

# La Spezia, ITALY

## Port expansion projects

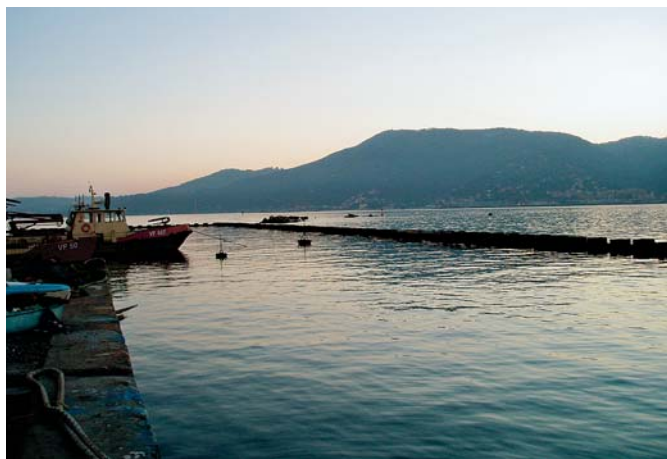
The city of La Spezia is situated about half way between Genoa and Pisa, the part of the country with the largest concentration of harbours. Among these ports are the harbours of Genoa, Savona, Livorno and La Spezia which have a joint annual cargo handling capacity of more than 100 million metric tons. It is from here that the industrial north of Italy exports its products.

The origins of the Malaspina and Garibaldi quays date back to the end of the 19th century. The quay structures of the port suffered considerably during WW II. The port authority of La Spezia therefore had to invest heavily to rebuild the damaged structures.

Today the port offers a combined quay length of 5,300 m with draughts of up to 14.5 m to receive container ships of the latest generation. The different terminals in La Spezia handle all kinds of products: containers, coal, oil, cement, cereals, food oils etc. The port's container quays dispose of a total mooring length of 1,500 m. The Gottwald cranes with their 100-metric-ton lifting power serve the 260,000 m<sup>2</sup> container yards.



Due to the predicted rise in cargo volume, the port of La Spezia is currently upgrading several terminals



La Spezia handles a large share of the container traffic engendered by the industries in northern Italy



27,500 t of sheet piles were used for eleven projects in La Spezia

Following a study that predicted a rise in cargo traffic beyond the present capacities, a modernisation programme was launched in 1995, with the goal of expanding the Ravano, Malaspina and Garibaldi terminals. In 2004, the port of La Spezia handled slightly more than one million TEU, a rise of 3.4% compared to the previous year. The modernisation programme called for a total of 27,500 t of sheet piles to be installed in the following parts of the harbour:

#### 1. GARIBALDI PIER: 9,000 t HZ/AZ combined wall

The effectiveness of the pier is guaranteed by three mooring spots totalling 510 m on the west side and two eastern mooring spots measuring 360 m. Garibaldi Pier offers a draught of up to twelve metres. Being the largest pier in

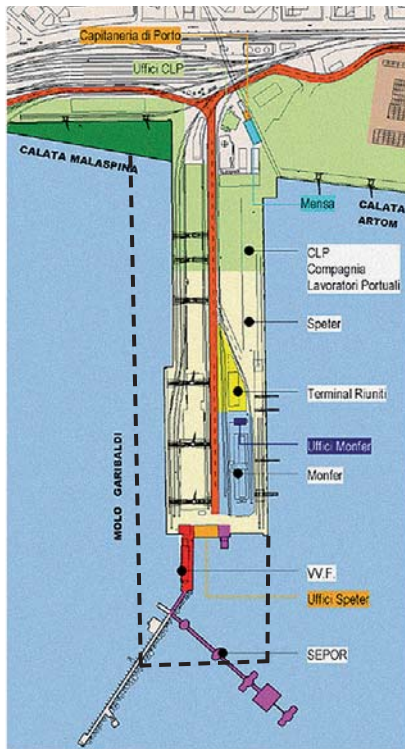
the port of La Spezia, the crane park comprises several 12-t capacity quayside cranes as well as four mobile 100-t cranes. Together with the large cereal and cement silos, the 4,300 m<sup>2</sup> covered storage area handles various goods including forest products, coal, iron and steel products.

The draught of 12 m was achieved by placing a new sheet pile quay wall 40 m in front of the existing gravity wall. The combined steel sheet pile wall is U-shaped, thus forming three parts.

For the first part closest to the coast, an HZ 975 C - 12/AZ 18 system with an elastic section modulus of 7,360 cm<sup>3</sup>/m was chosen as the main wall. The HZ king piles and the

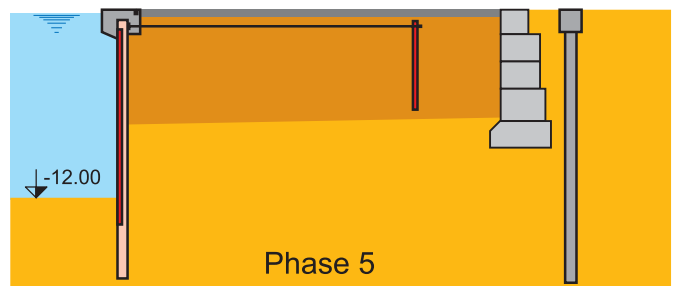
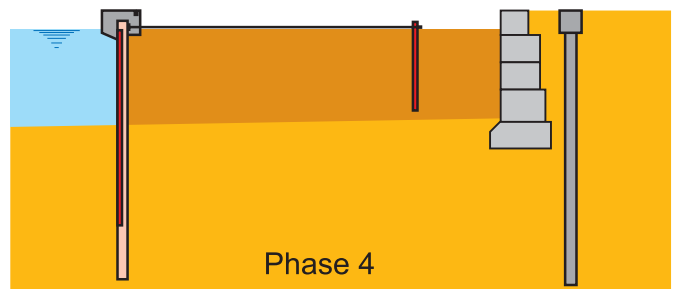
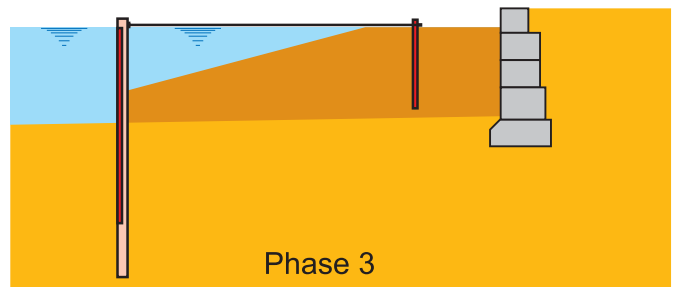
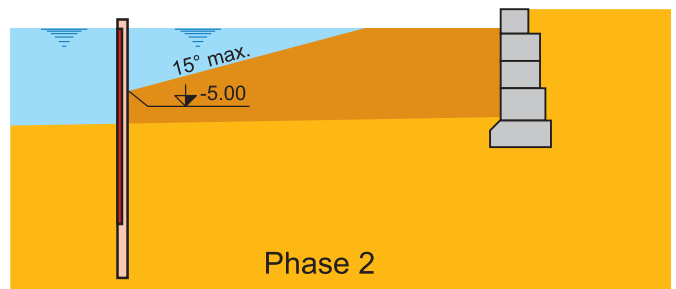
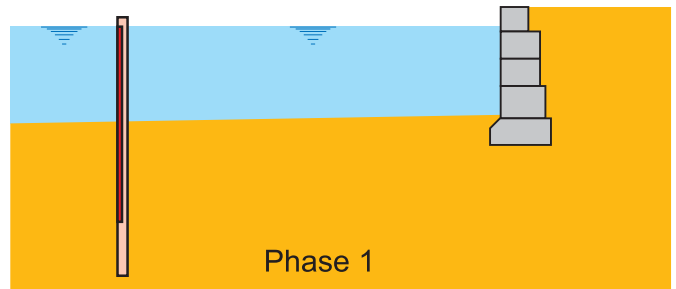


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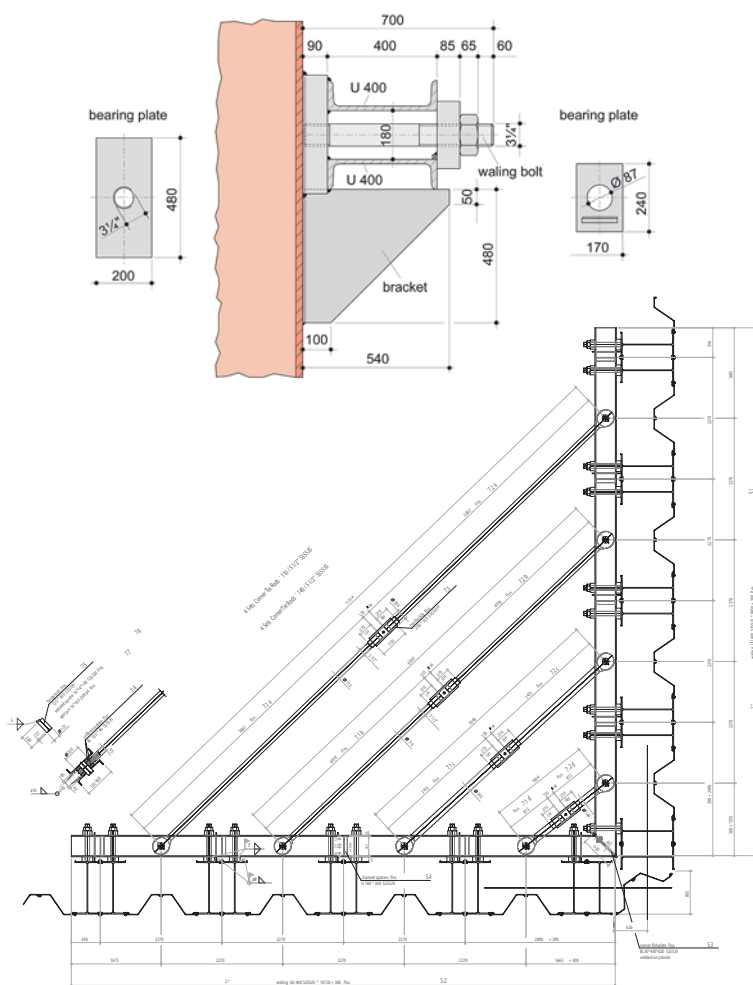


The new U-shaped quay wall was built around the existing terminal

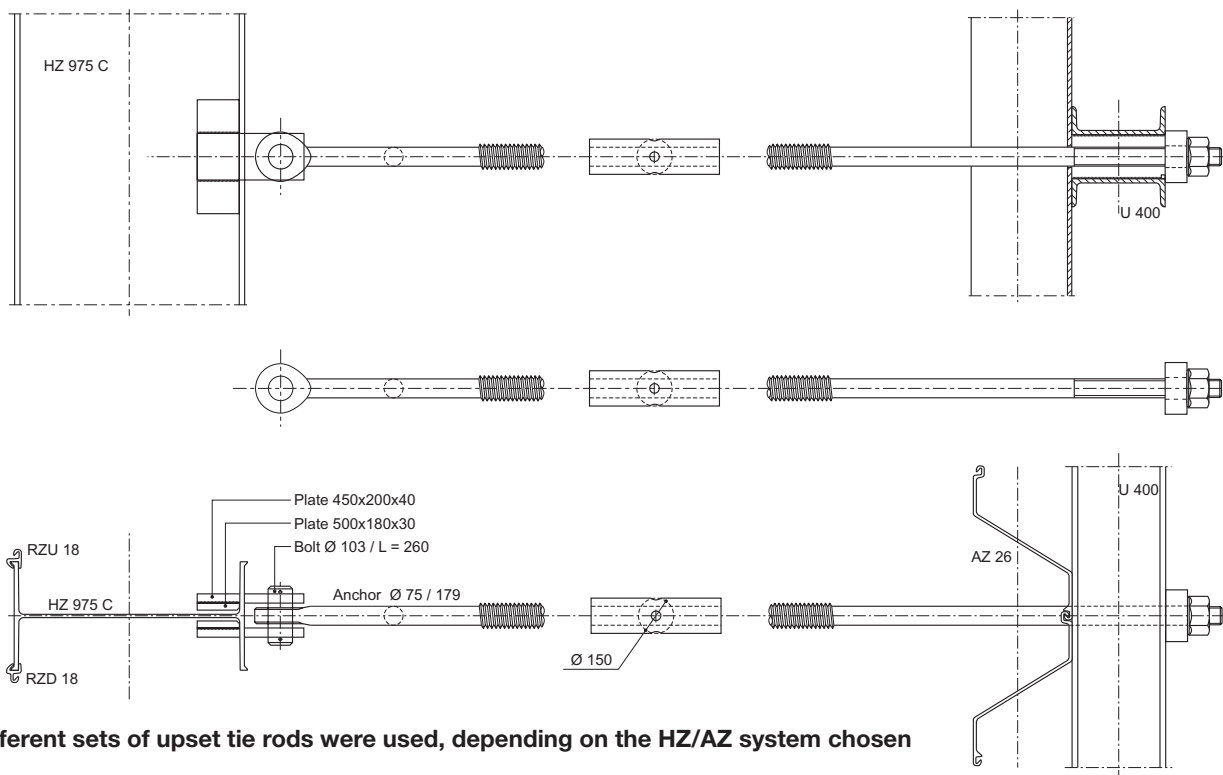
### Construction phases



The new wall was placed 40 m in front of the existing structure



Tie-rod system – Details of the quay wall corner



**Two different sets of upset tie rods were used, depending on the HZ/AZ system chosen**

AZ intermediary piles were supplied in lengths of 24 m and 18 m.

After the installation of the steel sheet piles, the next phase of construction called for backfilling of the area between the new and existing quay walls. Along the rear wall, the backfill material had to rise from the harbour bed to a point level with the top of the previously installed main wall. Closer towards the main wall, the dredger installed the backfill material only until halfway to the top of the combined wall. This minimised the forces and the deformations of the combined wall which acted as cantilever wall before installation of the tie-rod system.

During the following construction phase, the 8-m AZ 26 sheet piles

forming the rear anchor wall were driven. All the sheet piles used for the Garibaldi Pier project are made of high-strength steel (S 390 GP). The upset tie rods provided by Anker Schroeder from Dortmund, Germany were installed next. The anchors have a thread of 3.75", a diameter of 75 mm, a length of 25 m, and are connected every 1.79 m to the HZ beam at one end and to a UPN 400 waling at the other end. They were designed to take a working load of 839 kN.

Further from the shore, a stronger solution using the same high-strength steel grade was chosen for the second and third part: a HZ 975 B - 24/AZ 18 main wall with 27-m double HZ king piles and 22-m AZ 18 intermediary piles. The elastic section modulus

of the chosen system amounts to 10,840 cm<sup>3</sup>/m. AZ 36 double piles nine metres long were installed as an anchor wall. Due to the larger system width of 2.27 m, stronger upset tie rods with a working load of 1,250 kN were required. The tie rods have a diameter of 90 mm, a thread of 4.5" and a length of 33 m.

Once all the tie rods were installed, the area behind the main sheet pile wall was backfilled. As a final step, the top slab with the capping beam was installed and the harbour bed was dredged to the required depth of 12 m.

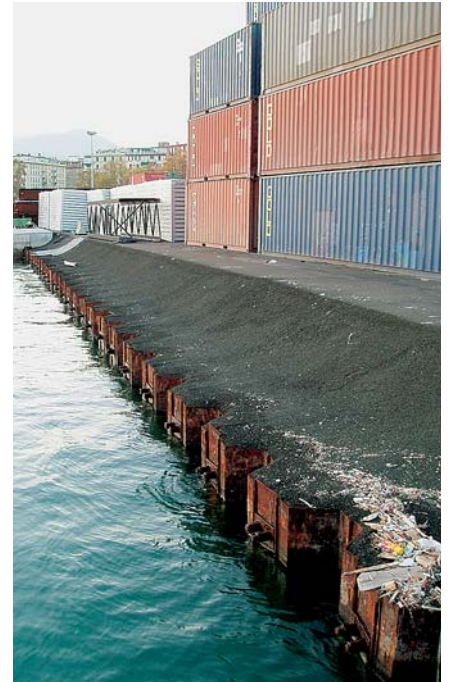


**With its draught of 12 m, Garibaldi Pier is the largest pier in La Spezia**





Malaspina Quay is a multipurpose wharf, mainly handling containers



**2. MALASPINA QUAY: 1,800 t HZ/AZ combined wall**

The 200-m multipurpose wharf with its depth of ten metres is equipped with four cranes and is used for handling Roll-on/Roll-off ships. Managed by the Compagnia Lavoratori Portuali, the wharf has a storage area of 2,500 m<sup>2</sup>.

**3. RAVANO PIER: 4,000 t HZ/AZ combined wall**

This container terminal is managed by La Spezia Container Terminal (Contship Italy Group) and Terrestre Marittima. The terminal offers a berthing line of

300 m, a depth of 11 m, three rail tracks, and a 40,000 m<sup>2</sup> yard.

**4. CANTIERI DEL GOLFO TERMINAL: 4,000 t HZ/AZ combined wall  
TARROS QUAY: 500 t HZ/AZ combined wall**

Situated close to the Ravano quay, the 310 m Golfo Terminal with a depth of 12 m is specialised in Roll-on/Roll-off and container ships. The Tarros Terminal handles passenger traffic. The quays are equipped with seven Roll-on/Roll-off moorings.

**5. IMMA maritime site: 500 t AZ sheet piles**

**6. PORTO LOTTI Marina: 3,500 t AZ sheet piles**

**7. FERRARI maritime construction site: 250 t AZ sheet piles**

**8. FINCANTIERI: 600 t AZ sheet piles**

**9. VALDEMARO maritime construction site: 250 t AZ sheet piles**



Thanks to the combined-wall system the new quay now offers a water depth of 10 m





The owner of Ferretti Quay, the Ferretti group, designs and builds luxury motor yachts

**10. GRAZIE Quay: 500 t  
AZ sheet piles**

**11. FERRETTI Quay: 2,600 t  
AZ sheet piles**

The Ferretti Group is a world leader in the design and construction of luxury motor yachts and sporting boats. The group has invested 26 million euros in

the construction of a shipyard for the Northern Tyrrhenian Sea based in the port of La Spezia. Works on the new shipyard began in May 2003 and are scheduled for completion in 2006. Several existing structures were demolished to make way for new hangars, offices and a 400 m pier. The 15,000 m<sup>2</sup> boatyard in the eastern part of the port is currently in operation.

The new boat yard was built using Z-type sheet piles in steel grade S 390 GP. The main wall consists of AZ 36 piles; their lengths range from 19 to 24 m. Eight-metre-long AZ 18 piles were installed as an anchor wall. A PTC vibratory hammer in combination with a template was used to drive the sheet piles. The 21 corners of the complex quay are formed by C9, C14 and Omega 18 connectors welded to special sheet piles. Some of the quay walls are 92 m long while others are only 7.5 m long.



The new 400-m pier will be completed by 2006 using AZ 36 and AZ 18 sheet piles



A template was used for the installation of the AZ piles



## La Spezia, ITALY



2,600 t of 24-m AZ 36 and 8-m AZ 18 sheet piles were installed



### Garibaldi Quay:

**Owner:** Condotte d'Acqua Spa

**Steel grade:** S 390 GP

**Sheet piles:**

- Main wall part 1: HZ 975 C, L = 24 m & AZ 18, L = 18 m
- Rear wall part 1: AZ 26, L = 8 m
- Main wall part 2 & 3: double HZ 975 B, L = 27 m & AZ 18, L = 22 m
- Rear wall part 2 & 3: AZ 36, L = 9 m

**Total quantity of sheet piles:**  
9,000 metric tons

### Ferretti Quay:

**Owner:** Ferretti Group

**Designer:** Studio Manfroni e Associati

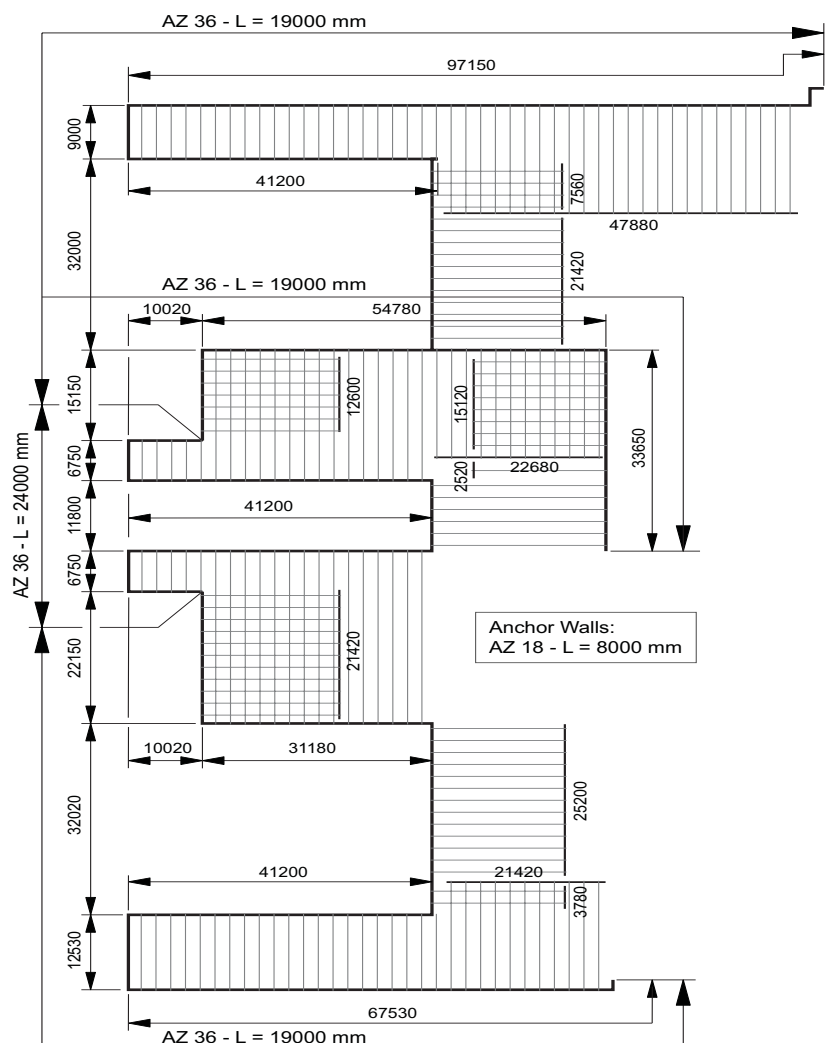
**Contractor:** Acmar (Ravenna)

**Steel grade:** S 390 GP

**Sheet piles:**

AZ 36, L = 19 – 24 m AZ 18, L = 8 m

**Total quantity of sheet piles:**  
2,600 metric tons



The complex quay layout includes numerous connectors forming 21 corners





**Installation proceeded smoothly with the PTC vibratory hammer and the driving template**

All the AZ 36 and AZ 18 double sheet piles including the special sheet piles for the corners were delivered via train from the mill in Luxembourg to the port of La Spezia. A sealing system was used for the Ferretti quay. The Roxan system used consists of a waterswelling product placed in the interlocks of the piles in a workshop in Luxembourg. The urethane prepolymer based Roxan

system is extremely durable and can resist water pressures up to 25 m.

When installing sheet piles with the Roxan sealing product, the contractor must take care that the system does not swell before installation. Contact of Roxan-filled interlocks with water must be avoided during transport and storage. By placing the treated

interlock to face downwards, unwanted swelling is generally avoided.

When installing the pile with the sealing product in the leading interlock, driving should not be interrupted for more than two hours. Otherwise the expanding sealing product may be torn off when driving resumes. ■



**A sealing system, the waterswelling Roxan system, was inserted into the piles interlocks**