

LIEBHERR

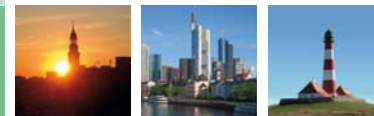
Liebherr-Study Multy Purpose Container Crane (MPC)

Fixed foundation of an MPC
using the example of a conventional inland port quay wall

Wasser

Land

sonst



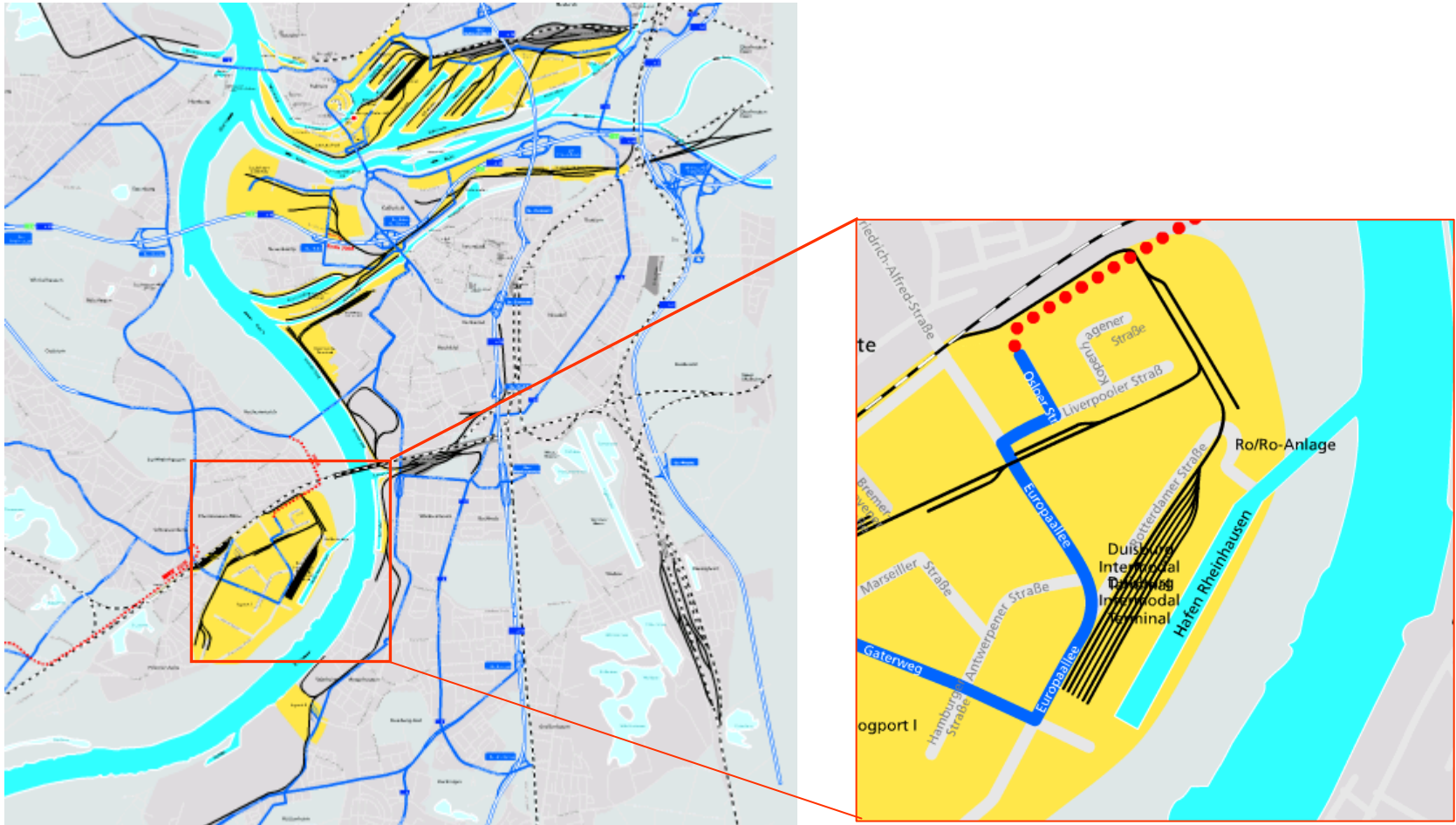
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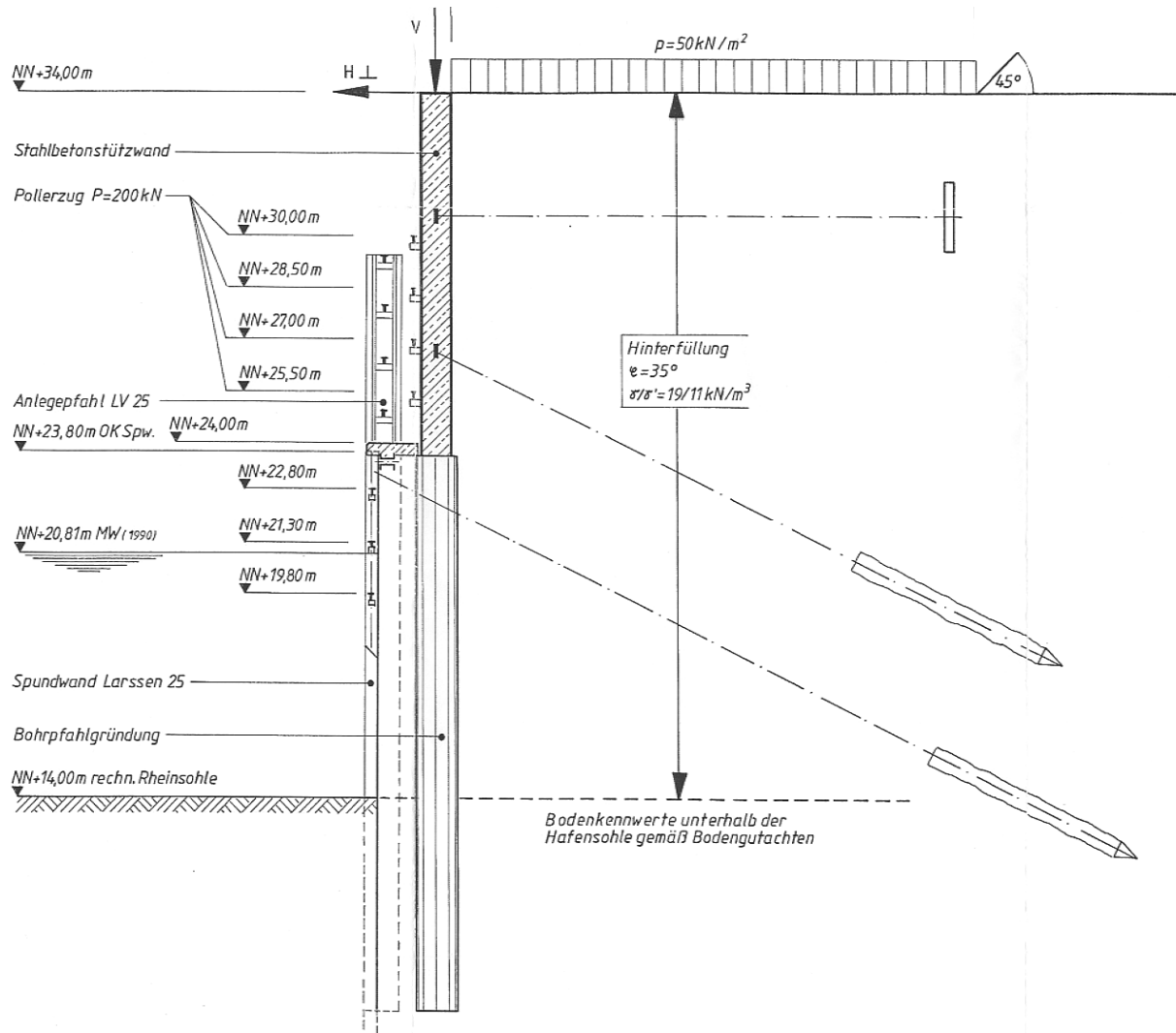
1. Description of the comparative structure in the Port of Duisburg (North Rhine Westfalia)
2. MPC as rail mounted travelling crane (TCC)
3. MPC as fixed pedestal crane (FCC)
4. Effects of the fixed foundation on the quay wall
5. Comparison of quantities and costs
6. Summary

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1.1 Comparative structure: Inland Port Site Plan Duisburg Rheinhausen

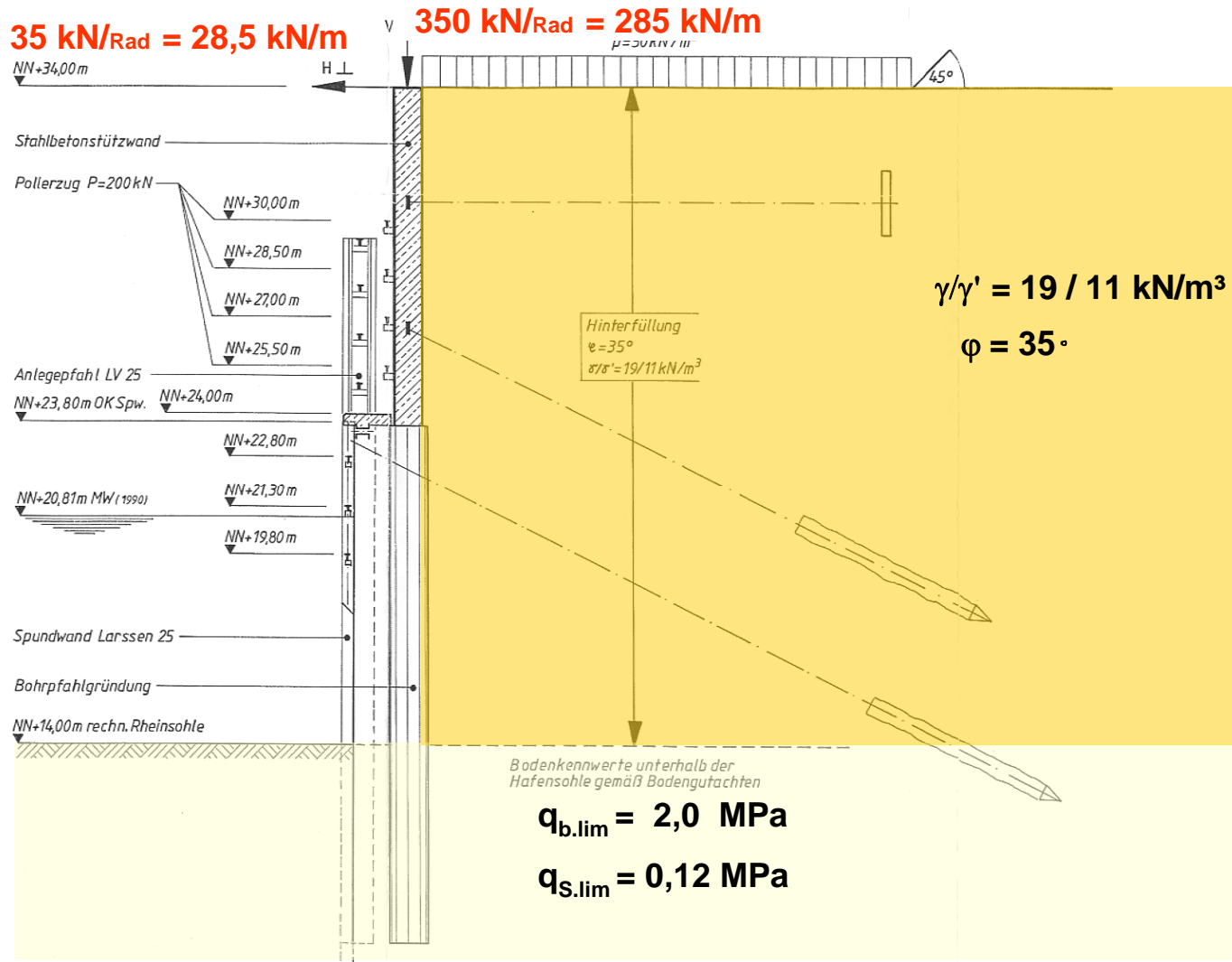


1.2 Comparative structure: Inland Port Cross section

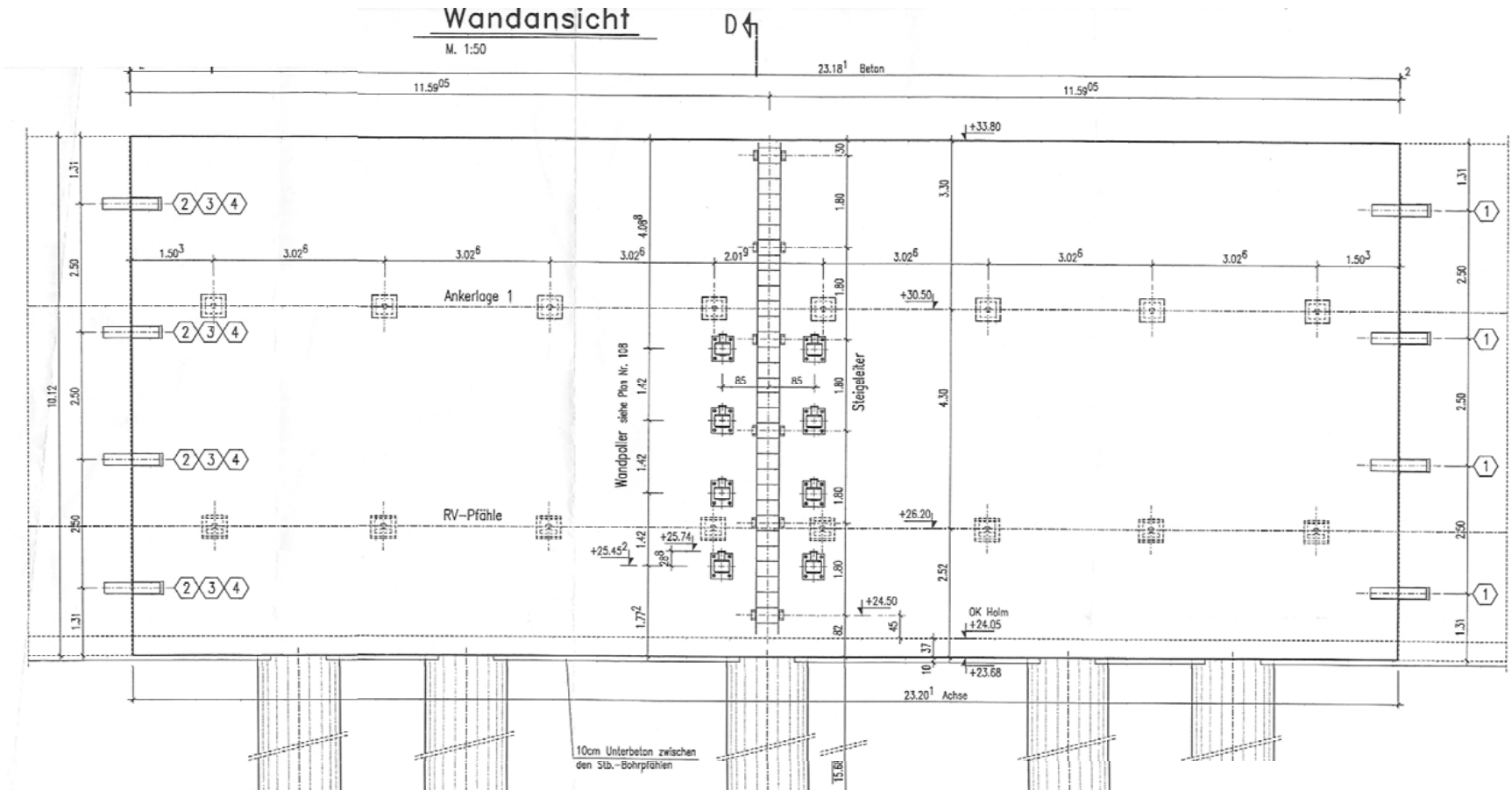


1.3 Comparative structure: Inland Port

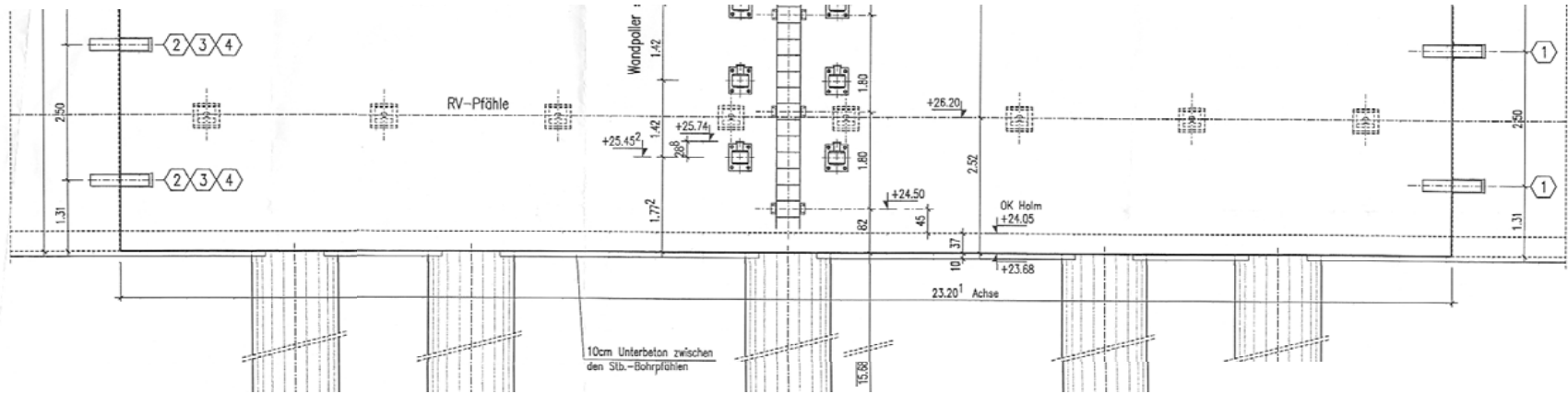
Cross section - subsoil



1.4 Comparative structure: Inland Port Front view

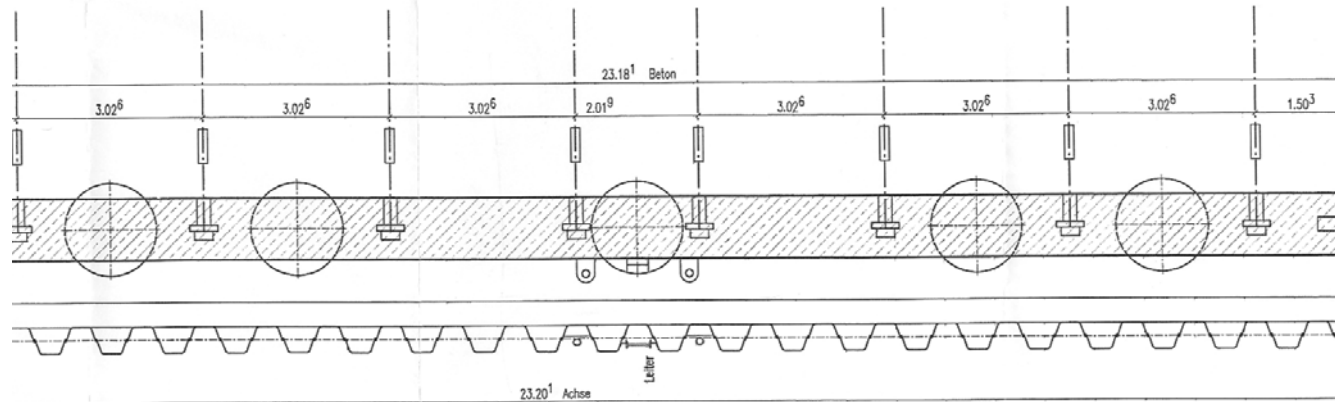


1.5 Comparative structure: Inland Port Ground plan



Grundriss

M. 1:50



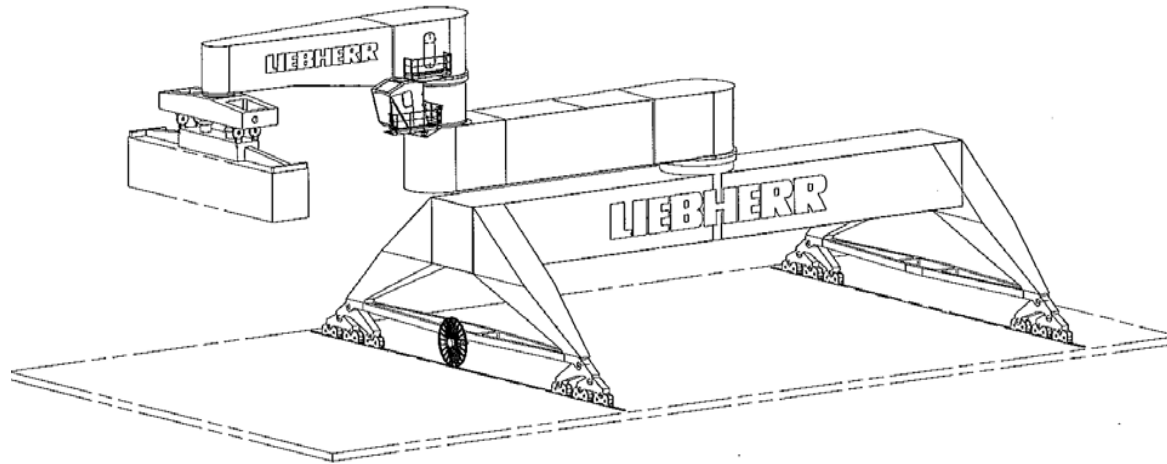
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2 Task:

A: Considerations on rail mounted foundations for the MPC



Design loads Liebherr:
Wheel load $p = 420 \text{ kN/m}$
(All loads are design loads incl.
Partial safety factor $\gamma = 1,35$ and oscillation factor $\Phi = 1,20$)

→ **Loads $420 \text{ kN/m}/(1,35 * 1,20) = 260 \text{ kN/m} \sim 285 \text{ kN/m}$ in comparable range as before ;
no advantage concerning foundation and quay wall to be expected.**

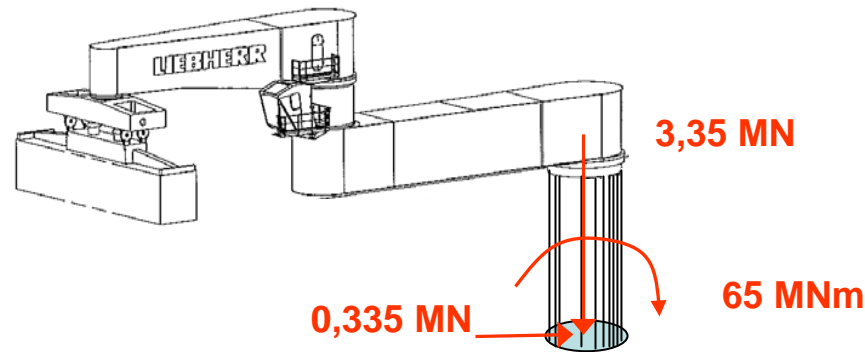
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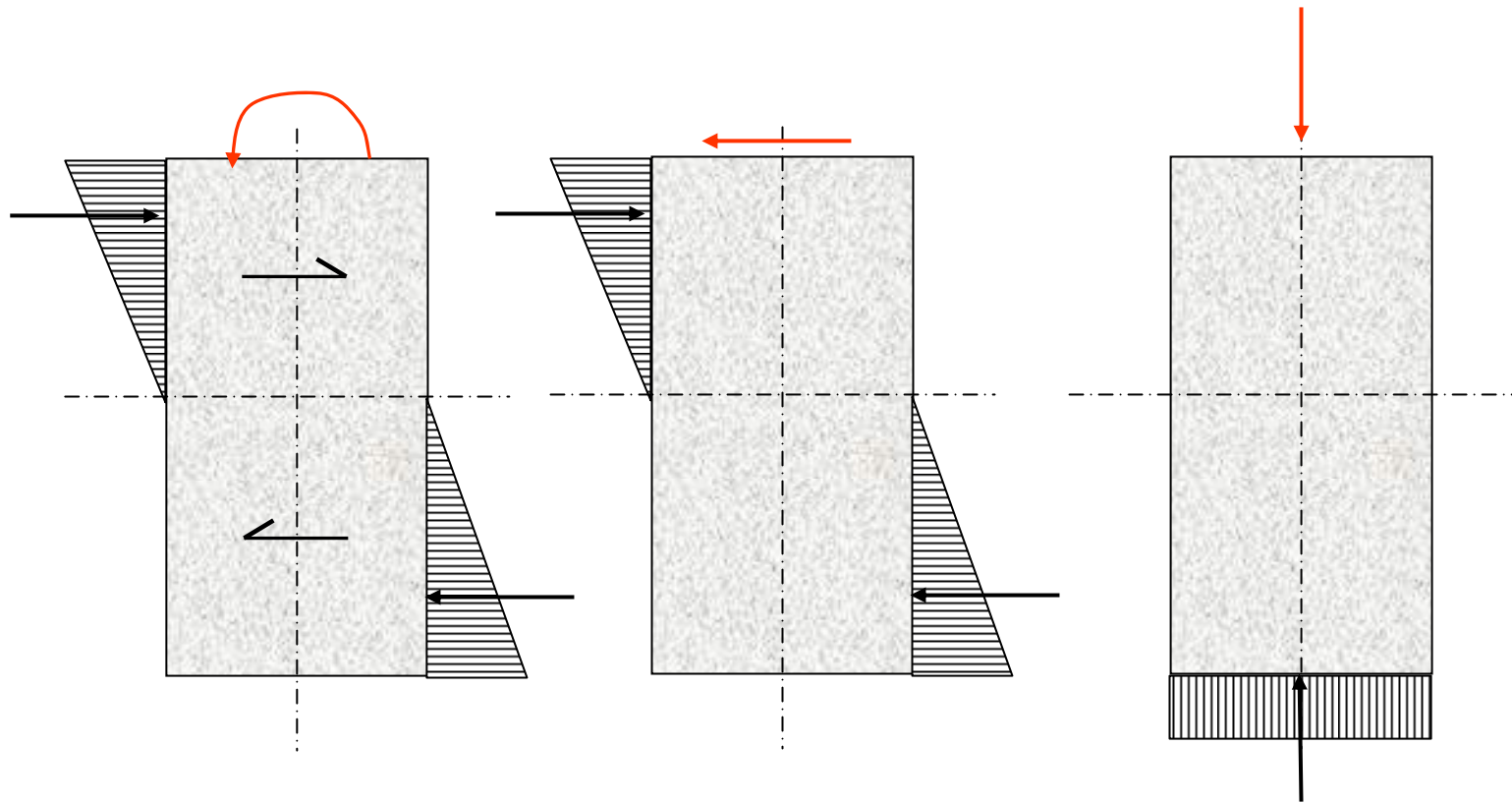
3 Task

Considerations on fixed foundations for the MPC



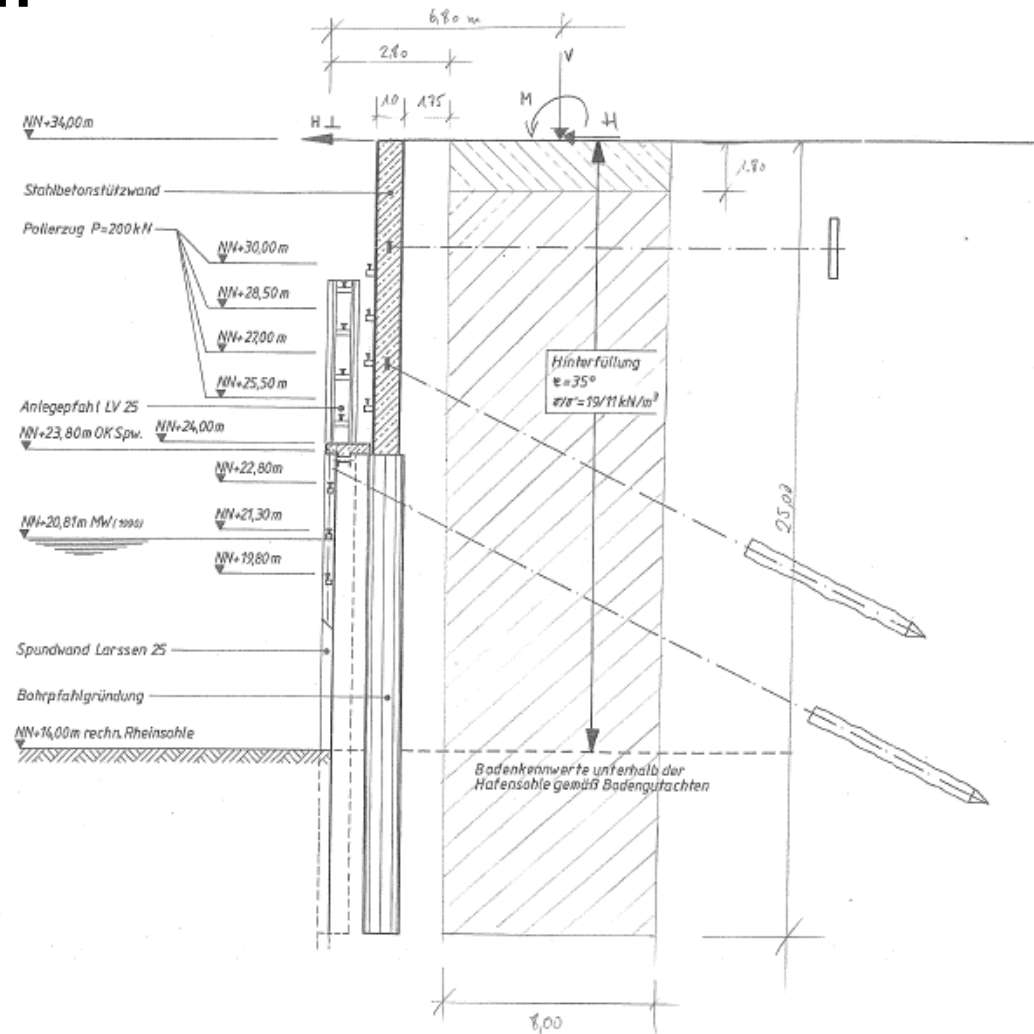
→ How can the foundation be constructed within the existing quay wall?

Considerations on fixed foundations for the MPC Bearing principle – deep beam foundation



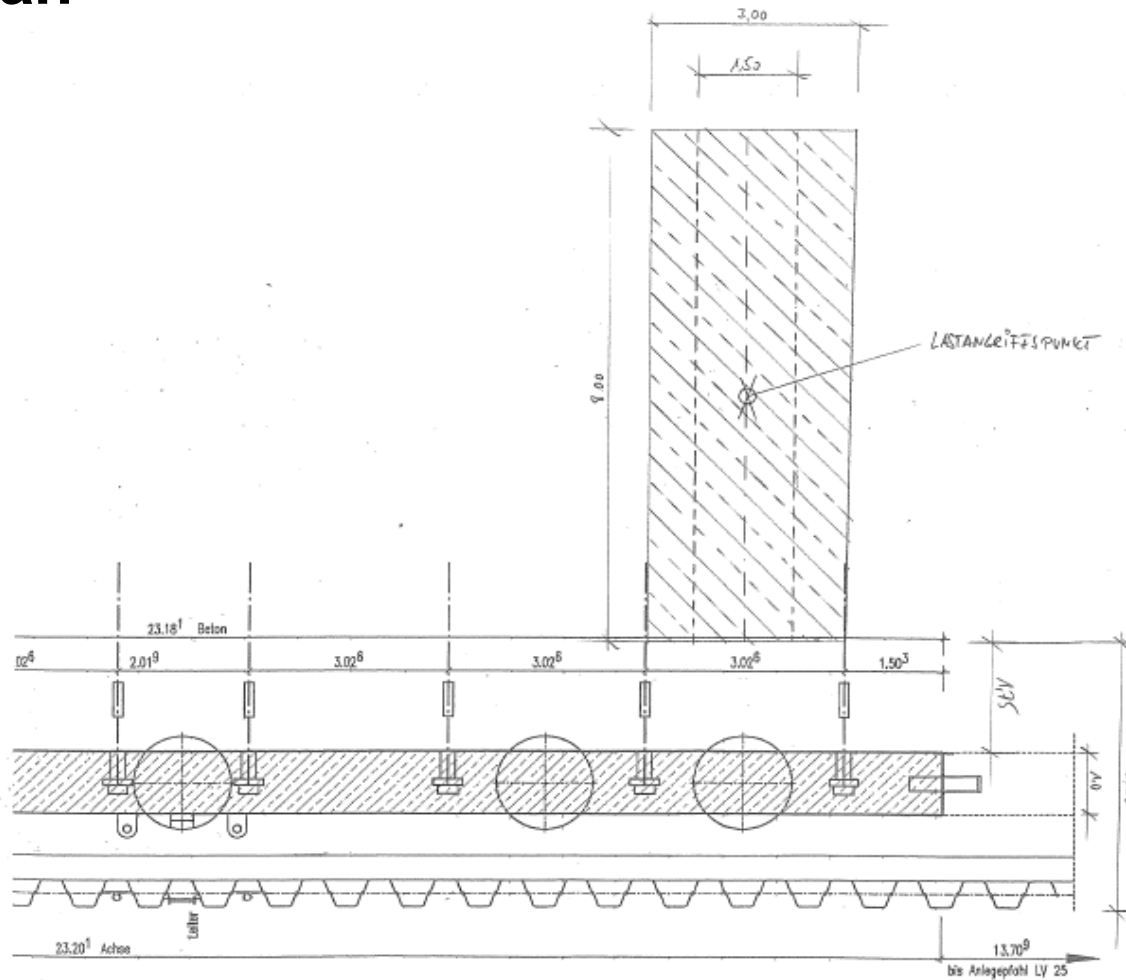
Deep beam foundation integrated into the comparative structure

Cross section



Deep beam foundation integrated into the comparative structure

Ground plan

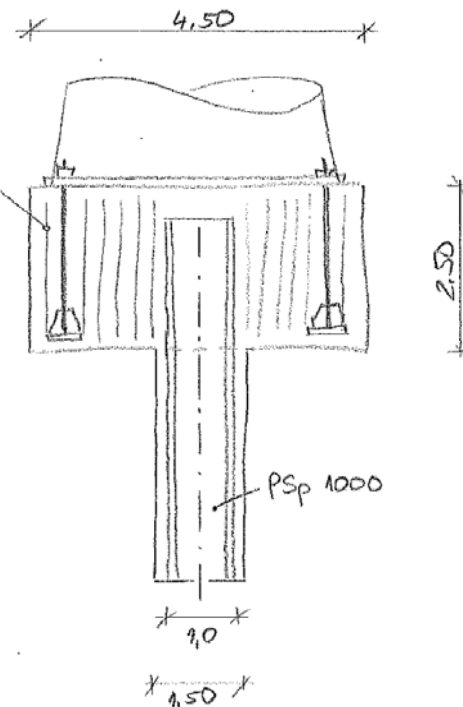


Deep beam foundation integrated into the comparative structure

Detail head joint



Upper connection with threaded rods



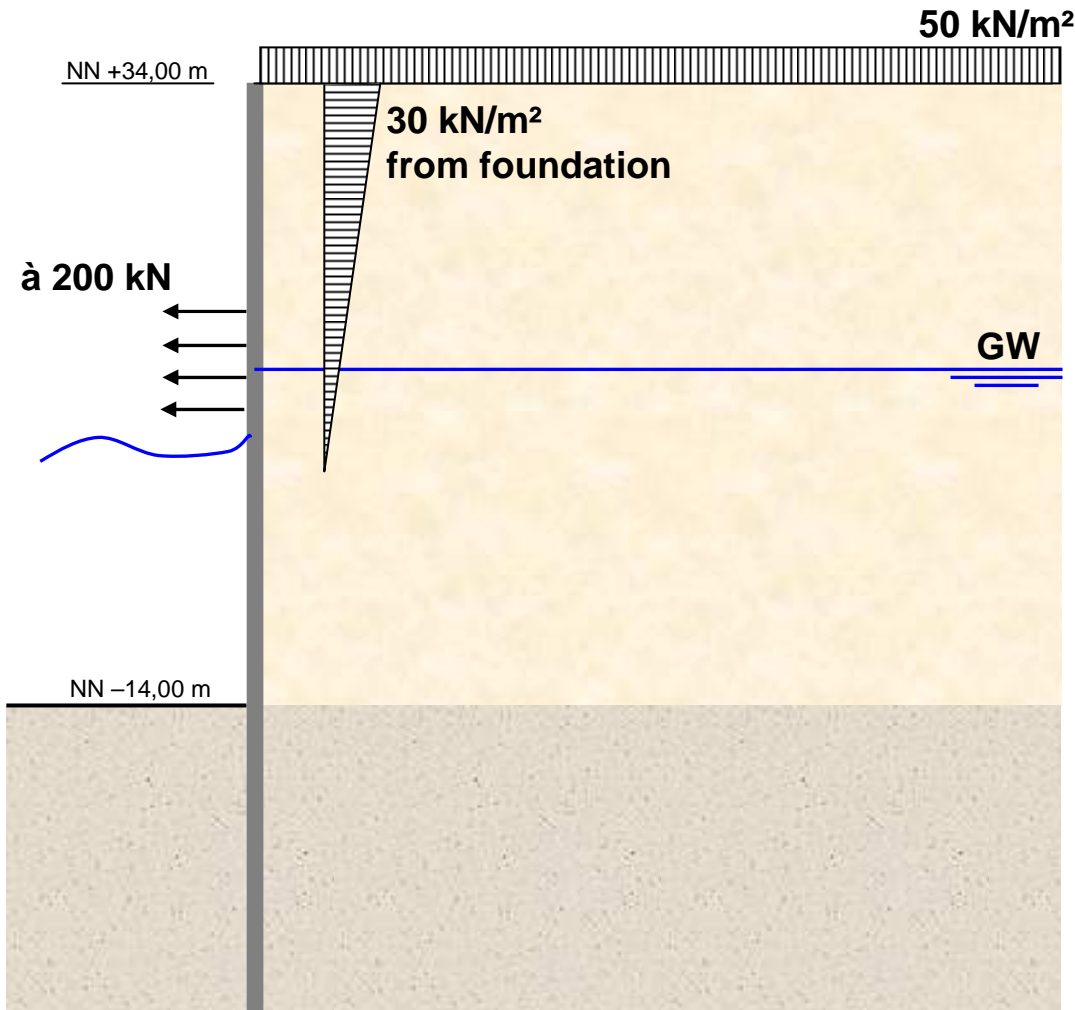
Lower connection with foot plates and welded web plates

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4 Effects on the quay wall construction

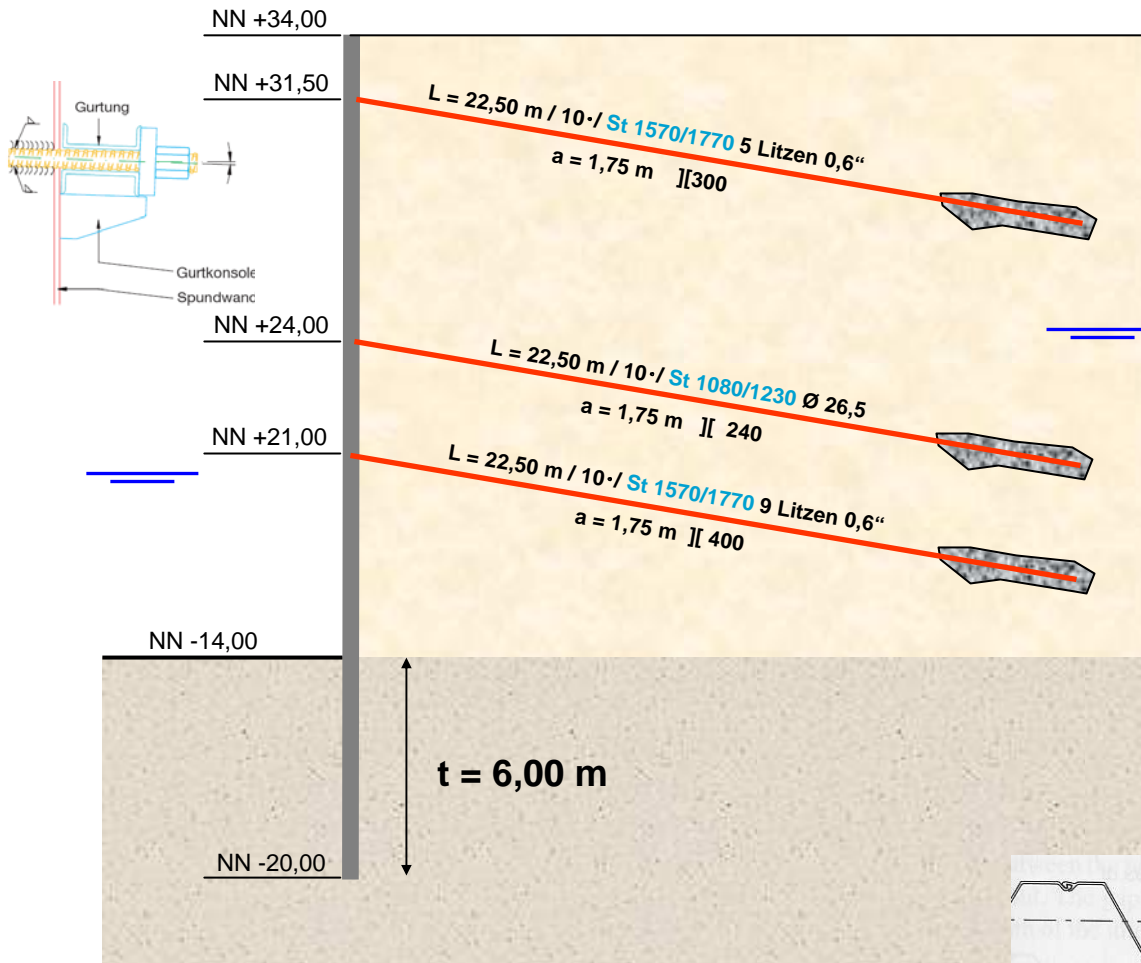


4 load cases are to be examined

How can the quay wall look like?

4 Effects on the quay wall construction

Alternative 1: Sheet pile wall

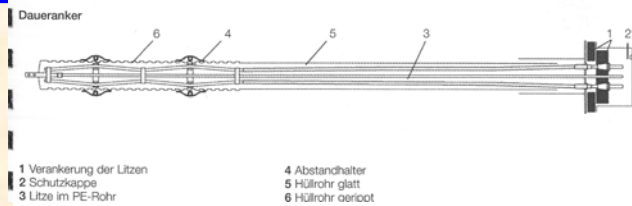


Arcelor AZ 28

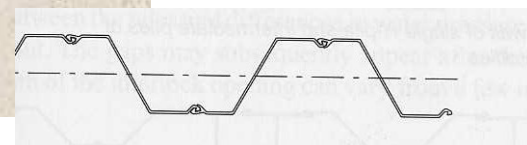
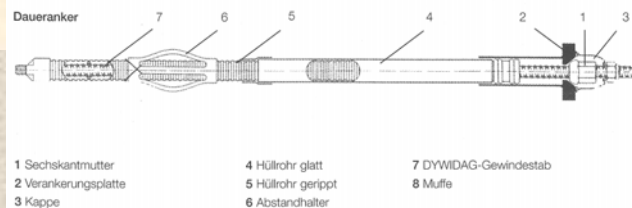
erf. $W_y = 2.325 \text{ cm}^3/\text{m}$

vorh. $W_y = 2.755 \text{ cm}^3/\text{m}$

Litzenanker



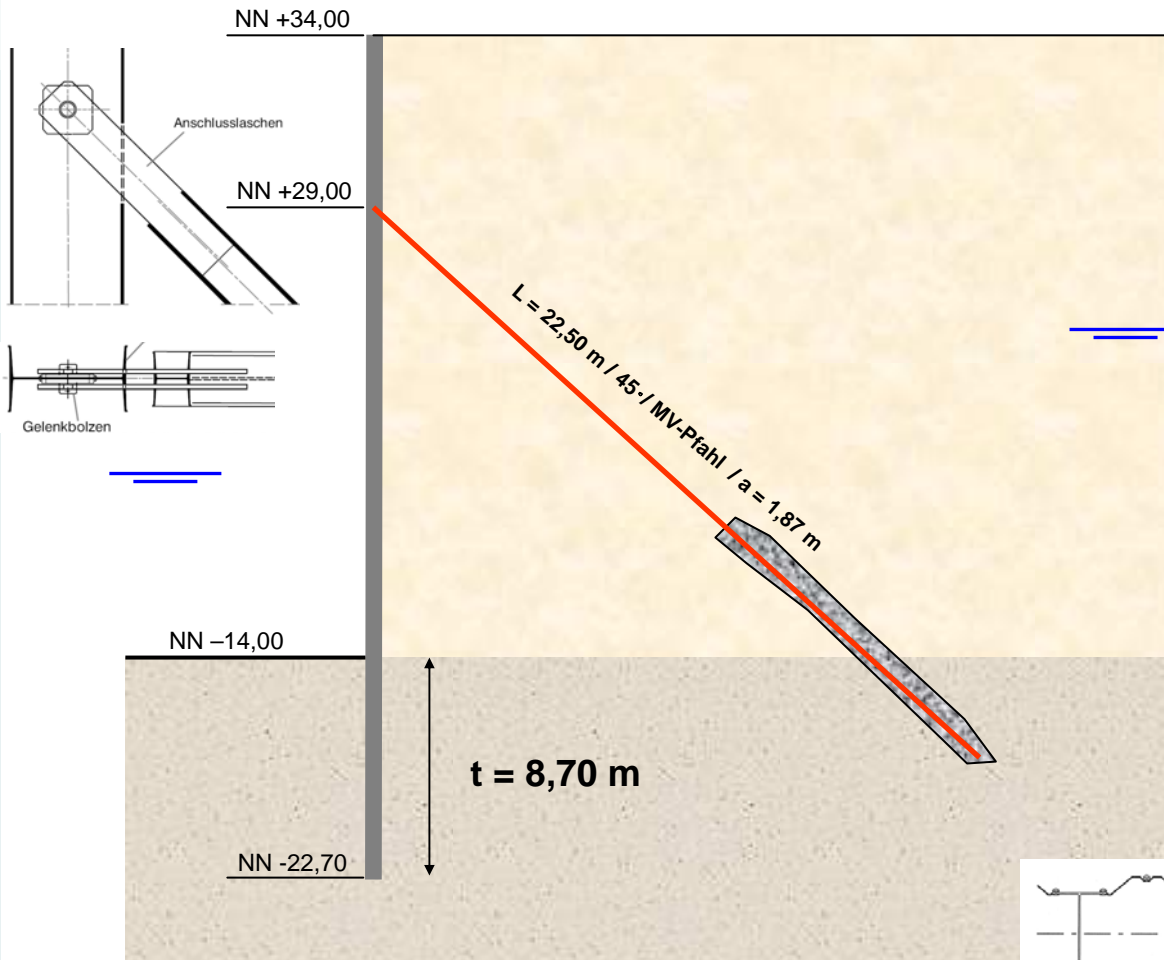
Einstabanker



S240 GP

4 Effects on the quay wall construction

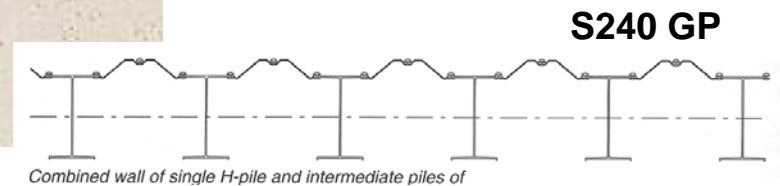
Alternative 2: Mixed wall - 1 anchor



Arcelor HZ 975 D -14 / AZ 13

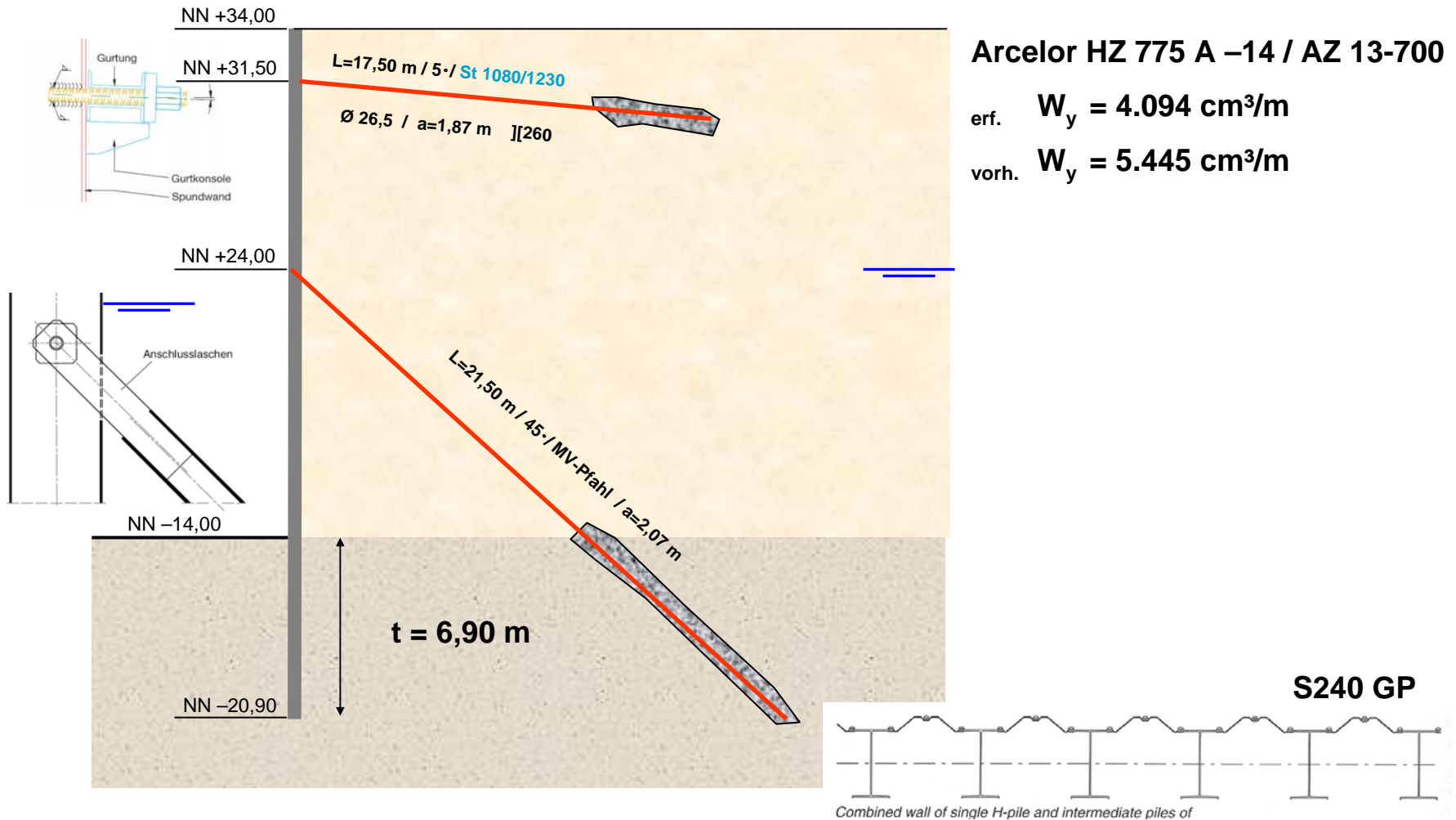
erf. $W_y = 7.858 \text{ cm}^3/\text{m}$

vorh. $W_y = 9.465 \text{ cm}^3/\text{m}$



4 Effects on the quay wall construction

Alternative 3: Mixed wall - 2 anchors



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5 Comparison of quantities and costs

60 [m] Wand

Variante	Stahl - Spw. S 240 GP [kg/m]	Stahl - Gurtung S 235 JR [kg/m]	Stahl - Anker [kg/m]	Stahlgüte - Anker	Summe Stahl [t/m] bzw. [t]	Einheitspreis [€/t]	Summe Beton [m³/m]	Einheitspreis [€/m³]	Preis [€]	Gesamtpreis [€] Variante und Einzelfundament	Kostenreduktion in [%] zum Vergleichsbauwerk
Variante 1 - Wellenspundwand	4308	302	198	St 1570/1770	4,90	1200,00	-	0,00	352.800,00 €	632.300,00 €	39,2
			58	St 1080/1230							
Variante 2 - Gemischte Spw.	7864	33	644	S 240 GP	8,54	1200,00	-	0,00	614.952,00 €	894.452,00 €	13,9
Variante 3 - Gemischte Spw.	5434	72	38	St 1080/1230	6,10	1200,00	-	0,00	439.200,00 €	718.700,00 €	30,8
			556	S 240 GP							
Vergleichsbauwerk Rheinkai Nord	3412 (S 355 GP)	90	797	S 355 JO	5,60	1200,00	16	500,00	883.200,00 €	€ 1.039.200,00	
landseitige Kranbahnbalcken f. Vergleichsbauwerk					0,50	1200,00	4	500,00	156.000,00 €		
Variante A - Gründung-T	-	-	-	-	85,00	1200,00	355	500,00	279.500,00 €		

(Basis for comparison are plain stell- and concrete costs)

Comparative structure „Rheinkai North“: approx. €1.000.000 / 60 m wall length

MPC-foundation with sheet pile wall: approx. €350.000 / 60 m wall length

Summary



1. A rail mounted MPC (TCC) does not lead to a significant cost reduction for the construction of the quay wall.
2. The cost reduction of a fixed MPC (FCC) compared to a conventional rail mounted container crane can be up to 40 percent.
3. The presented crane foundation is a new development.
4. The quay wall can be constructed at lower costs.
5. The bearing concept has to be verified in practice by further calculations (FEM) and on-site measurements at a reference construction.



**Thank you
for your attention**

Spezialist

Präzision

Kreativität

Generalist

Erfahrung

Team

Innovati

Wasser

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sonst

