01	-28.0	409	4424	3506	527	195
S01	-28.5	409	4512	3567	551	197
S01	-29.0	409	4598	3628	576	198
S05	-24.0	532	1099	1301	285	177
S05	-24.5	532	1299	1441	299	178
S05	-25.0	532	1775	1774	318	178
S05	-25.5	532	3832	3215	417	187
S05	-26.0	532	4005	3336	441	190
S05	-26.5	532	4091	3396	462	192
S05	-27.0	532	4178	3456	484	193
S05	-27.5	532	4266	3518	507	195
S05	-28.0	532	4352	3578	530	196
S05	-28.5	532	4438	3639	554	198
S05	-29.0	532	4525	3699	579	199

1) Spring stiffness not taking elastic deformation of the pile into account
2) Spring stiffness including elastic deformation of the pile

PileCore CPT results for S07			CEMS
X coordinate* [m]:	123787.0	Excavation level [m NAP]:	N.A.
Y coordinate* [m]:	483465.0	$\rho_{sur;rep}$ $[kN/m^2]$	0.0
Groundwater level [m NAP]:	-0.4	ξ [-]	1.39
Surface level [m NAP]:	0.12	qc-reduction:	N.A.

* The x and y coordinates of the CPT need to be in a Cartesian metric coordinate system.

Soil classification:

Soil code	Bottom	Thickness	γ_{unsat}	γ_{sat}	Φ'
[-]	[m NAP]	[m]	$[kN/m^3]$	$[kN/m^3]$	[°]
Zs1	0.04	0.08	19.0	21.0	32.5
Zs1	-0.58	0.62	19.0	21.0	32.5
Kv2s1	-1.08	0.5	16.0	16.0	15.0
Ks2z2	-2.98	1.9	21.0	21.0	27.5
Ks1	-3.78	0.8	21.0	21.0	27.5
Kv4s1	-6.08	2.3	16.0	16.0	15.0
Ks1v1	-6.48	0.4	21.0	21.0	27.5
Zk8s2	-10.48	4.0	19.0	21.0	30.0
Ks2	-11.18	0.7	18.0	18.0	22.5
Kv4s1	-11.68	0.5	15.0	15.0	15.0
Zs1	-13.38	1.7	18.0	20.0	27.0
Zs1	-14.27	0.9	18.0	20.0	27.0
Zs1	-19.66	5.39	18.0	20.0	27.0
Zs2k1	-23.15	3.49	18.0	20.0	27.0
Zs1	-25.24	2.09	18.0	20.0	27.0
Zs1	-26.53	1.29	18.0	20.0	27.0
Zs1	-28.7	2.18	18.0	20.0	27.0
Zs1	-32.56	3.85	18.0	20.0	27.0
Zs1	-34.77	2.21	18.0	20.0	27.0

Friction range:

Pile tip level	Negative friction range [m NAP]		Positive friction range [m NAP]	
[m NAP]	Top	Bottom	Top	Bottom
-24.0	0.12	-11.68	-11.68	-24.0
-24.5	0.12	-11.68	-11.68	-24.5
-25.0	0.12	-11.68	-11.68	-25.0
-25.5	0.12	-11.68	-11.68	-25.49
-26.0	0.12	-11.68	-11.68	-25.99
-26.5	0.12	-11.68	-11.68	-26.51
-27.0	0.12	-11.68	-11.68	-27.0
-27.5	0.12	-11.68	-11.68	-27.5
-28.0	0.12	-11.68	-11.68	-27.99
-28.5	0.12	-11.68	-11.68	-28.51
-29.0	0.12	-11.68	-11.68	-29.0

Negative skin friction[1)] :

Soil code	Bottom	Thickness	Average circum. [2]	$\sigma'_{v;rep}$	δ_k	$K_{0;k}$ [3]	$F_{nk;d}$
[-]	[m NAP]	[m]	[m]	$[kN/m^2]$	[°]	[-]	[kN]
Zs1	0.04	0.08	2.14	0.8	32.5	0.5	0
Zs1	-0.58	0.62	2.14	7.4	32.5	0.5	3
Kv2s1	-1.08	0.5	2.14	13.5	15.0	0.7	4
Ks2z2	-2.98	1.9	2.14	25.5	27.5	0.5	29
Ks1	-3.78	0.8	2.14	40.7	27.5	0.5	20
Kv4s1	-6.08	2.3	2.14	52.3	15.0	0.7	64
Ks1v1	-6.48	0.4	2.14	61.6	27.5	0.5	15
Zk8s2	-10.48	4.0	2.14	86.2	30.0	0.5	213
Ks2	-11.18	0.7	2.14	111.5	22.5	0.6	43
Kv4s1	-11.68	0.5	2.14	115.7	15.0	0.7	30

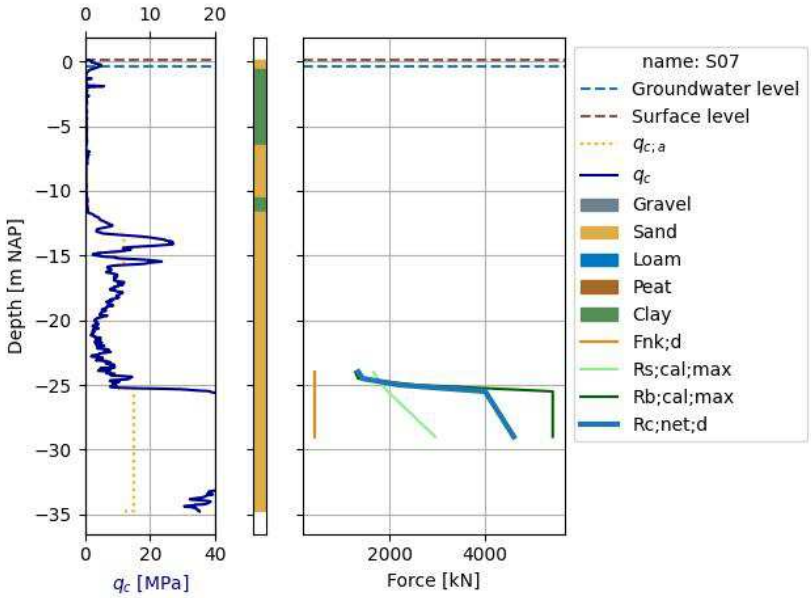
1) The results in this table are presented for the specific case when the pile-tip level is at -29.0 m NAP.
2) The average circumference of the pile per soil layer.
3) A minimum value of 0.25 for the product $K_{0;k}\tan(\delta_{j;k})$ is applied in the calculations (7.3.2.2(7)(d)).

Pile bearing capacity (ULS):

Pile tip level	Base resistance					Shaft resistance		Pile resistance			
	$q_{c;I;gem}$	$q_{c;II;gem}$	$q_{c;III;gem}$	$q_{b;max}$	$R_{b;cal;max}$	$q_{s;max;av}$ [4]	$R_{s;cal;max}$	$R_{c;k}$	$R_{c;d}$	$F_{nk;d}$	$R_{c;net;d}$
[m NAP]	[MPa]	[MPa]	[MPa]	[MPa]	[kN]	[kPa]	[kN]	[kN]	[kN]	[kN]	[kN]
-24.0	9.8	7.7	2.4	3.5	1269	62.76	1653	2102	1752	419	1332
-24.5	9.6	7.8	2.9	3.6	1323	63.68	1743	2206	1838	419	1419
-25.0	18.9	18.6	3.4	7.0	2534	64.51	1837	3145	2620	419	2201
-25.5	45.1	45.1	5.1	15.0	5448	66.13	1952	5324	4436	419	4017
-26.0	52.3	48.1	8.9	15.0	5448	68.52	2095	5426	4522	419	4103
-26.5	58.8	51.3	13.3	15.0	5448	70.84	2241	5531	4610	419	4190
-27.0	57.8	49.3	17.6	15.0	5448	72.93	2384	5634	4695	419	4276
-27.5	55.6	48.0	21.6	15.0	5448	74.88	2530	5739	4783	419	4363
-28.0	53.3	45.3	24.6	15.0	5448	76.71	2673	5842	4868	419	4449
-28.5	51.7	45.2	28.7	15.0	5448	78.5	2818	5946	4955	419	4536
-29.0	50.7	45.1	32.4	15.0	5448	80.12	2961	6049	5041	419	4621

4)The average maximum shaft friction in the positive friction zone.

CPT and bearing capacity



Pile settlement (SLS):

Pile tip level	SLS loads			Distributed capacity		Pile settlement/ spring stiffness				
	$F_{c;k}$	$F_{nk;k}$	$F_{c;k;tot}$	$R_{b;k}$	$R_{s;k}$	S_{el}	S_b	S_1	K_b	K_1
[m NAP]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm]	[mm]	[mm]	[kN/mm]	[kN/mm]
-24.0	933	419	1352	913	1189	3.1	4.7	7.8	286	172
-24.5	993	419	1413	952	1254	3.4	4.6	8.0	304	177
-25.0	1541	419	1960	1823	1322	5.2	5.9	11.1	332	176
-25.5	2812	419	3231	3919	1404	9.7	7.6	17.3	424	187
-26.0	2872	419	3291	3919	1507	10.0	7.4	17.4	445	189
-26.5	2933	419	3352	3919	1612	10.4	7.2	17.6	467	191
-27.0	2993	419	3413	3919	1715	10.7	7.0	17.7	489	193
-27.5	3054	419	3474	3919	1820	11.1	6.8	17.9	512	194
-28.0	3114	419	3534	3919	1923	11.5	6.6	18.1	535	196
-28.5	3175	419	3595	3919	2027	11.8	6.4	18.2	560	197
-29.0	3235	419	3654	3919	2130	12.2	6.2	18.4	585	198

PileCore CPT results for S06			
X coordinate* [m]:	123789.0	Excavation level [m NAP]:	N.A.
Y coordinate* [m]:	483485.0	$\rho_{sur;rep}$ $[kN/m^2]$	0.0
Groundwater level [m NAP]:	-0.4	ξ [-]	1.39
Surface level [m NAP]:	0.18	qc-reduction:	N.A.

* The x and y coordinates of the CPT need to be in a Cartesian metric coordinate system.

Soil classification:

Soil code	Bottom	Thickness	γ_{unsat}	γ_{sat}	Φ'
[-]	[m NAP]	[m]	$[kN/m^3]$	$[kN/m^3]$	[°]
Zs1	0.1	0.08	19.0	21.0	32.5
Zs1	-2.82	2.92	19.0	21.0	32.5
Kv4s1	-6.22	3.4	16.0	16.0	15.0
Kz5s2	-11.52	5.3	20.0	20.0	32.5
Zs1	-12.51	1.0	18.0	20.0	27.0
Zs1	-25.41	12.89	18.0	20.0	27.0
Zs1	-29.0	3.59	18.0	20.0	27.0
Zs1	-32.49	3.49	18.0	20.0	27.0
Zs1	-34.48	1.99	18.0	20.0	27.0
Zs1	-35.07	0.6	18.0	20.0	27.0

Friction range:

Pile tip level	Negative friction range [m NAP]		Positive friction range [m NAP]	
[m NAP]	Top	Bottom	Top	Bottom
-24.0	0.18	-11.52	-11.52	-24.01
-24.5	0.18	-11.52	-11.52	-24.51
-25.0	0.18	-11.52	-11.52	-25.01
-25.5	0.18	-11.52	-11.52	-25.51
-26.0	0.18	-11.52	-11.52	-26.0
-26.5	0.18	-11.52	-11.52	-26.5
-27.0	0.18	-11.52	-11.52	-27.0
-27.5	0.18	-11.52	-11.52	-27.5
-28.0	0.18	-11.52	-11.52	-28.0
-28.5	0.18	-11.52	-11.52	-28.5
-29.0	0.18	-11.52	-11.52	-29.0

Negative skin friction[1] :

Soil code	Bottom	Thickness	Average circum. [2]	$\sigma'_{v;rep}$	δ_k	$K_{0;k}$ [3]	$F_{nk;d}$
[-]	[m NAP]	[m]	[m]	$[kN/m^2]$	[°]	[-]	[kN]
Zs1	0.1	0.08	2.14	0.8	32.5	0.5	0
Zs1	-2.82	2.92	2.14	21.4	32.5	0.5	39
Kv4s1	-6.22	3.4	2.14	48.6	15.0	0.7	88
Kz5s2	-11.52	5.3	2.14	86.0	32.5	0.5	286

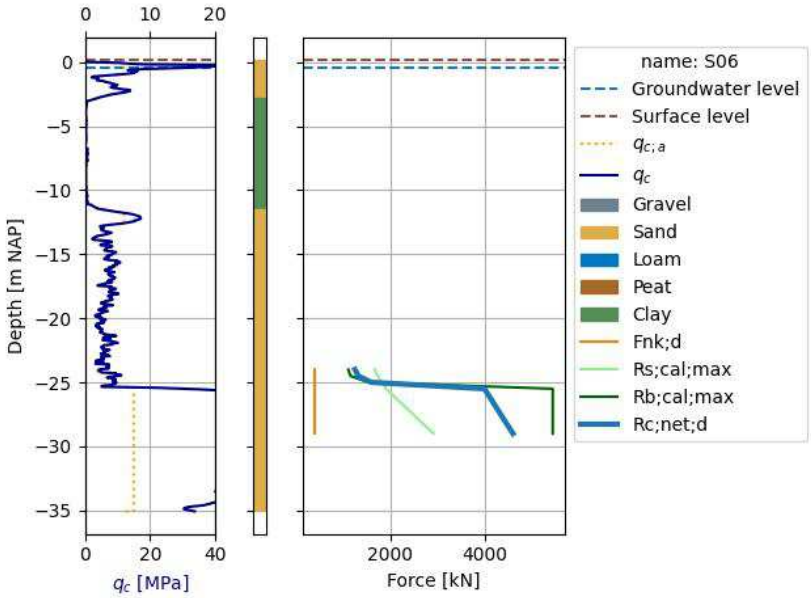
1) The results in this table are presented for the specific case when the pile-tip level is at -29.0 m NAP.
2) The average circumference of the pile per soil layer.
3) A minimum value of 0.25 for the product $K_{0;k}\tan(\delta_{j;k})$ is applied in the calculations (7.3.2.2(7)(d)).

Pile bearing capacity (ULS):

Pile tip level	Base resistance					Shaft resistance		Pile resistance			
	$q_{c;I;gem}$	$q_{c;II;gem}$	$q_{c;III;gem}$	$q_{b;max}$	$R_{b;cal;max}$	$q_{s;max;av}$ [4)]	$R_{s;cal;max}$	$R_{c;k}$	$R_{c;d}$	$F_{nk;d}$	$R_{c;net;d}$
[m NAP]	[MPa]	[MPa]	[MPa]	[MPa]	[kN]	[kPa]	[kN]	[kN]	[kN]	[kN]	[kN]
-24.0	7.9	5.0	3.3	3.1	1113	62.55	1669	2002	1668	413	1255
-24.5	8.2	5.1	3.5	3.2	1159	62.71	1738	2084	1737	413	1324
-25.0	10.8	8.8	3.6	4.2	1541	63.24	1821	2418	2015	413	1602
-25.5	48.6	48.5	4.3	15.0	5448	64.14	1913	5295	4413	413	3999
-26.0	56.6	52.6	8.3	15.0	5448	66.58	2057	5399	4499	413	4086
-26.5	57.4	52.5	12.7	15.0	5448	68.86	2201	5503	4585	413	4172
-27.0	56.6	50.9	17.0	15.0	5448	70.99	2345	5606	4672	413	4258
-27.5	55.0	49.2	20.7	15.0	5448	72.99	2489	5710	4758	413	4345
-28.0	53.7	49.2	24.9	15.0	5448	74.86	2633	5813	4844	413	4431
-28.5	53.0	49.2	29.1	15.0	5448	76.63	2777	5917	4931	413	4517
-29.0	52.1	46.5	31.8	15.0	5448	78.29	2923	6022	5019	413	4605

4)The average maximum shaft friction in the positive friction zone.

CPT and bearing capacity



Pile settlement (SLS):

Pile tip level	SLS loads			Distributed capacity		Pile settlement/ spring stiffness				
	$F_{c;k}$	$F_{nk;k}$	$F_{c;k;tot}$	$R_{b;k}$	$R_{s;k}$	S_{el}	S_b	S_1	K_b	K_1
[m NAP]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm]	[mm]	[mm]	[kN/mm]	[kN/mm]
-24.0	878	413	1292	801	1201	2.9	4.5	7.4	290	174
-24.5	926	413	1340	834	1251	3.1	4.4	7.5	304	178
-25.0	1121	413	1535	1109	1310	3.8	4.8	8.6	322	179
-25.5	2799	413	3213	3919	1376	9.6	7.7	17.3	419	186
-26.0	2860	413	3273	3919	1480	10.0	7.4	17.4	440	188
-26.5	2920	413	3334	3919	1583	10.3	7.2	17.6	461	190
-27.0	2981	413	3394	3919	1687	10.7	7.0	17.7	483	191
-27.5	3041	413	3455	3919	1790	11.1	6.8	17.9	506	193
-28.0	3102	413	3515	3919	1894	11.4	6.6	18.1	529	195
-28.5	3162	413	3575	3919	1998	11.8	6.5	18.3	554	196
-29.0	3224	413	3637	3919	2103	12.2	6.3	18.5	579	197

PileCore CPT results for S02			CEMS
X coordinate* [m]:	123797.0	Excavation level [m NAP]:	N.A.
Y coordinate* [m]:	483441.0	$\rho_{sur;rep}$ $[kN/m^2]$	0.0
Groundwater level [m NAP]:	-0.4	ξ [-]	1.39
Surface level [m NAP]:	-0.63	qc-reduction:	N.A.

* The x and y coordinates of the CPT need to be in a Cartesian metric coordinate system.

Soil classification:

Soil code	Bottom	Thickness	γ_{unsat}	γ_{sat}	Φ'
[-]	[m NAP]	[m]	$[kN/m^3]$	$[kN/m^3]$	[°]
Zs1	-1.31	0.68	19.0	21.0	32.5
Zs1	-5.13	3.82	19.0	21.0	32.5
Kv6z1	-6.23	1.1	16.0	16.0	15.0
Ks1v1	-6.73	0.5	21.0	21.0	27.5
Kz3s2	-10.73	4.0	20.0	20.0	32.5
Ks2	-12.13	1.4	18.0	18.0	22.5
Zs1	-15.53	3.4	18.0	20.0	27.0
Zs1	-16.53	1.0	18.0	20.0	27.0
Zs1	-17.53	1.0	18.0	20.0	27.0
Zs1	-19.23	1.7	18.0	20.0	27.0
Zs1	-21.53	2.3	18.0	20.0	27.0
Kz7s3	-23.92	2.4	18.0	18.0	27.5
Zs1	-24.42	0.5	18.0	20.0	27.0
Zs1	-25.82	1.4	18.0	20.0	27.0
Zs1	-32.5	6.69	18.0	20.0	27.0
Zs1	-34.0	1.5	18.0	20.0	27.0
Zs1	-35.39	1.4	18.0	20.0	27.0

Friction range:

Pile tip level	Negative friction range [m NAP]		Positive friction range [m NAP]	
[m NAP]	Top	Bottom	Top	Bottom
-24.0	-0.63	-23.92	-23.92	-24.0
-24.5	-0.63	-23.92	-23.92	-24.5
-25.0	-0.63	-23.92	-23.92	-25.0
-25.5	-0.63	-23.92	-23.92	-25.5
-26.0	-0.63	-23.92	-23.92	-25.99
-26.5	-0.63	-23.92	-23.92	-26.49
-27.0	-0.63	-23.92	-23.92	-26.99
-27.5	-0.63	-23.92	-23.92	-27.49
-28.0	-0.63	-23.92	-23.92	-27.99
-28.5	-0.63	-23.92	-23.92	-28.51
-29.0	-0.63	-23.92	-23.92	-29.01

Negative skin friction[1)] :

Soil code	Bottom	Thickness	Average circum. [2]	$\sigma'_{v;rep}$	δ_k	$K_{0;k}$ [3]	$F_{nk;d}$
[-]	[m NAP]	[m]	[m]	$[kN/m^2]$	[°]	[-]	[kN]
Zs1	-1.31	0.68	2.14	3.8	32.5	0.5	2
Zs1	-5.13	3.82	2.14	29.0	32.5	0.5	70
Kv6z1	-6.23	1.1	2.14	53.7	15.0	0.7	32
Ks1v1	-6.73	0.5	2.14	59.9	27.5	0.5	18
Kz3s2	-10.73	4.0	2.14	83.0	32.5	0.5	209
Ks2	-12.13	1.4	2.14	109.2	22.5	0.6	84
Zs1	-15.53	3.4	2.14	132.3	27.0	0.5	269
Zs1	-16.53	1.0	2.14	154.8	27.0	0.5	92
Zs1	-17.53	1.0	2.14	164.8	27.0	0.5	98
Zs1	-19.23	1.7	2.14	178.6	27.0	0.5	180
Zs1	-21.53	2.3	2.14	199.0	27.0	0.5	274
Kz7s3	-23.92	2.4	2.14	220.5	27.5	0.5	314

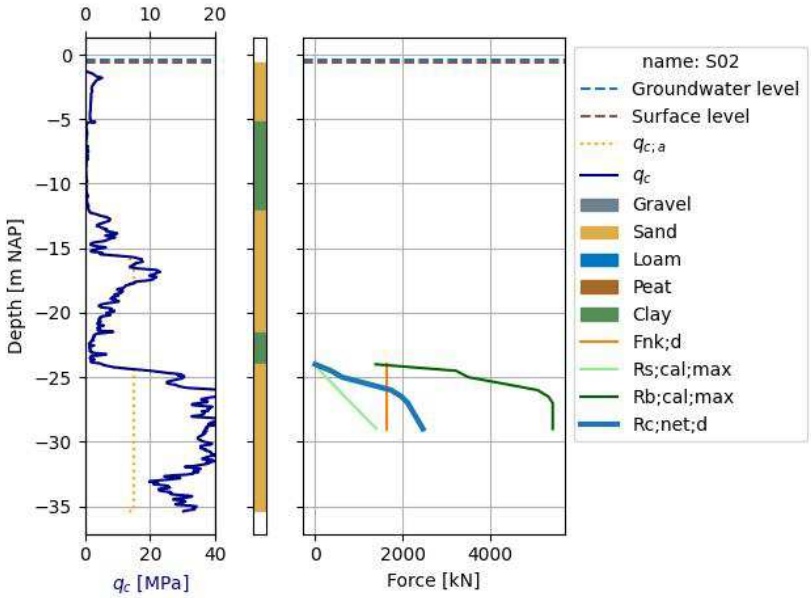
1) The results in this table are presented for the specific case when the pile-tip level is at -29.0 m NAP.
2) The average circumference of the pile per soil layer.
3) A minimum value of 0.25 for the product $K_{0;k}\tan(\delta_{j;k})$ is applied in the calculations (7.3.2.2(7)(d)).

Pile bearing capacity (ULS):

Pile tip level	Base resistance					Shaft resistance		Pile resistance			
	$q_{c;I;gem}$	$q_{c;II;gem}$	$q_{c;III;gem}$	$q_{b;max}$	$R_{b;cal;max}$	$q_{s;max;av}$ [4]	$R_{s;cal;max}$	$R_{c;k}$	$R_{c;d}$	$F_{nk;d}$	$R_{c;net;d}$
[m NAP]	[MPa]	[MPa]	[MPa]	[MPa]	[kN]	[kPa]	[kN]	[kN]	[kN]	[kN]	[kN]
-24.0	10.7	10.7	1.5	3.8	1386	44.77	8	1003	836	1637	0
-24.5	27.1	24.7	2.4	8.9	3230	86.18	106	2400	2000	1637	363
-25.0	27.3	25.2	4.5	9.7	3512	108.37	250	2707	2256	1637	619
-25.5	31.1	31.1	6.7	11.9	4316	116.69	394	3389	2824	1637	1187
-26.0	37.8	32.8	9.3	14.0	5098	121.05	538	4054	3378	1637	1742
-26.5	36.2	32.9	12.2	14.7	5347	123.73	682	4337	3615	1637	1978
-27.0	36.0	32.7	15.1	15.0	5448	125.55	826	4513	3761	1637	2124
-27.5	36.0	32.8	17.9	15.0	5448	126.86	969	4617	3847	1637	2210
-28.0	37.2	34.5	20.8	15.0	5448	127.86	1113	4720	3933	1637	2297
-28.5	36.7	34.6	23.9	15.0	5448	128.66	1260	4826	4021	1637	2385
-29.0	36.0	34.6	26.9	15.0	5448	129.28	1404	4929	4108	1637	2471

4)The average maximum shaft friction in the positive friction zone.

CPT and bearing capacity



Pile settlement (SLS):

Pile tip level	SLS loads			Distributed capacity		Pile settlement/ spring stiffness				
	$F_{c;k}$	$F_{nk;k}$	$F_{c;k;tot}$	$R_{b;k}$	$R_{s;k}$	S_{el}	S_b	S_1	K_b	K_1
[m NAP]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm]	[mm]	[mm]	[kN/mm]	[kN/mm]
-24.0	0	1637	1637	997	5	1.8	1000.0	1001.8	2	2
-24.5	254	1637	1891	2323	76	2.7	26.9	29.7	70	64
-25.0	433	1637	2070	2527	180	3.5	23.6	27.0	88	77
-25.5	831	1637	2468	3105	284	5.0	19.7	24.6	125	100
-26.0	1219	1637	2856	3667	387	6.5	17.4	23.8	164	120
-26.5	1384	1637	3021	3847	490	7.2	16.2	23.4	186	129
-27.0	1487	1637	3124	3919	594	7.8	15.4	23.1	203	135
-27.5	1547	1637	3184	3919	697	8.1	14.6	22.8	217	140
-28.0	1608	1637	3244	3919	801	8.5	13.9	22.5	233	144
-28.5	1669	1637	3306	3919	907	8.9	13.2	22.2	250	149
-29.0	1730	1637	3366	3919	1010	9.3	12.5	21.9	269	154

PileCore CPT results for S04			CEMS
X coordinate* [m]:	123759.0	Excavation level [m NAP]:	N.A.
Y coordinate* [m]:	483465.0	$\rho_{sur;rep}$ $[kN/m^2]$	0.0
Groundwater level [m NAP]:	-0.4	ξ [-]	1.39
Surface level [m NAP]:	-0.15	qc-reduction:	N.A.

* The x and y coordinates of the CPT need to be in a Cartesian metric coordinate system.

Soil classification:

Soil code	Bottom	Thickness	γ_{unsat}	γ_{sat}	Φ'
[-]	[m NAP]	[m]	$[kN/m^3]$	$[kN/m^3]$	[°]
Vk3	-0.23	0.08	12.0	12.0	15.0
Vk3	-0.25	0.02	12.0	12.0	15.0
Zs1	-2.85	2.6	19.0	21.0	32.5
Kz5s2	-11.94	9.09	20.0	20.0	32.5
Zs1	-15.63	3.69	18.0	20.0	27.0
Zs1	-16.83	1.2	18.0	20.0	27.0
Zs2k1	-24.41	7.58	18.0	20.0	27.0
Zs1	-25.8	1.4	18.0	20.0	27.0
Zs1	-32.69	6.88	18.0	20.0	27.0
Zs1	-34.86	2.17	18.0	20.0	27.0

Friction range:

Pile tip level	Negative friction range [m NAP]		Positive friction range [m NAP]	
[m NAP]	Top	Bottom	Top	Bottom
-24.0	-0.15	-11.94	-11.94	-24.01
-24.5	-0.15	-11.94	-11.94	-24.51
-25.0	-0.15	-11.94	-11.94	-25.0
-25.5	-0.15	-11.94	-11.94	-25.5
-26.0	-0.15	-11.94	-11.94	-26.0
-26.5	-0.15	-11.94	-11.94	-26.5
-27.0	-0.15	-11.94	-11.94	-27.0
-27.5	-0.15	-11.94	-11.94	-27.5
-28.0	-0.15	-11.94	-11.94	-28.0
-28.5	-0.15	-11.94	-11.94	-28.49
-29.0	-0.15	-11.94	-11.94	-28.99

Negative skin friction[1] :

Soil code	Bottom	Thickness	Average circum. [2]	$\sigma'_{v;rep}$	δ_k	$K_{0;k}$ [3]	$F_{nk;d}$
[-]	[m NAP]	[m]	[m]	$[kN/m^2]$	[°]	[-]	[kN]
Vk3	-0.23	0.08	2.14	0.4	15.0	0.7	0
Vk3	-0.25	0.02	2.14	1.0	15.0	0.7	0
Zs1	-2.85	2.6	2.14	16.8	32.5	0.5	28
Kz5s2	-11.94	9.09	2.14	77.8	32.5	0.5	443

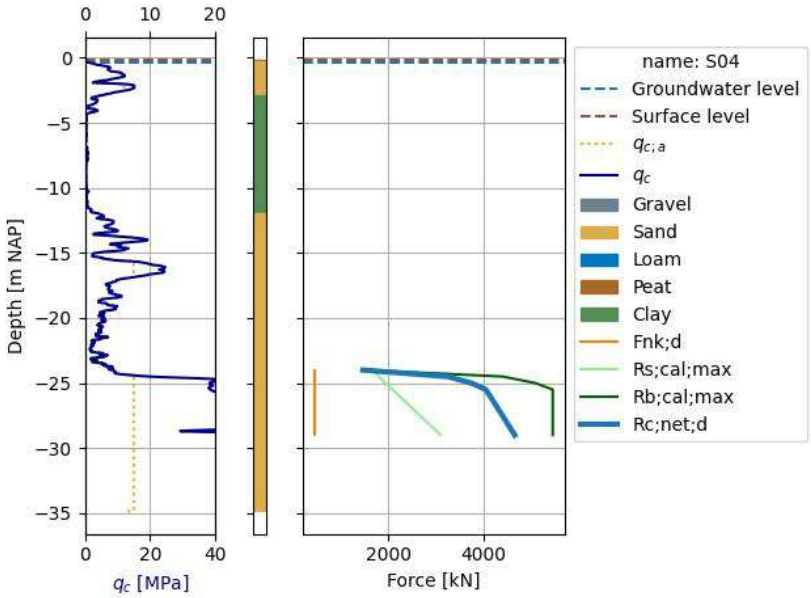
1) The results in this table are presented for the specific case when the pile-tip level is at -29.0 m NAP.
2) The average circumference of the pile per soil layer.
3) A minimum value of 0.25 for the product $K_{0;k}\tan(\delta_{j;k})$ is applied in the calculations (7.3.2.2(7)(d)).

Pile bearing capacity (ULS):

Pile tip level	Base resistance					Shaft resistance		Pile resistance			
	$q_{c;I;gem}$	$q_{c;II;gem}$	$q_{c;III;gem}$	$q_{b;max}$	$R_{b;cal;max}$	$q_{s;max;av}$ [4)]	$R_{s;cal;max}$	$R_{c;k}$	$R_{c;d}$	$F_{nk;d}$	$R_{c;net;d}$
[m NAP]	[MPa]	[MPa]	[MPa]	[MPa]	[kN]	[kPa]	[kN]	[kN]	[kN]	[kN]	[kN]
-24.0	11.3	11.3	2.2	4.2	1541	65.79	1696	2329	1940	471	1469
-24.5	35.9	34.9	3.1	12.1	4402	67.18	1801	4462	3718	471	3247
-25.0	38.5	38.0	6.2	14.0	5084	69.77	1944	5056	4214	471	3742
-25.5	43.4	43.4	9.5	15.0	5448	72.16	2088	5421	4518	471	4047
-26.0	59.6	29.2	10.6	15.0	5448	74.39	2232	5525	4604	471	4133
-26.5	58.8	29.5	13.1	15.0	5448	76.46	2379	5630	4692	471	4221
-27.0	56.8	29.5	15.7	15.0	5448	78.4	2523	5734	4778	471	4307
-27.5	54.0	29.6	18.2	15.0	5448	80.21	2666	5837	4864	471	4393
-28.0	50.1	29.6	20.7	15.0	5448	81.91	2810	5941	4951	471	4479
-28.5	42.9	38.7	23.2	15.0	5448	83.5	2954	6044	5037	471	4566
-29.0	57.5	56.0	26.7	15.0	5448	85.01	3098	6148	5123	471	4652

4)The average maximum shaft friction in the positive friction zone.

CPT and bearing capacity



Pile settlement (SLS):

Pile tip level	SLS loads			Distributed capacity		Pile settlement/ spring stiffness				
	$F_{c;k}$	$F_{nk;k}$	$F_{c;k;tot}$	$R_{b;k}$	$R_{s;k}$	S_{el}	S_b	S_1	K_b	K_1
[m NAP]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm]	[mm]	[mm]	[kN/mm]	[kN/mm]
-24.0	1028	471	1500	1109	1220	3.4	5.2	8.6	289	174
-24.5	2273	471	2744	3167	1295	7.5	7.5	15.0	367	183
-25.0	2620	471	3091	3657	1399	8.8	7.6	16.4	409	189
-25.5	2833	471	3304	3919	1502	9.7	7.5	17.2	441	192
-26.0	2893	471	3364	3919	1606	10.0	7.3	17.3	462	194
-26.5	2954	471	3426	3919	1711	10.4	7.1	17.5	484	196
-27.0	3015	471	3486	3919	1815	10.8	6.9	17.6	507	198
-27.5	3075	471	3546	3919	1918	11.1	6.7	17.8	530	199
-28.0	3135	471	3607	3919	2022	11.5	6.5	18.0	554	201
-28.5	3196	471	3667	3919	2125	11.8	6.3	18.2	579	202
-29.0	3256	471	3728	3919	2229	12.2	6.2	18.4	604	203

PileCore CPT results for S03			CEMS
X coordinate* [m]:	123774.0	Excavation level [m NAP]:	N.A.
Y coordinate* [m]:	483449.0	$\rho_{sur;rep}$ $[kN/m^2]$	0.0
Groundwater level [m NAP]:	-0.4	ξ [-]	1.39
Surface level [m NAP]:	-0.25	qc-reduction:	N.A.

* The x and y coordinates of the CPT need to be in a Cartesian metric coordinate system.

Soil classification:

Soil code	Bottom	Thickness	γ_{unsat}	γ_{sat}	Φ'
[-]	[m NAP]	[m]	$[kN/m^3]$	$[kN/m^3]$	[°]
Zk7s1	-0.33	0.08	19.0	21.0	30.0
Zk7s1	-13.34	13.01	19.0	21.0	30.0
Zs1	-14.94	1.6	18.0	20.0	27.0
Zs1	-15.74	0.8	18.0	20.0	27.0
Zs1	-16.84	1.1	18.0	20.0	27.0
Zs1	-19.64	2.8	18.0	20.0	27.0
Zk3s2	-24.33	4.69	18.0	20.0	25.0
Zs1	-25.73	1.4	18.0	20.0	27.0
Zs1	-27.32	1.59	18.0	20.0	27.0
Zs1	-28.91	1.59	18.0	20.0	27.0
Zs1	-32.38	3.47	18.0	20.0	27.0
Zs1	-35.41	3.03	18.0	20.0	27.0

Friction range:

Pile tip level	Negative friction range [m NAP]		Positive friction range [m NAP]	
[m NAP]	Top	Bottom	Top	Bottom
-24.0	-0.25	-0.25	-0.25	-23.99
-24.5	-0.25	-0.25	-0.25	-24.51
-25.0	-0.25	-0.25	-0.25	-25.01
-25.5	-0.25	-0.25	-0.25	-25.51
-26.0	-0.25	-0.25	-0.25	-26.0
-26.5	-0.25	-0.25	-0.25	-26.5
-27.0	-0.25	-0.25	-0.25	-27.0
-27.5	-0.25	-0.25	-0.25	-27.5
-28.0	-0.25	-0.25	-0.25	-27.99
-28.5	-0.25	-0.25	-0.25	-28.49
-29.0	-0.25	-0.25	-0.25	-29.01

Negative skin friction[1)] :

Soil code	Bottom	Thickness	Average circum. [2]	$\sigma'_{v;rep}$	δ_k	$K_{0;k}$ [3]	$F_{nk;d}$
[-]	[m NAP]	[m]	[m]	$[kN/m^2]$	[°]	[-]	[kN]

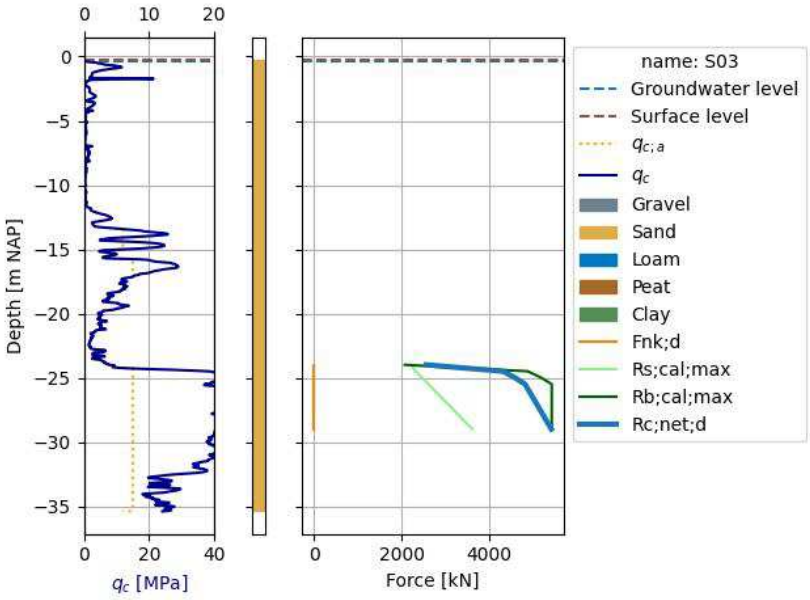
1) The results in this table are presented for the specific case when the pile-tip level is at -29.0 m NAP.
2) The average circumference of the pile per soil layer.
3) A minimum value of 0.25 for the product $K_{0;k}\tan(\delta_{j;k})$ is applied in the calculations (7.3.2.2(7)(d)).

Pile bearing capacity (ULS):

Pile tip level	Base resistance					Shaft resistance		Pile resistance			
	$q_{c;I;gem}$	$q_{c;II;gem}$	$q_{c;III;gem}$	$q_{b;max}$	$R_{b;cal;max}$	$q_{s;max;av}$ [4]	$R_{s;cal;max}$	$R_{c;k}$	$R_{c;d}$	$F_{nk;d}$	$R_{c;net;d}$
[m NAP]	[MPa]	[MPa]	[MPa]	[MPa]	[kN]	[kPa]	[kN]	[kN]	[kN]	[kN]	[kN]
-24.0	16.1	16.1	2.1	5.7	2077	43.6	2211	3085	2571	0	2571
-24.5	41.5	36.9	3.6	13.5	4898	45.01	2329	5199	4332	0	4332
-25.0	40.4	36.9	6.8	14.3	5204	46.83	2472	5522	4602	0	4602
-25.5	51.4	39.4	10.1	15.0	5448	48.57	2616	5801	4834	0	4834
-26.0	50.6	40.8	13.5	15.0	5448	50.24	2760	5905	4920	0	4920
-26.5	47.2	39.6	16.9	15.0	5448	51.85	2903	6008	5007	0	5007
-27.0	44.8	38.3	20.1	15.0	5448	53.41	3050	6113	5094	0	5094
-27.5	42.3	37.7	23.2	15.0	5448	54.9	3193	6216	5180	0	5180
-28.0	42.2	37.8	26.5	15.0	5448	56.34	3337	6319	5266	0	5266
-28.5	41.1	37.7	29.8	15.0	5448	57.73	3480	6422	5352	0	5352
-29.0	39.7	33.4	29.6	15.0	5448	59.13	3626	6528	5440	0	5440

4)The average maximum shaft friction in the positive friction zone.

CPT and bearing capacity



Pile settlement (SLS):

Pile tip level	SLS loads			Distributed capacity		Pile settlement/ spring stiffness				
	$F_{c;k}$	$F_{nk;k}$	$F_{c;k;tot}$	$R_{b;k}$	$R_{s;k}$	S_{el}	S_b	S_1	K_b	K_1
[m NAP]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm]	[mm]	[mm]	[kN/mm]	[kN/mm]
-24.0	1800	0	1800	1495	1591	4.3	4.0	8.3	455	218
-24.5	3033	0	3033	3523	1675	8.3	6.0	14.3	502	212
-25.0	3221	0	3221	3744	1779	9.0	6.0	15.1	533	214
-25.5	3384	0	3384	3919	1882	9.7	6.0	15.7	563	215
-26.0	3444	0	3444	3919	1985	10.0	5.9	15.9	587	217
-26.5	3505	0	3505	3919	2089	10.4	5.7	16.1	613	218
-27.0	3566	0	3566	3919	2194	10.7	5.6	16.3	640	219
-27.5	3626	0	3626	3919	2297	11.1	5.4	16.5	667	220
-28.0	3686	0	3686	3919	2400	11.4	5.3	16.7	694	220
-28.5	3746	0	3746	3919	2503	11.8	5.2	17.0	723	221
-29.0	3808	0	3808	3919	2608	12.2	5.1	17.2	753	221

PileCore CPT results for S01			CEMS
X coordinate* [m]:	123805.0	Excavation level [m NAP]:	N.A.
Y coordinate* [m]:	483464.0	$\rho_{sur;rep}$ $[kN/m^2]$	0.0
Groundwater level [m NAP]:	-0.4	ξ [-]	1.39
Surface level [m NAP]:	-0.22	qc-reduction:	N.A.

* The x and y coordinates of the CPT need to be in a Cartesian metric coordinate system.

Soil classification:

Soil code	Bottom	Thickness	γ_{unsat}	γ_{sat}	Φ'
[-]	[m NAP]	[m]	$[kN/m^3]$	$[kN/m^3]$	[°]
Ks2	-1.5	1.28	21.0	21.0	27.5
Ks2	-4.72	3.22	21.0	21.0	27.5
Kv2s1	-6.12	1.4	16.0	16.0	15.0
Ks1	-6.82	0.7	21.0	21.0	27.5
Zk6s2	-10.22	3.4	19.0	21.0	30.0
Ks2	-11.22	1.0	18.0	18.0	22.5
Kv4s1	-11.62	0.4	15.0	15.0	15.0
Zs1k1	-13.91	2.3	18.0	20.0	27.0
Zs1	-19.2	5.29	18.0	20.0	27.0
Zs2	-23.29	4.09	18.0	20.0	27.0
Zs1	-25.08	1.79	18.0	20.0	27.0
Zs1	-25.58	0.5	18.0	20.0	27.0
Zs1	-28.47	2.88	18.0	20.0	27.0
Zs1	-33.53	5.06	18.0	20.0	27.0
Zs1	-35.46	1.94	18.0	20.0	27.0

Friction range:

Pile tip level	Negative friction range [m NAP]		Positive friction range [m NAP]	
[m NAP]	Top	Bottom	Top	Bottom
-24.0	-0.22	-11.62	-11.62	-24.01
-24.5	-0.22	-11.62	-11.62	-24.51
-25.0	-0.22	-11.62	-11.62	-25.0
-25.5	-0.22	-11.62	-11.62	-25.5
-26.0	-0.22	-11.62	-11.62	-26.0
-26.5	-0.22	-11.62	-11.62	-26.5
-27.0	-0.22	-11.62	-11.62	-27.0
-27.5	-0.22	-11.62	-11.62	-27.49
-28.0	-0.22	-11.62	-11.62	-27.99
-28.5	-0.22	-11.62	-11.62	-28.51
-29.0	-0.22	-11.62	-11.62	-29.0

Negative skin friction[1)] :

Soil code	Bottom	Thickness	Average circum. [2]	$\sigma'_{v;rep}$	δ_k	$K_{0;k}$ [3]	$F_{nk;d}$
[-]	[m NAP]	[m]	[m]	$[kN/m^2]$	[°]	[-]	[kN]
Ks2	-1.5	1.28	2.14	8.7	27.5	0.5	7
Ks2	-4.72	3.22	2.14	34.0	27.5	0.5	66
Kv2s1	-6.12	1.4	2.14	56.4	15.0	0.7	42
Ks1	-6.82	0.7	2.14	64.6	27.5	0.5	27
Zk6s2	-10.22	3.4	2.14	87.5	30.0	0.5	184
Ks2	-11.22	1.0	2.14	110.6	22.5	0.6	61
Kv4s1	-11.62	0.4	2.14	115.8	15.0	0.7	23

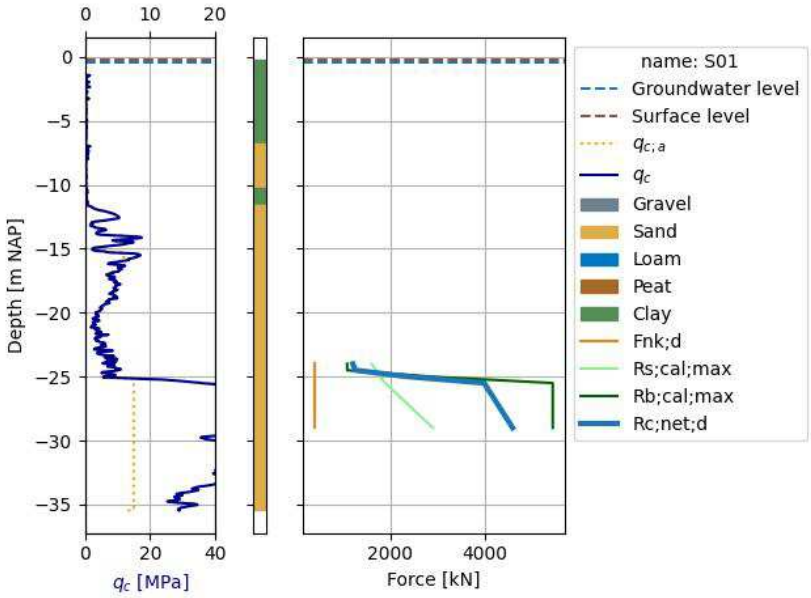
1) The results in this table are presented for the specific case when the pile-tip level is at -29.0 m NAP.
2) The average circumference of the pile per soil layer.
3) A minimum value of 0.25 for the product $K_{0;k}\tan(\delta_{j;k})$ is applied in the calculations (7.3.2.2(7)(d)).

Pile bearing capacity (ULS):

Pile tip level	Base resistance					Shaft resistance		Pile resistance			
	$q_{c;I;gem}$	$q_{c;II;gem}$	$q_{c;III;gem}$	$q_{b;max}$	$R_{b;cal;max}$	$q_{s;max;av}$ [4]	$R_{s;cal;max}$	$R_{c;k}$	$R_{c;d}$	$F_{nk;d}$	$R_{c;net;d}$
[m NAP]	[MPa]	[MPa]	[MPa]	[MPa]	[kN]	[kPa]	[kN]	[kN]	[kN]	[kN]	[kN]
-24.0	8.2	5.3	2.8	3.0	1085	60.83	1610	1939	1616	409	1207
-24.5	7.5	5.4	3.1	3.0	1088	61.59	1695	2003	1669	409	1259
-25.0	21.8	21.8	3.4	7.9	2879	61.82	1769	3343	2786	409	2377
-25.5	50.4	44.1	5.3	15.0	5448	63.95	1894	5282	4401	409	3992
-26.0	50.9	44.6	9.1	15.0	5448	66.41	2037	5385	4487	409	4078
-26.5	49.0	44.6	13.0	15.0	5448	68.7	2184	5490	4575	409	4166
-27.0	47.7	35.8	14.5	15.0	5448	70.85	2327	5593	4661	409	4252
-27.5	46.7	35.8	17.4	15.0	5448	72.86	2471	5697	4747	409	4338
-28.0	45.7	35.8	20.4	15.0	5448	74.75	2614	5800	4833	409	4424
-28.5	43.9	35.8	23.4	15.0	5448	76.6	2760	5905	4921	409	4512
-29.0	42.3	35.9	26.2	15.0	5448	78.27	2904	6008	5007	409	4598

4)The average maximum shaft friction in the positive friction zone.

CPT and bearing capacity



Pile settlement (SLS):

Pile tip level	SLS loads			Distributed capacity		Pile settlement/ spring stiffness				
	$F_{c;k}$	$F_{nk;k}$	$F_{c;k;tot}$	$R_{b;k}$	$R_{s;k}$	S_{el}	S_b	S_1	K_b	K_1
[m NAP]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm]	[mm]	[mm]	[kN/mm]	[kN/mm]
-24.0	845	409	1254	781	1158	2.8	4.5	7.3	278	171
-24.5	882	409	1291	783	1219	3.0	4.4	7.3	296	176
-25.0	1664	409	2073	2071	1272	5.6	6.3	11.9	327	174
-25.5	2794	409	3204	3919	1362	9.5	7.7	17.2	417	187
-26.0	2855	409	3264	3919	1466	9.8	7.5	17.3	437	189
-26.5	2916	409	3325	3919	1571	10.2	7.2	17.5	459	191
-27.0	2976	409	3386	3919	1674	10.6	7.0	17.6	481	192
-27.5	3037	409	3446	3919	1778	10.9	6.8	17.8	503	194
-28.0	3097	409	3506	3919	1881	11.3	6.7	17.9	527	195
-28.5	3158	409	3567	3919	1986	11.7	6.5	18.1	551	197
-29.0	3218	409	3628	3919	2089	12.0	6.3	18.3	576	198

PileCore CPT results for S05			CEMS
X coordinate* [m]:	123778.0	Excavation level [m NAP]:	N.A.
Y coordinate* [m]:	483481.0	$\rho_{sur;rep}$ $[kN/m^2]$	0.0
Groundwater level [m NAP]:	-0.4	ξ [-]	1.39
Surface level [m NAP]:	0.2	qc-reduction:	N.A.

* The x and y coordinates of the CPT need to be in a Cartesian metric coordinate system.

Soil classification:

Soil code	Bottom	Thickness	γ_{unsat}	γ_{sat}	Φ'
[-]	[m NAP]	[m]	$[kN/m^3]$	$[kN/m^3]$	[°]
Zs1k1	0.12	0.08	19.0	21.0	32.5
Zs1k1	-0.5	0.62	19.0	21.0	32.5
Zs1	-4.6	4.1	19.0	21.0	32.5
Kz5s2	-11.9	7.3	20.0	20.0	32.5
Zs1	-18.49	6.6	18.0	20.0	27.0
Zs1	-25.39	6.89	18.0	20.0	27.0
Zs1	-26.78	1.4	18.0	20.0	27.0
Zs1	-31.27	4.49	18.0	20.0	27.0
Zs1	-32.77	1.5	18.0	20.0	27.0
Zs1	-35.04	2.27	18.0	20.0	27.0

Friction range:

Pile tip level	Negative friction range [m NAP]		Positive friction range [m NAP]	
[m NAP]	Top	Bottom	Top	Bottom
-24.0	0.2	-11.9	-11.9	-24.01
-24.5	0.2	-11.9	-11.9	-24.51
-25.0	0.2	-11.9	-11.9	-25.0
-25.5	0.2	-11.9	-11.9	-25.5
-26.0	0.2	-11.9	-11.9	-26.0
-26.5	0.2	-11.9	-11.9	-26.5
-27.0	0.2	-11.9	-11.9	-27.0
-27.5	0.2	-11.9	-11.9	-27.5
-28.0	0.2	-11.9	-11.9	-28.0
-28.5	0.2	-11.9	-11.9	-28.5
-29.0	0.2	-11.9	-11.9	-29.0

Negative skin friction[1] :

Soil code	Bottom	Thickness	Average circum. [2]	$\sigma'_{v;rep}$	δ_k	$K_{0;k}$[3]	$F_{nk;d}$
[-]	[m NAP]	[m]	[m]	$[kN/m^2]$	[°]	[-]	[kN]
Zs1k1	0.12	0.08	2.14	0.6	32.5	0.5	0
Zs1k1	-0.5	0.62	2.14	7.2	32.5	0.5	3
Zs1	-4.6	4.1	2.14	35.3	32.5	0.5	92
Kz5s2	-11.9	7.3	2.14	95.7	32.5	0.5	437

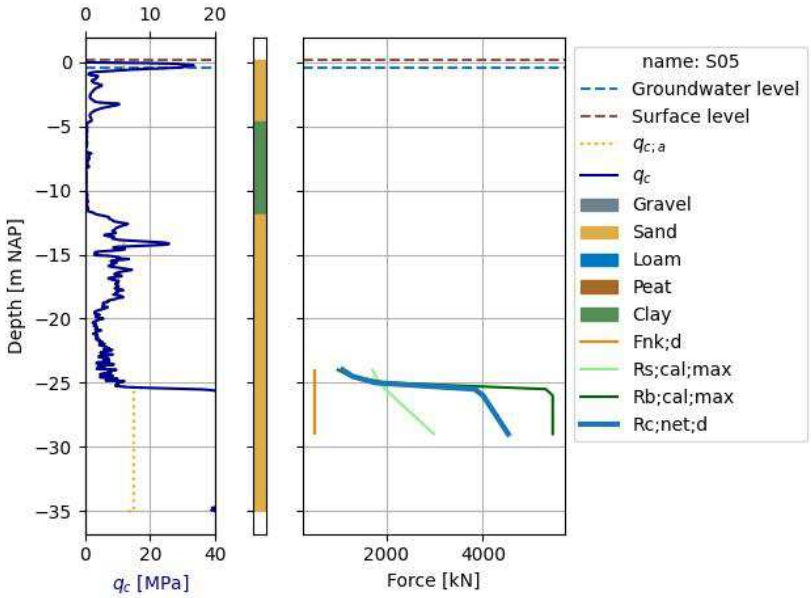
1) The results in this table are presented for the specific case when the pile-tip level is at -29.0 m NAP.
2) The average circumference of the pile per soil layer.
3) A minimum value of 0.25 for the product $K_{0;k} \tan(\delta_{j;k})$ is applied in the calculations (7.3.2.2(7)(d)).

Pile bearing capacity (ULS):

Pile tip level	Base resistance					Shaft resistance		Pile resistance			
	$q_{c;I;gem}$	$q_{c;II;gem}$	$q_{c;III;gem}$	$q_{b;max}$	$R_{b;cal;max}$	$q_{s;max;av}$ [4)]	$R_{s;cal;max}$	$R_{c;k}$	$R_{c;d}$	$F_{nk;d}$	$R_{c;net;d}$
[m NAP]	[MPa]	[MPa]	[MPa]	[MPa]	[kN]	[kPa]	[kN]	[kN]	[kN]	[kN]	[kN]
-24.0	6.8	4.7	3.1	2.8	1003	66.43	1717	1957	1631	532	1099
-24.5	8.4	7.3	3.3	3.5	1268	66.28	1785	2197	1831	532	1299
-25.0	13.8	13.5	3.7	5.5	1982	66.68	1865	2768	2307	532	1775
-25.5	41.8	41.4	4.8	14.6	5303	68.12	1977	5237	4364	532	3832
-26.0	43.5	43.0	8.3	15.0	5448	70.49	2121	5445	4537	532	4005
-26.5	50.2	50.2	12.0	15.0	5448	72.69	2264	5548	4623	532	4091
-27.0	58.9	54.9	16.3	15.0	5448	74.75	2408	5652	4710	532	4178
-27.5	58.0	54.9	21.0	15.0	5448	76.68	2555	5757	4798	532	4266
-28.0	56.5	51.4	25.0	15.0	5448	78.48	2699	5861	4884	532	4352
-28.5	55.8	51.5	29.4	15.0	5448	80.18	2843	5964	4970	532	4438
-29.0	54.4	48.6	32.7	15.0	5448	81.78	2987	6068	5057	532	4525

4)The average maximum shaft friction in the positive friction zone.

CPT and bearing capacity



Pile settlement (SLS):

Pile tip level	SLS loads			Distributed capacity		Pile settlement/ spring stiffness				
	$F_{c;k}$	$F_{nk;k}$	$F_{c;k;tot}$	$R_{b;k}$	$R_{s;k}$	S_{el}	S_b	S_1	K_b	K_1
[m NAP]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm]	[mm]	[mm]	[kN/mm]	[kN/mm]
-24.0	769	532	1301	721	1235	2.8	4.6	7.4	285	177
-24.5	909	532	1441	913	1284	3.3	4.8	8.1	299	178
-25.0	1242	532	1774	1426	1342	4.4	5.6	10.0	318	178
-25.5	2683	532	3215	3815	1422	9.4	7.7	17.2	417	187
-26.0	2804	532	3336	3919	1526	10.0	7.6	17.6	441	190
-26.5	2864	532	3396	3919	1629	10.4	7.3	17.7	462	192
-27.0	2924	532	3456	3919	1733	10.7	7.1	17.9	484	193
-27.5	2986	532	3518	3919	1838	11.1	6.9	18.0	507	195
-28.0	3046	532	3578	3919	1942	11.5	6.7	18.2	530	196
-28.5	3107	532	3639	3919	2045	11.8	6.6	18.4	554	198
-29.0	3167	532	3699	3919	2149	12.2	6.4	18.6	579	199

PileCore results for user defined CPT Group

CPT[1)]	X coordinate[2)]	Y coordinate[2)]	Surface level	Groundwater level	Excavation level	$\rho_{sur;rep}$
	[m]	[m]	[m NAP]	[m NAP]	[m NAP]	[kN/m^2]
S07	123787.00	483465.00	0.12	-0.4	0.12	0
S06	123789.00	483485.00	0.18	-0.4	0.18	0
S02	123797.00	483441.00	-0.63	-0.4	-0.63	0
S04	123759.00	483465.00	-0.15	-0.4	-0.15	0
S03	123774.00	483449.00	-0.25	-0.4	-0.25	0
S01	123805.00	483464.00	-0.22	-0.4	-0.22	0
S05	123778.00	483481.00	0.2	-0.4	0.2	0

1) Other input parameters that are used to calculate the bearing capacity (e.g. positive skin friction trajectory) can be found in the individual CPT results report.
2) The x and y coordinates of the CPT need to be in a Cartesian metric coordinate system.

Pile Tip Level	$R_{c;cal;mean}$	$R_{c;cal;min}$	Factor	Var. co-eff	Nominal CPT	$R_{c;k}$	$R_{c;d}$	$F_{nk;d}$[3)]	$R_{c;net;d}$	ξ[4)]
[m NAP]	[kN]	[kN]	[-]	[%]	[-]	[kN]	[kN]	[kN]	[kN]	[-]
-24.0	2863	1394	4	29.9	S02	1003	836	1637	0	1.39
-24.5	4081	2783	4	44.9	S01	2003	1669	409	1259	1.39
-25.0	4956	3362	4	34.3	S06	2418	2015	413	1602	1.39
-25.5	7099	4710	4	15.3	S02	3389	2824	1637	1187	1.39
-26.0	7375	5635	4	10.9	S02	5579	4650	1637	3013	1.01
-26.5	7555	6029	3	9.5	Group av.	5949	4957	555	4403	1.27
-27.0	7714	6273	3	8.9	Group av.	6074	5061	555	4507	1.27
-27.5	7858	6417	3	8.7	Group av.	6187	5156	555	4602	1.27
-28.0	8002	6561	3	8.5	Group av.	6300	5250	555	4696	1.27
-28.5	8146	6708	3	8.4	Group av.	6414	5345	555	4791	1.27
-29.0	8291	6852	3	8.2	Group av.	6528	5440	555	4886	1.27

3) The design negative friction force is based on the Nominal CPT. If the 3 factor is applied, the friction force is the group average.
4) The values are related to the net pile bearing capacity (NEN9997-1 7.6.2.3). Based on the lowest outcome of Rc;net;d, this can either be a 3 or 4 value (based on the nominal CPT). In case the variation coefficient is above 12

Pile settlement (SLS):

Pile tip level	SLS loads			Distributed capacity		Pile settlement/ spring stiffness				
	$F_{c;k}$	$F_{nk;k}$	$F_{c;k;tot}$	$R_{b;k}$	$R_{s;k}$	S_{el}	S_b	S_1	K_b	K_1
[m NAP]	[kN]	[kN]	[kN]	[kN]	[kN]	[mm]	[mm]	[mm]	[kN/mm]	[kN/mm]
-24.0	0	1637	1637	997	5	1.8	1000.0	1001.8	2	2
-24.5	882	409	1291	783	1219	3.0	4.4	7.3	296	176
-25.0	1121	413	1535	1109	1310	3.8	4.8	8.6	322	179
-25.5	831	1637	2468	3105	284	5.0	19.7	24.6	125	100
-26.0	2109	1637	3746	5047	532	6.5	14.8	21.2	253	176

-26.5	3082	555	3637	4278	1671	9.9	7.5	17.4	485	209
-27.0	3155	555	3709	4289	1784	10.3	7.3	17.6	508	211
-27.5	3221	555	3776	4289	1898	10.6	7.1	17.7	532	213
-28.0	3287	555	3842	4289	2011	11.0	6.9	17.9	557	215
-28.5	3354	555	3908	4289	2125	11.4	6.7	18.1	583	216
-29.0	3420	555	3974	4289	2239	11.8	6.5	18.3	609	217