

Anping, TAIWAN

Quay Construction



Anping Quay 1 - anchor wall



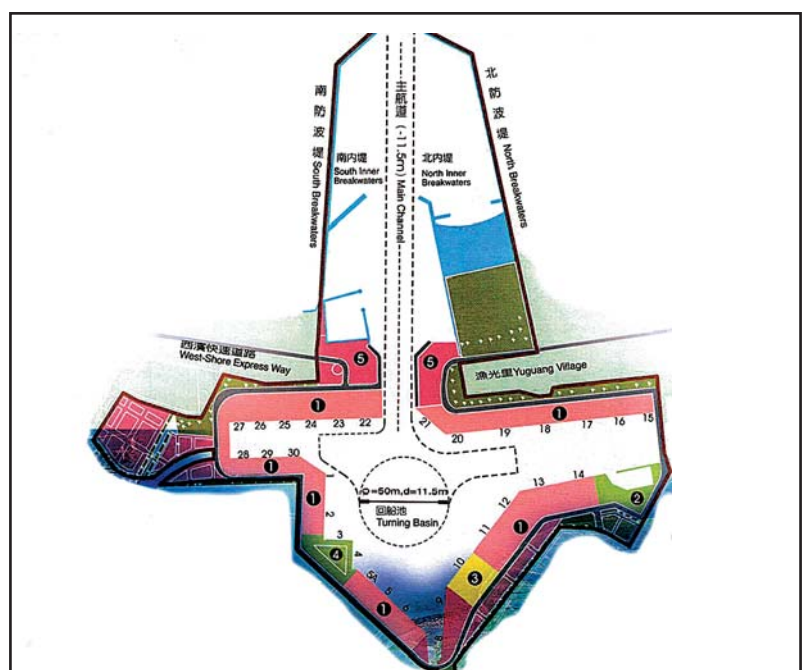
Taiwan's Anping Port was expanded recently to accommodate larger vessels

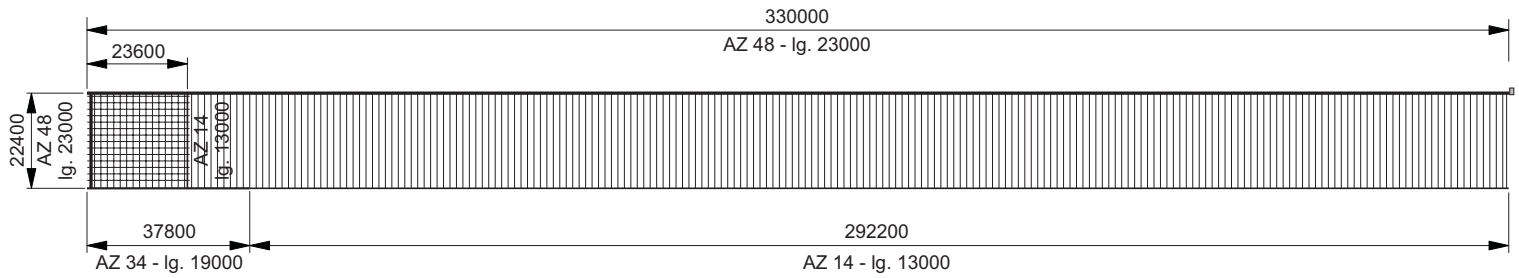
Anping, the most important auxiliary port of Kaohsiung Harbour, is situated on Taiwan's southwest coast some 40 km north of its mother port. The volume of cargo handled has been growing considerably in recent years as Anping has developed into a multi-functional harbour connecting east Asia, China, Hong Kong, and Taiwan's offshore islands. Due to its excellent geographical location and natural conditions, Anping used to be Taiwan's largest harbour, with origins dating back to the Ming dynasty. However, the importance of the harbour declined as a result of silting up.

In more recent times the Kaohsiung Harbour Bureau started to rebuild Anping Port in order to improve local economic development. The port has been equipped with advanced port facilities and a tourist service centre transforming it into an international commercial harbour with growing international trading capacities.

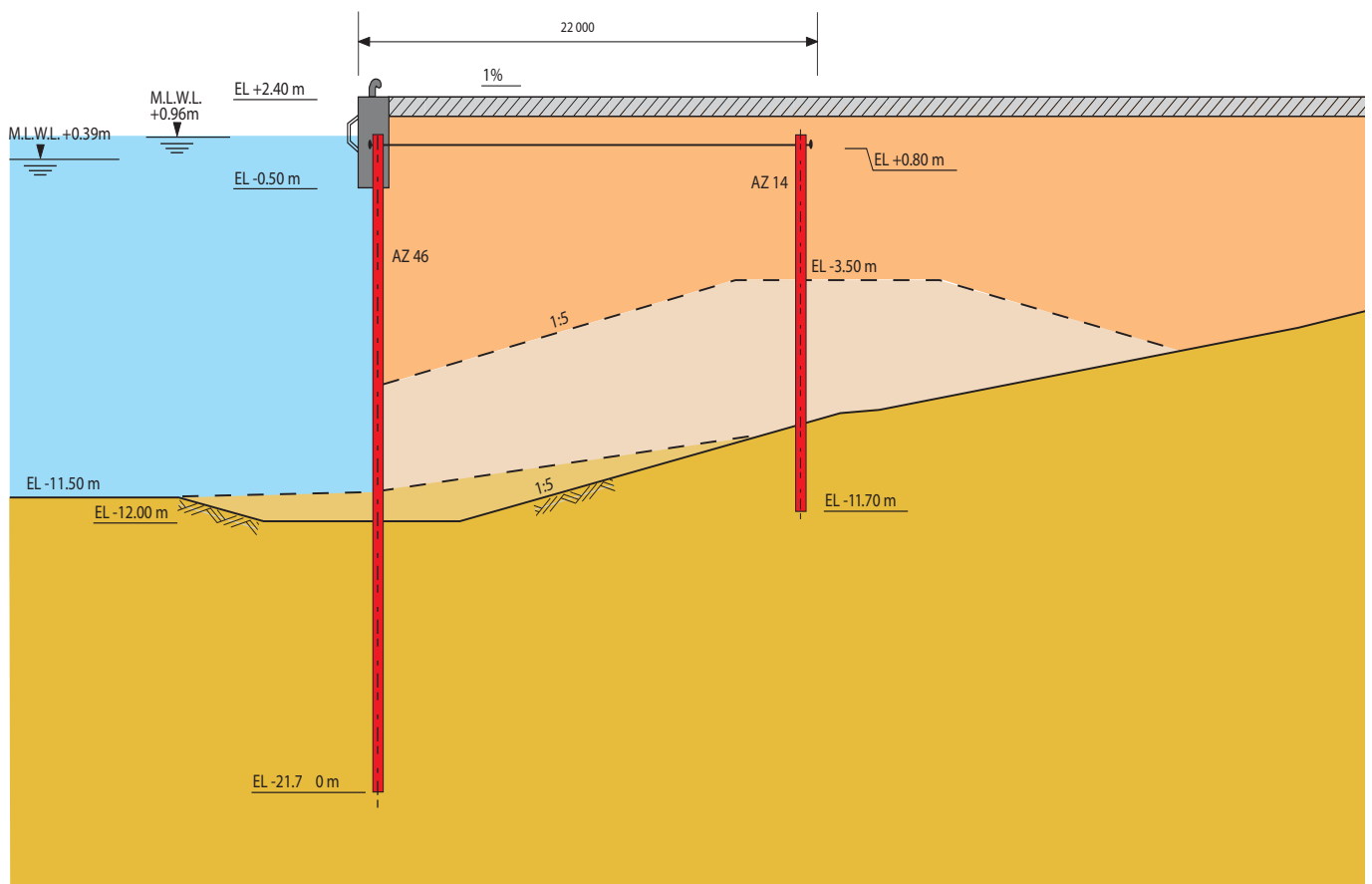
The depth of the navigation channel is 11.5 metres, the wharves of the harbour offer a water depth varying between 7.5 and 11 m. The combined wharf length totals 1,450 m for the deeper quays and 1,330 m for the shallower quays. After completion of the different expansion phases, Anping will have 32 wharves with a waterline of 5,566 m. The port will be able to handle vessels of up to 30,000 DWT, boosting its annual cargo capacity.

The Kaohsiung Harbour Bureau planned to build Quays No.1 and 2 in the bulk and general cargo area near the entrance of the port. The new U-shaped quay is 330 m long, 24 m wide, and has a water depth of 9 m. The quay's design required three different types of sheet piles. The predicted resisting design moments amounted to 1,050 kNm/m, 690 kNm/m and 250 kNm/m respectively. The required steel grades were





The 330-m quay wall was urgently required to handle the port's increasing amount of general cargo



The AZ 46 sheet piles of Quays 1 & 2 were installed 52 m in front of existing berths

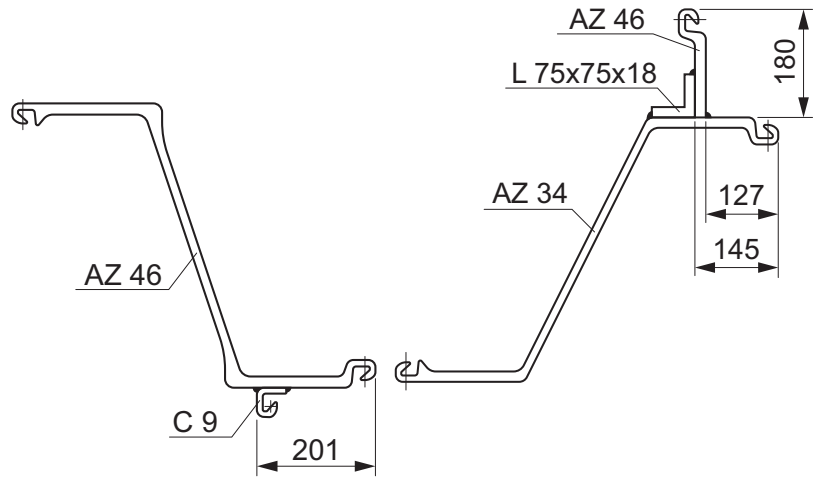
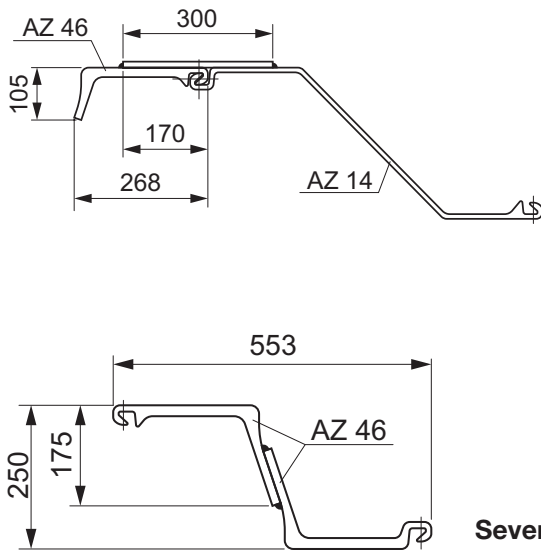
optimised in accordance with the prevailing forces, which led to the following line-up of steel sheet piles:

- AZ 46, steel grade S 390 GP, bending moment capacity: 1,195 kNm/m > 1,050 kNm/m
- AZ 34, steel grade S 355 GP, bending moment capacity: 812 kNm/m > 690 kNm/m
- AZ 14, steel grade S 270 GP, bending moment capacity: 252 kNm/m > 250 kNm/m

Kaohsiung Harbour Bureau placed an order for the following amounts of steel sheet piles:

- 480 t AZ 14
- 140 t AZ 34
- 1,860 t AZ 46

The main wall of the U-shaped quay consists of 283 AZ 46 double piles. The anchor wall situated 22.2 m behind the main wall (wall axis to wall axis) is composed



Several special piles were used to connect the different wall axes



of 218 AZ 14 double piles plus 29 AZ 34 double piles near the head of the wall. The 24-m return wall consists of 18 AZ 46 double piles anchored to 15 AZ 14 double piles.

Several special piles and one PU pile were required to form the walls' corners and to attach the new quay wall to the existing structure. The following special piles were supplied by a subcontractor of Arcelor and shipped to Taiwan together with the other sheet piles:

- AZ 46 single pile with C9 connector welded on.
- An oxycut AZ 46 single pile welded back together to obtain a reduced pile height of 250 mm.

- AZ 14 single pile interlocked with cut-off AZ 46. A plate was welded over the interlock to stabilise the cut-off AZ 46 sheet pile.
- AZ 34 single pile with additional Larsen interlock welded on.

The quay wall was installed using a jack-up barge on which the driving equipment was set up. Large parts of the parallel main and anchor walls were installed in open water some 52 m in front of the existing berths. Other parts of the quay allowed land-based installation of the steel sheet piles with a vibratory hammer. An impact hammer later drove the AZ piles to design depth, which was reached once the head of the piles passed the elevation of +1.2 m.



Welded on rebars prevent interlock rotation so as to precisely achieve the planned quay wall length

Owner:
Kaohsiung Harbour Bureau

Sheet piles:
AZ 46, AZ 34, AZ 14

Pile length:
23 m, 19 m, 13 m

Steel grade:
S 390 GP, S 355 GP, S 270 GP

Total quantity of sheet piles:
2,500 metric tons



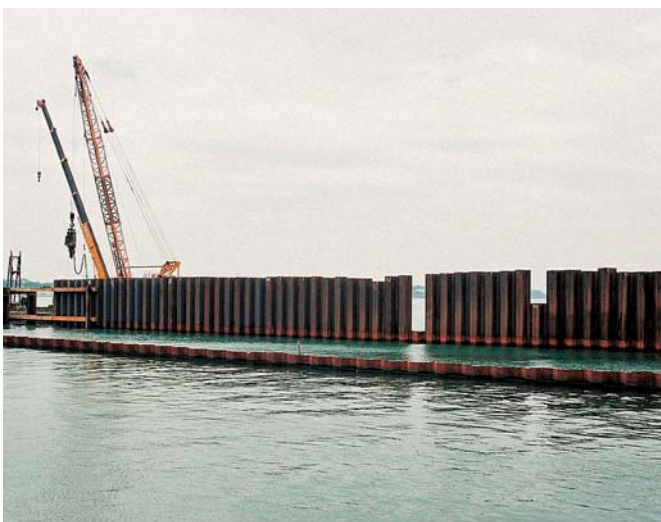
The sheet piles were installed in open water using barge-mounted vibratory and impact hammers



The installation team controlled the straightness of the wall axis optically

In contrast to most sheet pile construction sites, the contractor decided to install several AZ piles without the assistance of a driving template. Great care was taken to achieve the exact design length of the quay wall. The contractor welded rebars on the inside of the AZ 46 sheet piles to prevent rotation of the middle interlock which could have increased or reduced the width of the AZ 46 double piles. The target wall length was achieved by driving the quay wall in an optically controlled straight line. The contractor relied on the help of a driving guide for installation of the greater part of the 330-m quay wall, however.

The new infrastructure and facilities built under the “Anping Commercial Port Land Acquisition and First Stage Construction Plan” soon proved their worth. Implemented between July 1998 and September 2005, the project triggered strong growth in the cargo volumes handled: Anping handled 11.15 million metric tons of cargo volume in 2006, which represents growth of 66% compared to 2005. ■



With the new quays, the port was able to handle 11.15 million metric tons of cargo in 2006

