Beräknade och uppmätta rörelser hos stödkonstruktioner-Västlänken

E03 Kvarnberget

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HM Geokonsult AB

ASTALDI • GÜLERMAK • NRC

HAGA

TRAFIKVERKET

Agenda:

Kort information om projektet följt av redogörelse av beräknade och uppmätta rörelser i slitsmurar för södra tunneldelen.

E03 Kvarnberget, Totalentreprenad

Beställare: Trafikverket

Entreprenör: AGN Haga AB

Konsulter: COWI, Ramböll och SGS

Slutbesiktning 15 maj 2024

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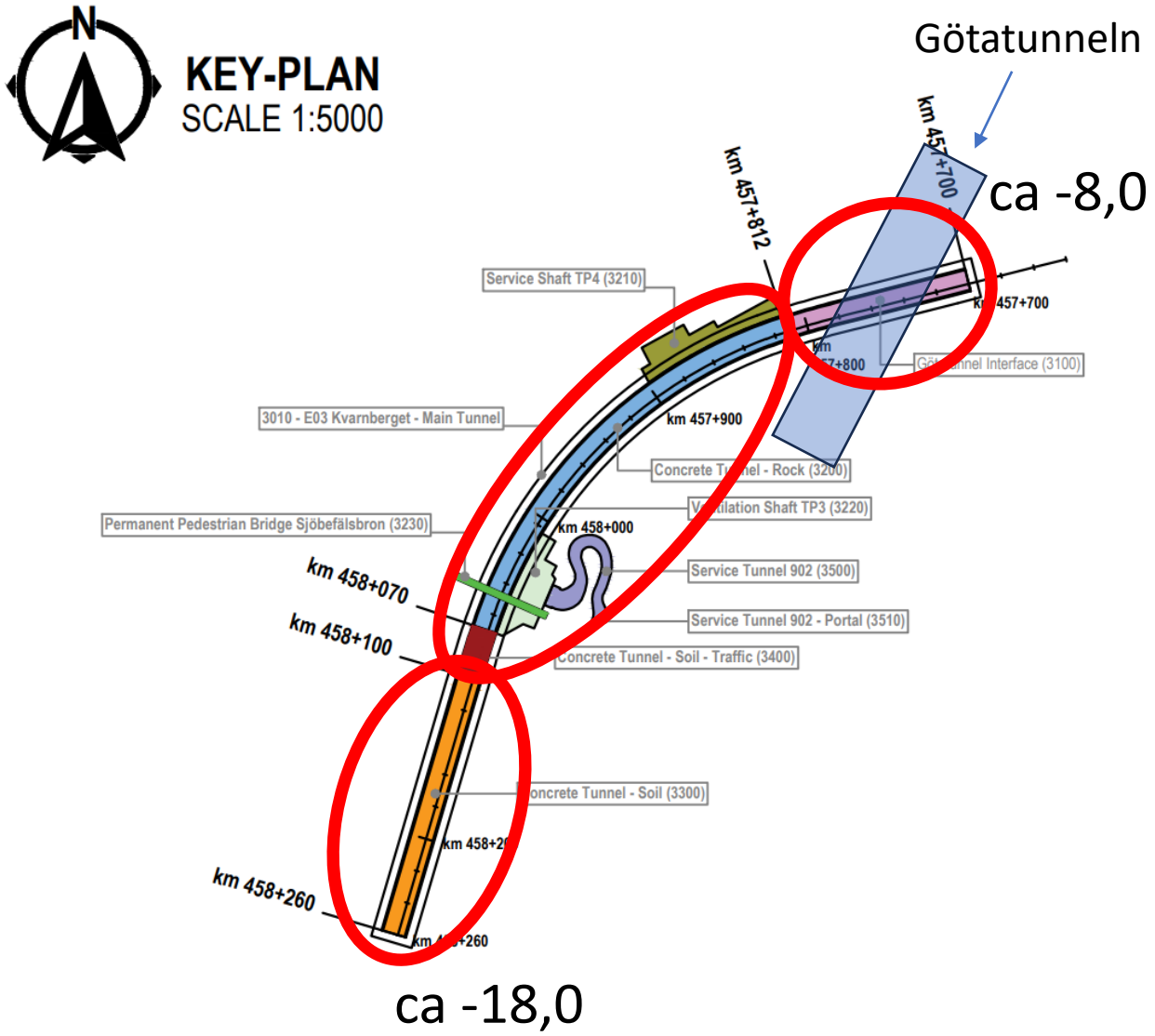
pålgrundläggning

- Norra delen, Götatunneln, svävande spont, stämp och bergstag. Kc-i skivor passivzon. Stödmur. Anslutning E02. Schaktbotten ca -8,0

- Mitt delen, västra sidan spont slagen till berg. Stämp och bergstag (några jordstag). Förankrad kantbalk på berg. Östra sidan sågad eller sprängd bergvägg, förstärkningar. Schaktbotten ca -8 till -15.

- Södra delen, slitsmurar, top-down, kc-pelare i block. Anslutning E04. Schaktbotten ca -15 till -18.



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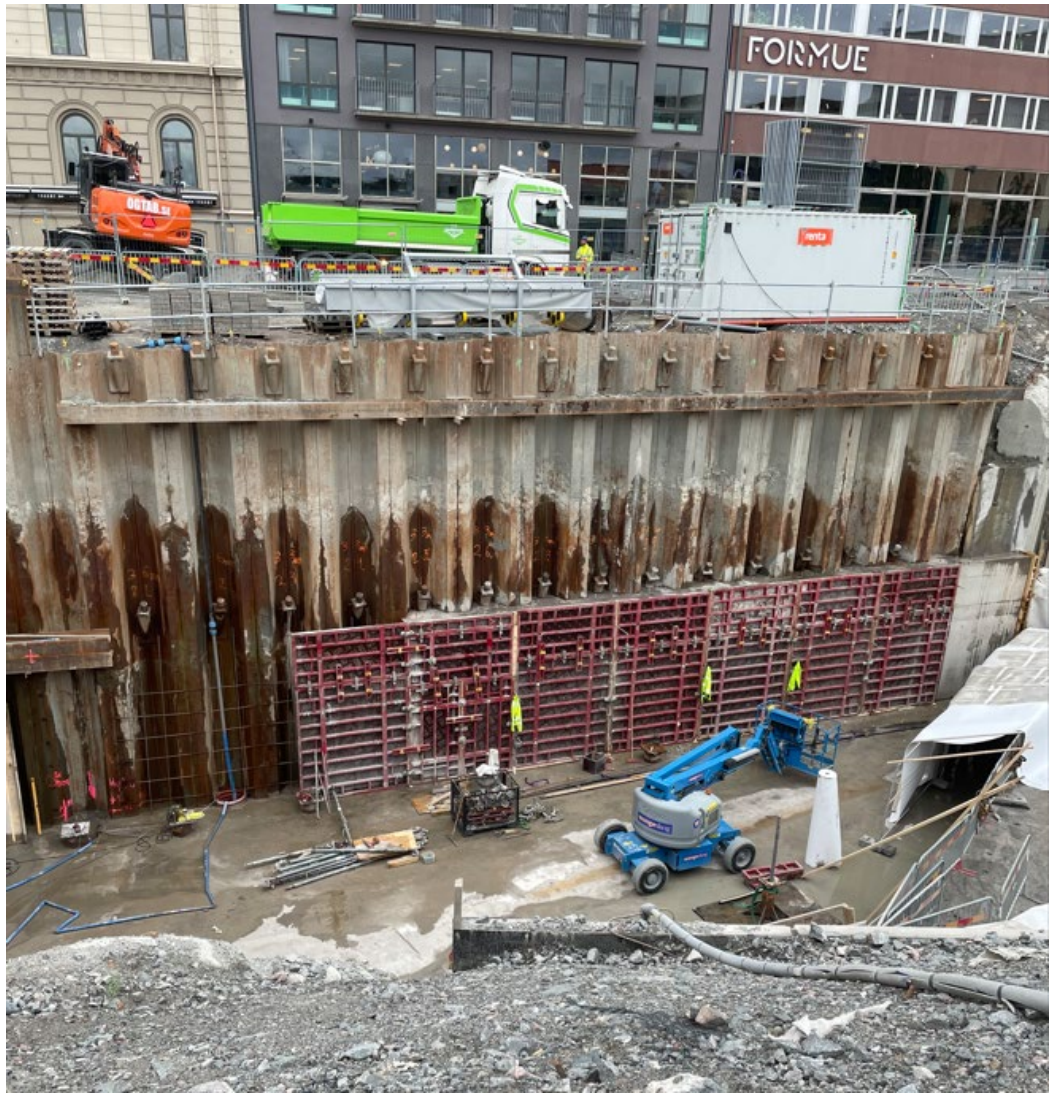
pålgrundläggning

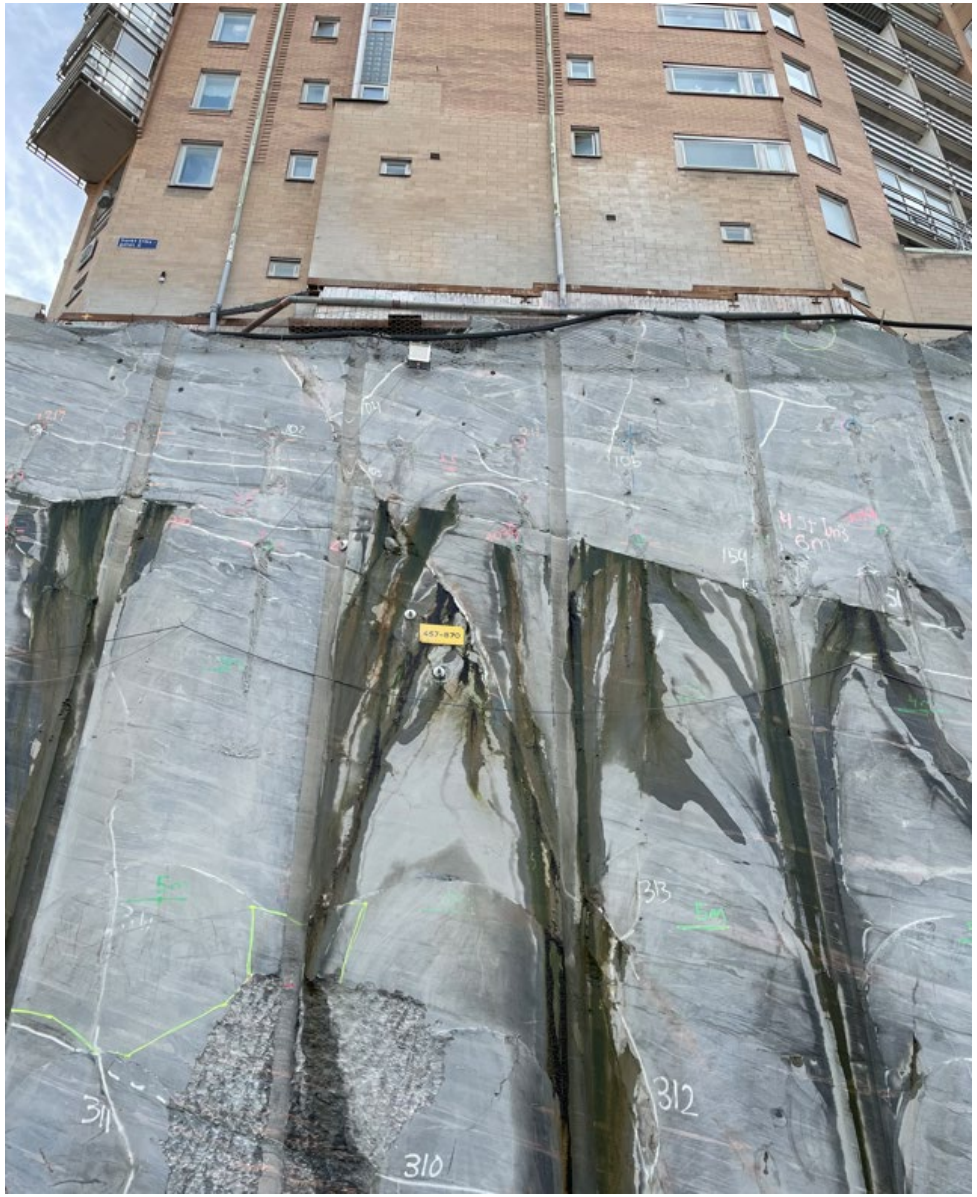
Norra delen



Norra delen E02

Mitten delen, västra sidan

Mitten delen, östra sidan



Mitten delen, Service tunnel

Mitten delen

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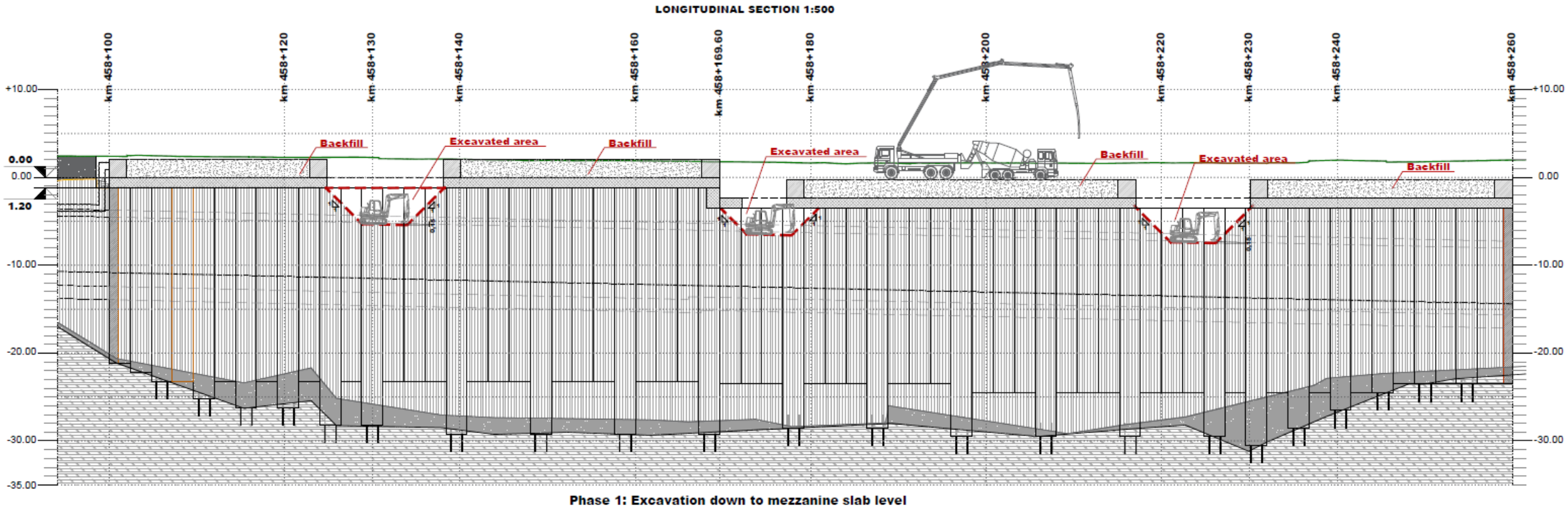
pålgrundläggning



Phase 1: Excavation down to mezzanine slab level

SS - Studio Geotecnico Strutturale s.r.l.
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Phone +3906/2316703
e-mail: amministrazione@studiosgsroma.com
website: www.studiosgsroma.com

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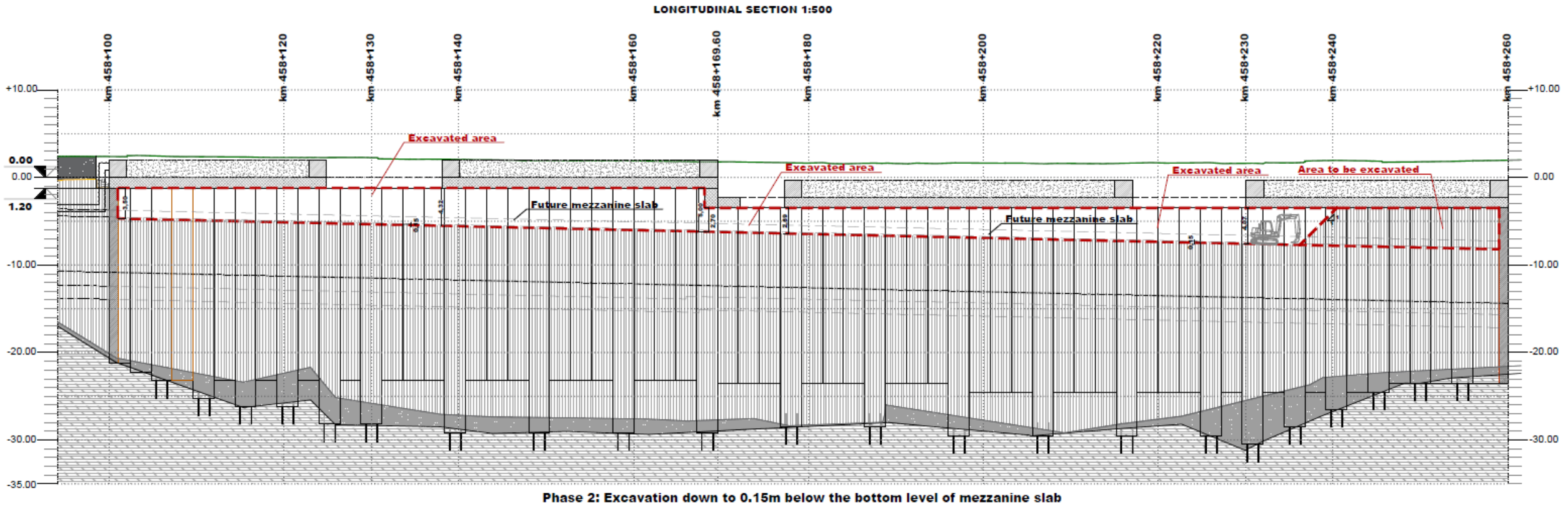
pålgrundläggning



Phase 2: Excavation down to 0.15m below the bottom level of mezzanine slab

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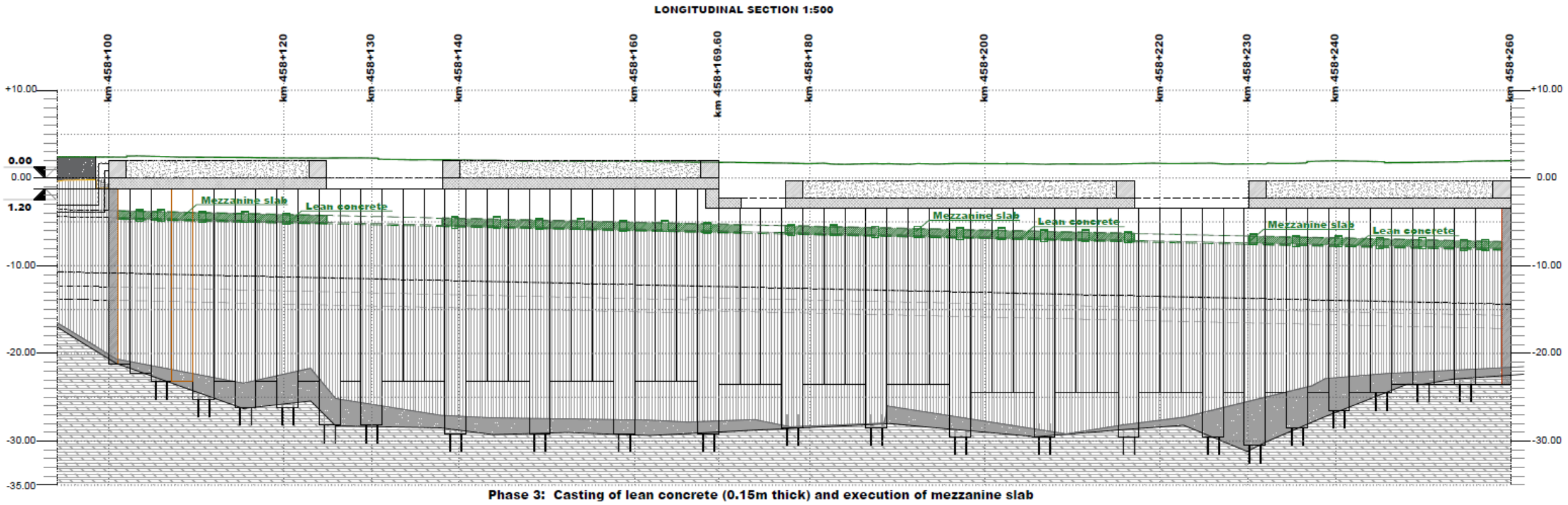

Phase 3: Casting of lean concrete (0.15m thick) and execution of mezzanine slab

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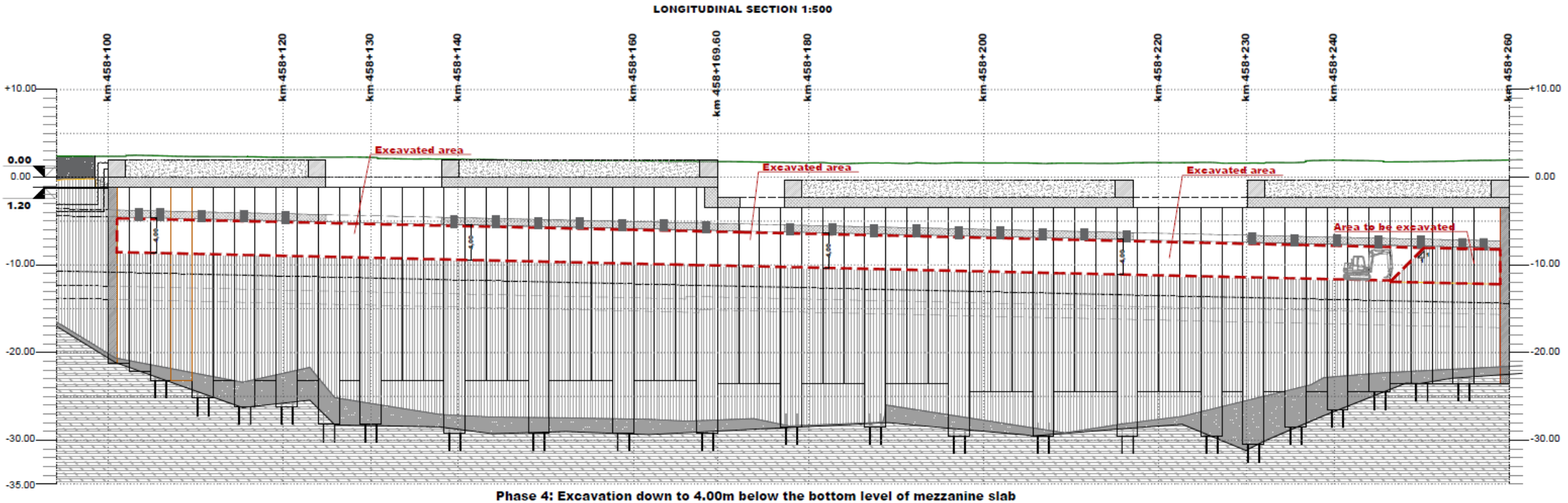

Phase 4: Excavation down to 4.00m below the bottom level of mezzanine slab

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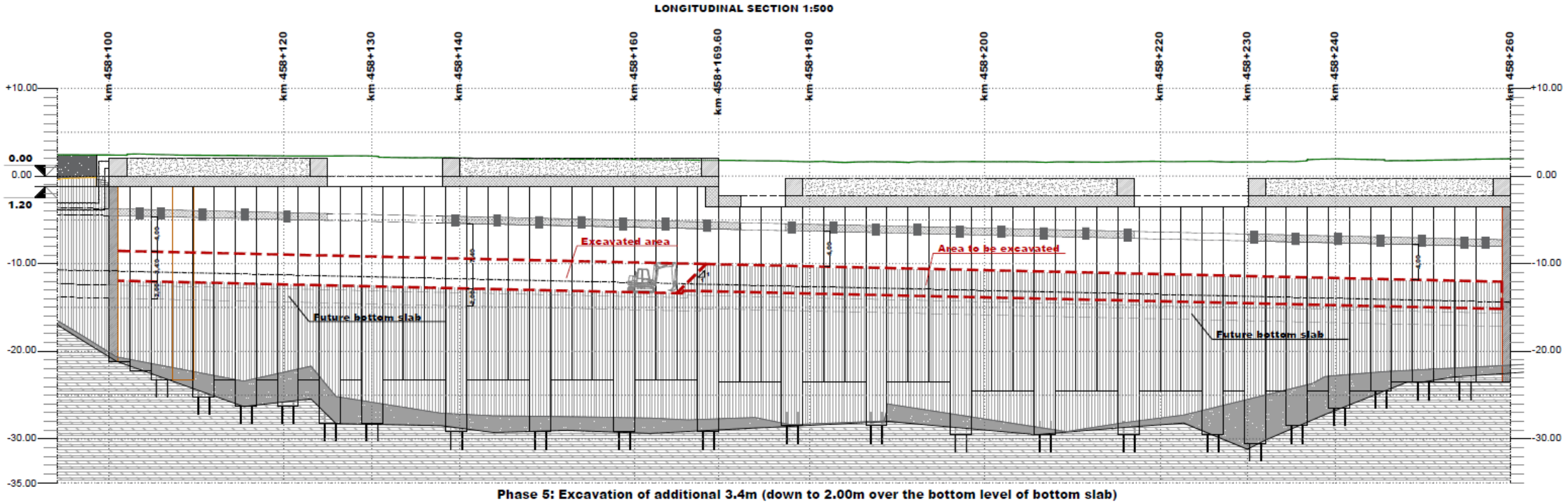

Phase 5: Excavation of additional 3.4m (down to 2.00m over the bottom level of bottom slab)

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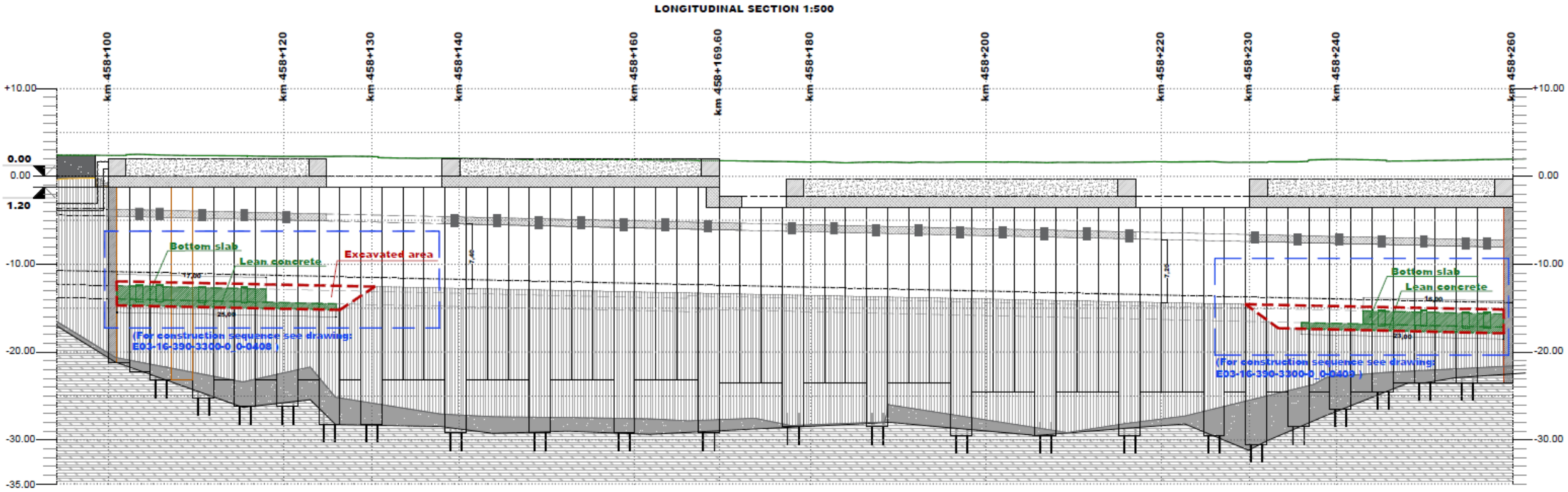

Phase 6: Local excavation, casting of lean concrete (0.70m thick) and partial execution of bottom slab at transition areas

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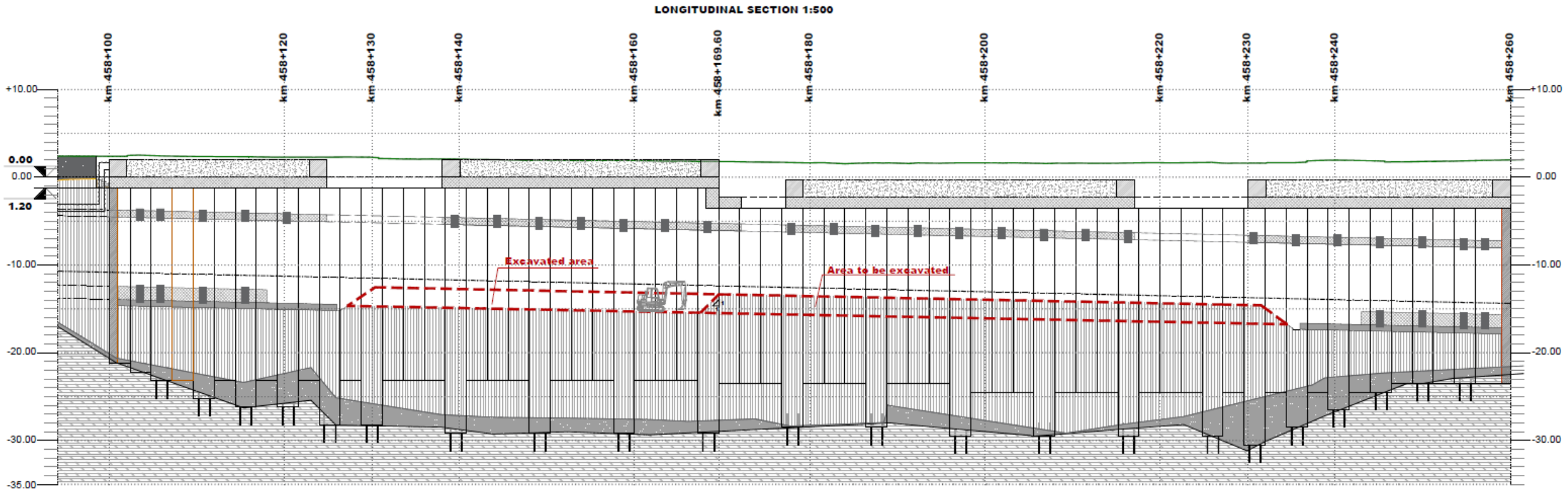

Phase 7: Excavation down to 0.15m below the bottom level of bottom slab

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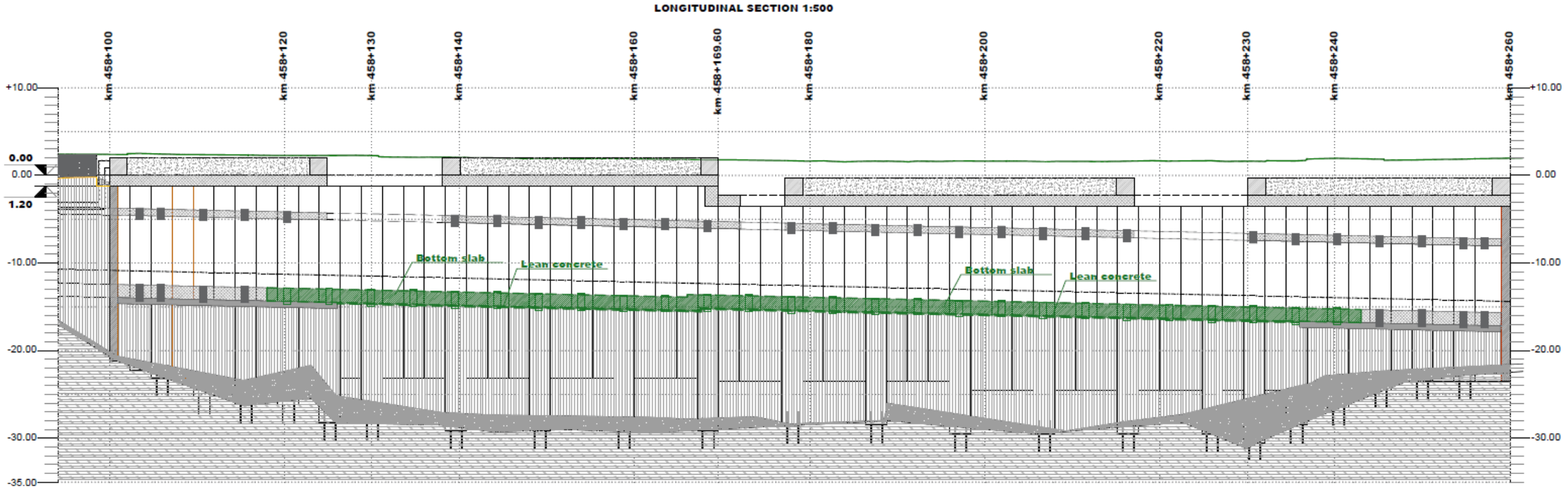

Phase 8: Casting of lean concrete (0.15m thick) and full installation of bottom slab

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Södra delen, slitsmurar, kc i block, top-down

Södra delen

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pålgrundläggning

Södra delen

Kc-pelare i block, DSM A

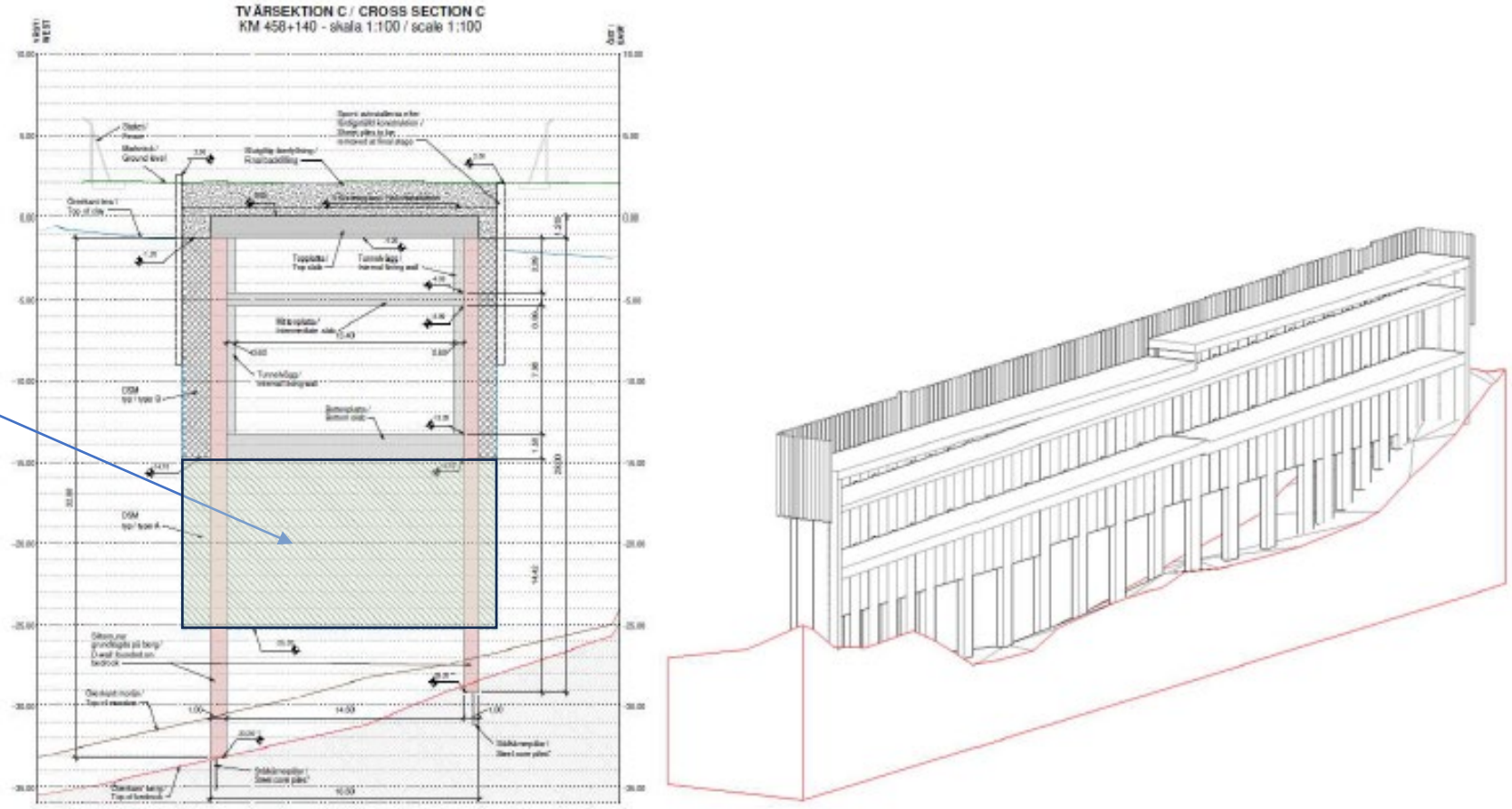


Figure 40 Typical section at Southern area (left) and 3D view (right)

Soil	Unit weight γ_{sat} [kN/m³]	Cohesion c_u [kPa]	Elastic modulus E' [Mpa]	Poisson ratio v [-]
DSM type B	16.5	100	52	0.3
DSM type A	16.5	250	130	0.3

Geometry

- column diameter is 800mm and spacing is 640mm
- two types of DSM are present: type A below excavation level and type B above excavation level

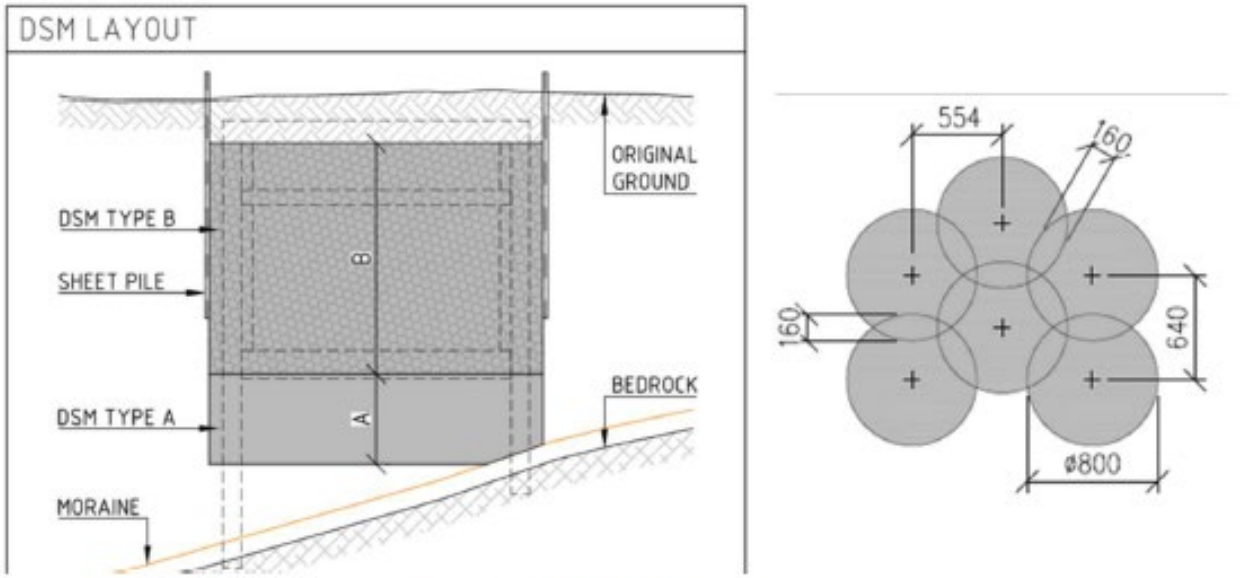


Figure 2 Main DSM geometry

DSM A, Kc-pelare i block tester

- n.89 of FKPS tests
- n.10 of FOPS tests
- n.9 of OPS tests
- n.38 of JB tests (done to verify bedrock level)
- coring with sample recovery and UCS tests (total of 14 tests from 4 boreholes)
- pressumeter tests (a total of 14 tests in 5 boreholes)
- down-hole and Cross-hole tests (very limited)

Medelvärden!!

Table 4 Summary of DSM parameters

TEST TYPE	AVERAGE UNIT WEIGHT γ (kN/m3)	AVERAGE SHEAR STRENGTH Cu (kPa)	AVERAGE STIFFNESS E' (Mpa)
FKPS	-	289-415	-
FOP / OPS	-	300	-
Lab tests on cores	17,1	555	-
Pressumeter	-	317-549	205-250
Seismic tests	-	-	345
JB soundings	-	-	-
DESIGN VALUES	16,5	250	130

FKPS

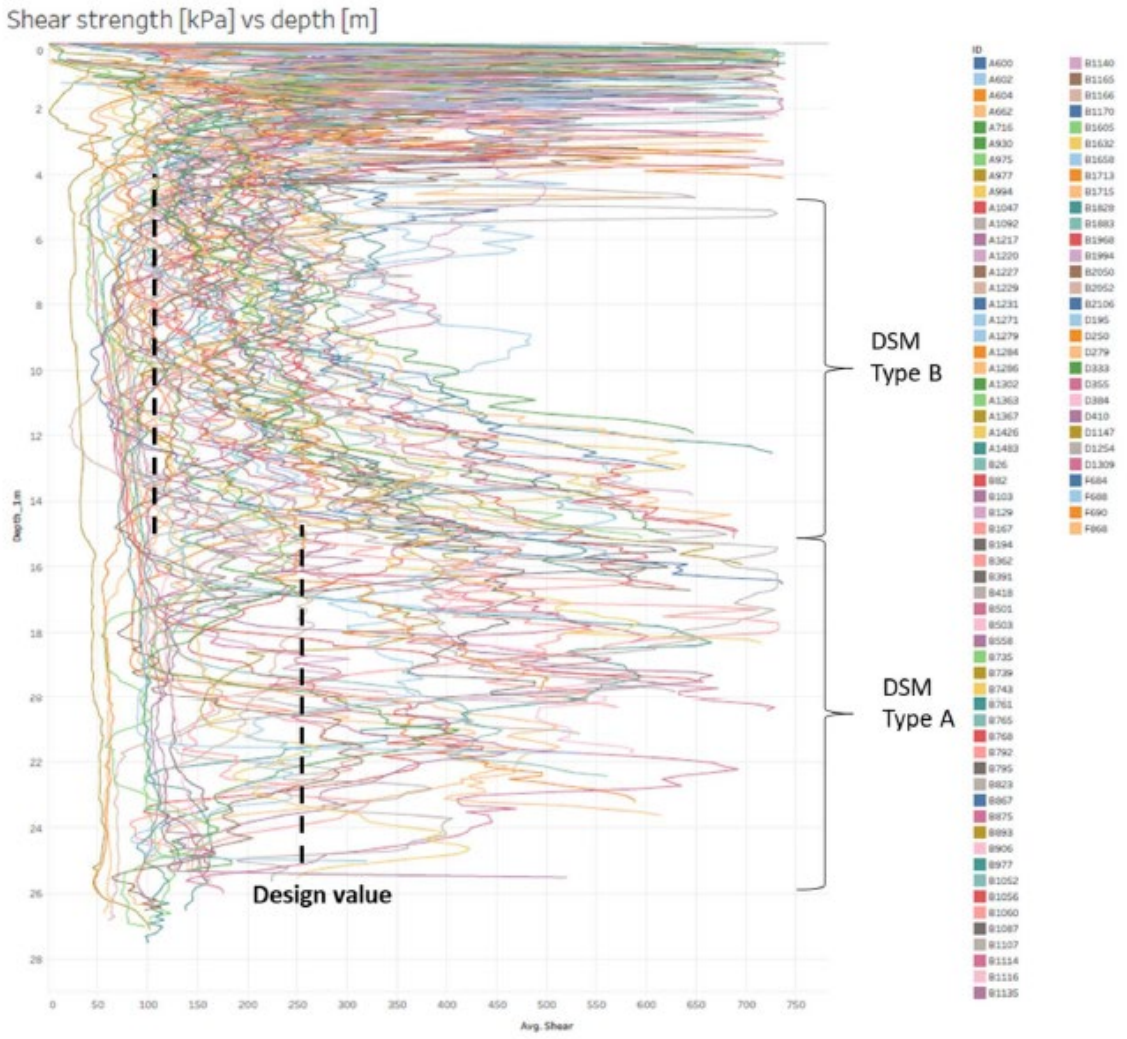


Figure 12 FKPS results

Pre-drilling force/FKPS

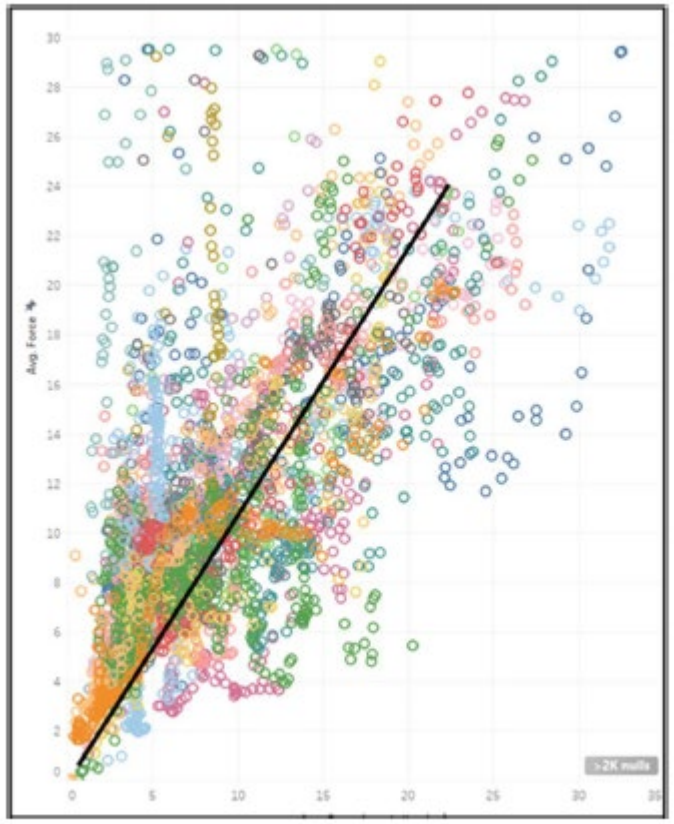
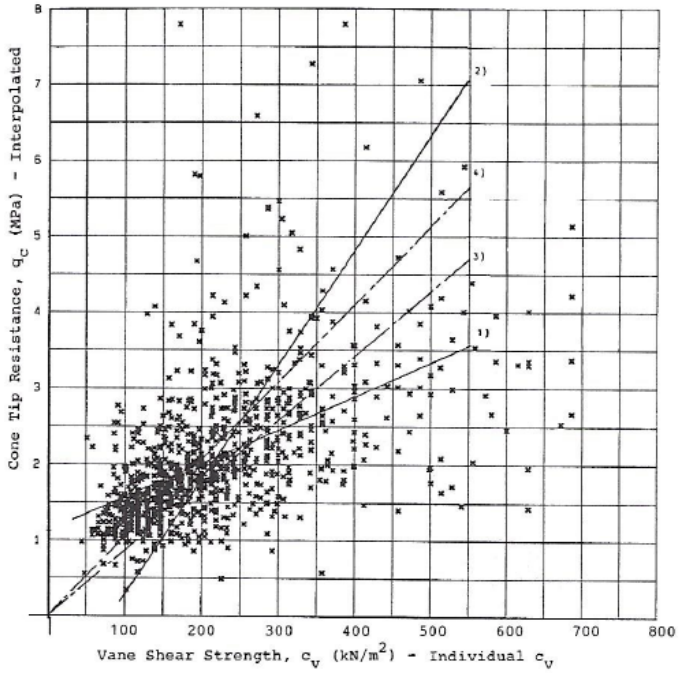


Figure 15 Correlation between pre-drilling force (x-axis) and wing force(y-axis)



Note: 1) Simple linear regression, q_c as dependent variable (q_c = 4.45 c_v+1107.4 (kN/m²))
2) Simple linear regression, c_v as dependent variable (c_v = 0.06734 q_c+75.7 (kN/m²) or q_c = 14.85 c_v-1124.1 (kN/m²))
3) Straight line regression through (0,0), q_c as dependent variable (q_c = 8.51 c_v (kN/m²))
4) Straight line regression through (0,0), c_v as dependent variable (c_v = 0.09798 q_c (kN/m²) or q_c = 10.20 c_v (kN/m²))

Fig. 12. Scatterplot q_c, c_v, individual c_v

Inklinometrar ingjutna i slitsmurar

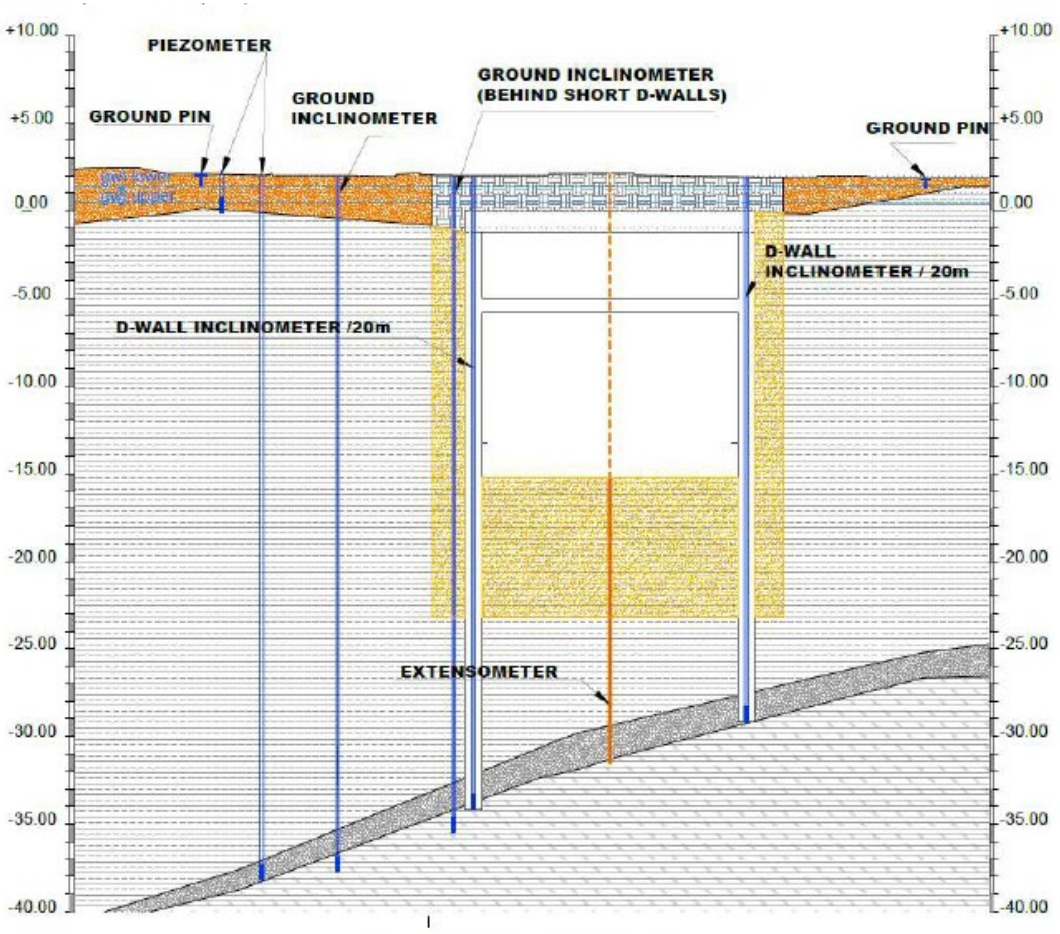
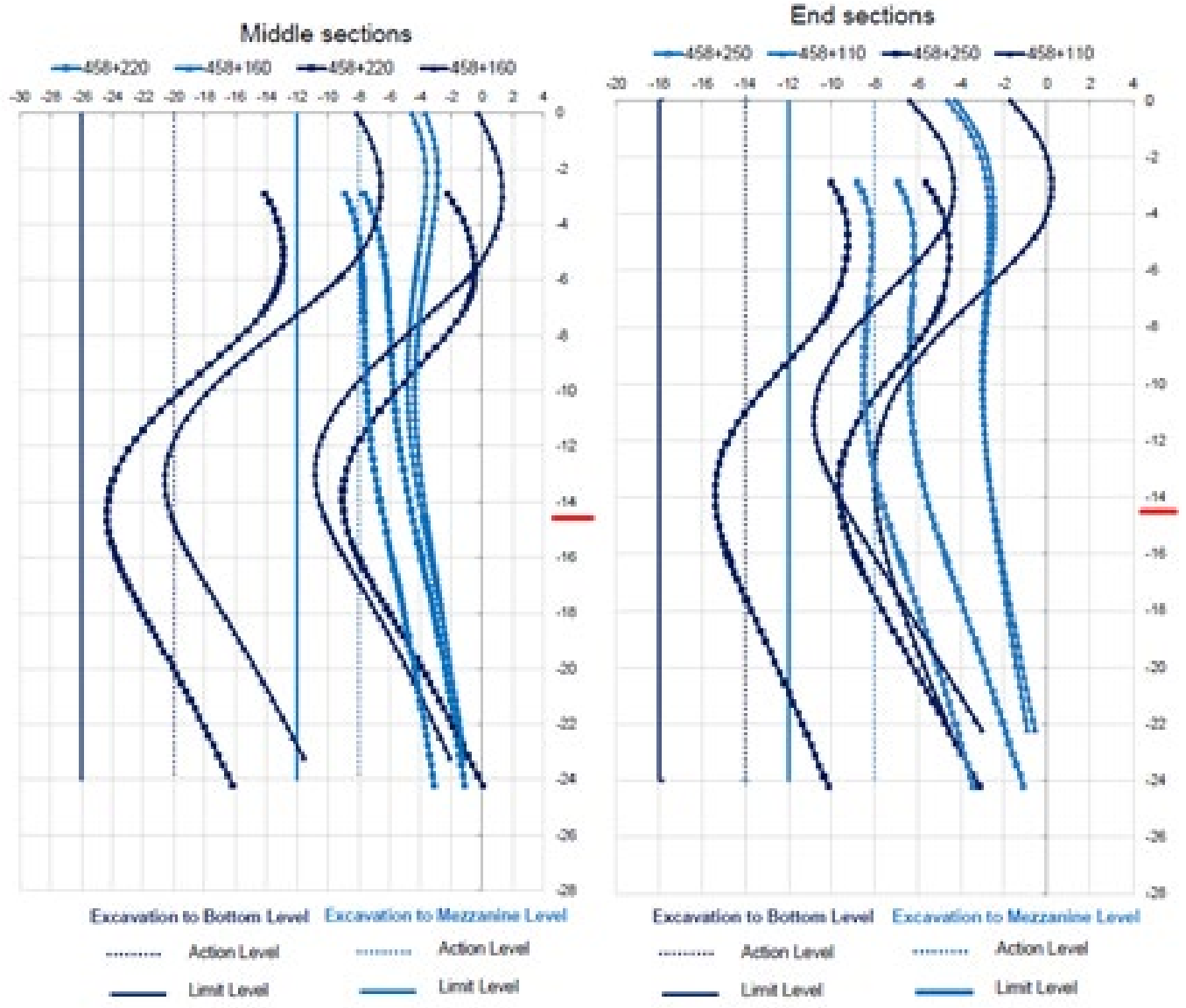
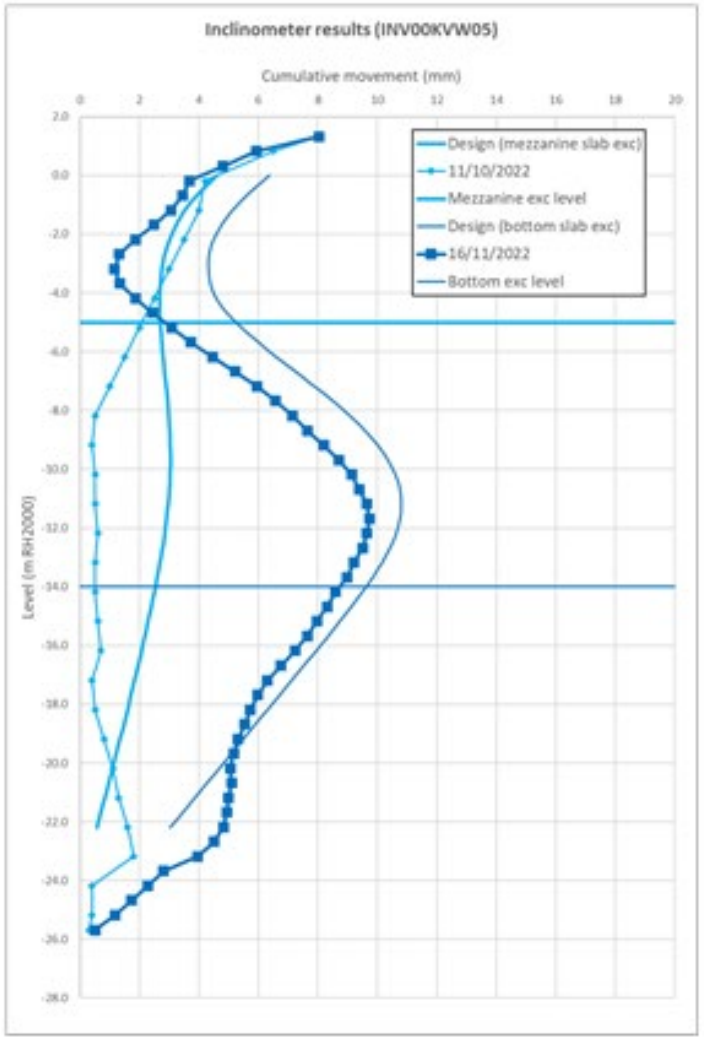


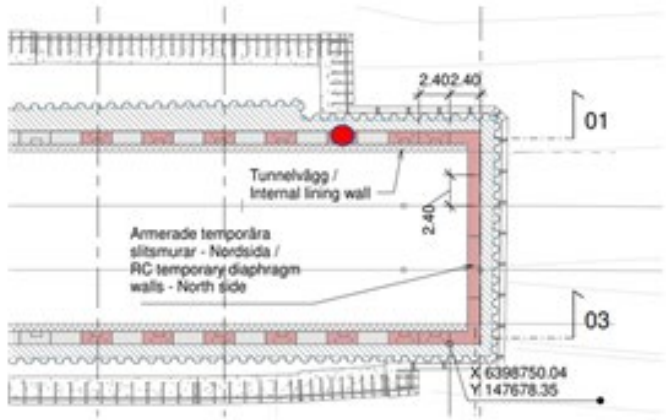
Figure 46 Typical monitoring section

Rörelse prognoser



W05 panel


Inclinometer results (INV00KVW05)
Cumulative movement (mm)
0
2
4
6
8
10
12
14
16
18
20
Level (m RH2000)
2.0
0.0
-2.0
-4.0
-6.0
-8.0
-10.0
-12.0
-14.0
-16.0
-18.0
-20.0
-22.0
-24.0
-26.0
-28.0
Design (mezzanine slab exc)
11/10/2022
Mezzanine exc level
Design (bottom slab exc)
16/11/2022
Bottom exc level


2.402.40
01
Tunnelvägg /
Internal lining wall
2.40
Armerade temporära
slitsmurar - Nordsida /
RC temporary diaphragm
walls - North side
03
X 6398750.04
Y 147678.35

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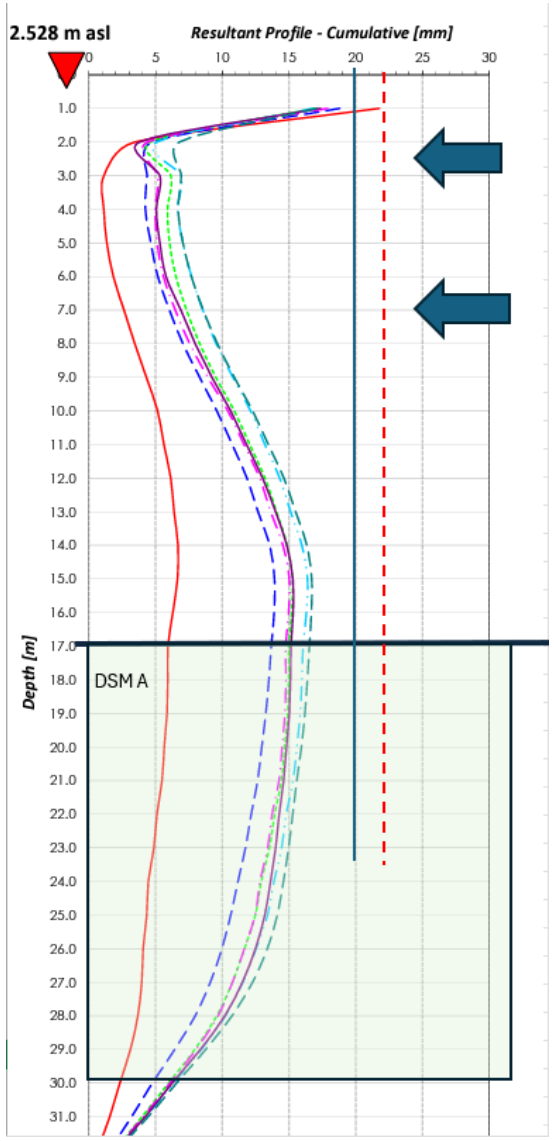
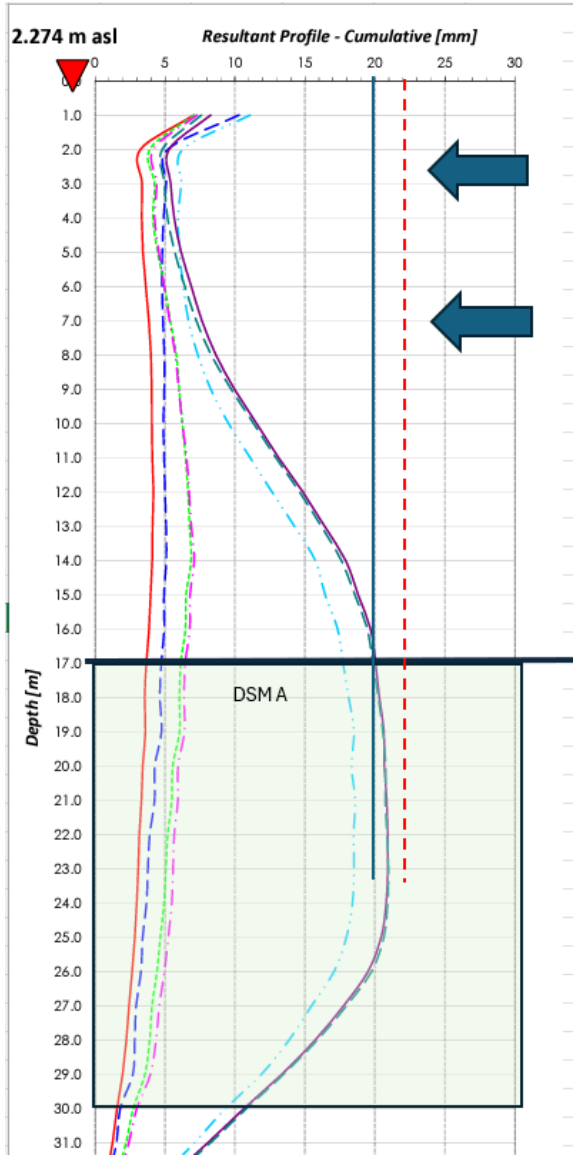
pålgrundläggning

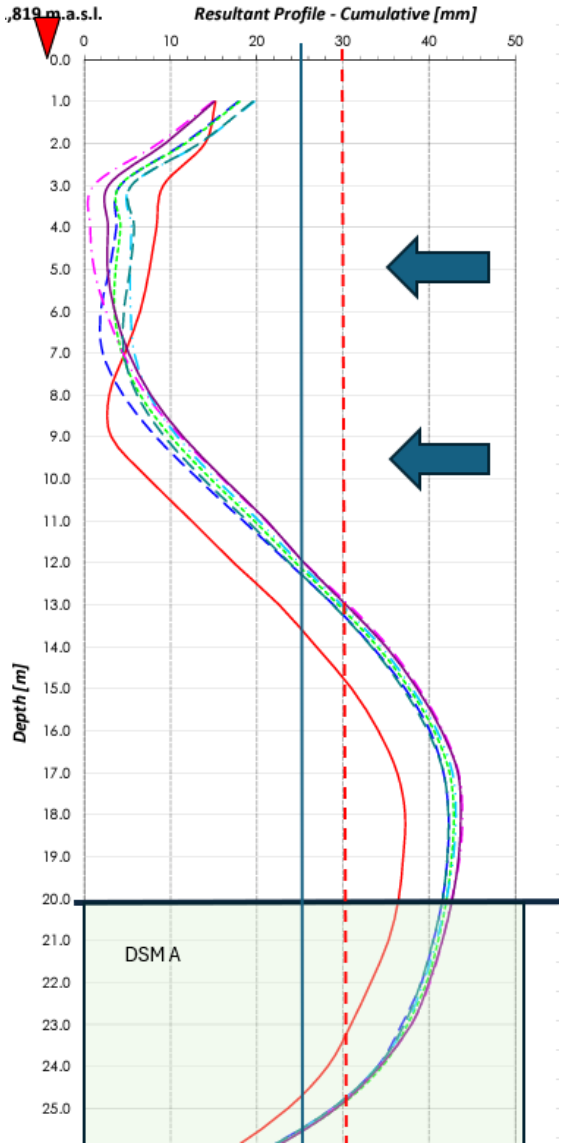
KVW17



KVW21



KVE63



Horisontalrörelser i schaktbotten

Inklinometer	Mätt (mm)	Prognos (mm)	Skillnad (%)
KVW05	13	11	118
KVE13	7	8	88
KVW17	16	20	80
KVW21	20	20	100
KVE21	11	20	55
KVE33	5	20	25
KVE43	3	25	12
KVE53	4	25	16
KVE63	42	25	168

E-Modul 130 MPa
Antagen bäddmodul 22500 kN/m3