

# Marine works

Diaphragm walling - Dewatering - Slurry walling - Civil works - Earth moving  
Dredging - Sheet piling - Ground anchors - Detection of ordinance

## PORT 2000 - EXTERNAL QUAY

LE HAVRE - FRANCE



### Realisation of the first 4 quayside berths for Port 2000 operation (1,602m of length)

**W**ithin the construction of Port 2000 launched by the Port Autonome du Havre to increase its operating capacity, Soletanche Bachy was awarded as main contractor the first phase of these works. This consists of the construction, under the cover of a new breakwater, of four berths (over a length of 1,602m) in an operation called External Harbour. These works, which started in May 2001 and were delivered to the Port Autonome du Havre in April 2005, included all the various operations necessary for the construction: foundations, dewatering, earth moving and dredging, civil works, sheet pile wall and anchors, furniture and container crane tracks.

#### Description of the works

The structure designed for this quay comprises a diaphragm wall constructed beneath the future container crane front rail, footed in the Villerville chalk. This structure is capped with a L shaped concrete beam linking the panels of the diaphragm wall and permitting the installation of future fittings to the quay wall (fenders, bollards, ladders and

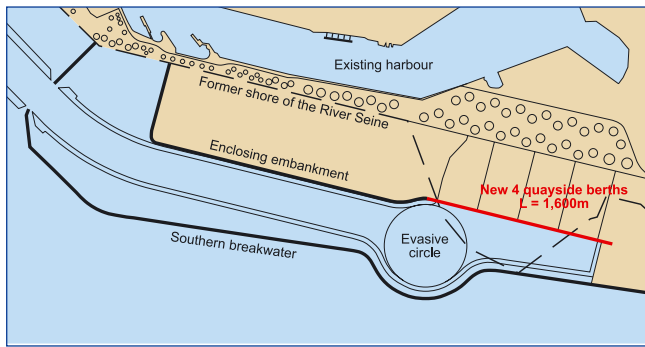


*Aerial view of the site*

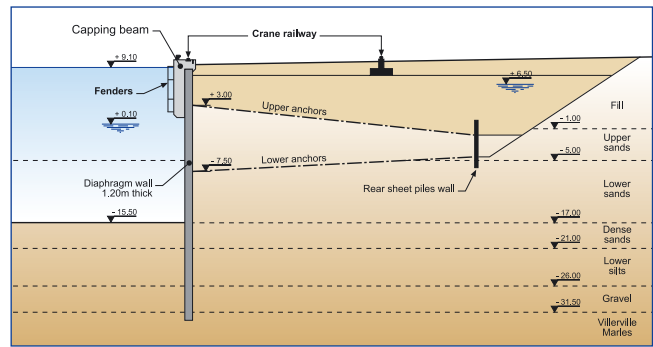
OWNER:	PORT AUTONOME DU HAVRE
ENGINEER:	PORT AUTONOME DU HAVRE
MAIN CONTRACTOR:	SOLETANCHE BACHY FRANCE
DATE OF WORKS:	MAY 2001 TO APRIL 2005

#### MAIN QUANTITIES:

- Diaphragm walling ..... : 80,000m<sup>3</sup>
- Slurry walling ..... : 80,000m<sup>2</sup>
- Concrete ..... : 150,000m<sup>3</sup>
- Steel ..... : 20,000tons
- Ground anchors ..... : 125,000m
- Sheet piling ..... : 6,000 tons
- Dredging ..... : 10,000,000m<sup>3</sup>
- Earth moving ..... : 3,500,000m<sup>3</sup>
- Dewatering ..... : 220 units



Plan showing the location of the new quay wall to Port 2000



Typical cross section through the quay wall

container crane track). On completion, the quay wall will be retained by an anchoring system to the rear made of a sheet pile wall and two layers of inclined passive anchors, installed during backfilling of a 17m deep excavation behind the quay wall. At the end of these works (including the backfilling to the rear of the quay wall) the dredging to the front of the quay wall is then made to its final level. The attached figure shows a typical cross section of the structure.

**Programming and particular items of the works**

Due to the hydraulic constraints of the site, the works had to be undertaken in a strict sequence of operations. Phase 1: preparatory works, scraping and clearing of the working and warehousing zones. This phase included in particular the setting of the logistics to the site, including steel assembly areas, erection and certification of



Diaphragm wall construction of the quay wall

concrete ready-mix plant, delivery of the steel, anchors and sheet piles by rail. Phase 2: installation of the diaphragm wall with Hydrofraise to more than 40m deep with 2 service cranes for the handling of reinforcement cages each weighting over 60 tons. Phase 3: dewatering in front and behind the quay; this dewatering enabled the continuation of the works and needed slurry walls to more than 40m deep. It was necessary to mobilise 4 KS 3000 excavation rigs working 24 hours a day to construct these walls.

Phase 4: earth moving following the dewatering in front of the quay and undertaking of the civil works for the capping beam on the top of the diaphragm wall.

Phase 5: earth moving behind the quay wall under the continuous dewatering.

Phase 6: installation of the sheet piles and the lower layer of anchors.

Phase 7: 1<sup>st</sup> phase backfilling and installation of the upper layer of anchors.

Phase 8: 2<sup>nd</sup> phase backfilling up to almost the finished level.

Phase 9: cease dewatering, the quay now being safe.

Phase 10: dredging in front of the quay wall of Port 2000.

Phase 11: installation of the quay wall furniture and construction of the rear rail for the container crane.

Phase 12: finishing works: dredging the harbour to profile, re-profiling the breakwater, 3<sup>rd</sup> phase backfilling behind the quay and completing works.



Sheet piling, anchors and backfilling behind the quay



Construction of the civil works and capping beam



Dredging of the harbour in front of the quay wall