ArcelorMittal SHEET PILING

INTERMODAL Africa 2016, Ghana

Innovative cost efficient foundation solutions

ArcelorMittal

The world’s leading steel and mining company

- ArcelorMittal is the world's leading steel and mining company, with around 222,000 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

Agenda

- **Steel Sheet Piling** : Introduction
- **Port structures** : examples
- **new developments** : AMLoCor and AZ800 new range

Temporary applications
basements / foundation works

Permanent transport and urban developments

Flood protection schemes

Harbour structures , Cochin Shipyard , India

Sheet pile AZ 26-700 in length of 24 meters
abt. 700 tons – ready-to-use in full length

Quay Wall Rehabilitation , Littlehampton UK

Land Reclamation/Shore protection – ESSAR Hazira

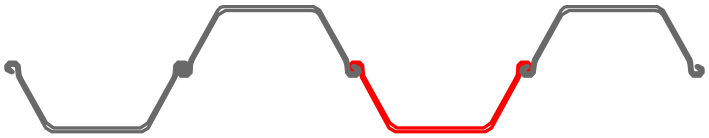
Deep Port structures – Greenfield Developments

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

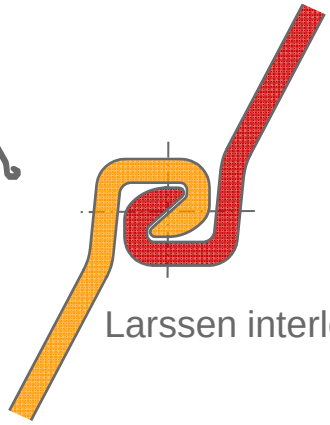
- **Kaohsiung Container Terminal , Taiwan**

Section Modulus Type _ Bending Moments

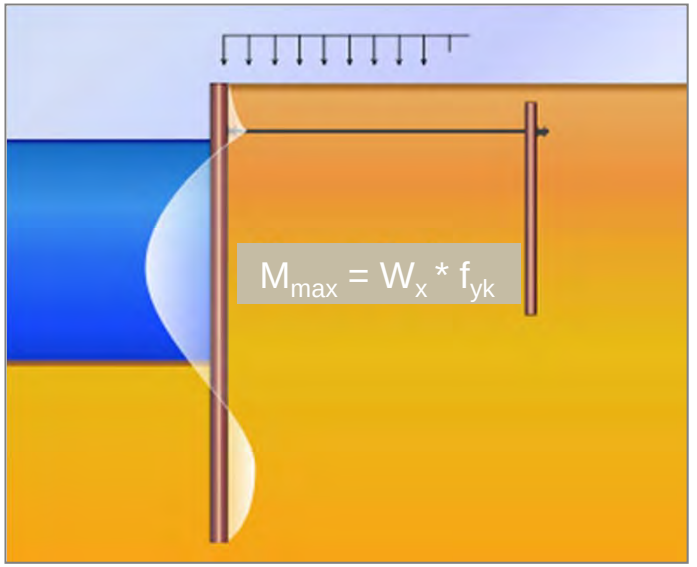
Bending resistant



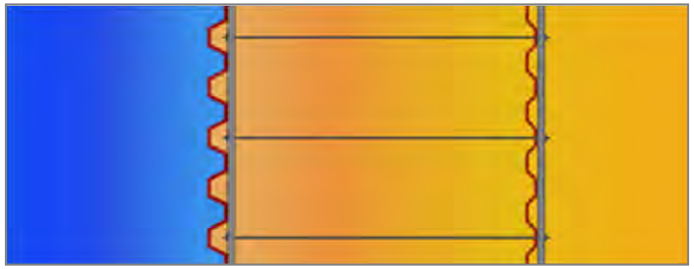
U - section



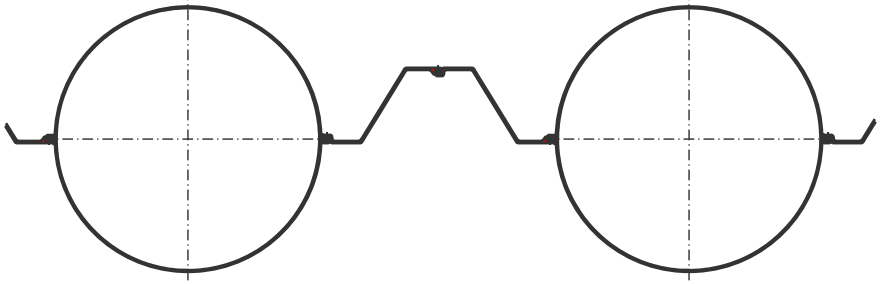
Larssen interlock



Z - section



Combined wall

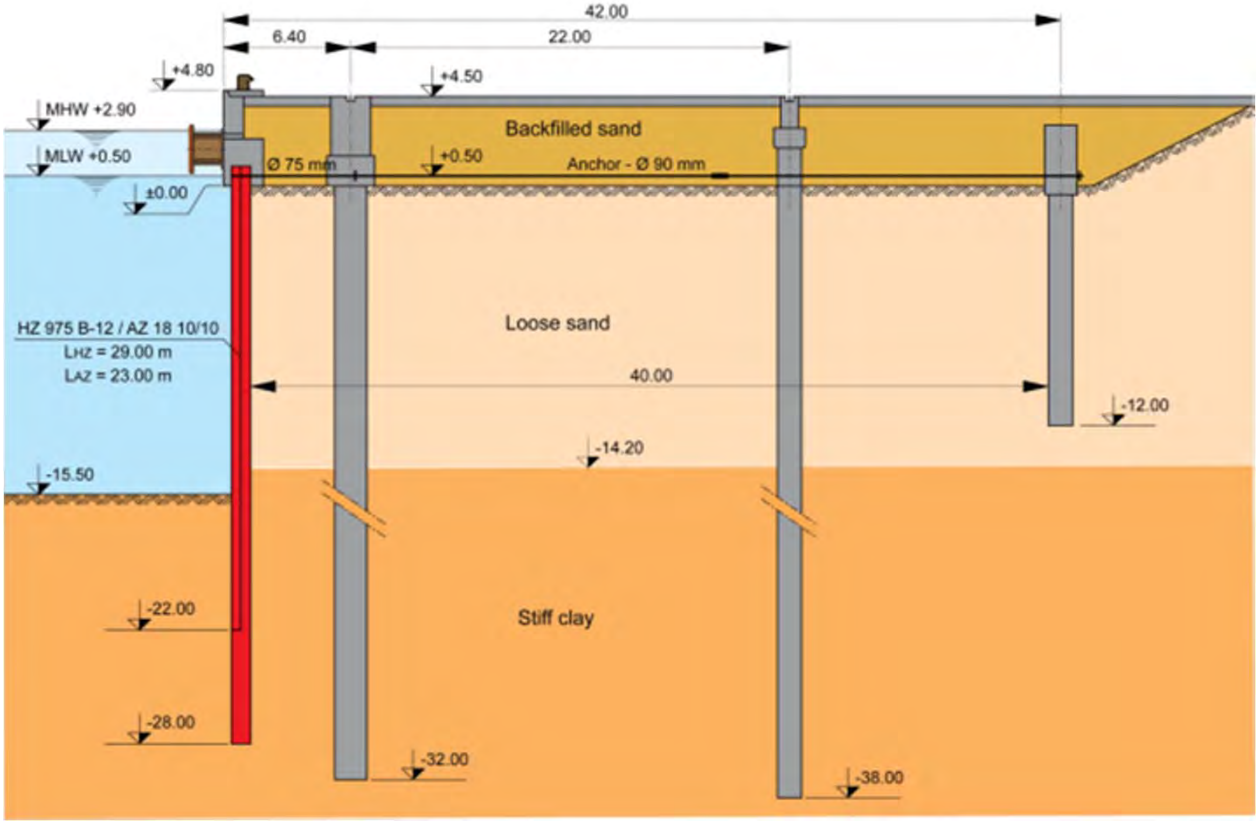


Cao Fei Dian Port, Hebei Province, China / Solid Bulk Terminal

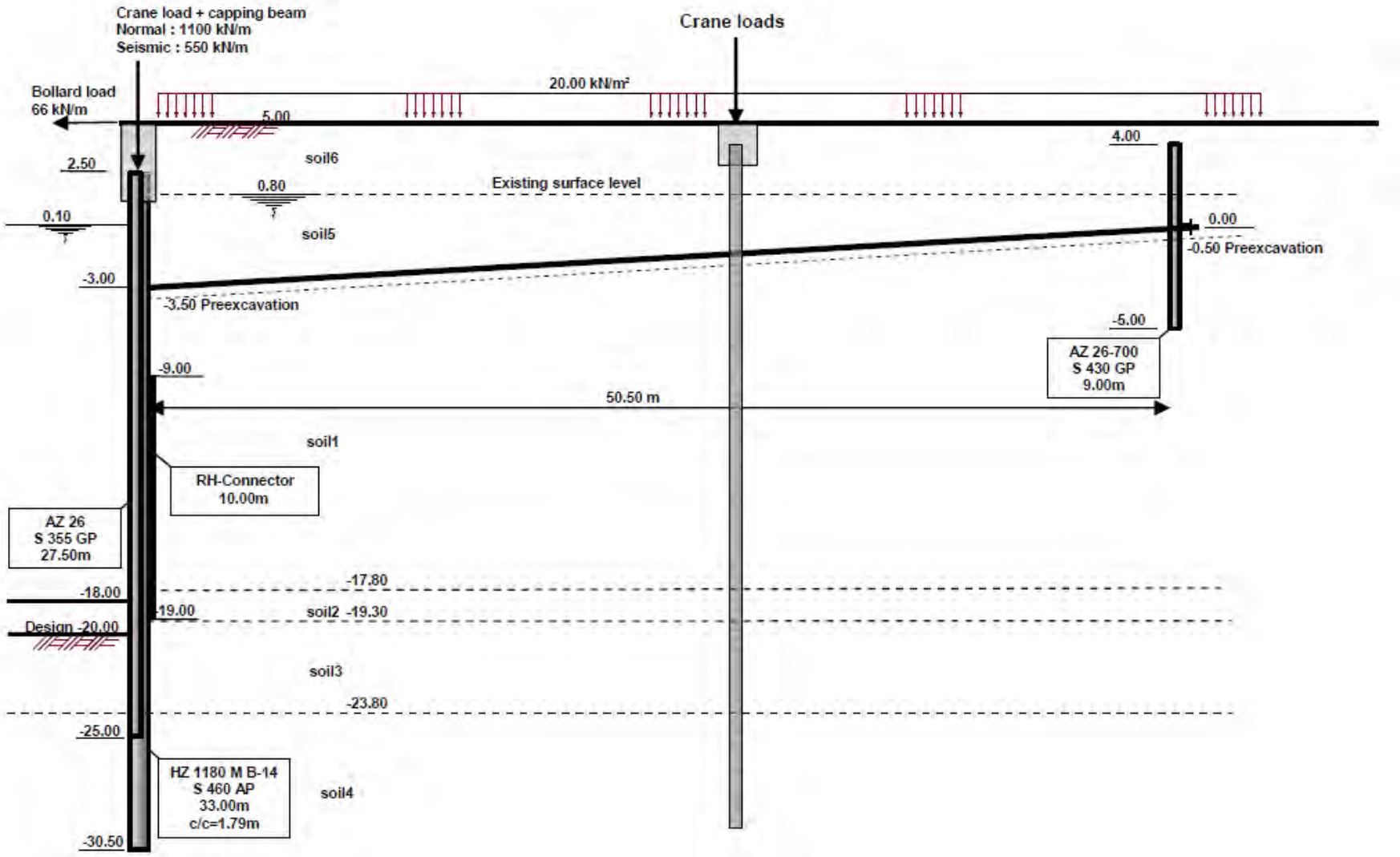
ArcelorMittal

- **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%

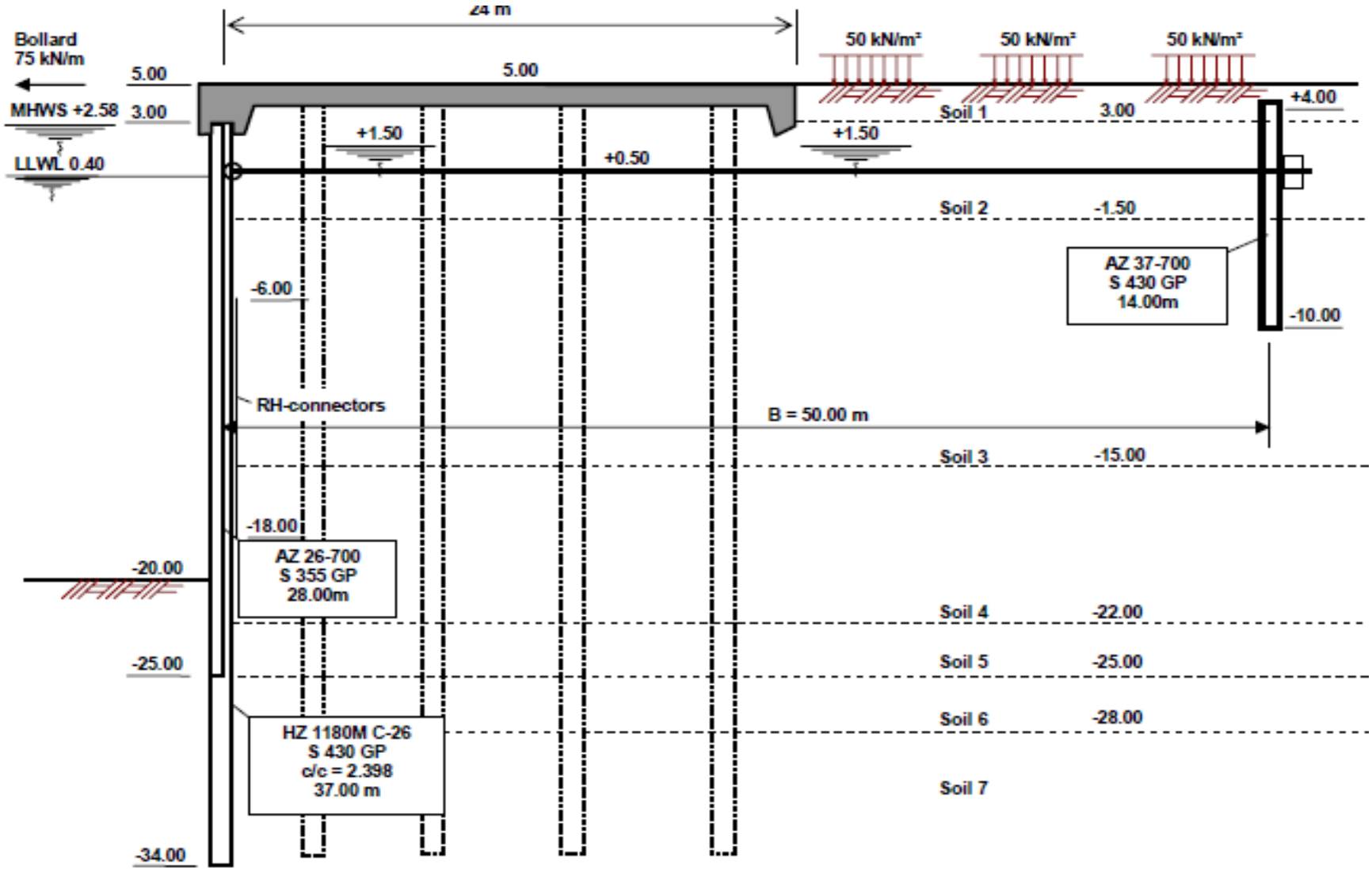
Owner:
China State Development & Investment Corporation (SDIC)
Contractor:
China Harbour Engineering Corporation (CHEC Tianjin)
Sheet piles:
HZ 975 B – 12 / AZ 18 10/10
Steel grade: S390GP CU3550
Pile length: L_{HZ} = 29 m; L_{AZ} = 23 m
Total sheet pile quantity: 10220 t



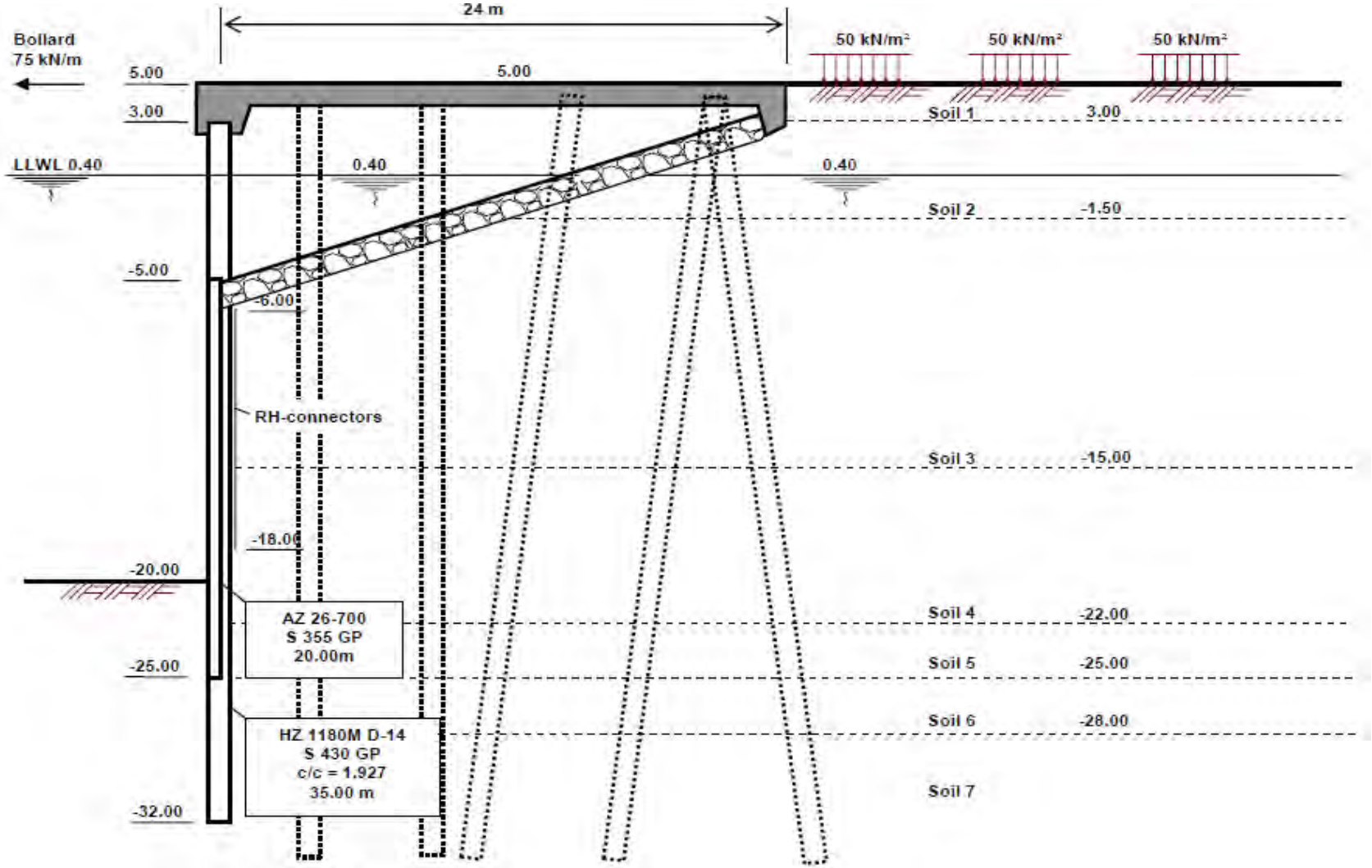
Design Cross-section : Option 1



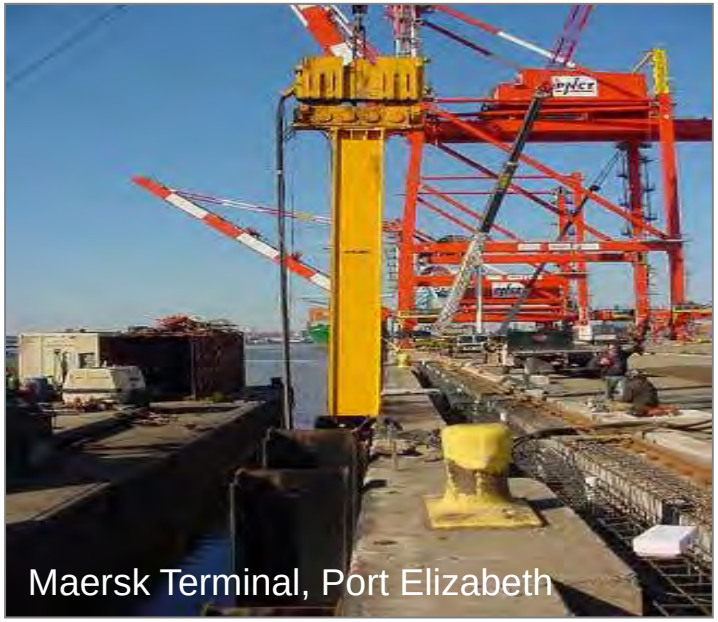
Design Cross-section : Option 2



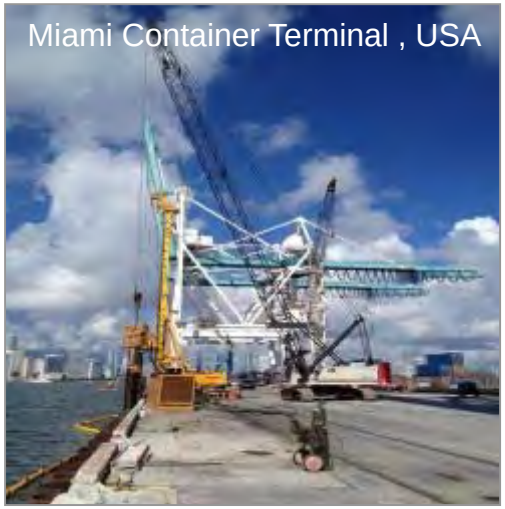
Design Cross-section : Option 3



Deepening in front of existing quay walls


Maersk Terminal, Port Elizabeth

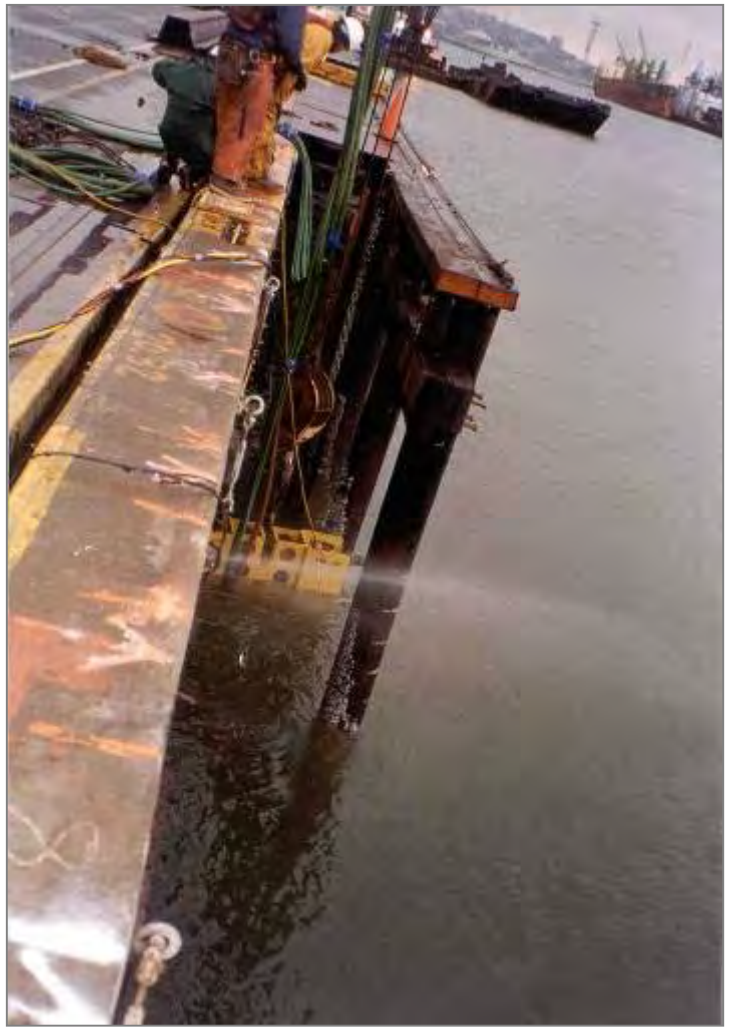

Maydon Wharf, Berth Rehabilitation

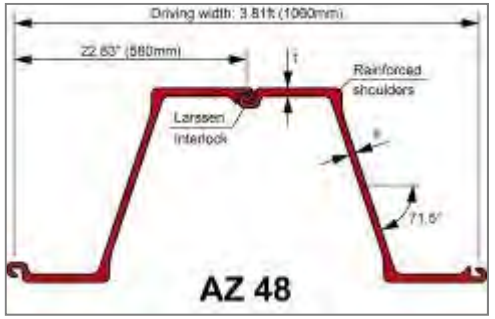

Miami Container Terminal , USA

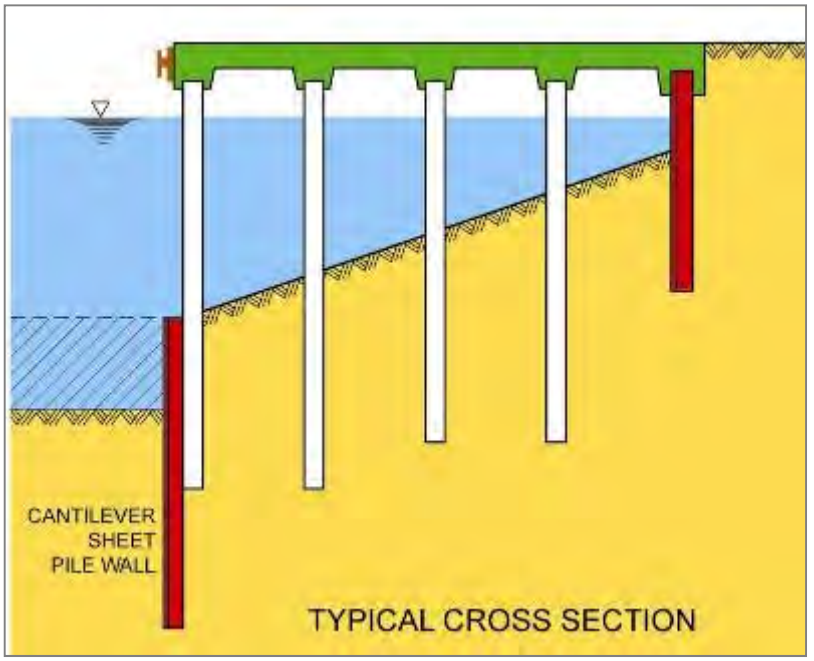

Terminal 5, Port of Seattle


Quay Wall – Cochin Shipyard

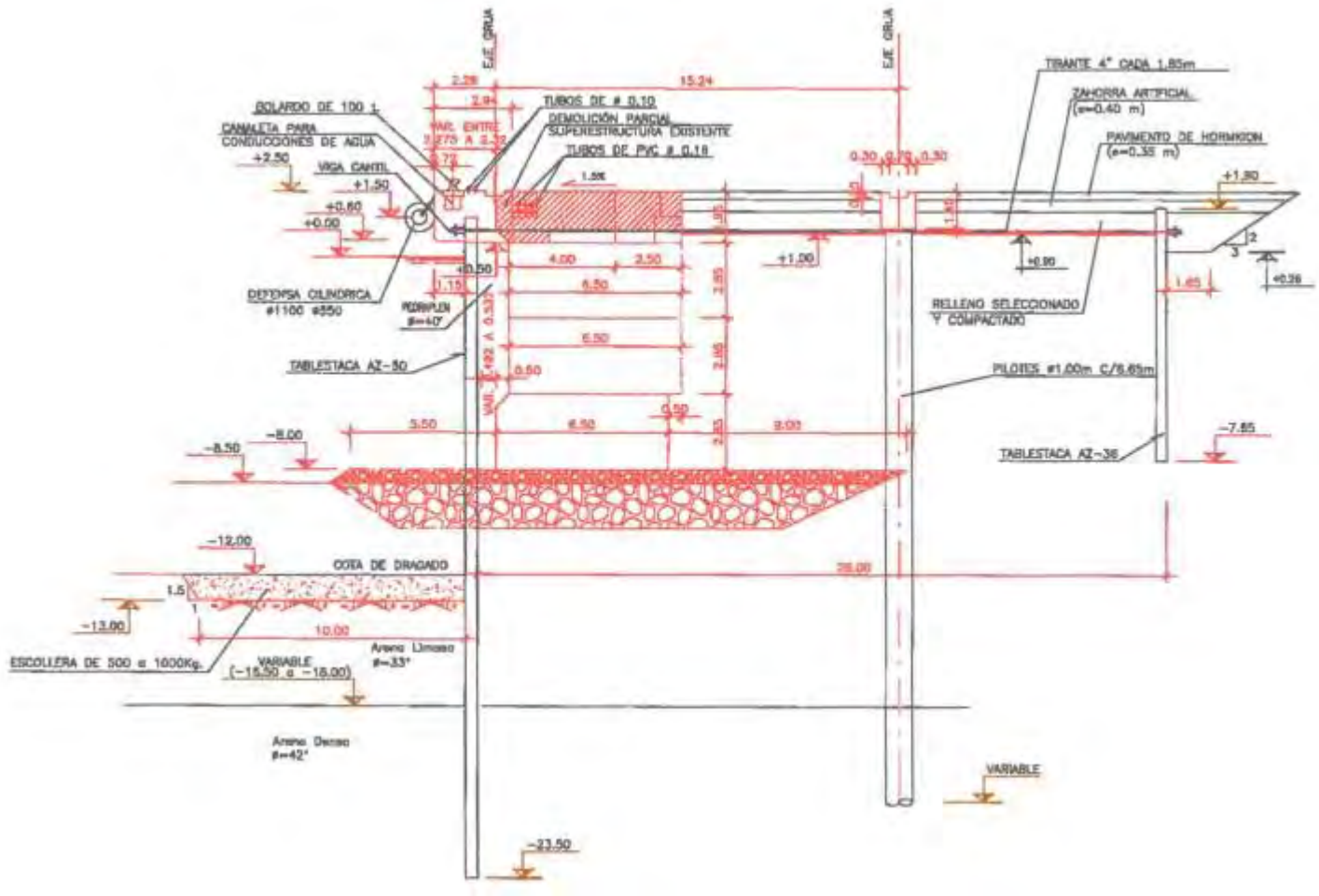
Terminal 5, Port of Seattle USA



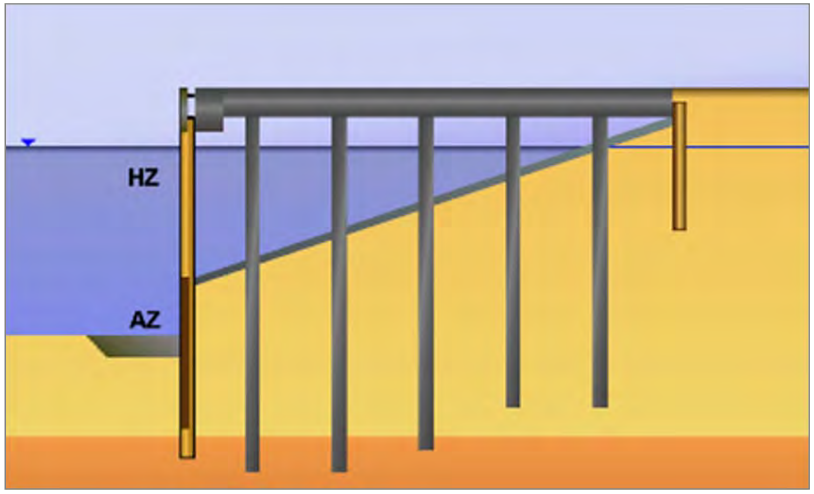




Port of Barcelona

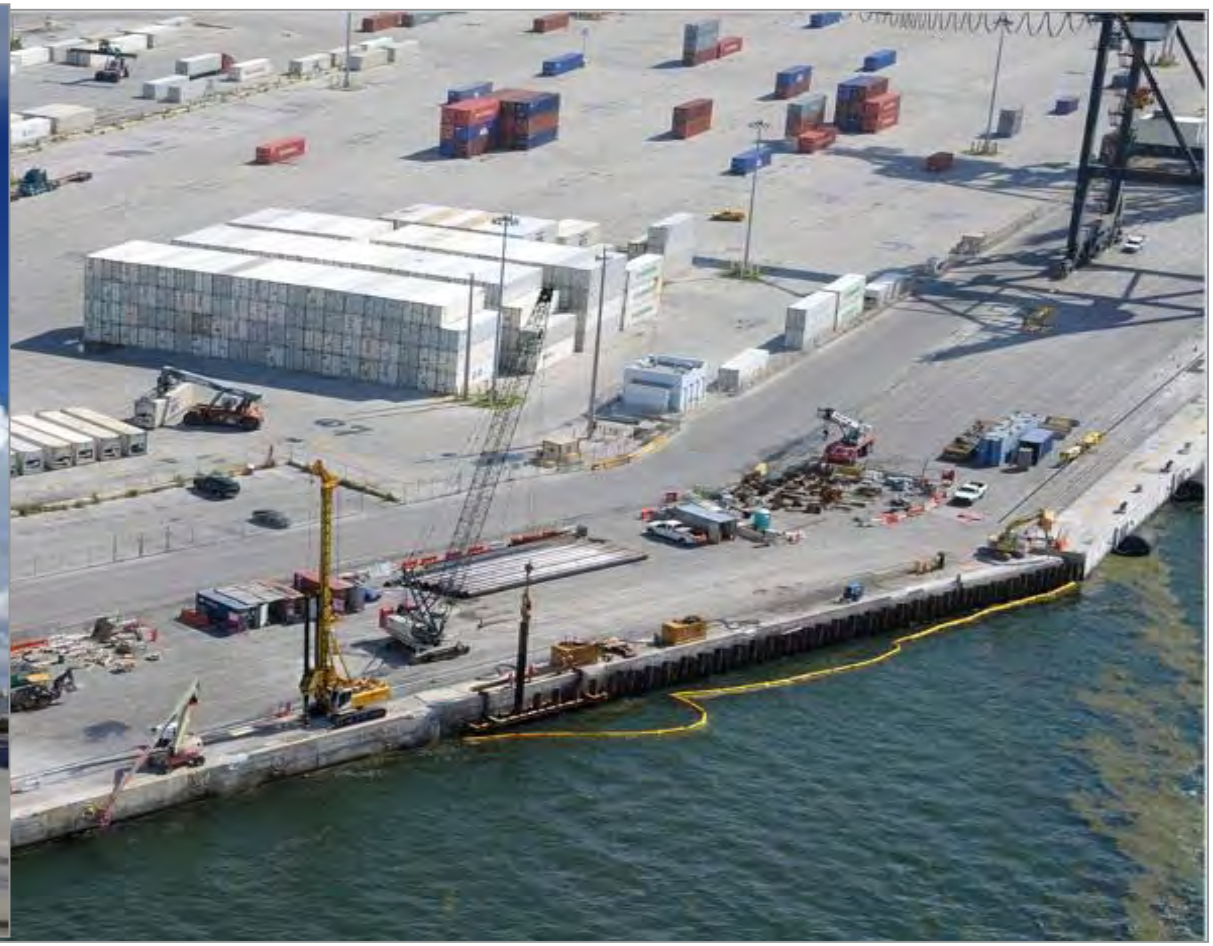


Maersk Terminal, Port Elizabeth, NJ, USA

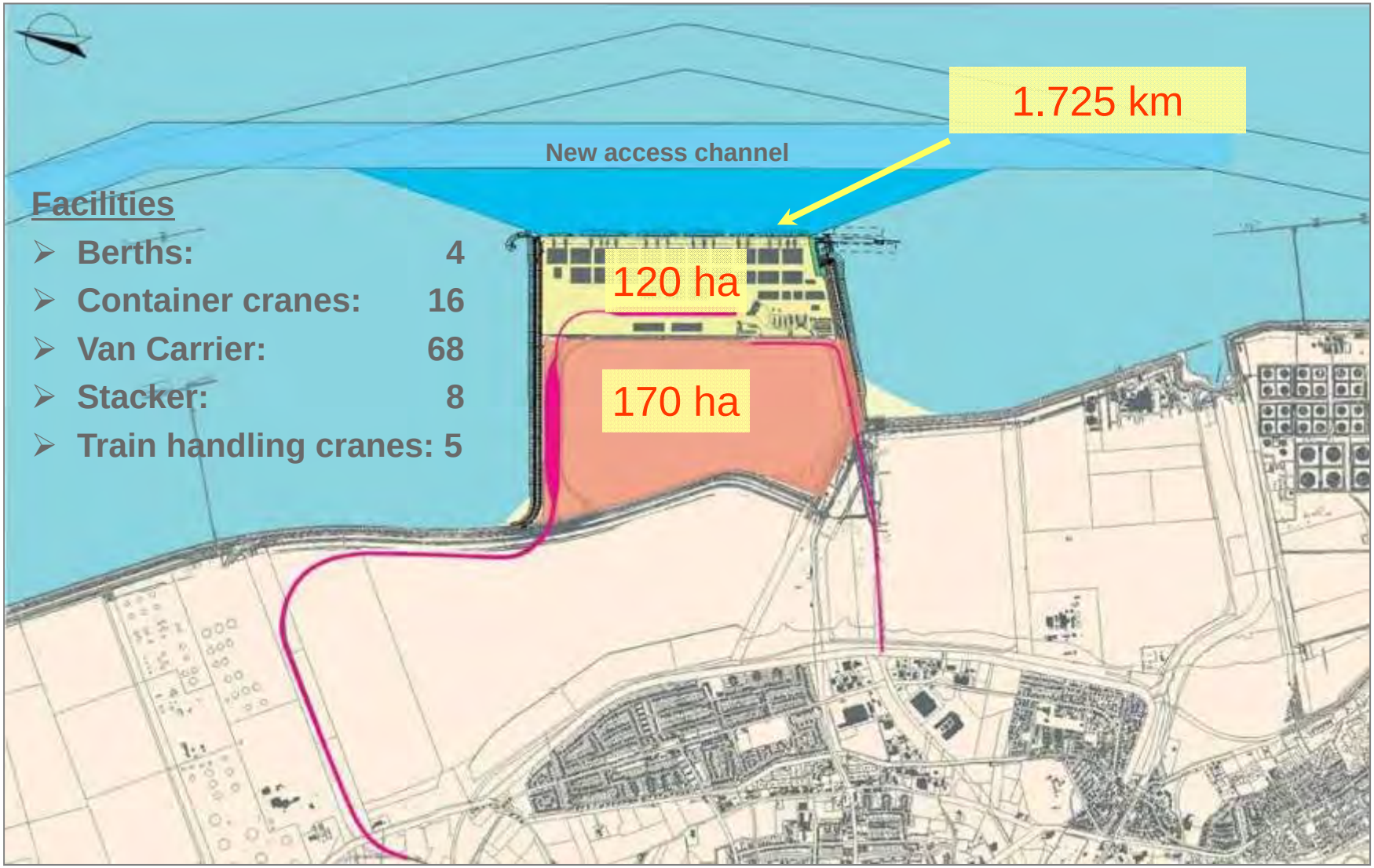


•HZ 575 B & C-12/AZ18: 1220 mt
HZ: ± 24.4m
AZ: ± 7.6m

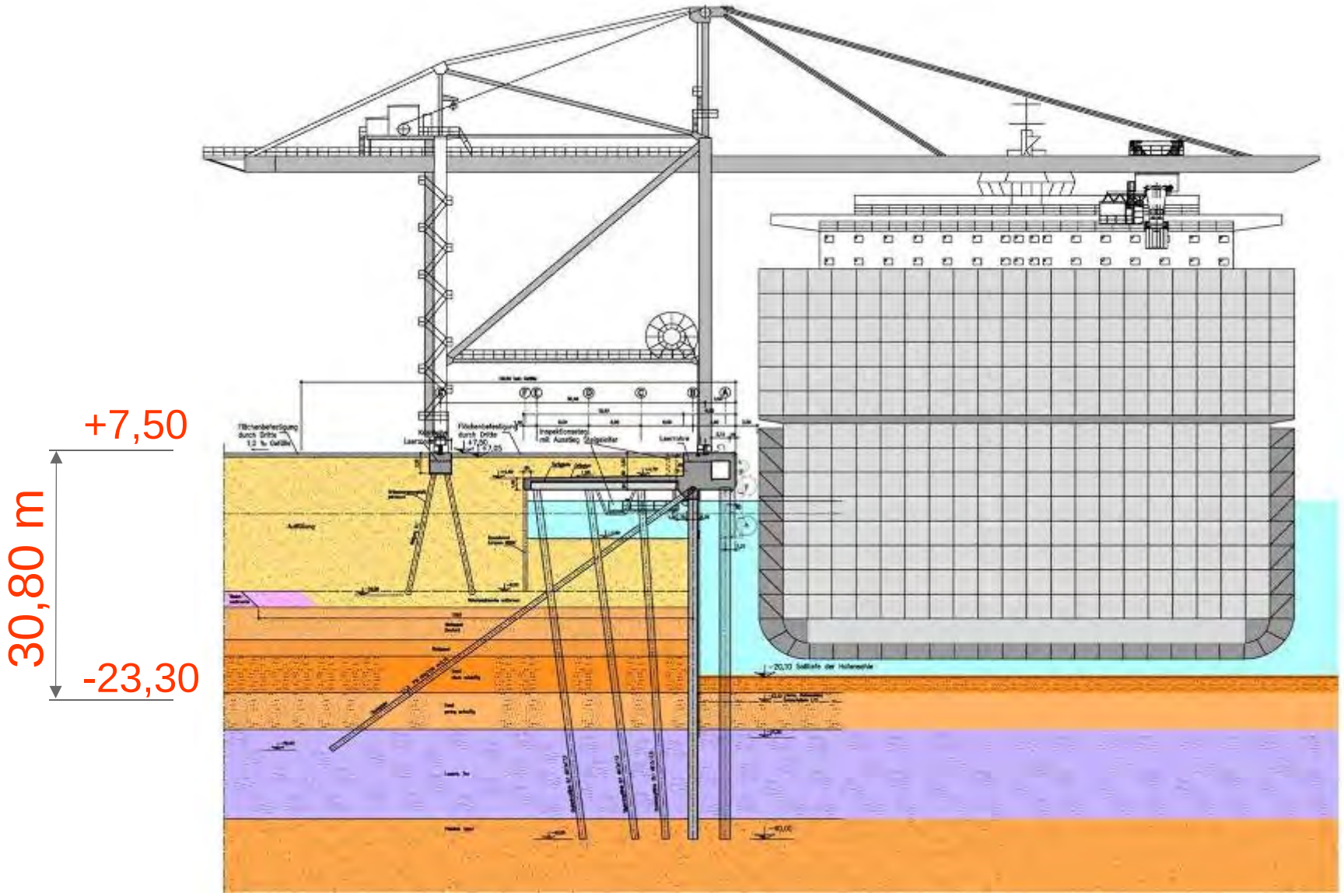
Miami Container Terminal , USA



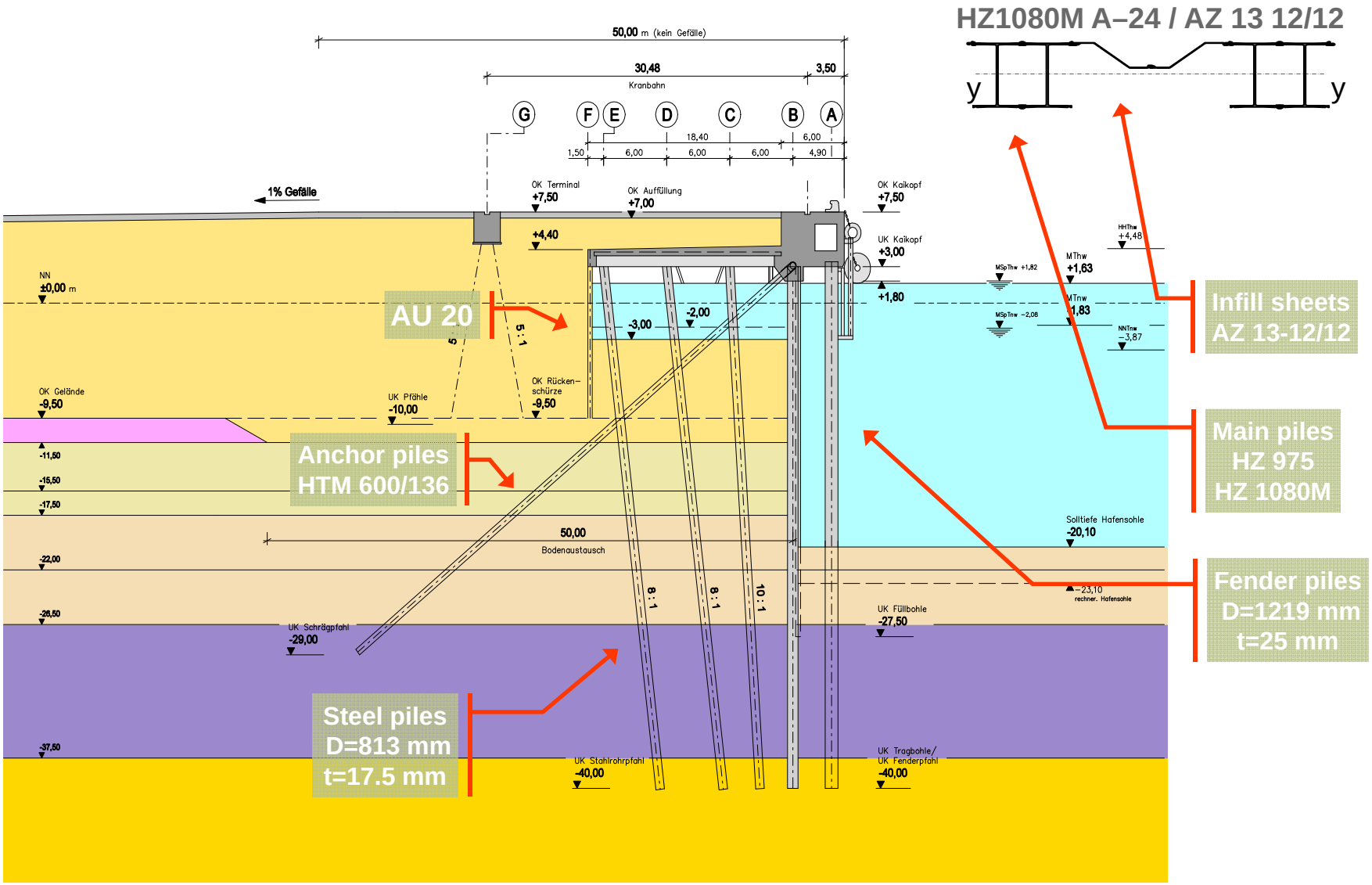
Deep Sea Terminal JadeWeserPort, Germany



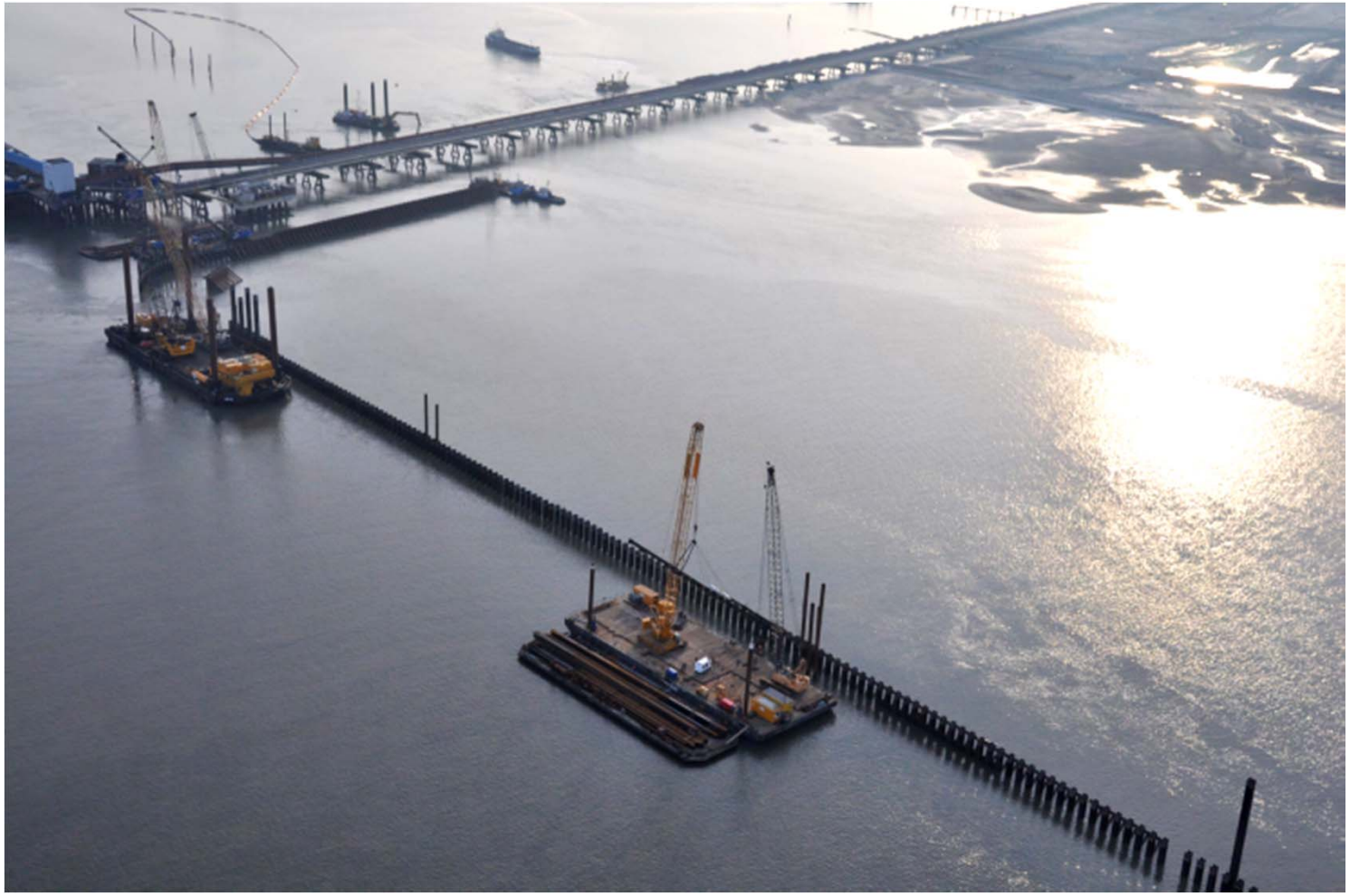
JadeWeserPort , Quay wall cross section



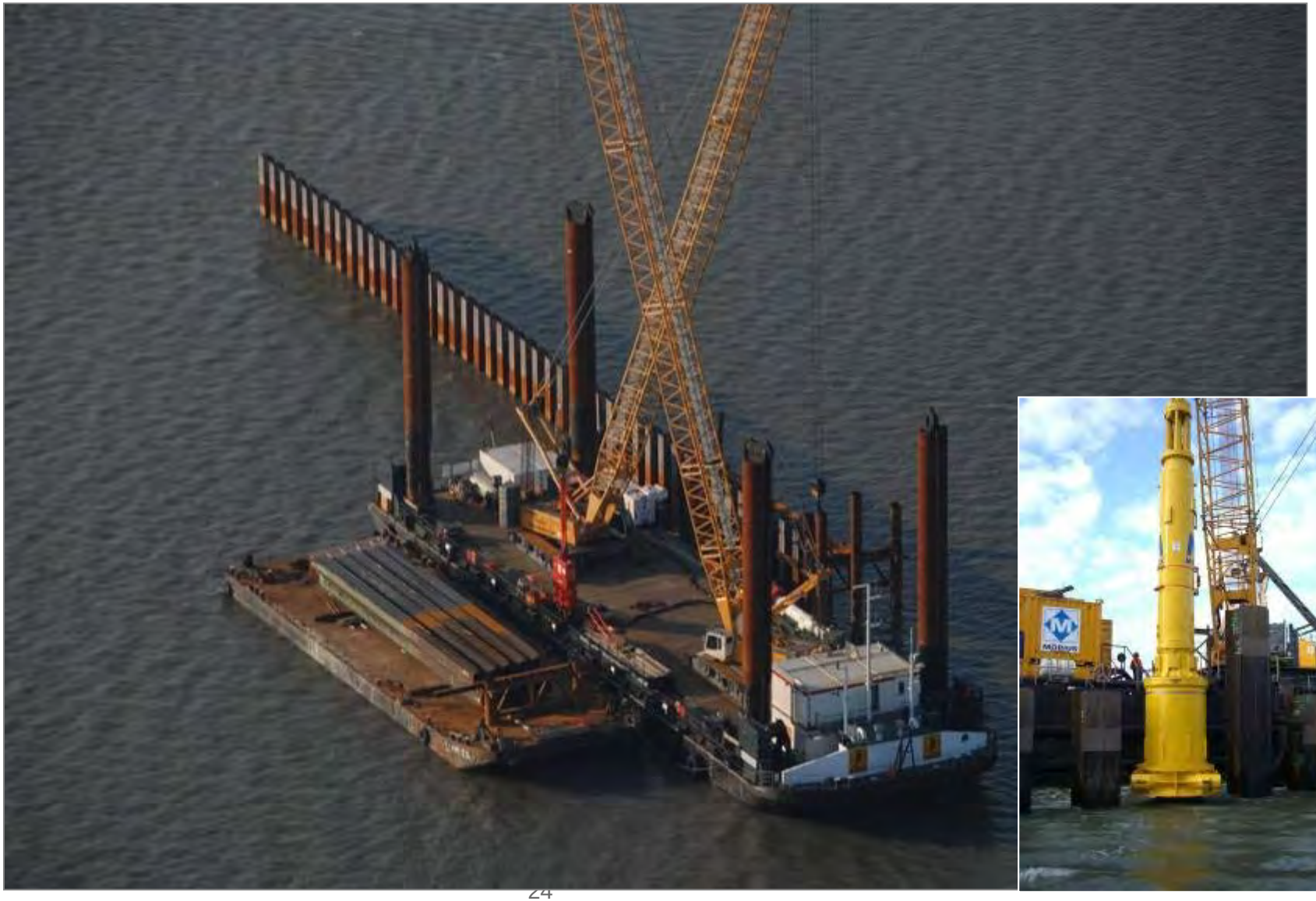
JadeWeserPort , construction details



Sheet Pile installation works from water



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

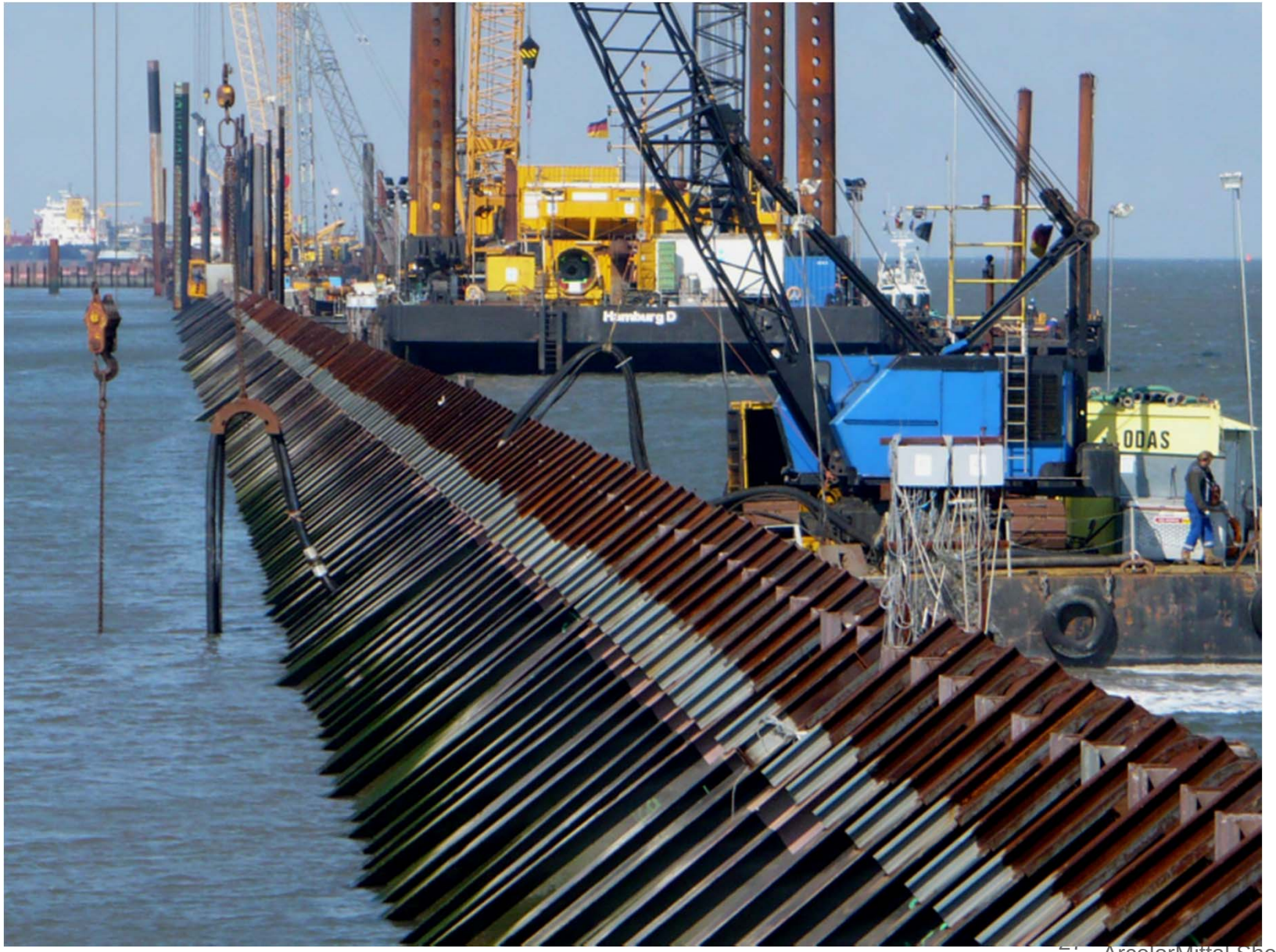


JadeWeserPort, Germany
Positioning of HZM king piles in template

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

ArcelorMittal

JWP : Main Wall and Anchor Piles installed



Piling works completed

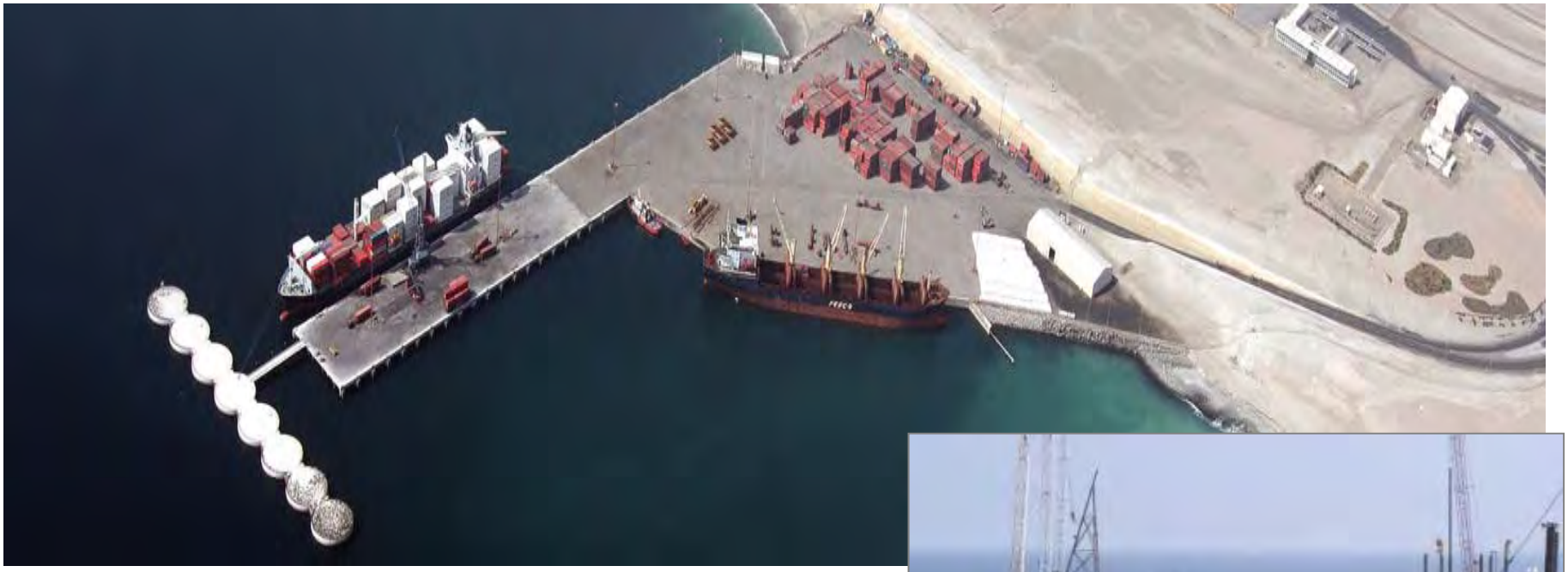
JadeWeser Port

Marsden Point, Northport Berth 3,New Zealand

ArcelorMittal

NorthPort , Marsden Point , NZ

Port of Mejillones , Antofagasto , Chile



Seismic zone

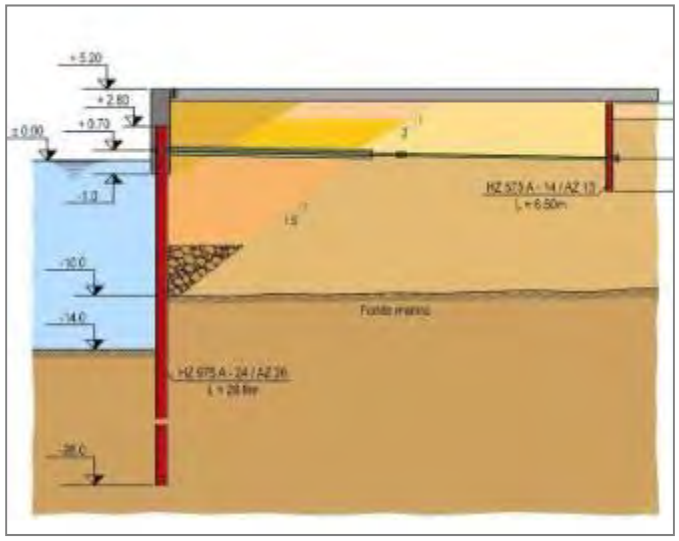
Muelle

HZ 575A-14/AZ13

HZ 975A-24/AZ26

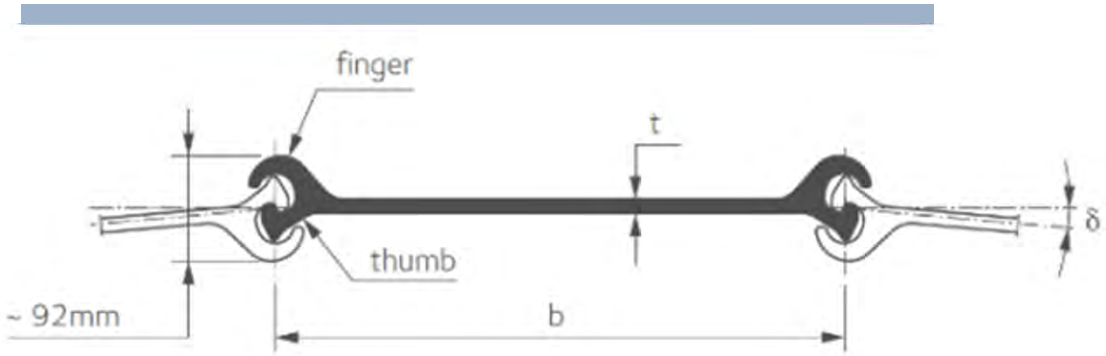
Length 6.0 – 28.8 m

About 5000 t



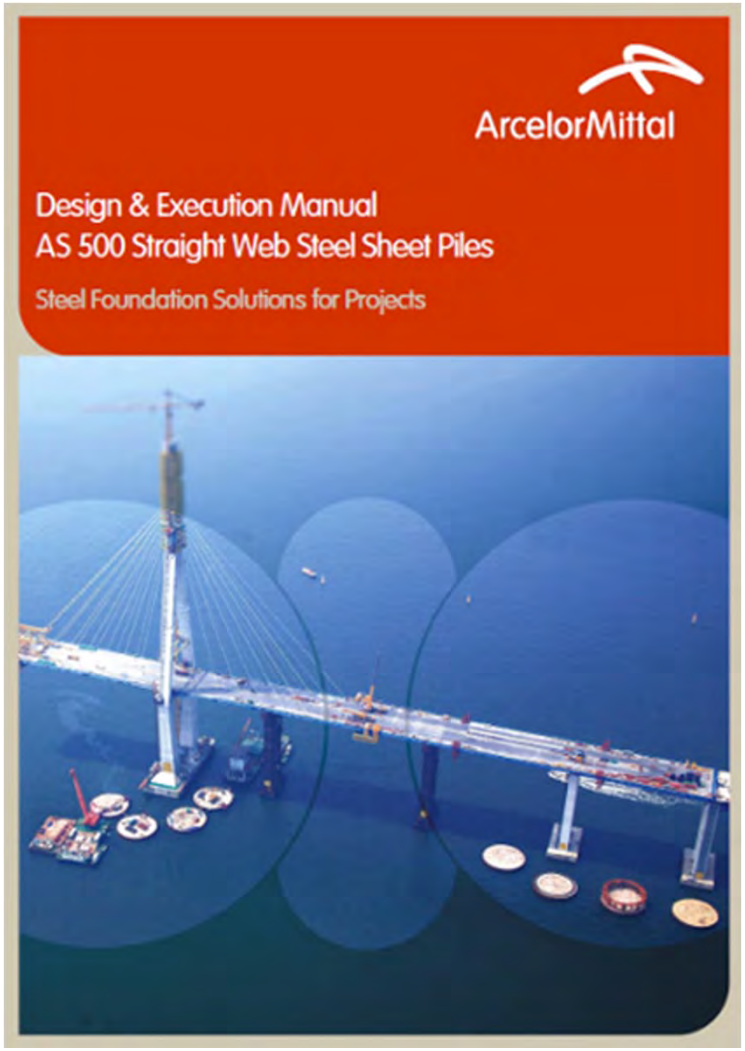
Gdansk Container Terminal , Poland

AS500 Sheet Pile Gravity Structures



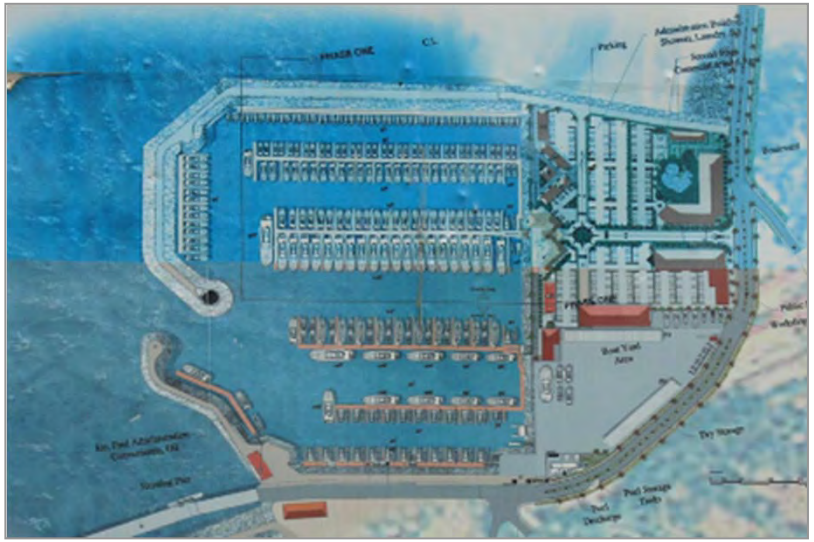
Straight web AS500

- gravity structure
- deep wharfs / quays / breakwaters / cofferdams
- structures founded on bedrock
- no anchors
- interlock strength up to 6000 kN/m



Marina Pez Vela | Quepos | Costa Rica

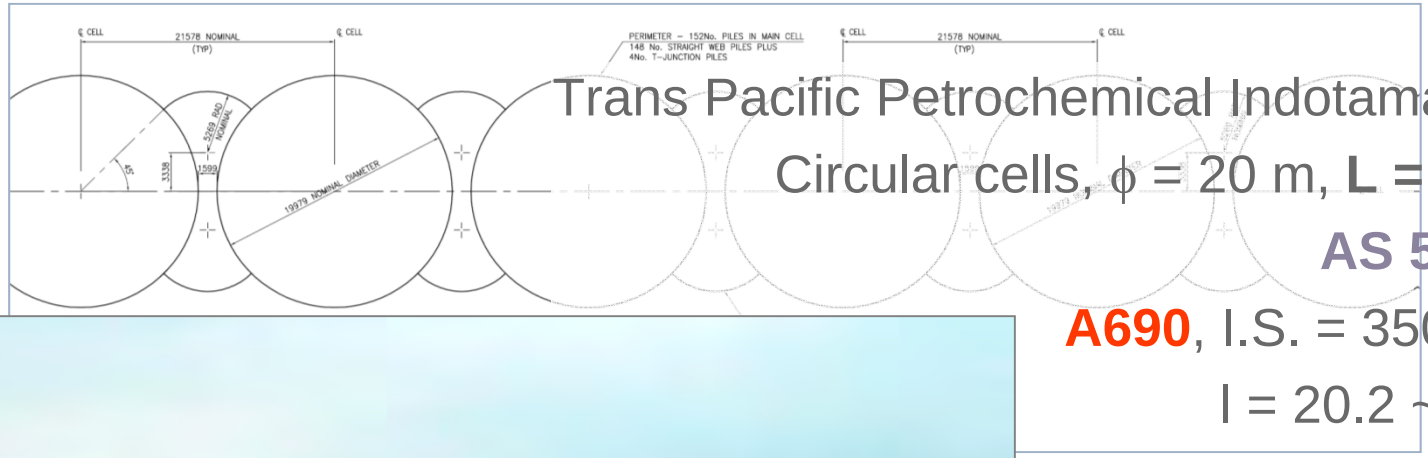
- Breakwater
- Circular cells, D = 12.2 / 18.6 m,
- L = 540 m
- AS 500-11.0 & 12.0
- A690, I.S. = 3500 / 5500 kN/m
- l = 7.0 ~ 15.0 m ; 3 440 t



Marina Pez Vela Breakwater – Costa Rica

Seismic and Tsunami loadings – AS500 gravity structures

Breakwater, Port of Tuban. Indonesia



Trans Pacific Petrochemical Indotama (TPPI)

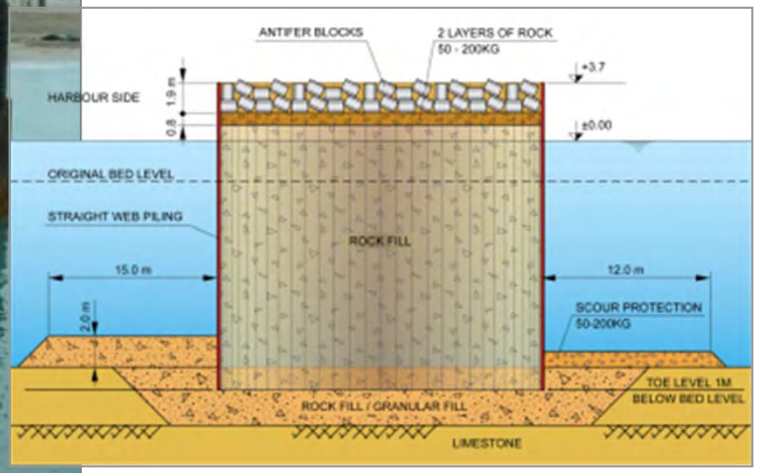
Circular cells, ϕ = 20 m, **L = 1720 m**

AS 500-11.0

A690, I.S. = 3500 kN/m

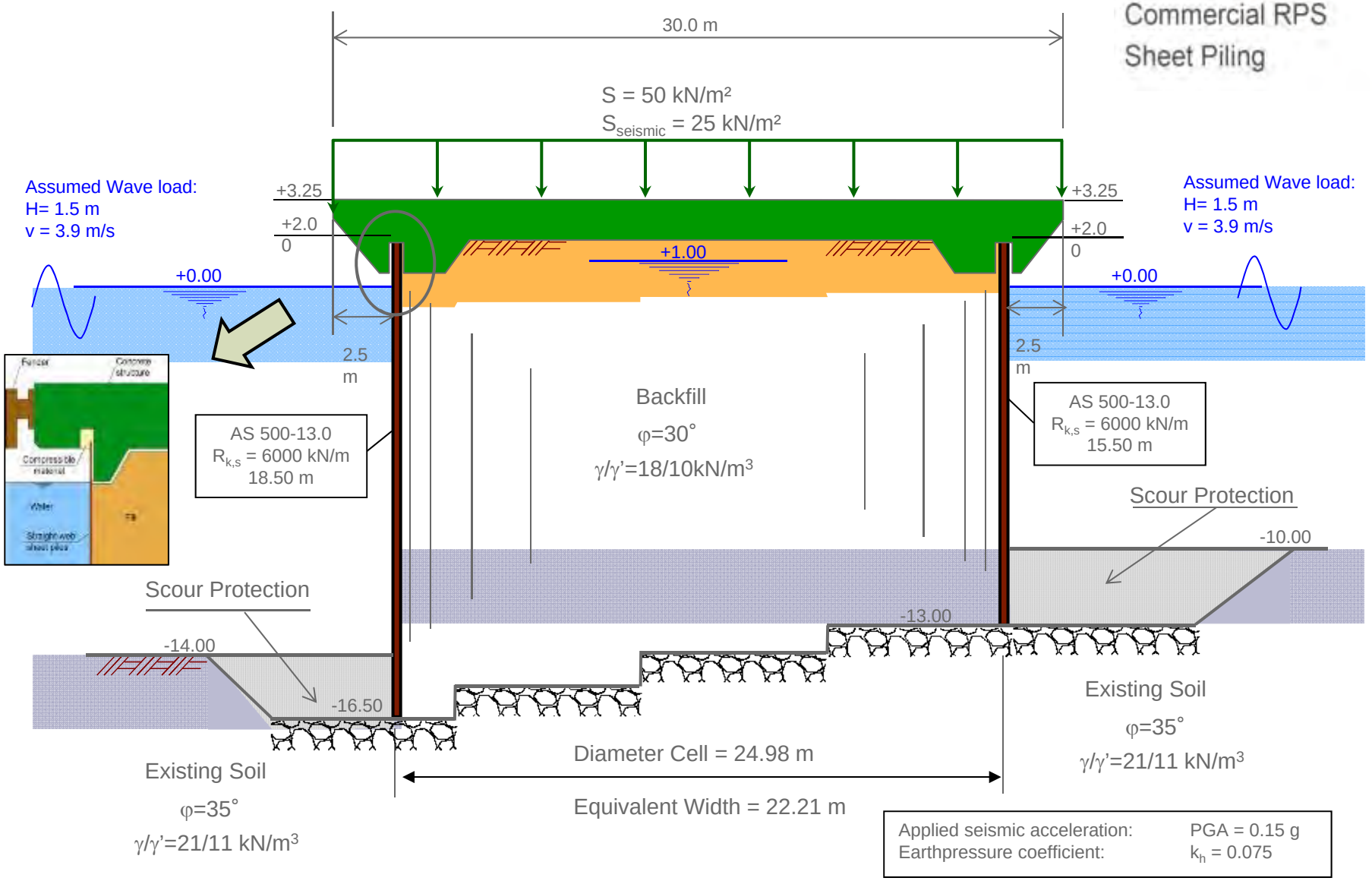
l = 20.2 ~ 26.0 m

21'100 t



Typical Cross Section AS-500 Cofferdam

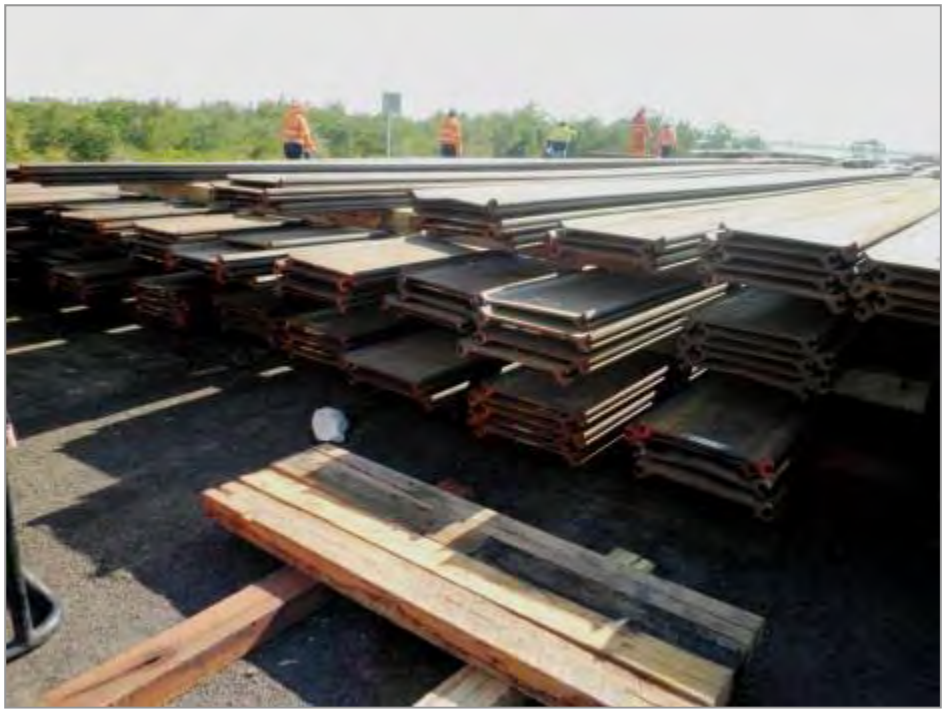
ArcelorMittal
Commercial RPS
Sheet Piling

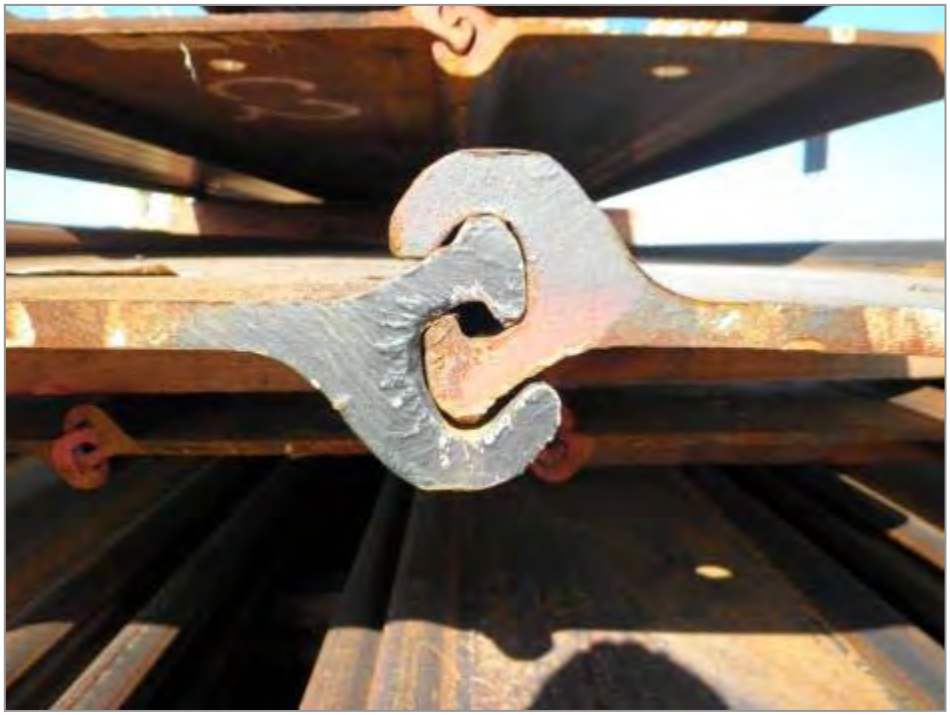


Ichthys LNG Terminal , MOF - Darwin

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

Waterfront Regeneration ; Colywn Bay | Wales (UK)

ArcelorMittal

Sea-defense / Shoring protection walls

Manalapan Seawall , West Palm Beach Florida

ArcelorMittal

severe property damages caused by Hurricane Sandy , Oct. 2012

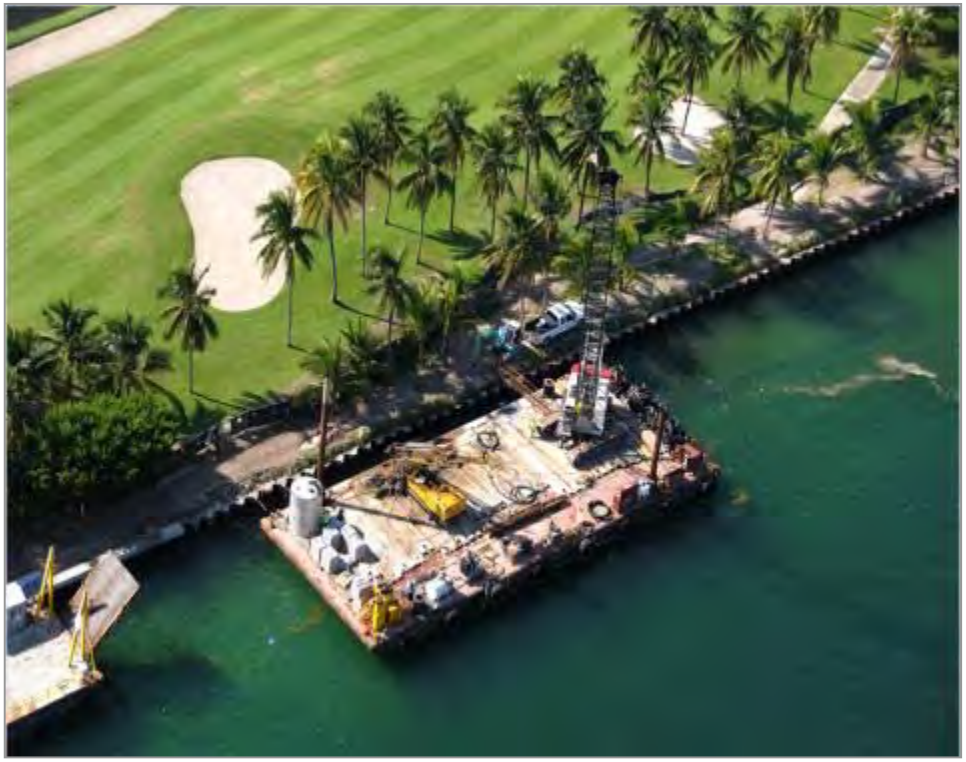
Manalapan Seawall , backfilling

Manalapan Seawall , Florida

new seawall in AZ 26-700 ; 100Y event

Miami Waterfront Rehabilitation

fast execution method – all works done from barges



Agenda

- Steel Sheet Piling : Introduction
- Port structures : example
- new developments : **AMLoCor and AZ800 new range**

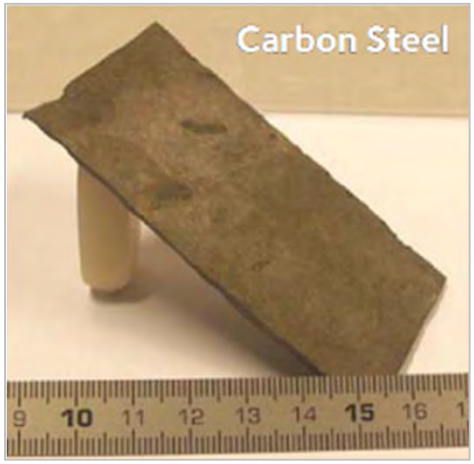
New steel grade: AMLoCor

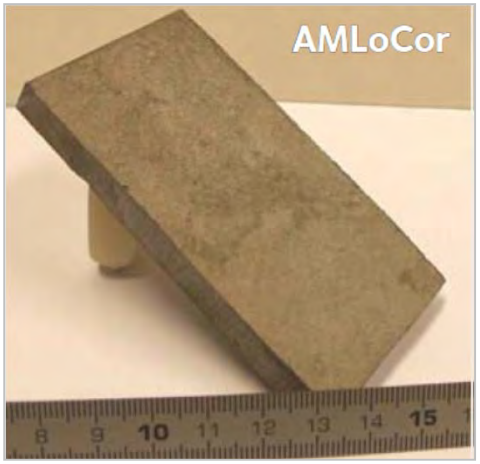
Arcelor**M**ittal **Lo**w **Cor**rosion Steel Grade

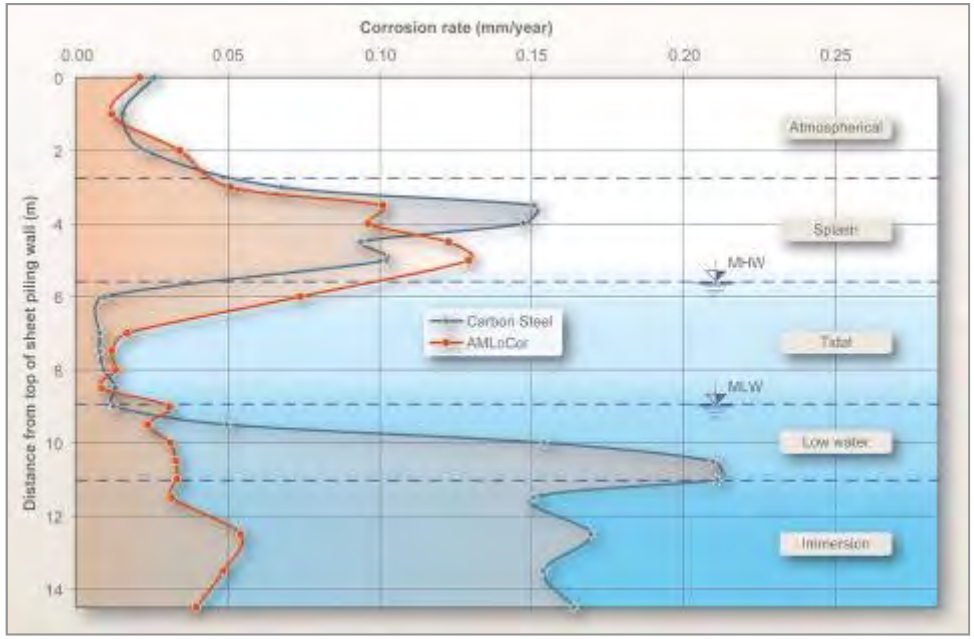
ArcelorMittal

Higher corrosion resistance
(special chemical composition)

CIR (corrosion impediment ratio)	
Low Water Zone	Permanent immersion zone
5	**3**

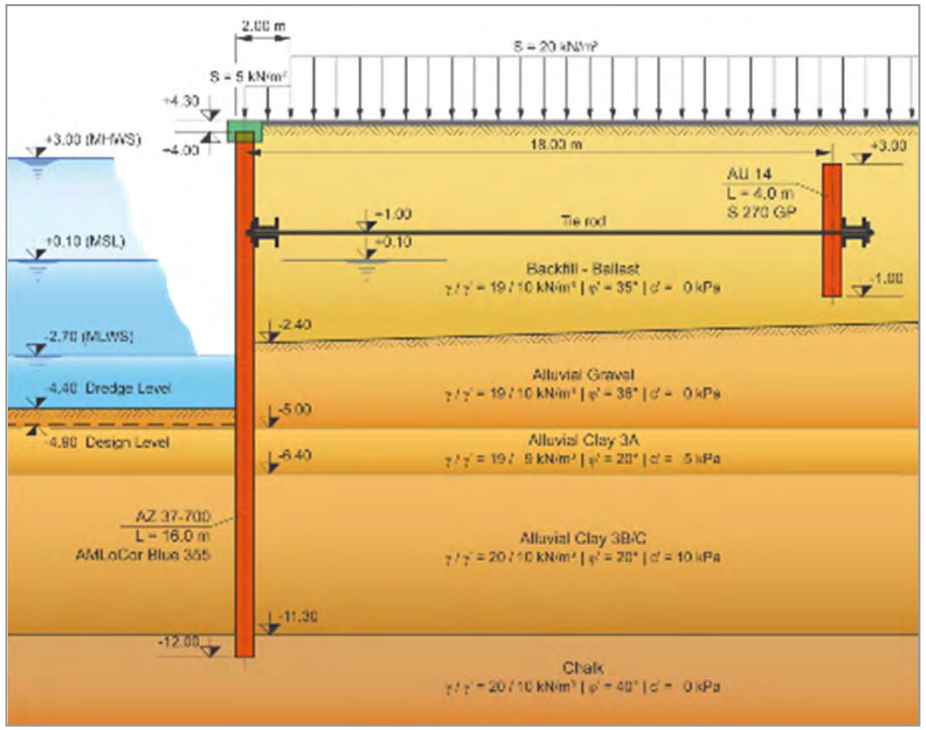






- Measured corrosion rates in a port in UK (over 15 years)

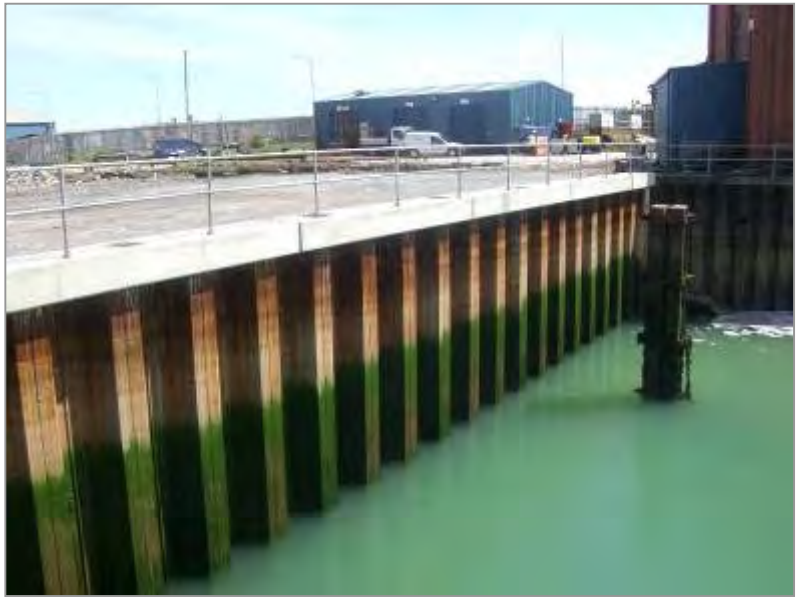
Pilot project. Shoreham, UK (2010)



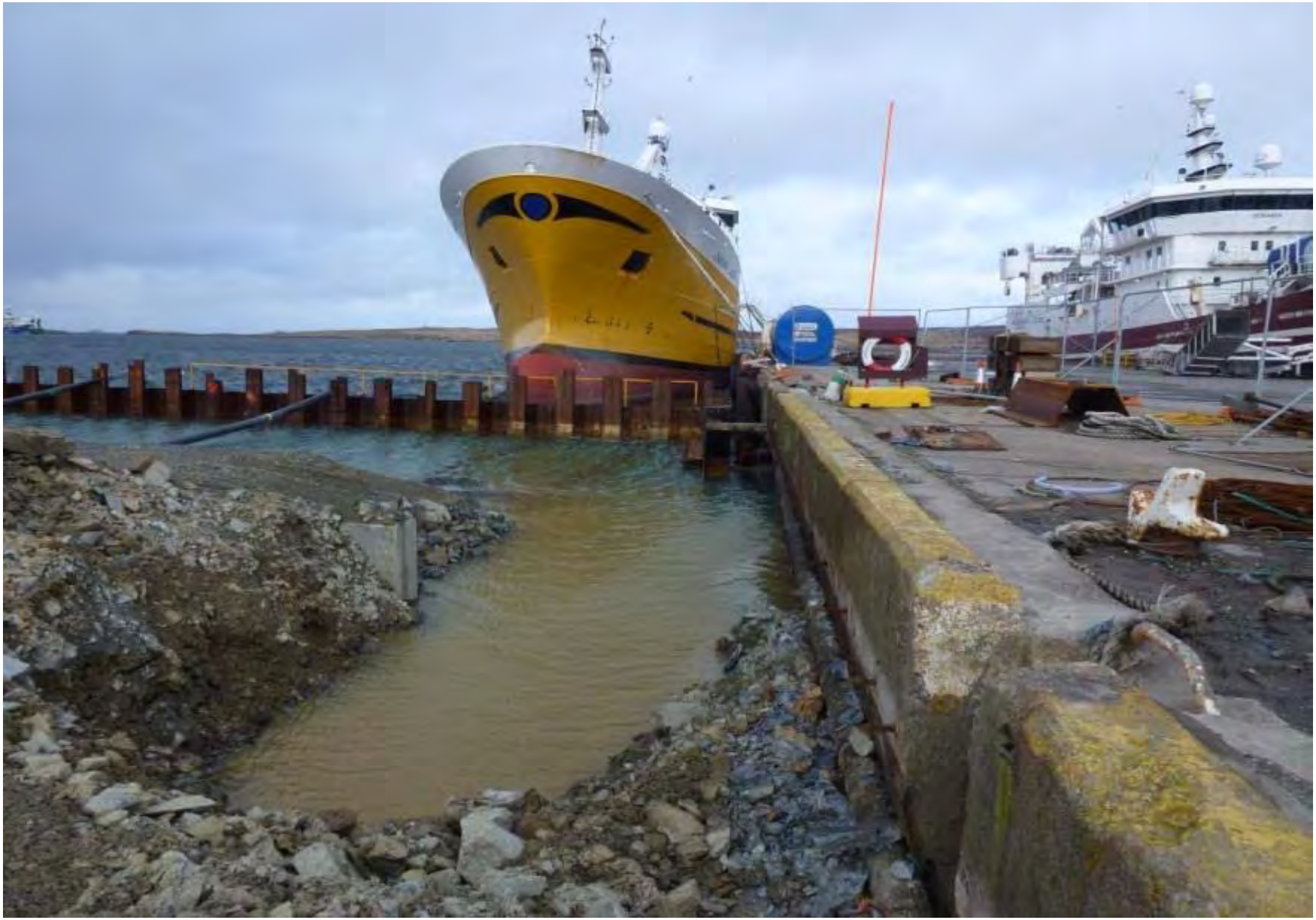
- Single-anchored quay ~30 m long retained height of 8.7 m
  AZ 37-700, **16.0 m** long, **AMLoCor Blue355**.
- **Vibratory hammer** PVE '2315'. If required, double acting **hydraulic impact hammer** BSP 'SL 30'.
- Driving through alluvial gravel layer (SPT up to 25) down into a stiff alluvial clay layer. Some sheets penetrated the chalk layer.

4 sheet piles equipped with additional channel elements required for the inspection of the residual thickness in the future.

2 standard S 355 GP sheet piles serve as reference samples.



Mairs Yard Port of Lerwick ,Shetland Islands ,UK



Port of Lerwick , Shetland Islands , UK

Quay Wall in Ravavu – Papua New Guinea

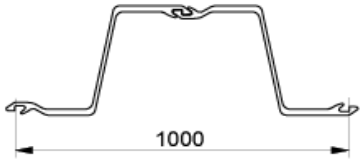
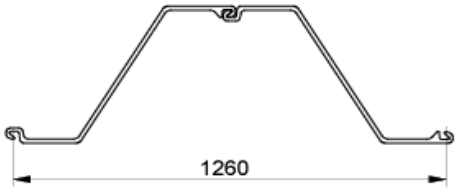
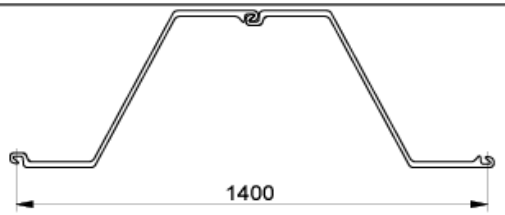
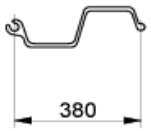
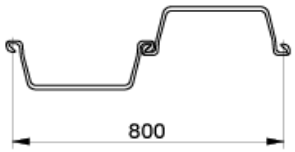
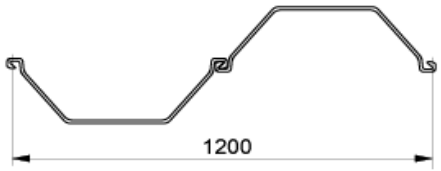
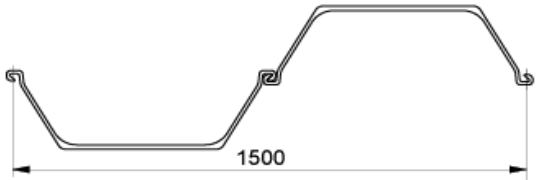
AZ 26-700, **16.0 m** long,

AMLoCor Blue355 – 800 tons

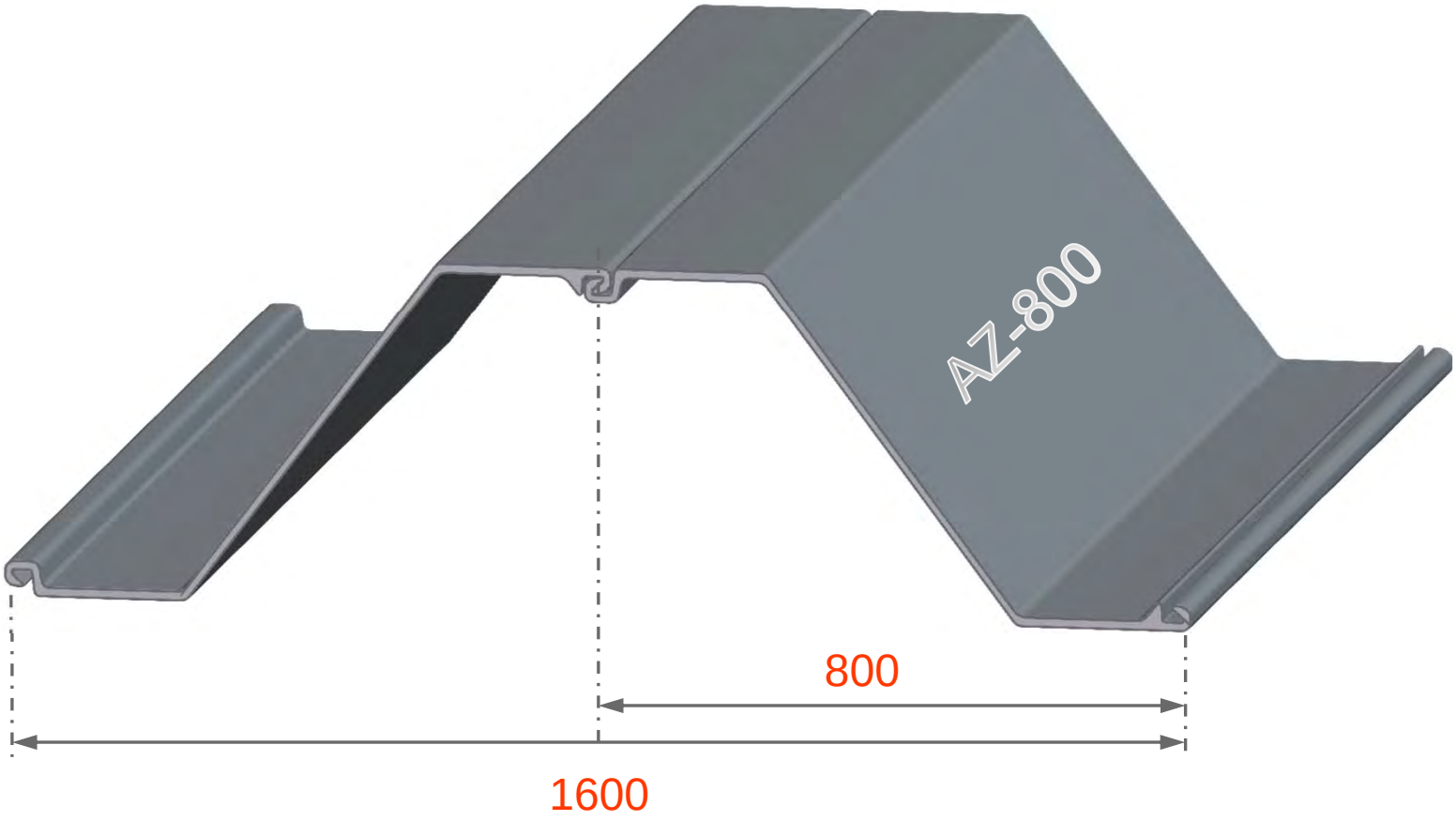
Historical overview & New developments

STEEL SHEET PILING 100 YEARS MADE IN LUXEMBOURG

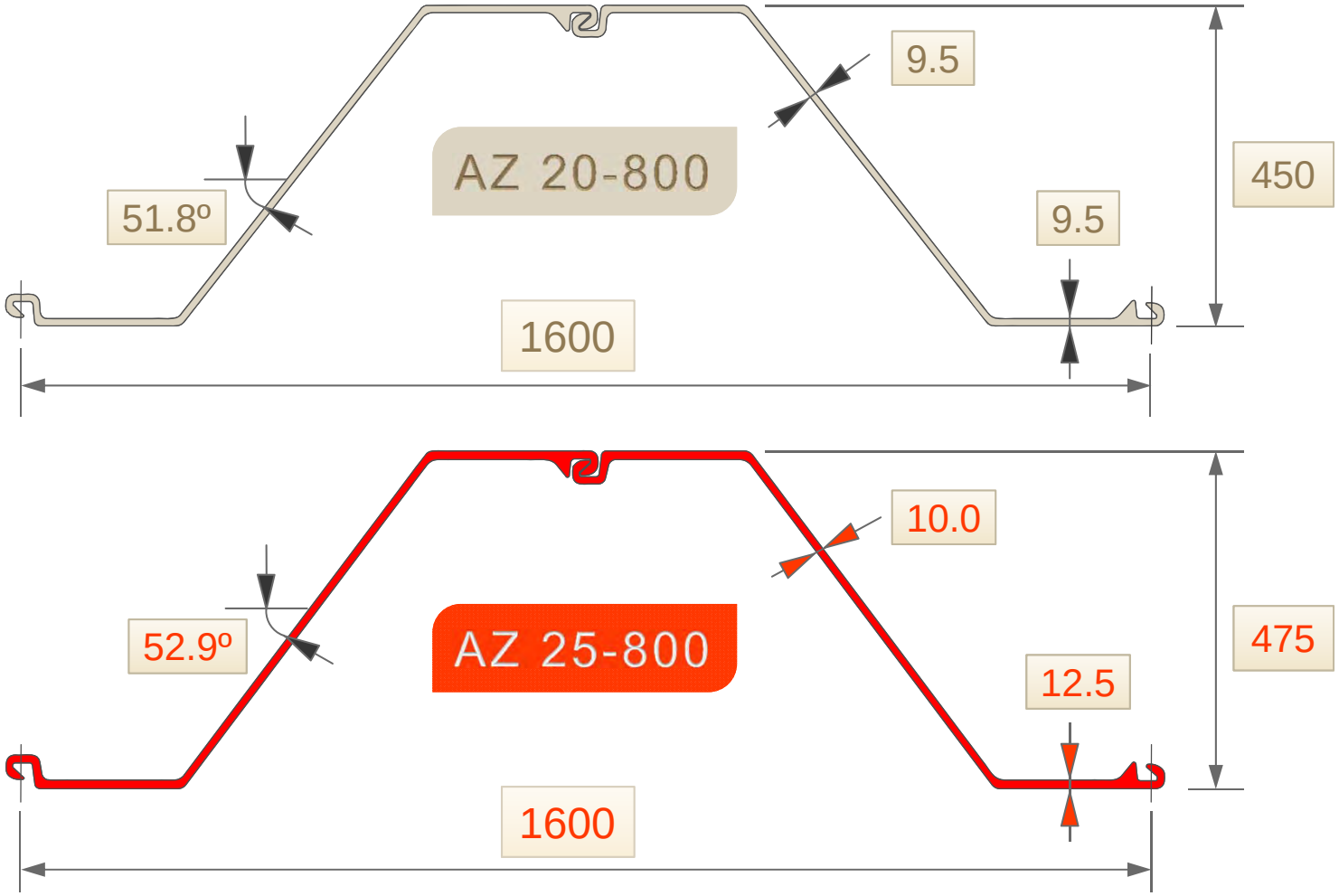
- first hot rolled steel sheet pile in USA: Lackawana type (1908)
- since 1911, **Belval** has improved its sheet pile sections, **WORLDWIDE LEADER** for more than 20 years

Type	RANSOME 1911	BZ 1933	AZ 1990	AZ - 700 2004
Z				
Type	**TERRE-ROUGE 1912**	**LARSSEN 1914**	**PU 1988**	**AU 2000**
U				

New AZ-800 range



AZ – 800 sections



New AZ-800 range: advantages

wider

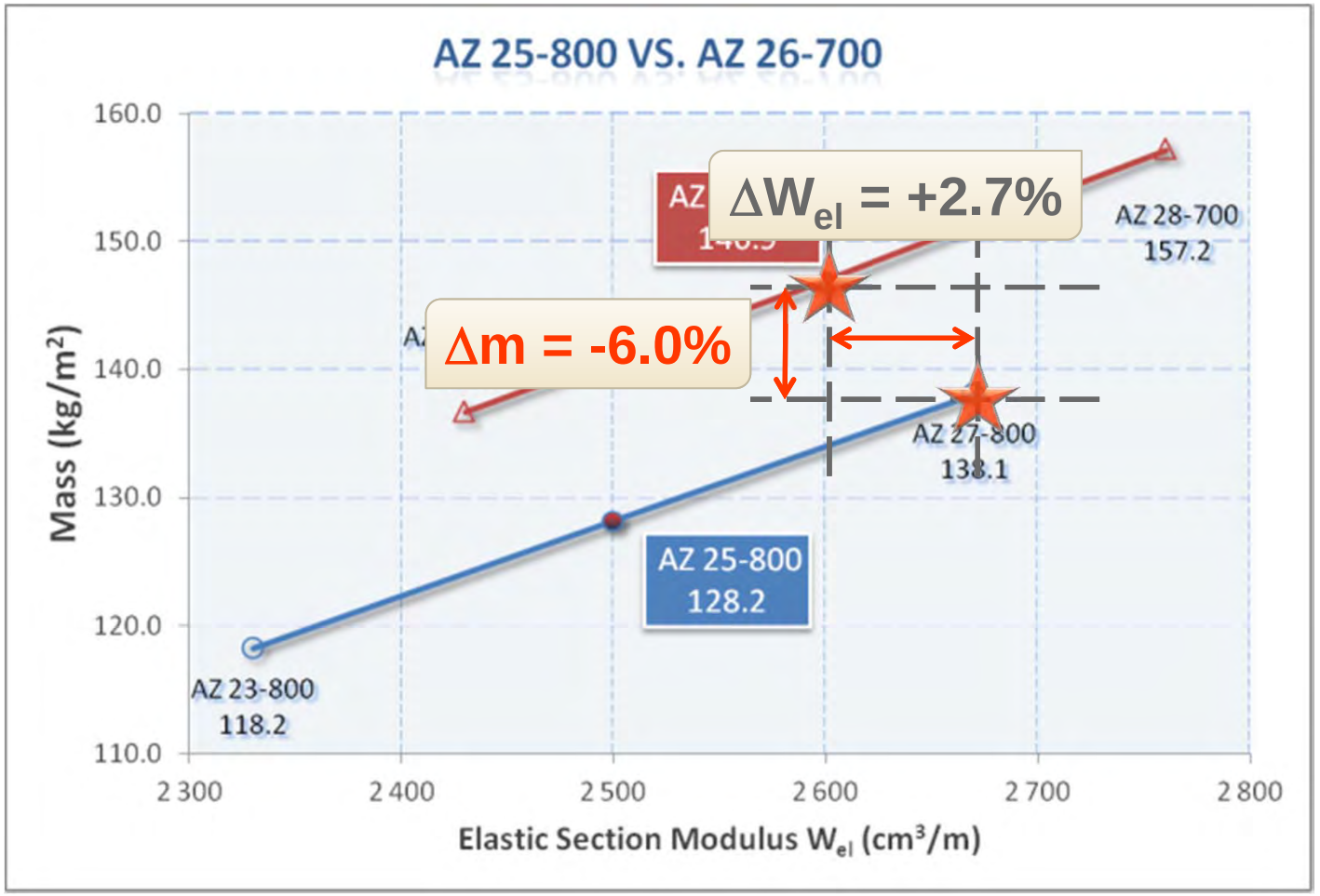
lighter

faster installation

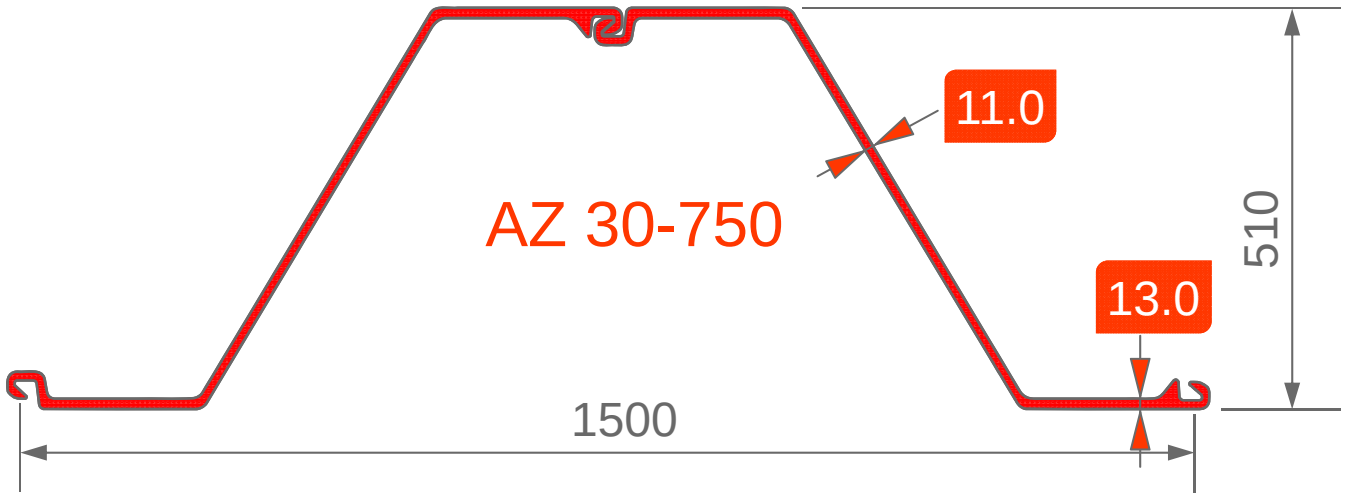
⇒ **HIGHER COST-EFFICIENCY**

- for our customers
- compared to competing materials

Comparison of similar sections

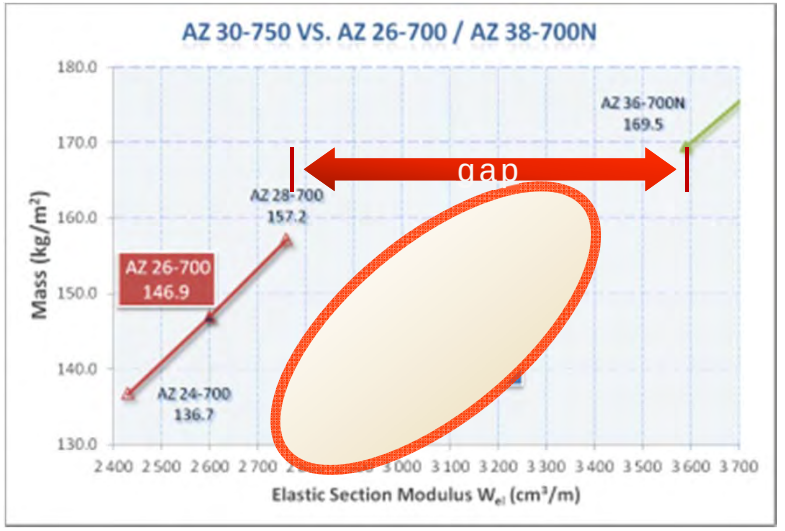


New sections. AZ 30-750

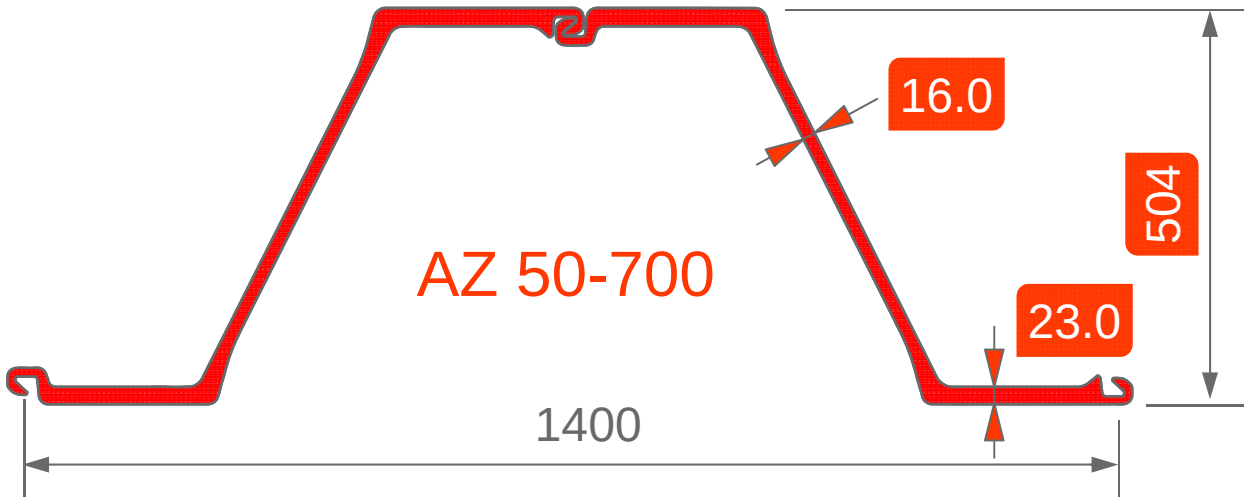


fills a gap between AZ 26-700 and AZ 36-700N

⇒ exclusive Z-type section in this range

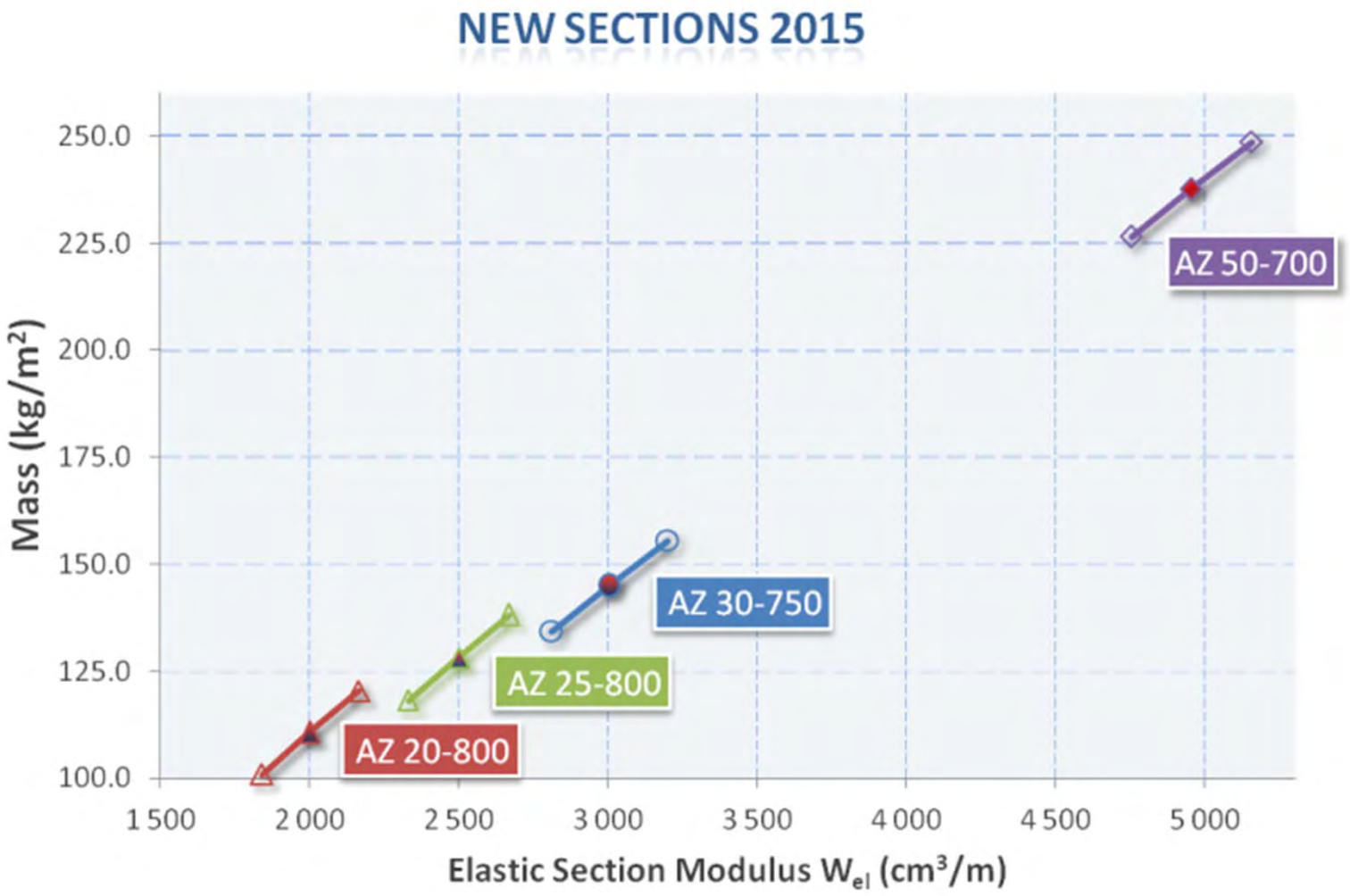


New sections. AZ 50-700



World premiere!
Strongest sheet pile

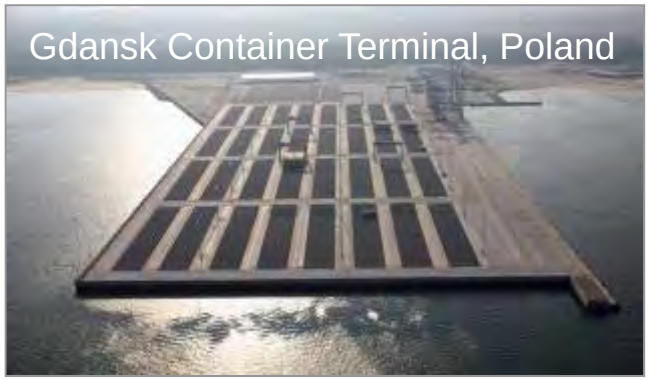
New sections 2016



State-of-the-Art Construction Method

- **easy in design** : wide range of products & steel grades ; standarized ; versatile in applications ; full package solutions
- **fast execution** : pre-fab construction elements ; high installation speed , proximity material stocks , JIT supply chain « from rolling mill to the driving rig »
- **safe** : steel as construction material , properties not change in time , can be checked throughout the project lifetime ; high stress reserves , flexible
- **cost efficient** : wide range of optimization potential ; tailormade solutions
- **sustainable** : using scrap material ; high re-use potential ; 100% recyclable

Port Structures : fast – reliable – cost efficient



Happy Landing with AM Sheet Pile Solutions

Excellence in Products , Services and Customer Satisfaction