



ArcelorMittal

HZ[®]-M / AZ[®] combined wall system

Sustainable and Cost efficient Port Structures

19th INTERMODAL AFRICA 2018

Key Facts about ArcelorMittal

The world's leading steel and mining company

- ArcelorMittal is the world's leading steel and mining company, with around **200,000** employees in more than **60** countries. ArcelorMittal is the leader in all major global steel markets, including automotive, construction, household appliances and packaging, with leading R&D and technology, as well as sizeable captive supplies of raw materials and outstanding distribution networks.
- An industrial presence in **19** countries exposes the company to all major markets, from emerging to mature.
- We are the largest producer of steel in the EU, North and South America and Africa, a significant steel producer in the CIS region, and have a growing presence in Asia, including investments in China and India.

Underpinning all our operations is a philosophy to produce safe, sustainable steel

ArcelorMittal **SHEET PILING**



Innovative cost efficient foundation solutions



Project References





Port of Køge will be the biggest harbour in Denmark



with ArcelorMittal Sheet Pile Solutions

Antwerp Port – new Jetty Oil Tanking Terminal ; Belgium



Contractor : Herbosch-Kiere
Sheet Piles : AZ18-800
new IHC Driving Equipment for AZ800

Deep Port structures – Greenfield Developments



- **LLX / Prumo Açu Superport , Brazil**

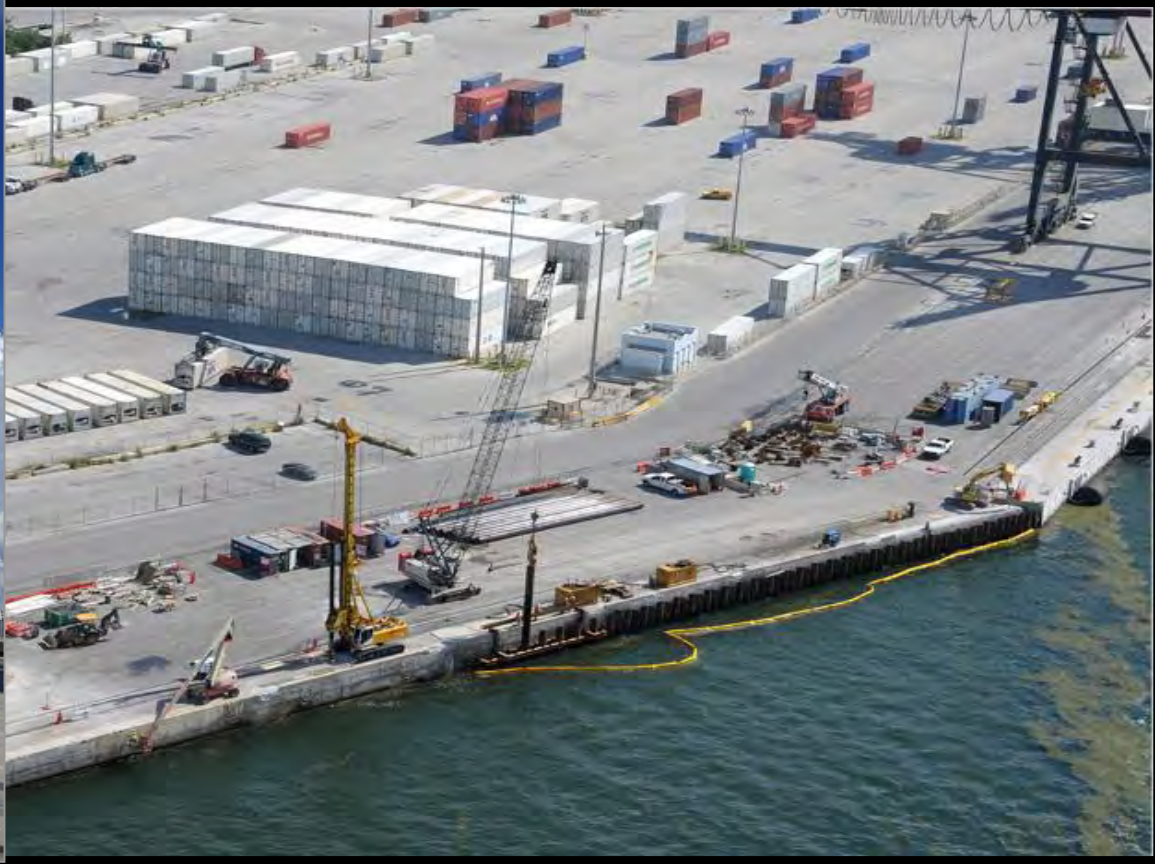


- **Container Terminal , KHH Taiwan**

Marsden Point | Northport Berth 3 | New Zealand



Miami Container Terminal , USA



Berlin Canal rehabilitation works , Germany



with ArcelorMittal Sheet Pile Solutions

Shoreham Flood Defences , UK

“When we were out talking to the residents recently they said: ‘Oh it doesn’t flood in Shoreham’.”



ArcelorMittal



SHOREHAM FLOOD DEFENCES

- | | | | |
|---|---|----|--|
| 1 | Soldiers Point
Floodglass, walls | 6 | Recreation Ground
Embankment,
concrete works |
| 2 | Emerald Quay and
South Wharf
Floodglass, walls | 7 | Shoreham Airport
New embankment |
| 3 | Riverside Road
Floodglass, walls, steel
sheet piles | 8 | Talkhouse Bridge
Sheet piles via jack up
barge |
| 4 | Ferry Bridge
Sheet piles, concrete
works | 9 | Ropetackle
CFA secant pile wall |
| 5 | Riverbank Reach
Sheet piles
embankment/footpath | 10 | Old Railway
Sheet piles,
concrete works,
embankment |

with ArcelorMittal Sheet Pile Solutions

Transforming **Dover's waterfront** for future generations , UK



Caspian Waterfront Baku , Azerbaijan

Crescent Hotel & Sea Pavillon
Caspian Waterfront
Boran Gilan/Urban Ltd.
Section : AZ28-700N
abt. 4990 tons



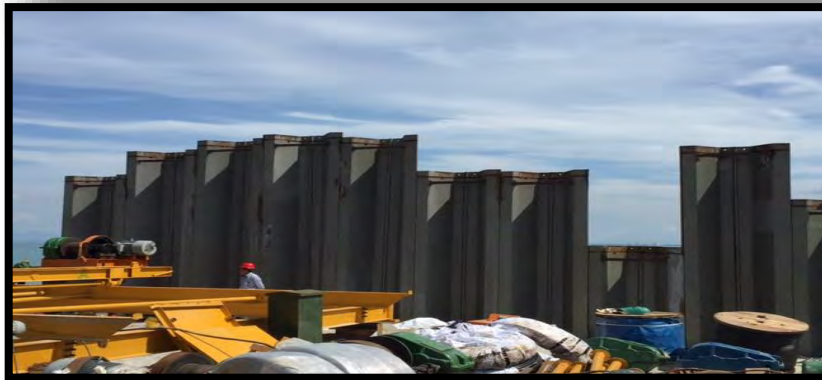
ArcelorMittal Sheet Pile Solutions

Yamuna Ghats River Banks rehabilitation , India with ArcelorMittal Sheet Pile Solutions



Seri Tanjung Pinang , Malaysia

Safe and Sustainable Waterfront Development



with ArcelorMittal Sheet Pile Solutions

Sea-defense / Shoring protection walls



ArcelorMittal



“We’re Building a Gateway to the World” FRA Terminal3 , Germany



with ArcelorMittal Sheet Pile Solutions



ArcelorMittal

We Are Passionate About Football



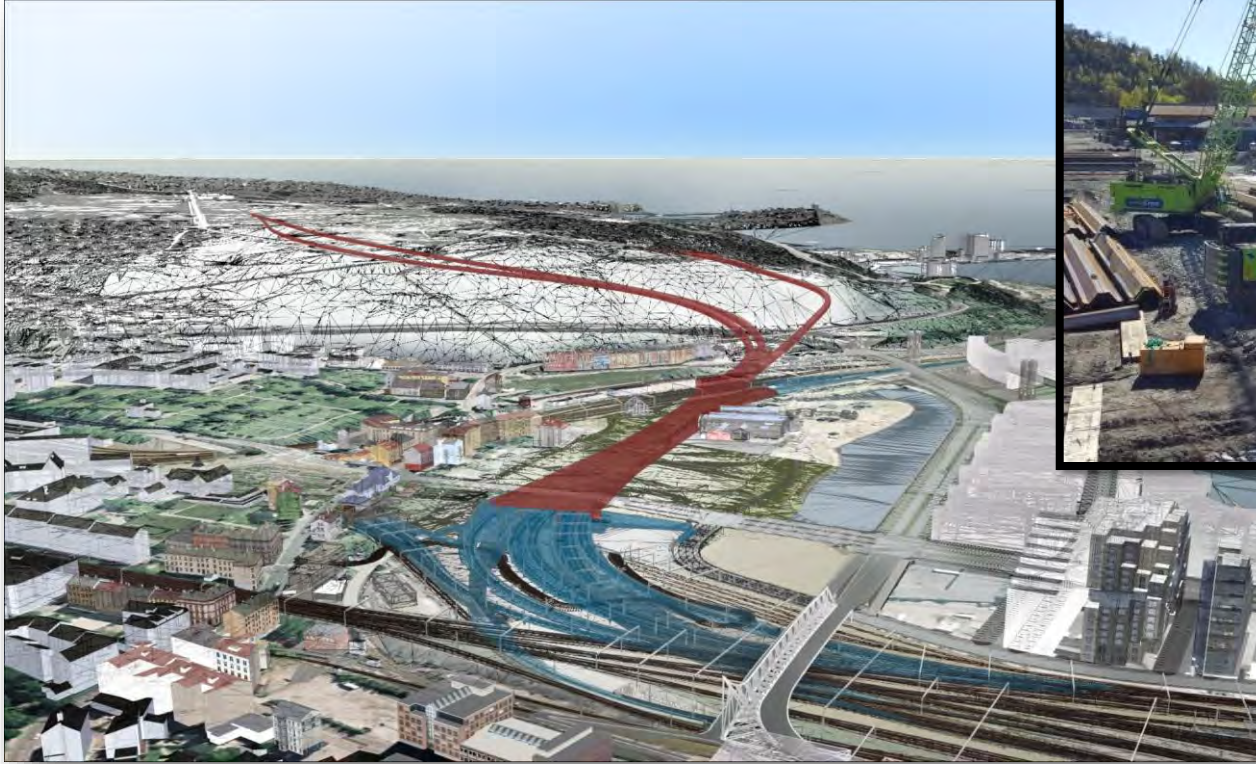
with ArcelorMittal Sheet Pile Solutions

The Follo Railway Line Project , Oslo ; Norway

The project is currently the largest transport project in Norway and will form the core part of the InterCity development southwards from Oslo



ArcelorMittal



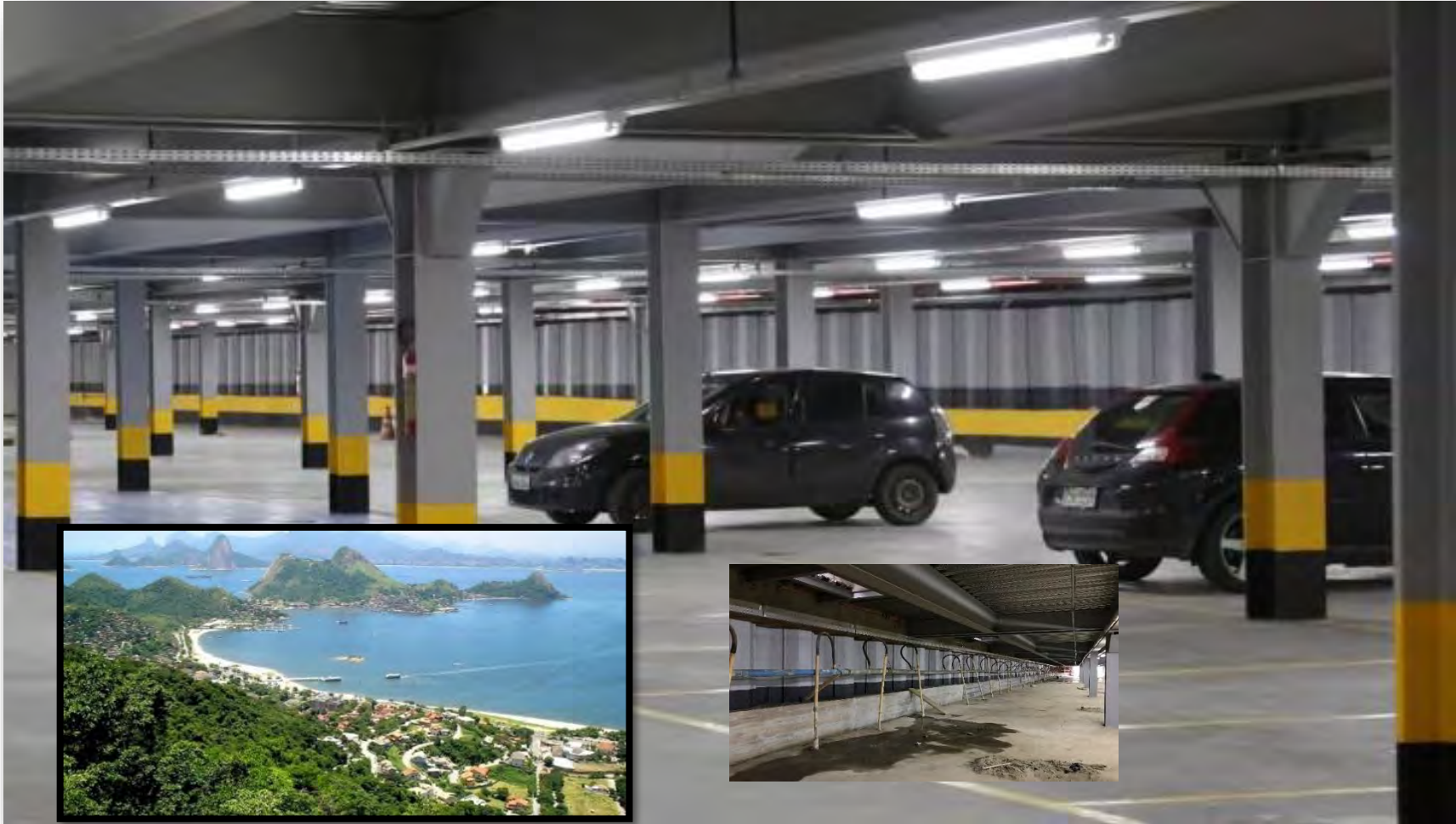
with ArcelorMittal Sheet Pile Solutions

Traffic improvement City of Bogota , Calle94



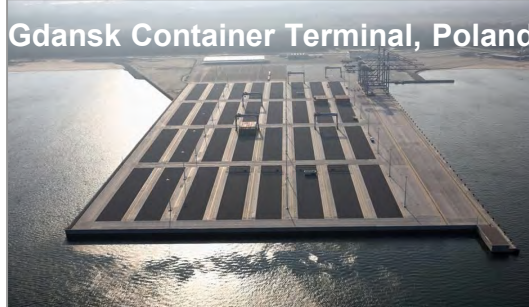
with ArcelorMittal Sheet Pile Solutions

Below Sea level proves no problem for Sheet Pile Underground Parking Facility , Rio de Janeiro, Brazil



with ArcelorMittal Sheet Pile Solutions

Smart Port Structures : fast – reliable – cost efficient HZM System



Types of steel sheet piles

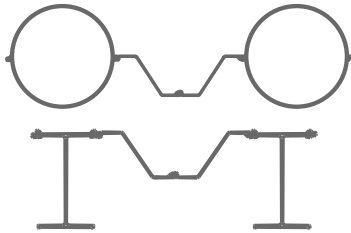
Bending resistant



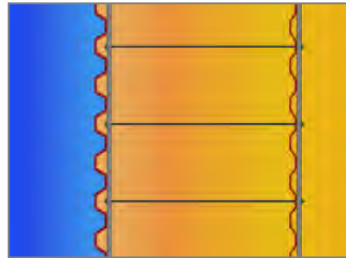
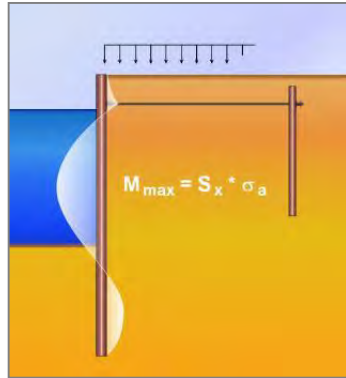
U - section



Z - section



Combi-wall & HZM / AZ

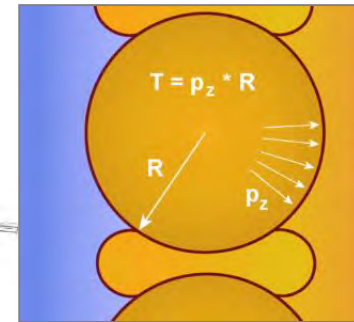
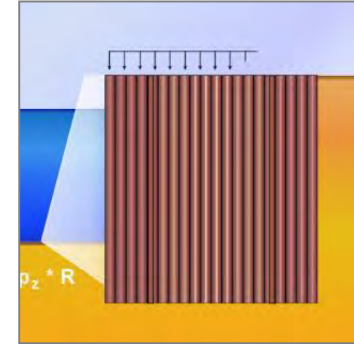
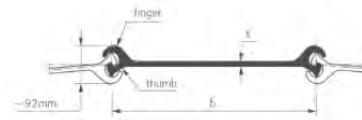


Resisting by interlock tension

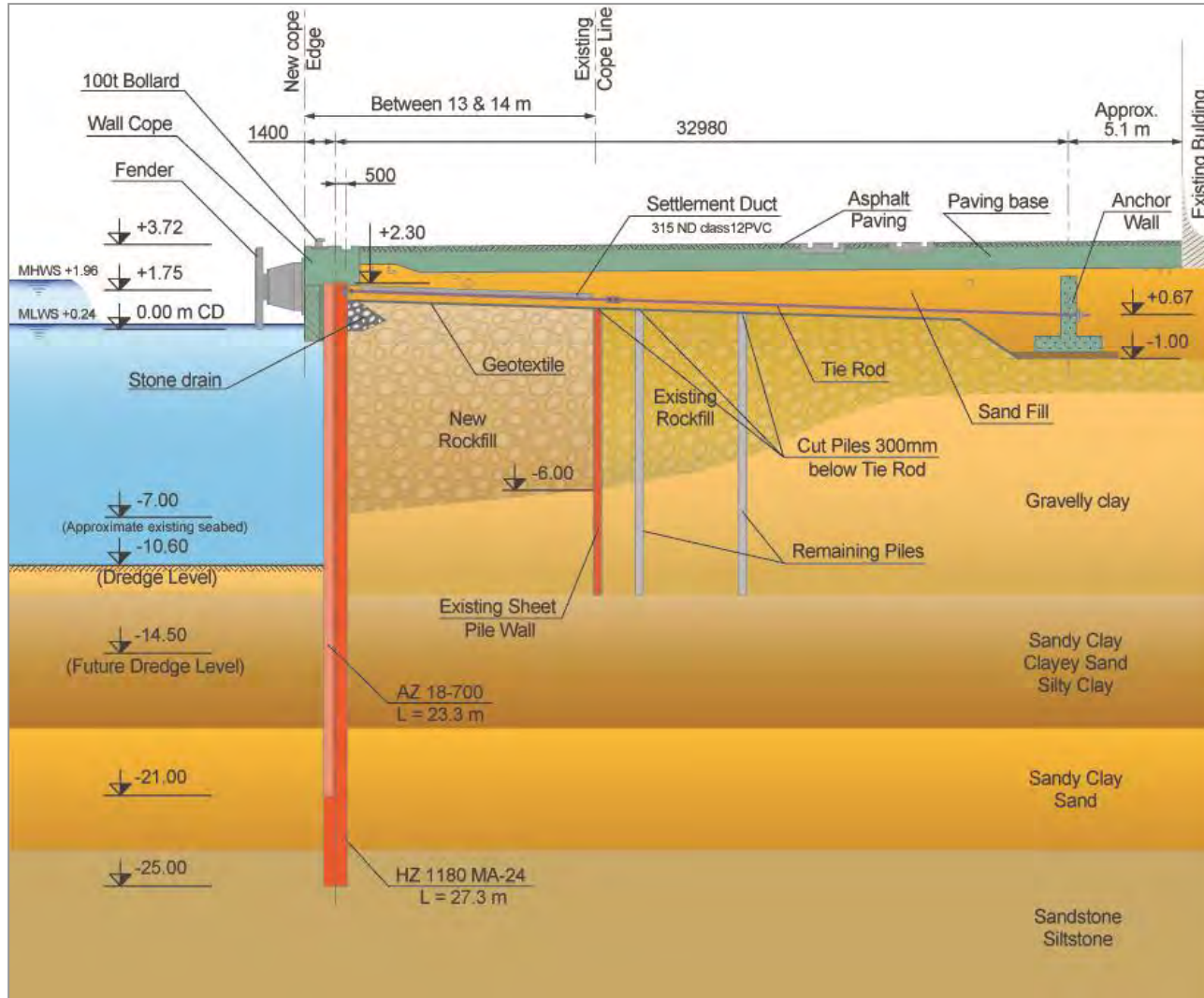


Straight web AS500

- gravity structure
- deep wharfs, quays, breakwaters, cofferdams
- structures founded on rock
- no anchors



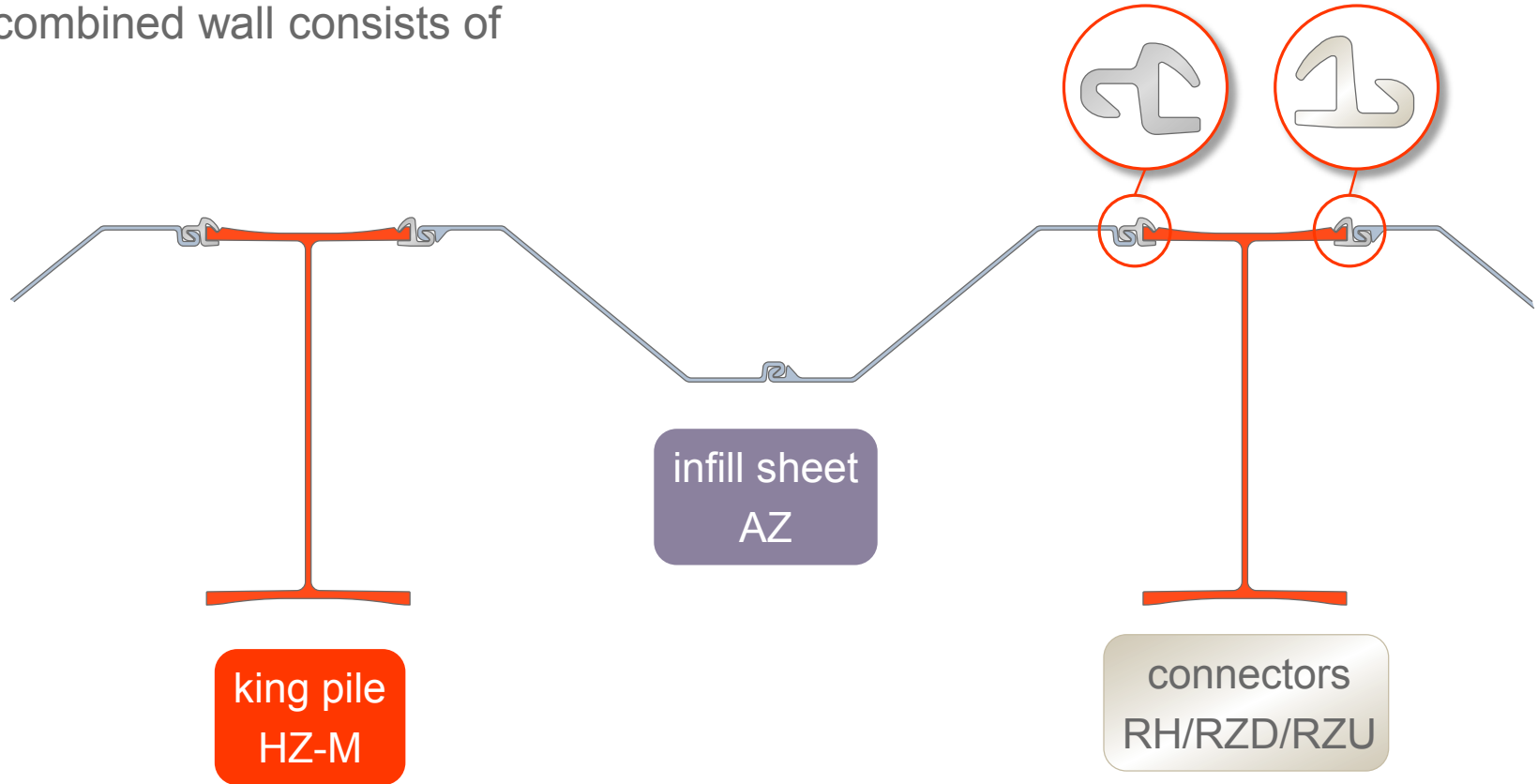
Combined walls. Main applications



- waterfront structures with deep dredge level (quay walls)
- high retaining walls and deep cofferdams
- structures with limited deflection requirements (i.e. cantilever walls)

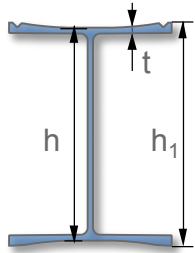
HZ-M/AZ combined wall system

A combined wall consists of



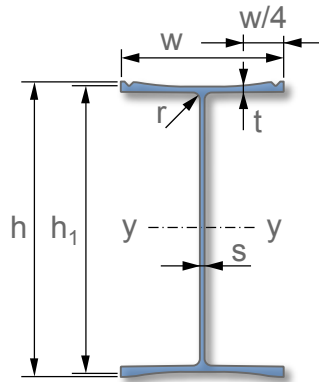
HZ[®]-M range

	Nb of sections	h (mm)	t (mm)	s (mm)	w (mm)
HZ 680 M	LT	632	17	14	460
HZ 880 M	A, B, C	831	19 - 23	13 - 15	458 - 460
HZ 1080 M	A, B, C, D	1075	20 - 30	16 - 19	454 - 457
HZ 1180 M	A, B, C, D	1075 - 1087	31 - 37	20 - 22	458 - 460



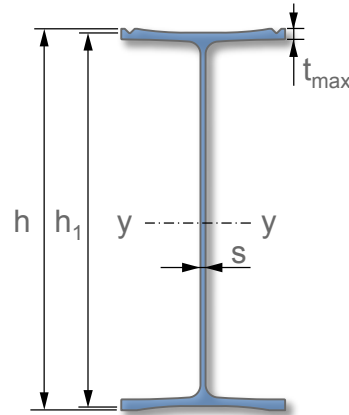
$t = 17 \text{ mm}$

HZ 680 M



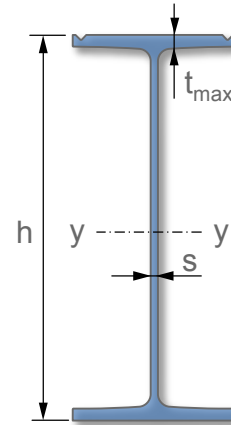
$t = 19, 21, 23 \text{ mm}$

HZ 880 M



$t = 20, 23, 26, 30 \text{ mm}$

HZ 1080 M

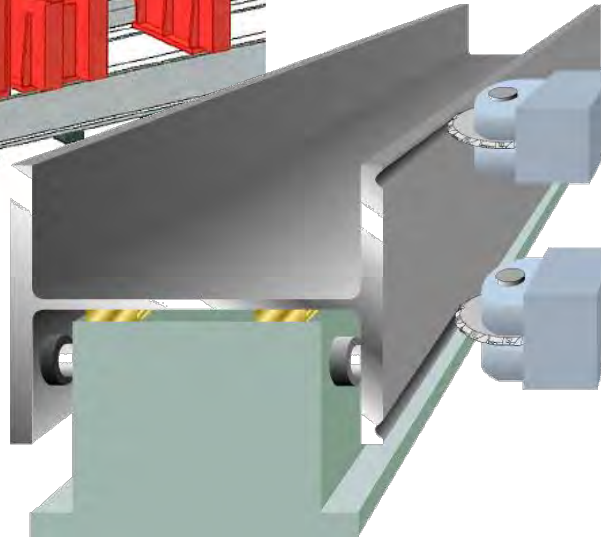
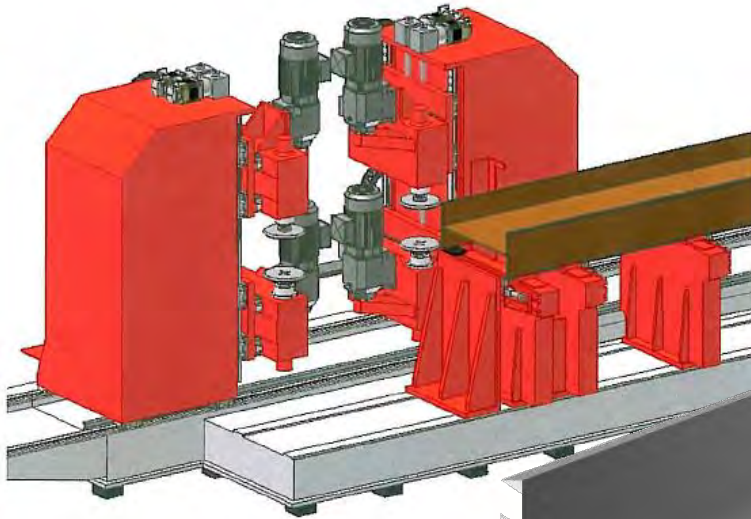


$t = 31, 33, 35, 37 \text{ mm}$

HZ 1180 M

Milling equipment: concept

- two separate & independent devices will mill a groove on one side of the HZ-M



Steel grades Hot rolled SSP

EN 10248	
	f_y [MPa]
S 240 GP	240
S 270 GP	270
S 320 GP	320
S 355 GP	355
S 390 GP	390
S 430 GP	430

Mill specification	
	f_y [MPa]
S 460 AP	460

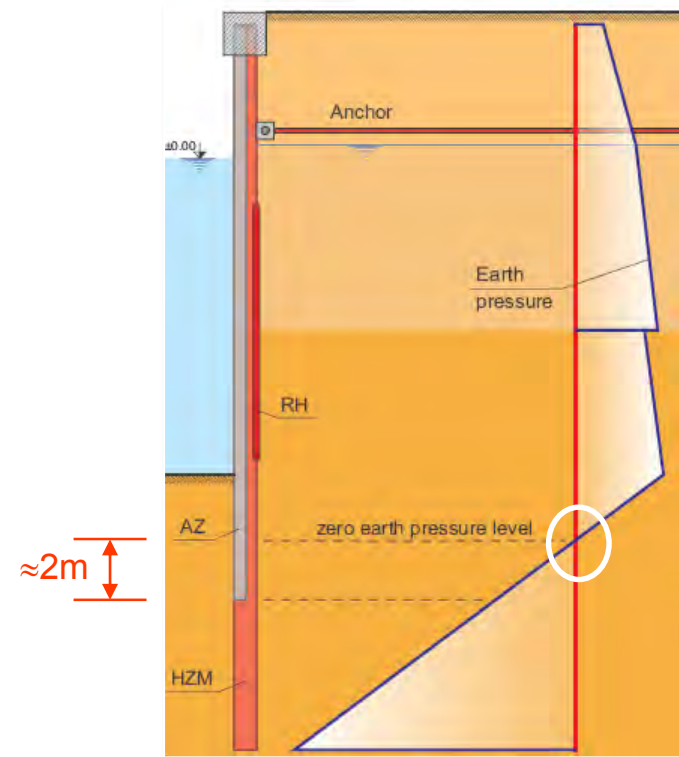
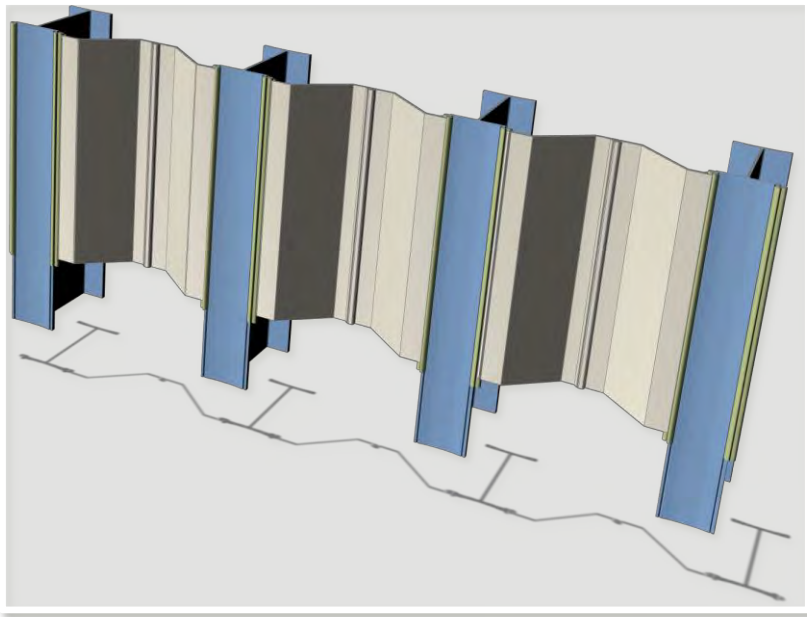
ASTM		
	f_y [ksi]	f_y [MPa]
A 328	39	270
A 572 Gr. 50	50	345
A 572 Gr. 55	55	380
A 572 Gr. 60	60	415

ASTM		
	f_y [ksi]	f_y [MPa]
A 572 Gr. 65	65	450

- Addition of copper 0.35 %, 0.50 %
- ASTM **A 690**: high strength low alloy steel for use in **marine environments**
- Supplied in up to 33 meters rolled length

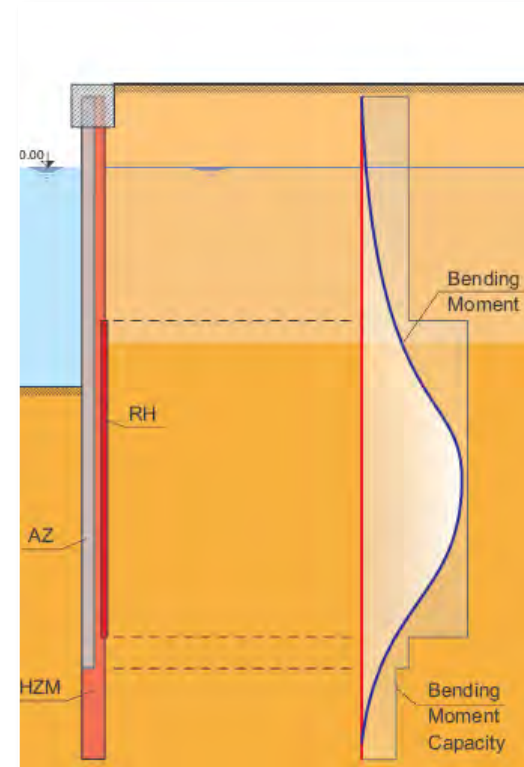
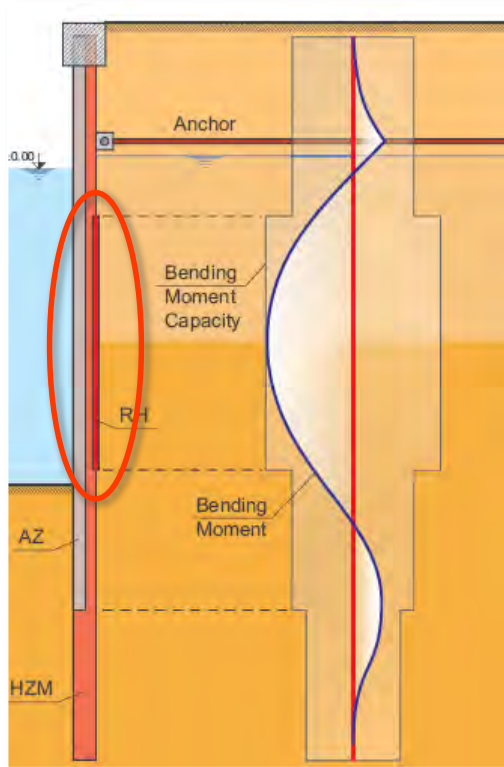
Reduced length of infill sheet piles

- passive 3D effect: design as continuous wall
- shorten AZ: \Rightarrow weight savings



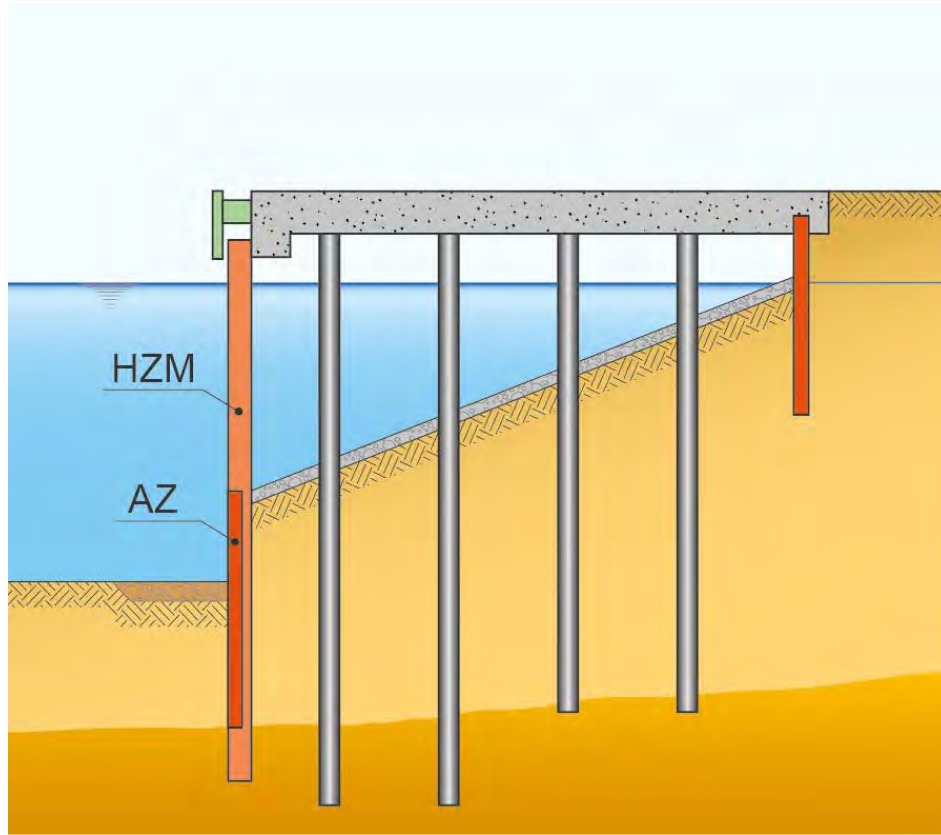
Local strengthening with optimized geometrical lay-out

- optimize W_{el} with RH connector in zone of high M \Rightarrow lighter solution



Reduced length of infill sheet piles

Underwater
driving

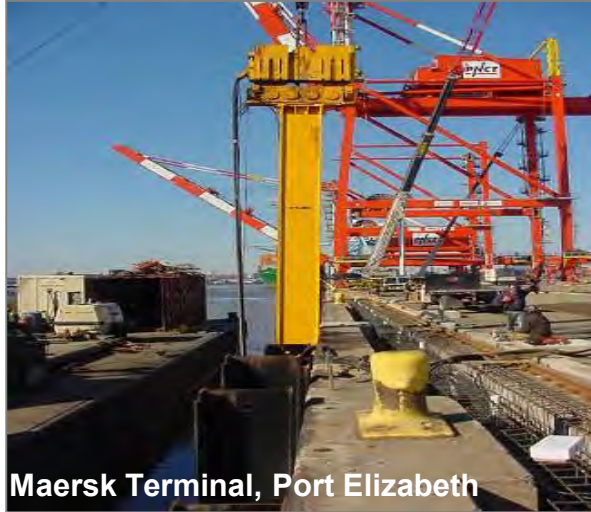


Design and Promotion of Steel Sheetpile





Deepening in front of existing quay walls



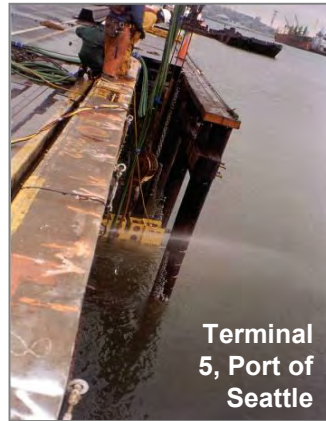
Maersk Terminal, Port Elizabeth



Maydon Wharf, Berth Rehabilitation



Miami Container Terminal, USA

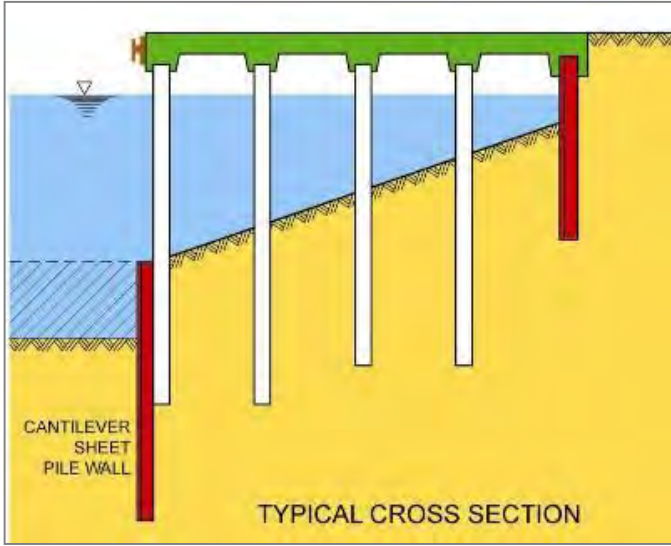
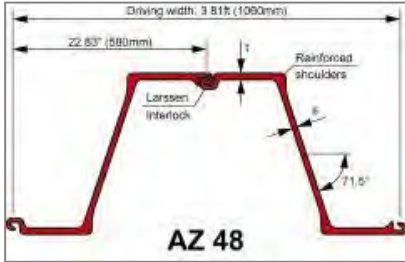
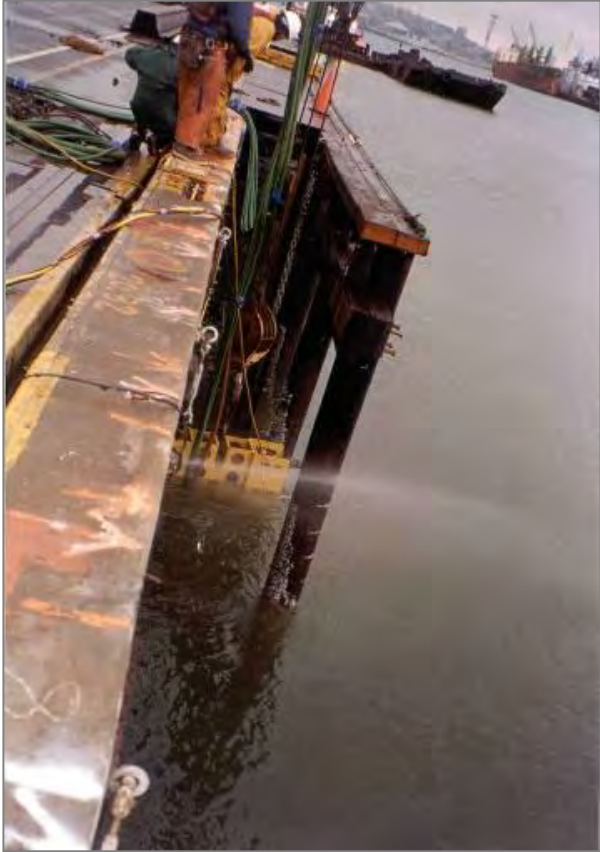


Terminal 5, Port of Seattle

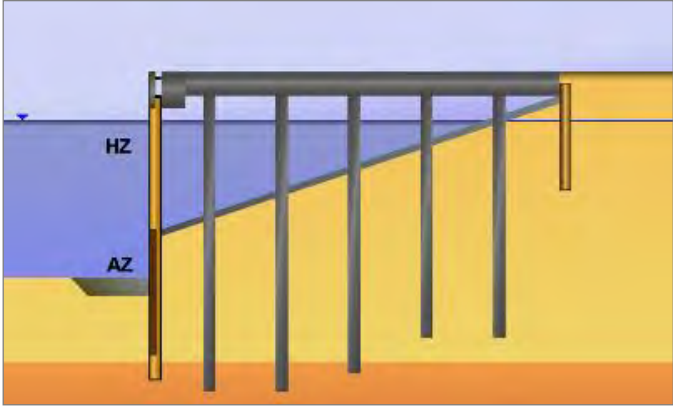


Quay Wall - Cochin Shipyard

Terminal 5, Port of Seattle USA

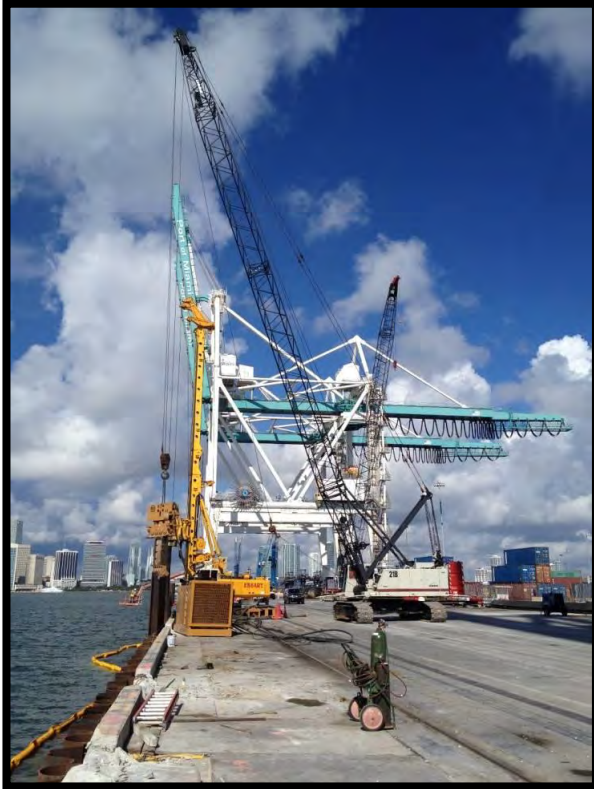


Maersk Terminal, Port Elizabeth, NJ, USA



•HZ 575 B & C-12/AZ18: 1220 mt
HZ: $\pm 24.4\text{m}$
AZ: $\pm 7.6\text{m}$

Miami Container Terminal , USA

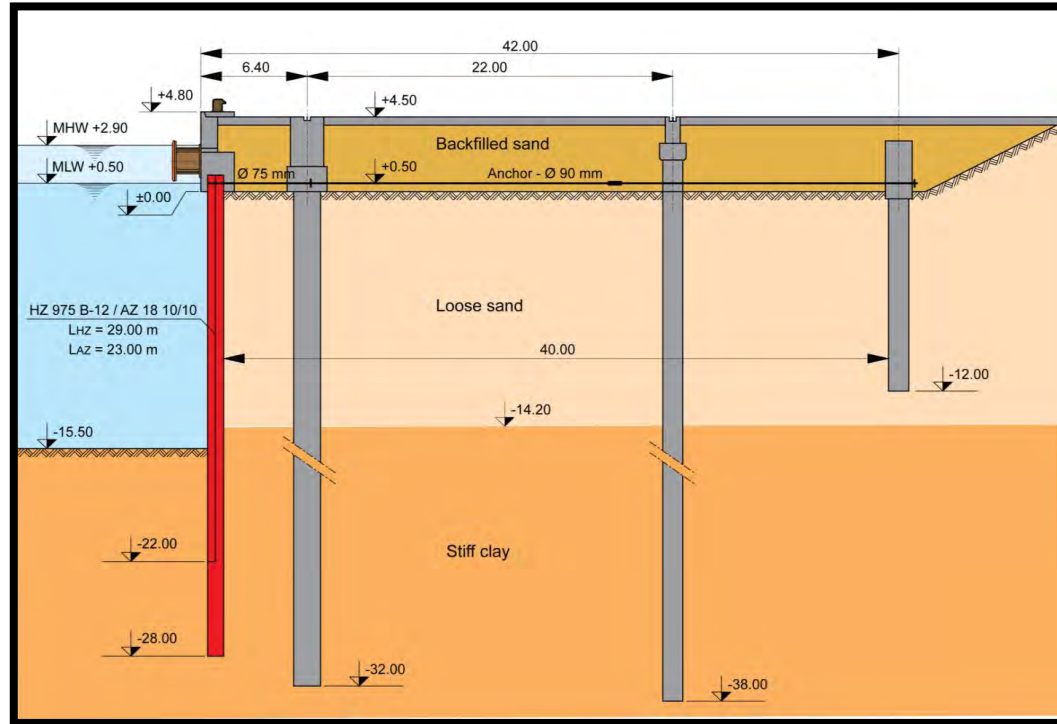


Cao Fei Dian Port, Hebei Province, China

/Solid Bulk Terminal

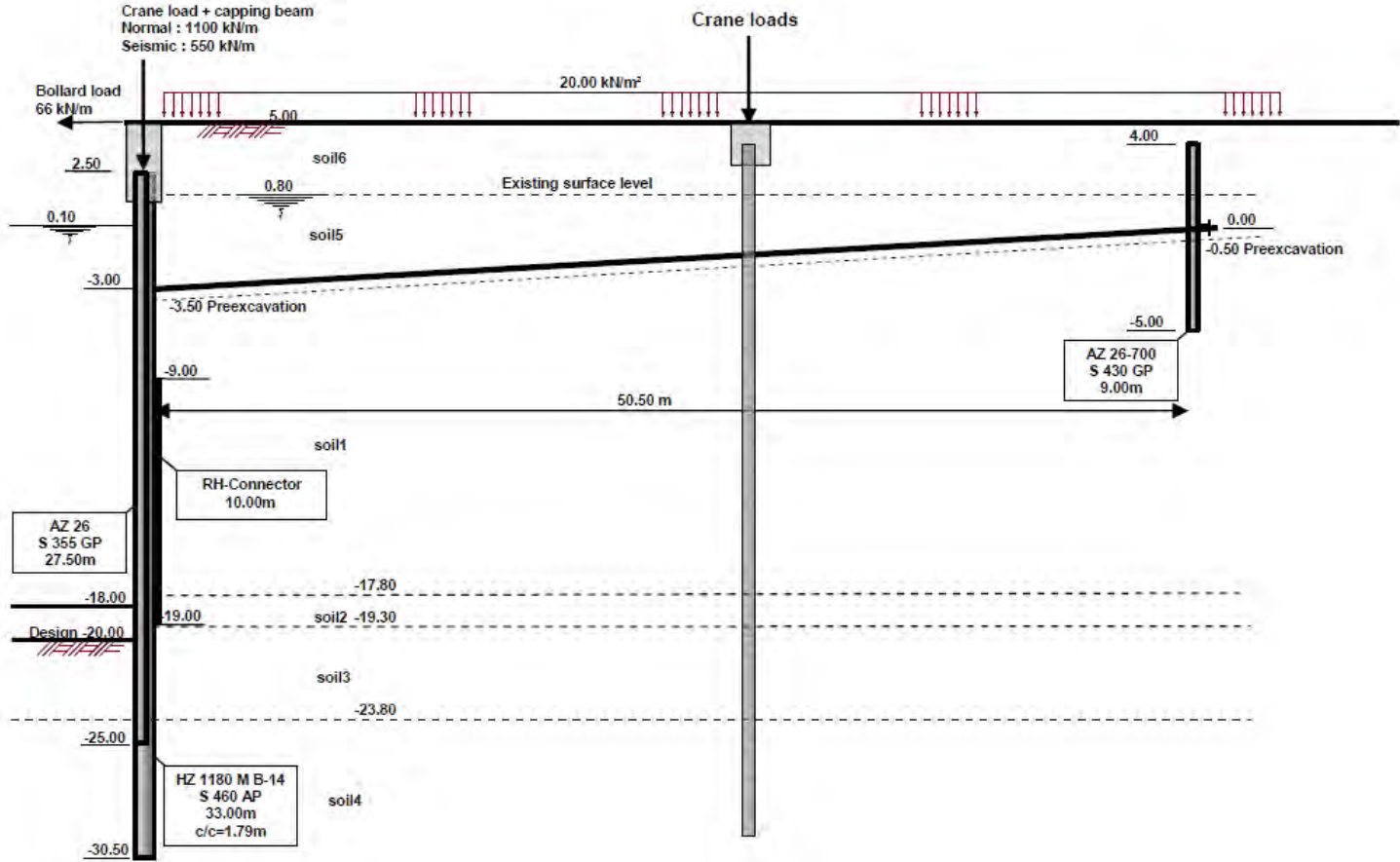


- **1565m** long terminal for handling raw materials
- **15.5m water depth** combined with **seismic design and soils with low bearing capacity**
- → **high strength steel** :HZ 975 B-12 / AZ 18 10/10
- with grade S390GP with copper content 0.35-0.50%

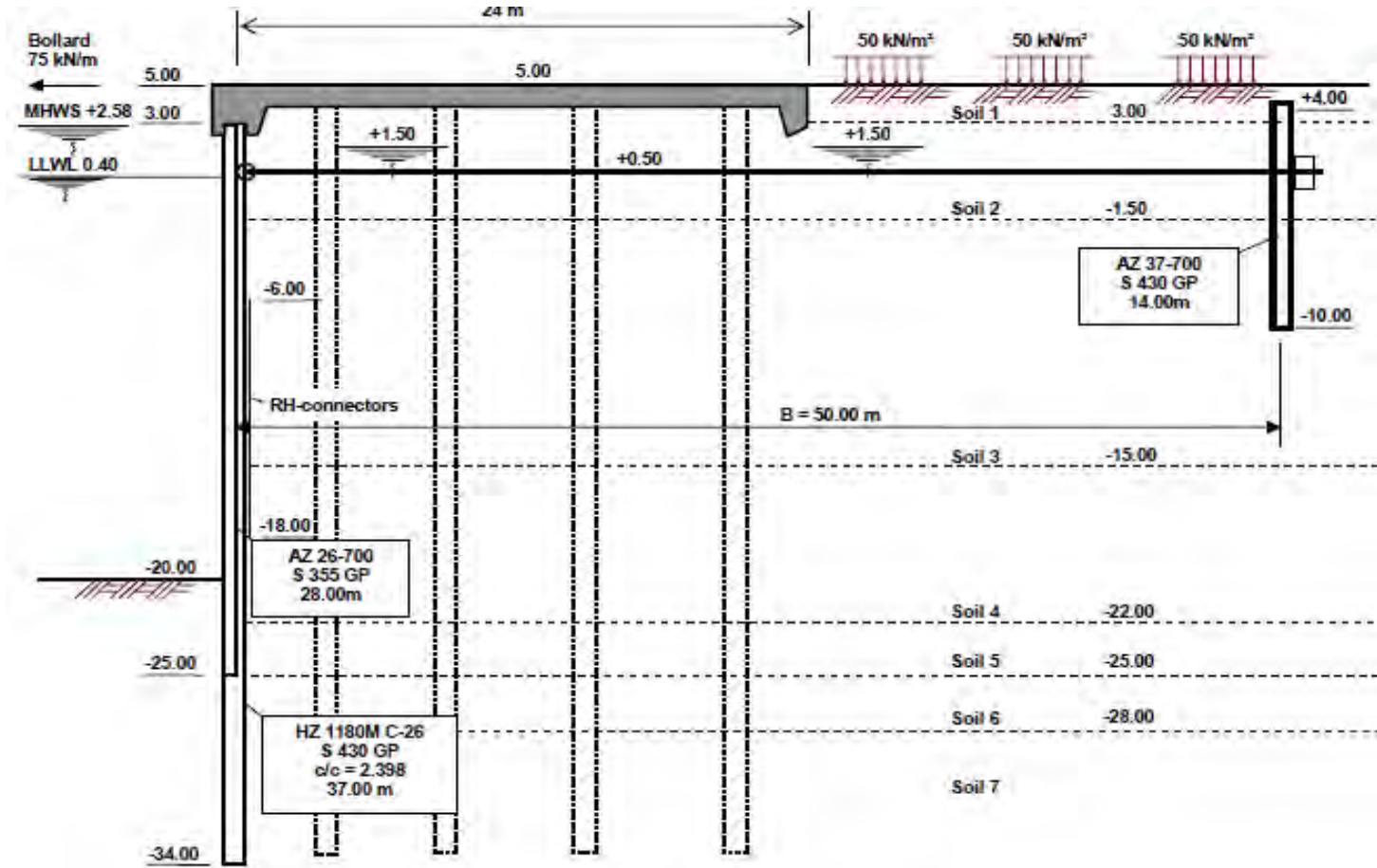


Owner:
 China State Development & Investment Corporation (SDIC)
Contractor:
 China Harbour Engineering Corporation (CHEC Tianjin)
Sheet piles:
 HZ 975 B - 12 / AZ 18 10/10
Steel grade: S390GP CU3550
Pile length: L_{HZ} = 29 m; L_{AZ} = 23 m
Total sheet pile quantity: 10220 t

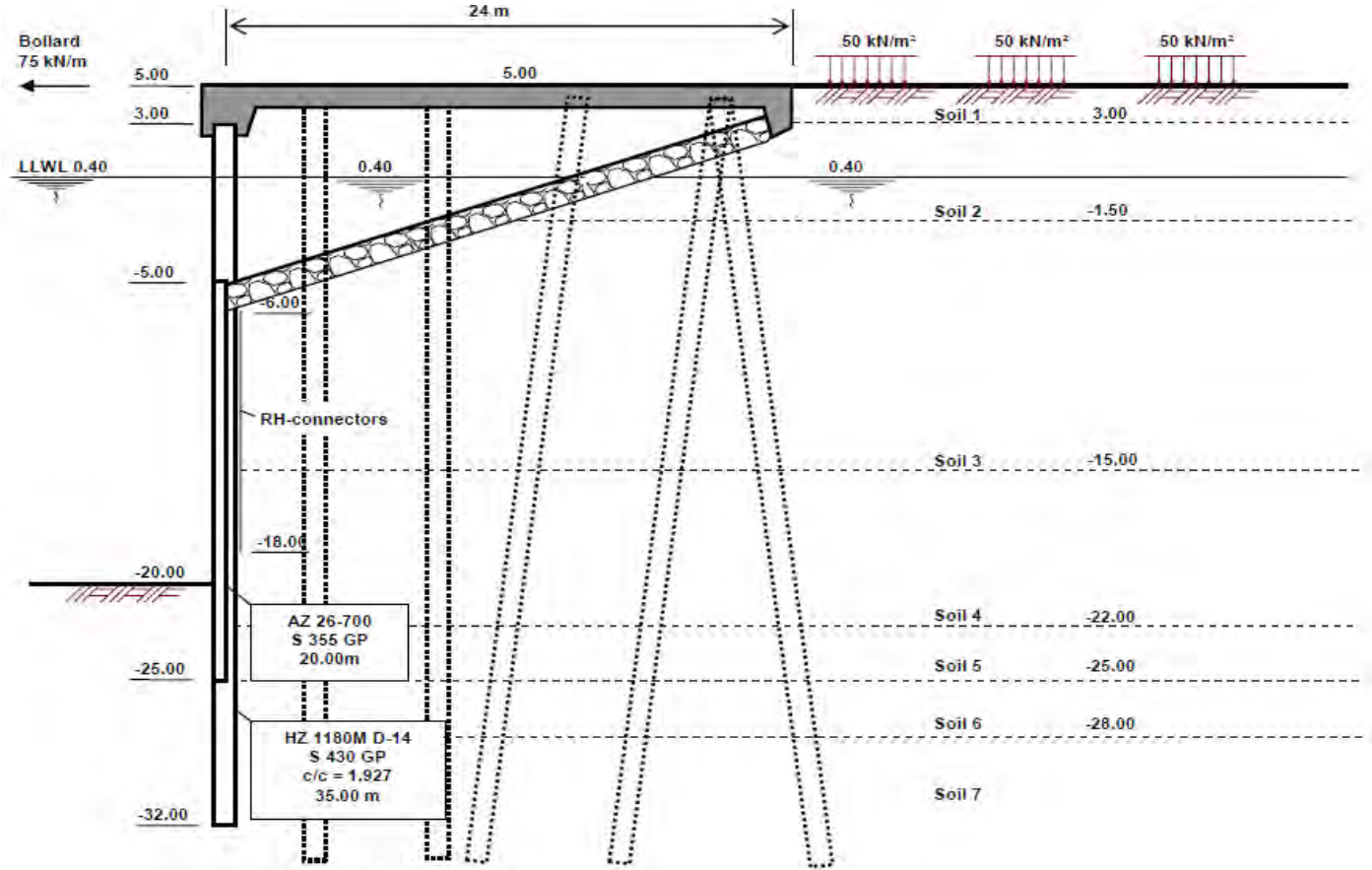
Design Cross-section : Option 1



Design Cross-section : Option 2

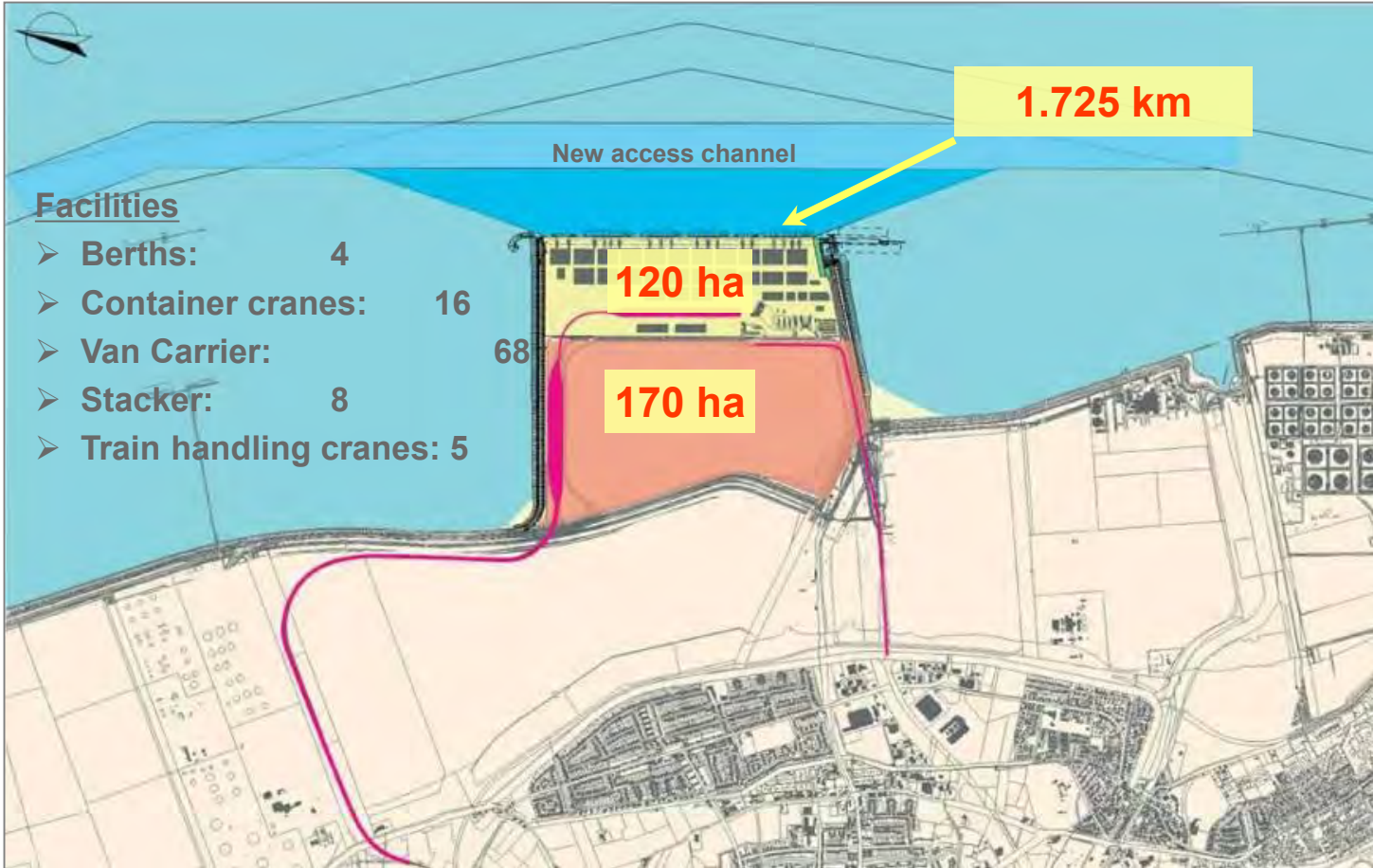


Design Cross-section : Option 3

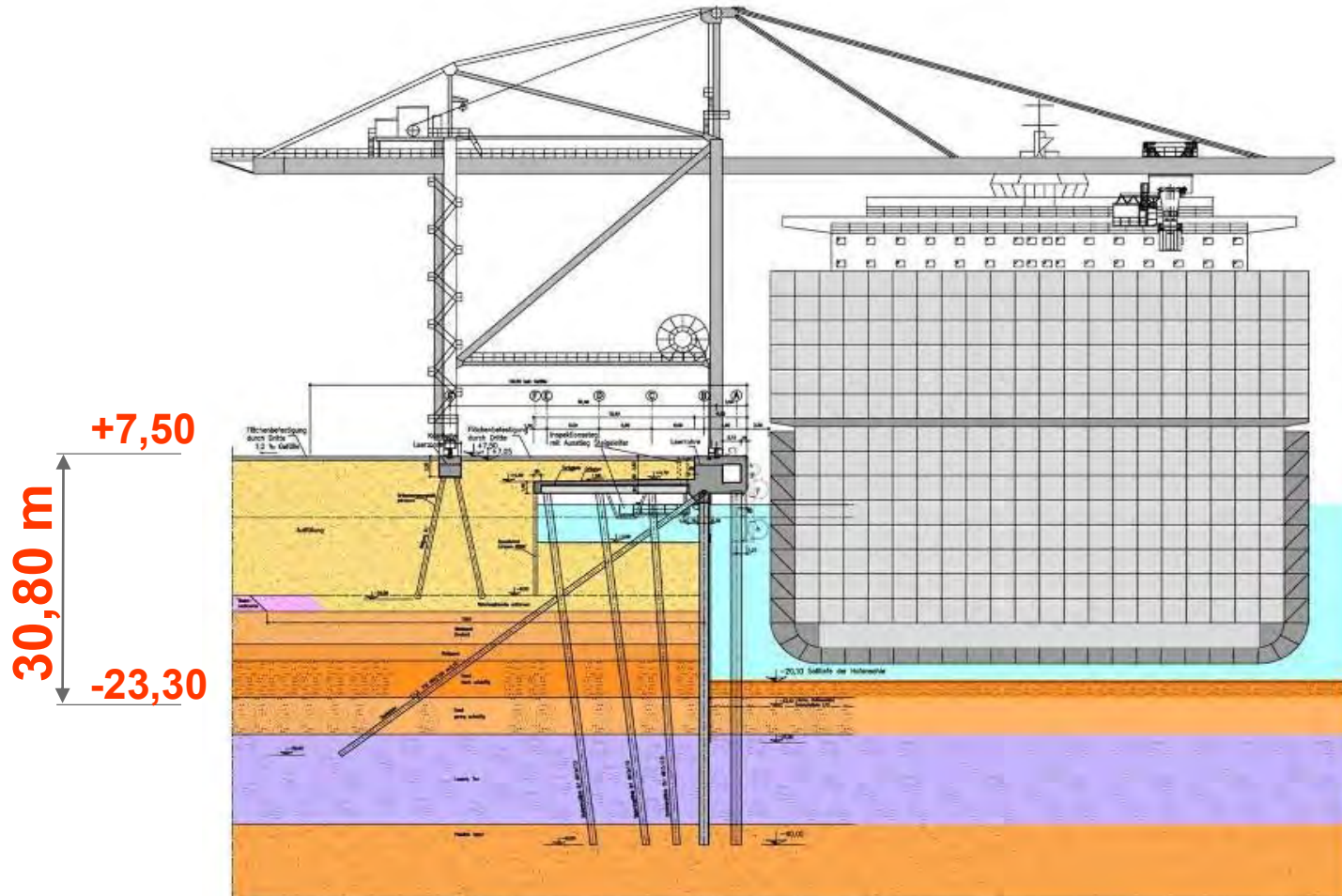




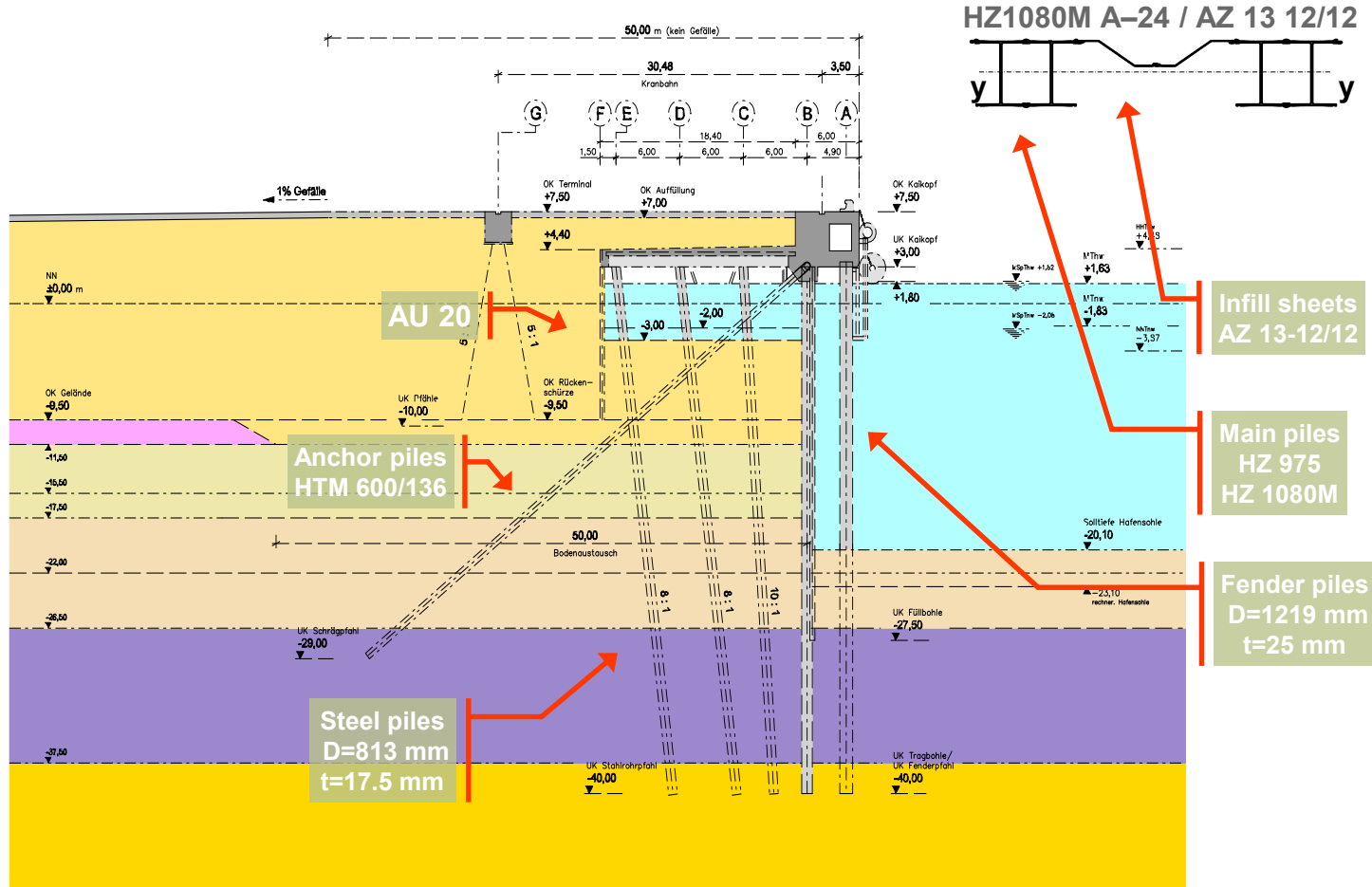
Deep Sea Terminal JadeWeserPort, Germany



JadeWeserPort , Quay wall cross section



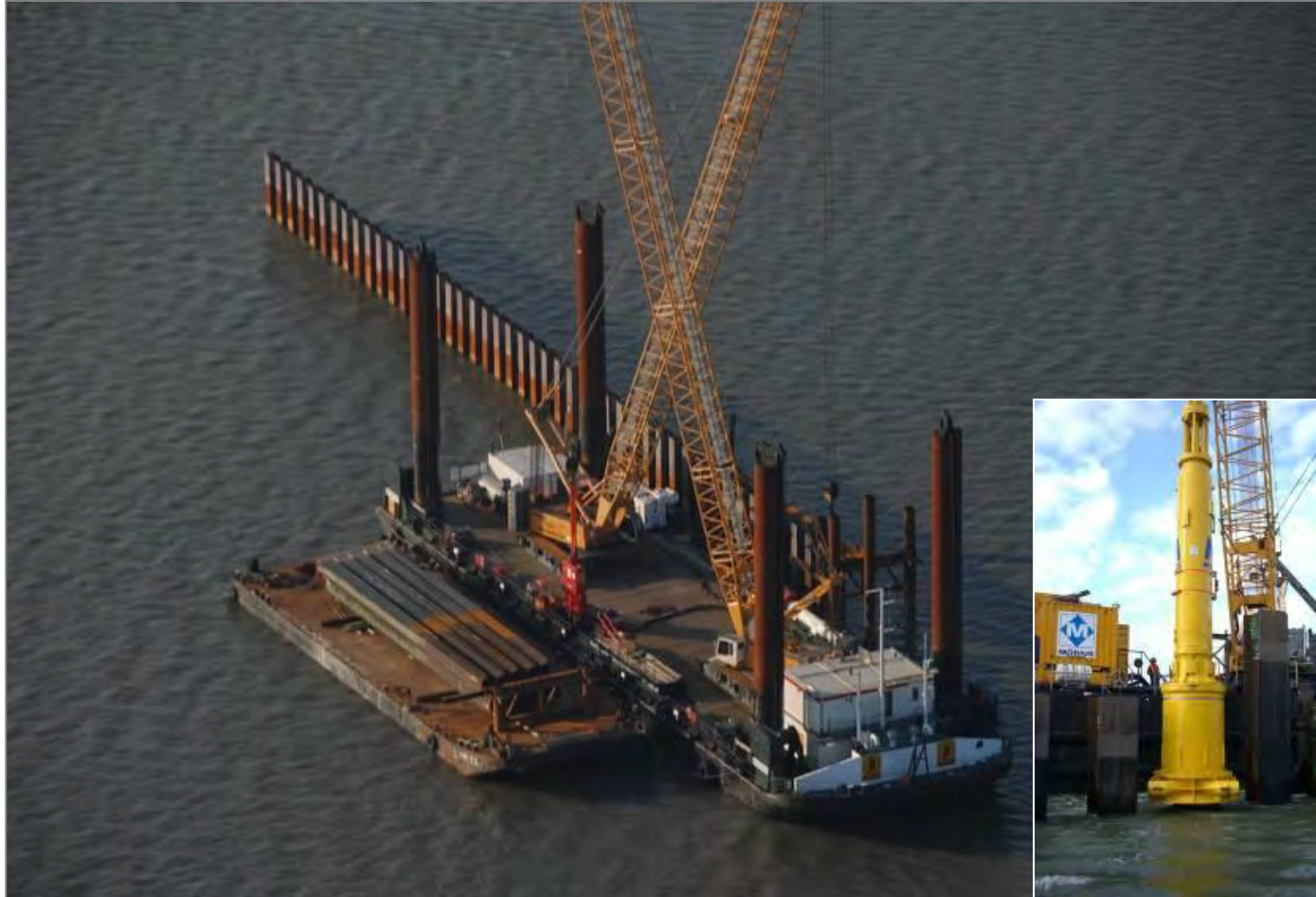
JadeWeserPort , construction details



Sheet Pile installation works from water



JadeWeserPort , Driving Equipment on Jack-up platform ; supply barge



JadeWeserPort, Germany

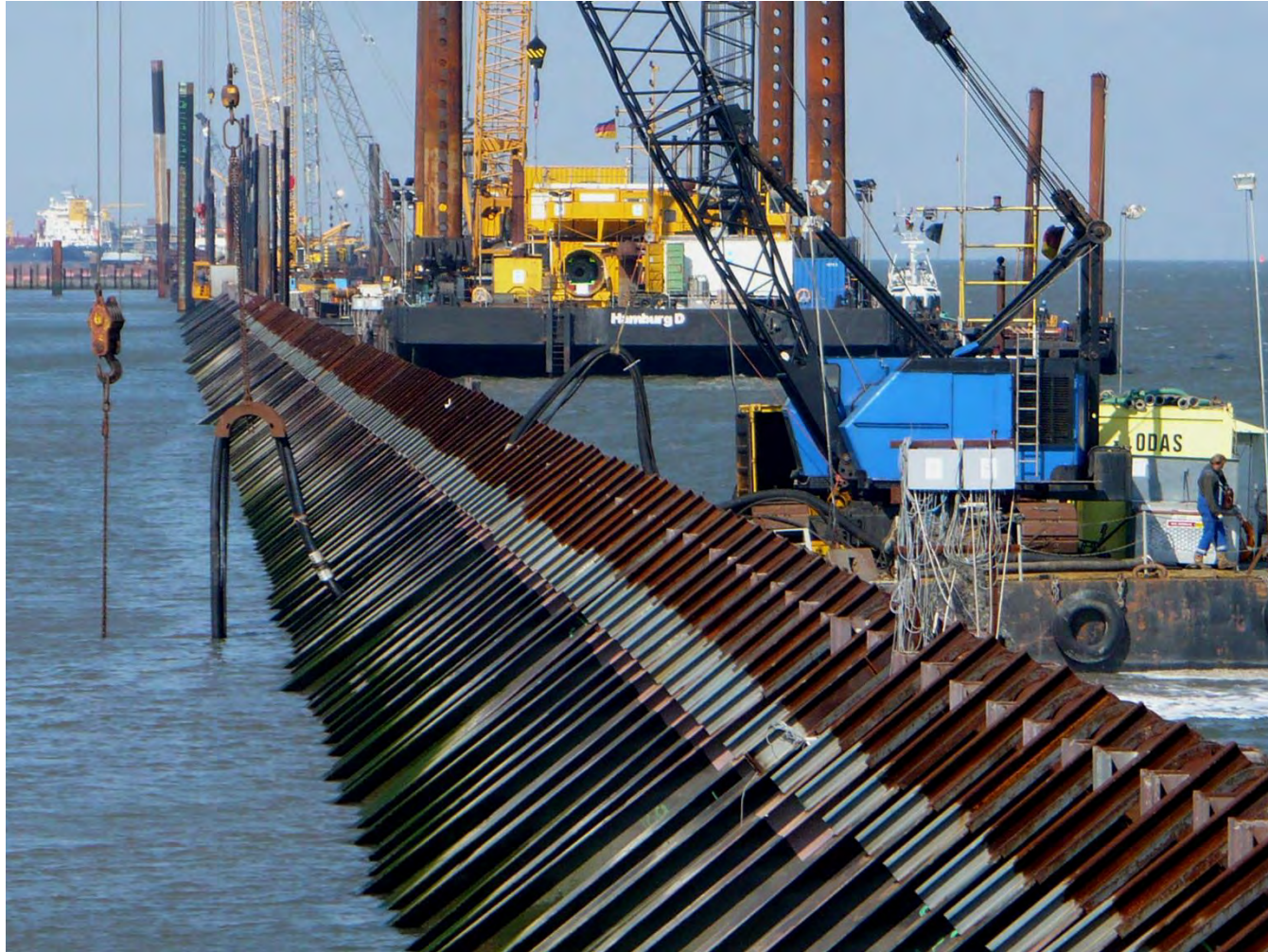
Positioning of HZM king piles in template



JadeWeserPort , driving of HTM anchor piles, hydraulic hammer on inclined leader



JWP : Main Wall and Anchor Piles installed



Piling works completed

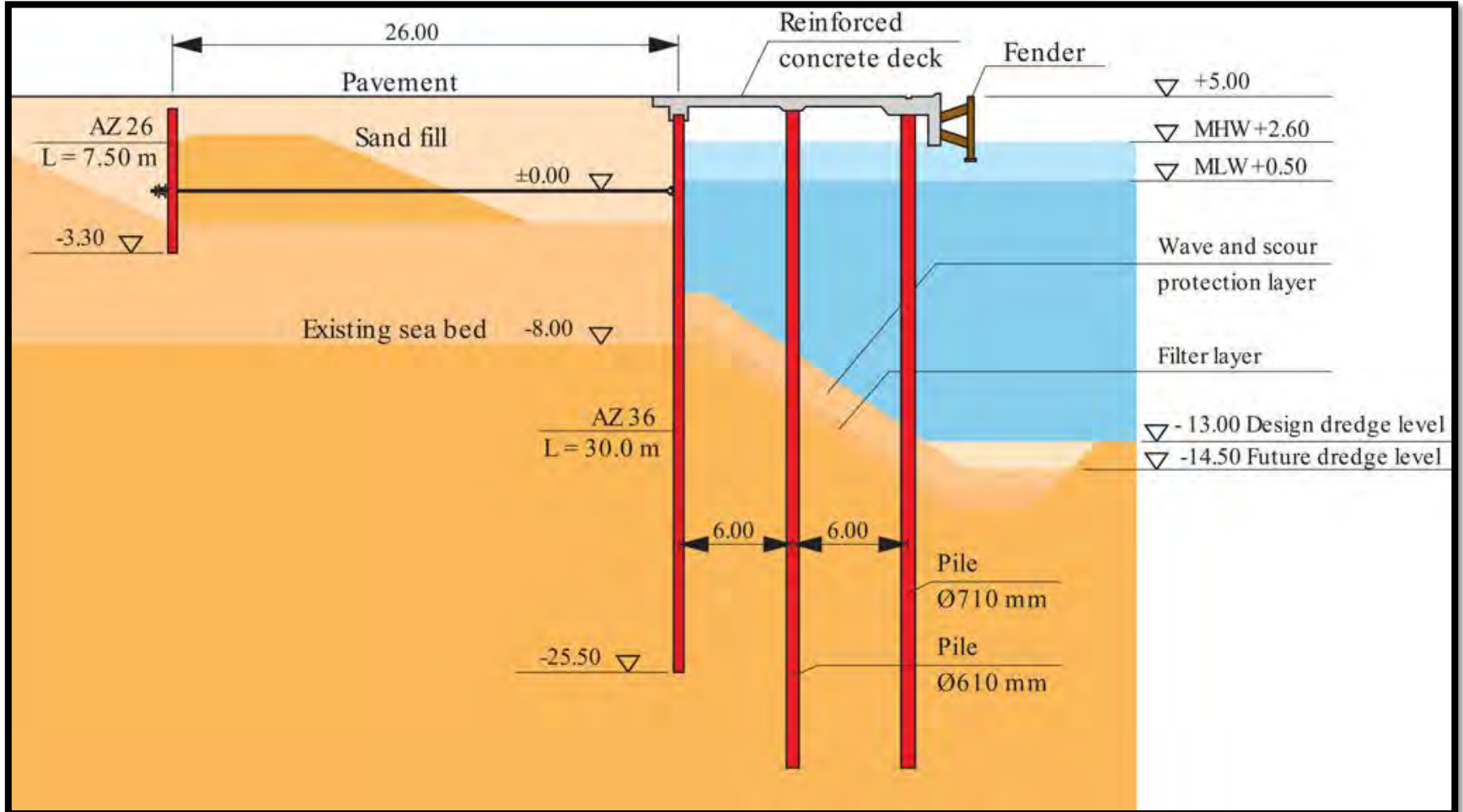


JadeWeser Port



Marsden Point, Northport Berth 3, New Zealand

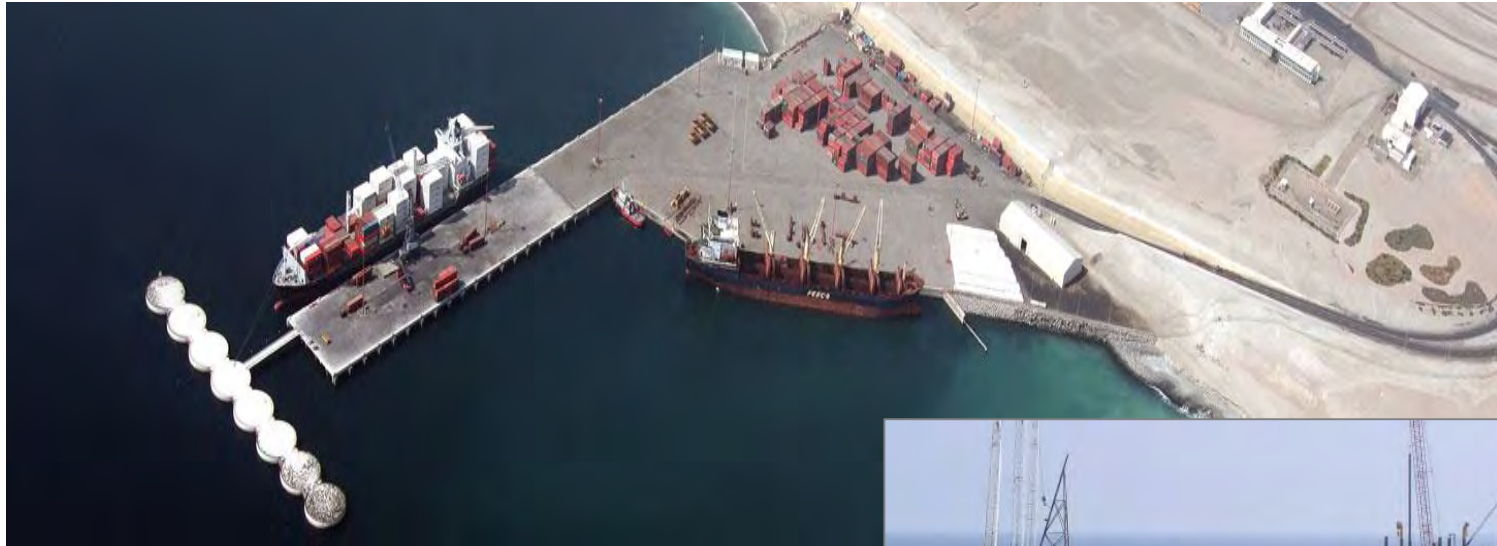




NorthPort , Marsden Point , NZ



Port of Mejillones , Antofagasto , Chile



Seismic zone

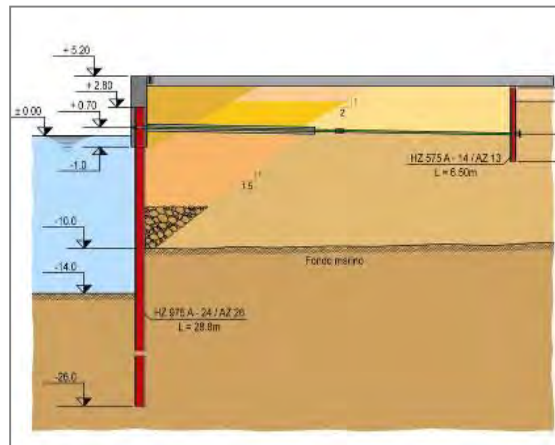
Muelle

HZ 575A-14/AZ13

HZ 975A-24/AZ26

Length 6.0 – 28.8 m

About 5000 t



Gdansk Container Terminal , Poland

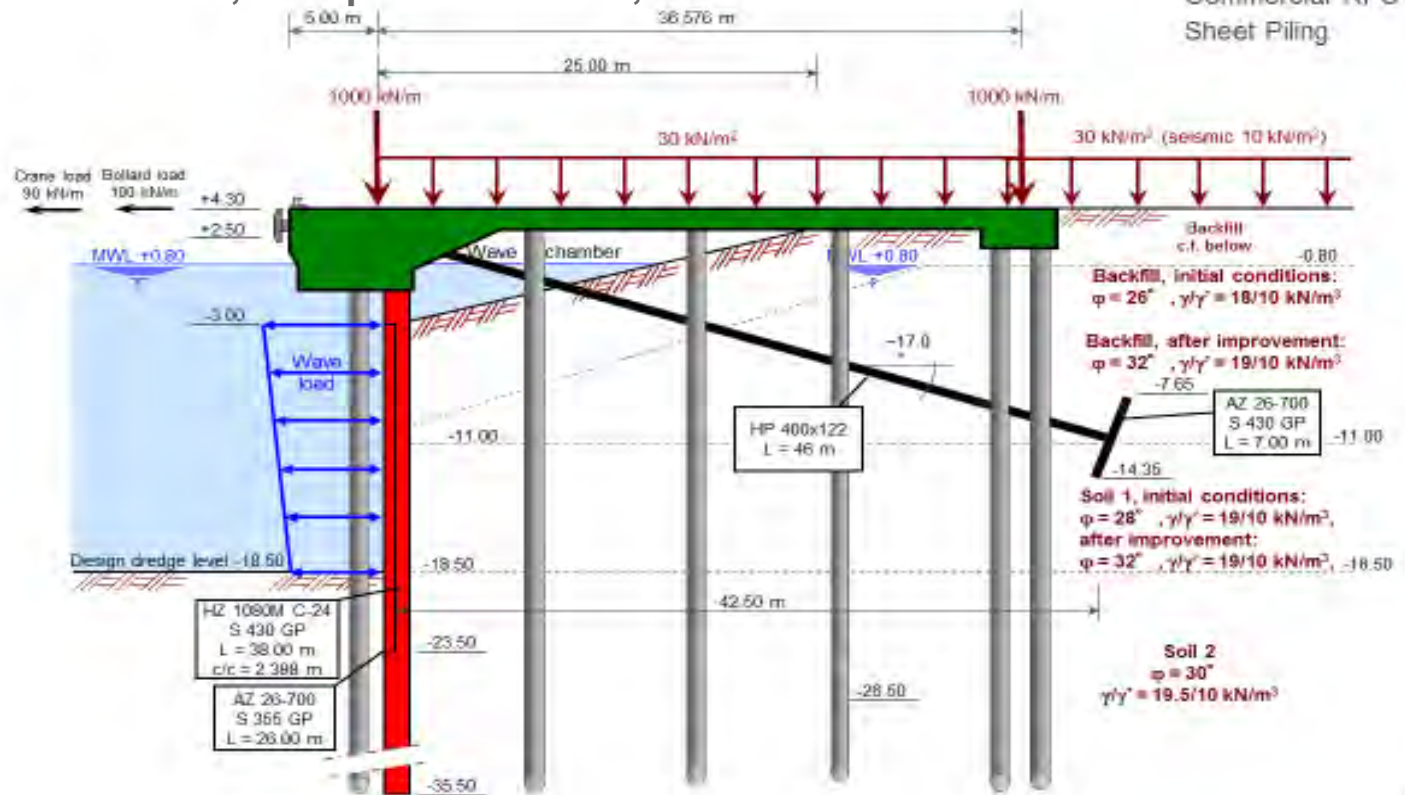


Main project data

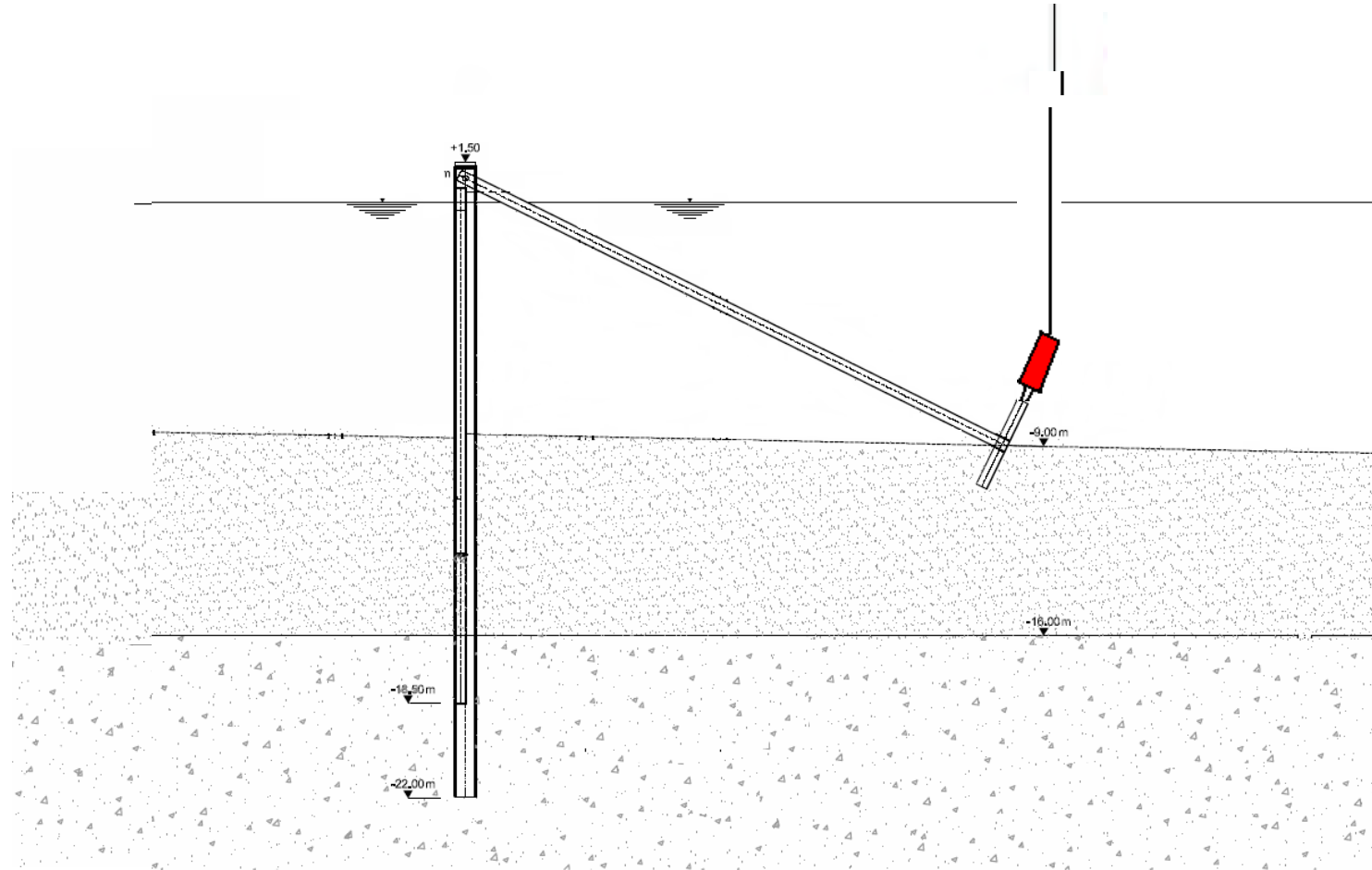
- total length of SSP wall 2000 m

- area of DCT – 44 hectares

- depth of harbor-bed EL -13,5 m up to and EL- 18,5 m



Vibrodriving of anchor plate



Flap anchors assembling



Flap anchors assembling procedure

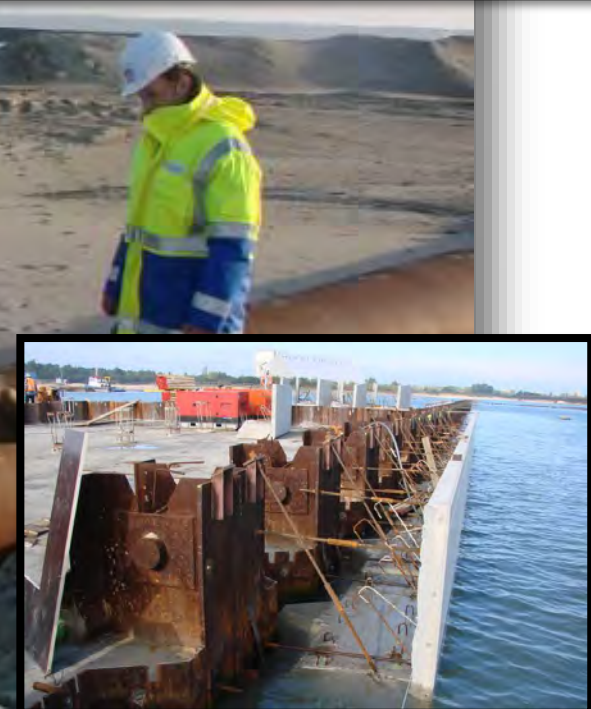
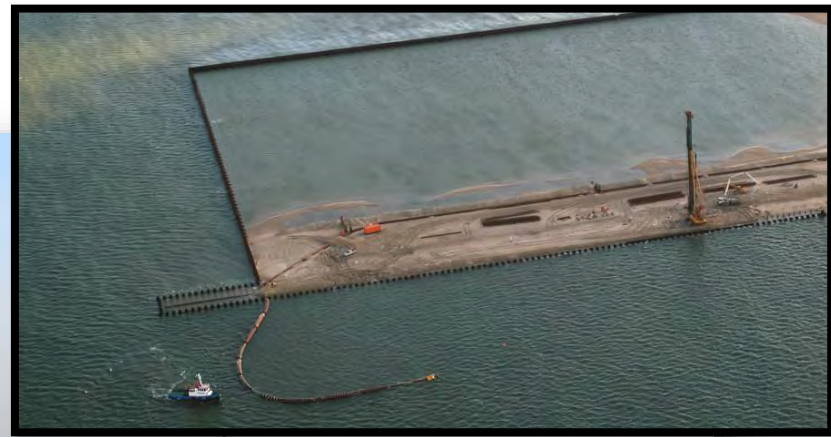
- flap anchors were monted in sockets cuted in HZ piles



Flap anchor on HZ king piles



Land reclamation





Ichthys LNG Terminal , MOF - Darwin



Ichthys LNG Terminal , MOF – Darwin

- AS 500-12.5 mm , length up to 18.5 m ; abt. 3 200 tons



Interlock Strength IS min. 6000 kN/m



Hydraulic driven Guiding Template

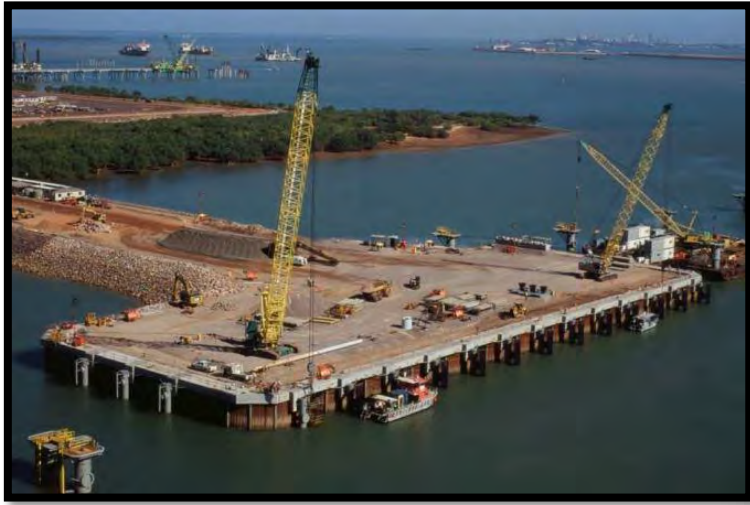


Triple – AS500 Clamps

Ichthys - Darwin, Australia



Ichthys LNG – INPEX Darwin, Australia





CMA CGM ANTOINE DE SAINT EXUPERY

TEU's : 20776

400 x 59 m

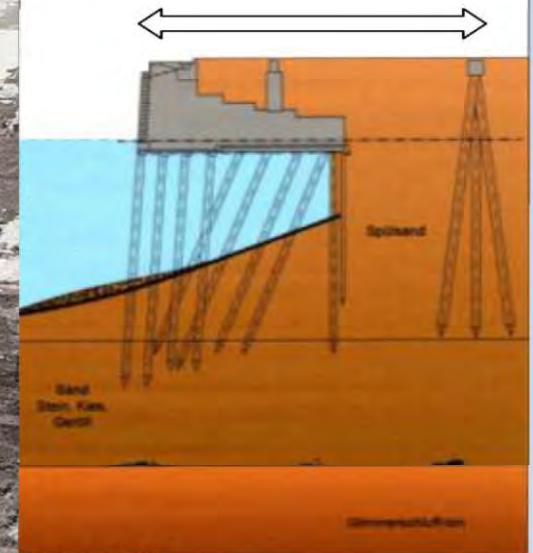
Draft : 16 m

Ausbau Burchardkai Liegeplatz 3 + 4

Luftbild von der Baustelle Burchardkai um 1900

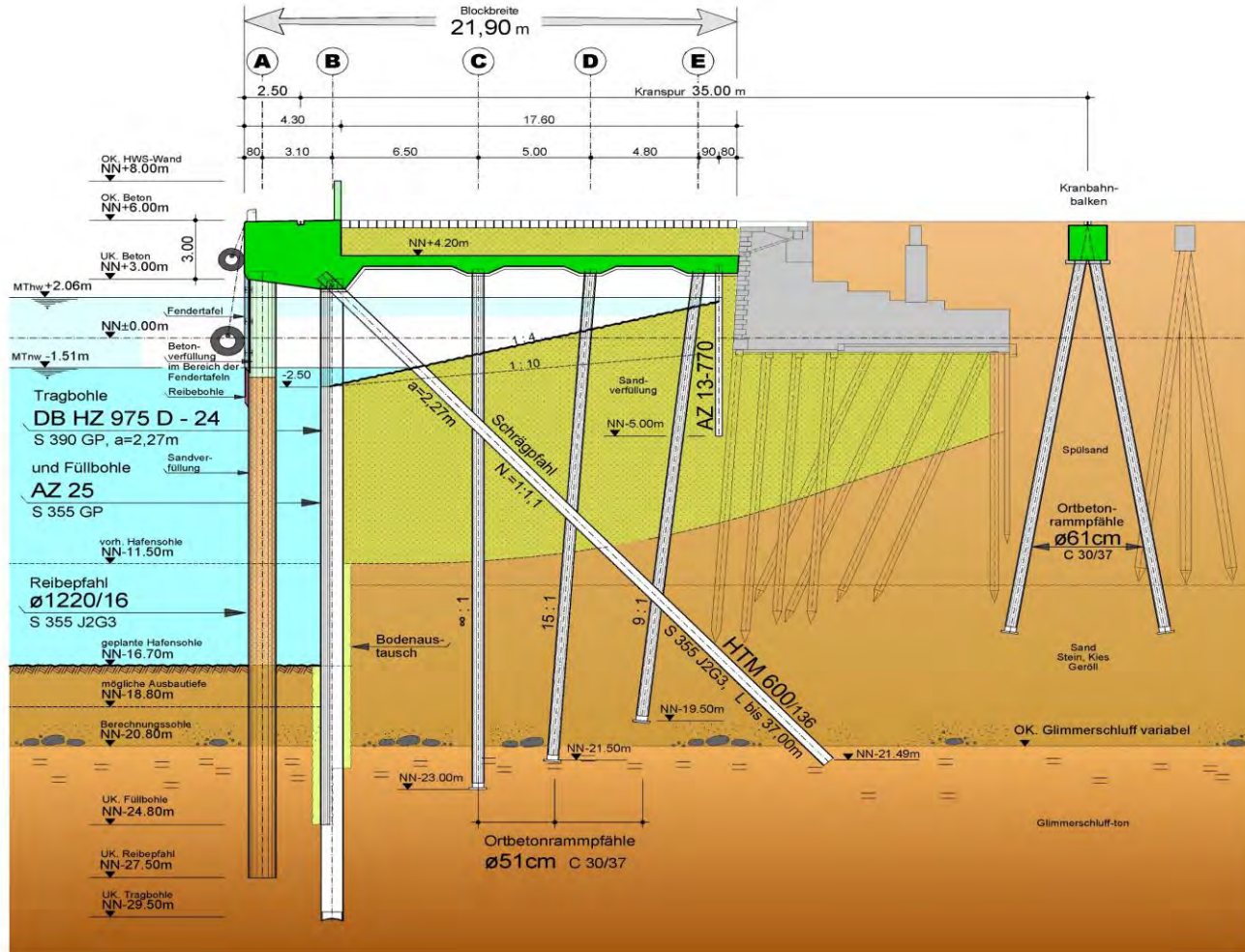


Bauweise 1912



Seite 3

Port of Hamburg – Burchardkai





Summary



Key Facts about Sheet Piles

- ArcelorMittal has gained **worldwide LEADERSHIP for SSP technology**
- offering the **most competitive range** of products
- only supplier to provide **extensive range of services** from project concept to job site support
- provide to all levels of stakeholder most **cost efficient , fast and safe project package solutions**



Marsden Point, Northport Berth 3. NZ (2005)



Copenhagen, Metros (2007)

Happy Landing with AM Smart Port Steel Solutions



Thank you for your attention

Excellence in Products , Services and Customer Satisfaction