

Harbour structure

Box caissons - Marine stone columns - Civil engineering

PATRAS HARBOUR EXTENSION - PHASE 1

PATRAS - GREECE



Construction of a breakwater and a quay wall made of box caissons

Bachy Soletanche was part of a joint venture chosen by the Greek Ministry of Public Works for Phase 1 of the Patras harbour extension.

The work comprised :

- the construction of a breakwater 900m long made of 42 reinforced-concrete caissons, in an average water depth of 27m.

- the construction of a quay wall 550m long, made of 25 reinforced-concrete caissons, in an average water depth of 15m (draught 8m). The platform behind the quay was also included in the contract.



General view of site

Sequence of work

- Reinforcement of the seabed using marine stone columns (114,000m in 600 and 800mm diameter, 130,000m in 1,000mm) and vertical drains (850,000m). This phase was of particular importance as the project straddled several major tectonic faults (Patras and its surrounding region often experience seisms of magnitude 4 to 6).

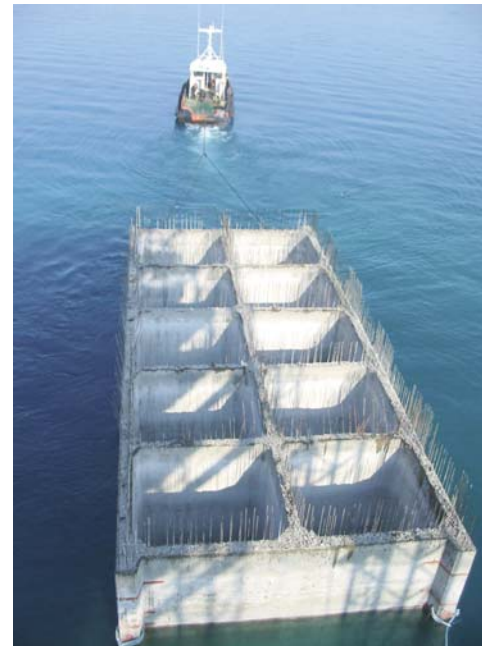
CUSTOMER:	PATRAS HARBOR FUND
OWNER:	D4-DIRECTORATE / GENERAL SECRETARIAT OF PUBLIC WORKS / MINISTRY
CONTRACTOR:	BACHY SOLETANCHE LTD
TECHNICAL CONTROL:	ADK TRITON
CONSTRUCTION PERIOD:	NOVEMBER 99 - JANUARY 2004

MAIN QUANTITIES:

- 67 box caissons (21.00m long, 11.00m wide and 11.30m high)
- 1.5 million m³ of rock fill



Caisson construction



Towing a caisson

- Preloading up to 1,000,00m³, to consolidate the structure areas. The surcharge was removed when the settlement had been stabilized.

- A rock backfill was placed by boat on the reinforced seabed. The fill material was laid in successive layers of 3m maximum thickness, with bathymetric checks. The rock fill material came from quarries 10 to 45 nautical miles from the site, next to which temporary loading wharfs had been built. The barges were either self-propelled or towed by tugs.

- A subgrade of 0.10 to 0.40m thickness was placed on the backfill to even it out before the caissons were set down. The work was carried out by divers using a scraping tool and submerged guide-frames.

The box caissons were precast on-site. To do this, a temporary jetty was built with a 13m draught and a metal gantry crane was set up at the end of

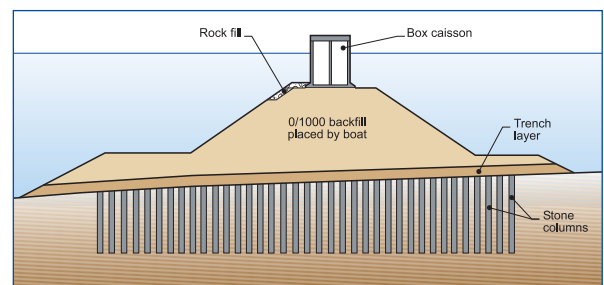
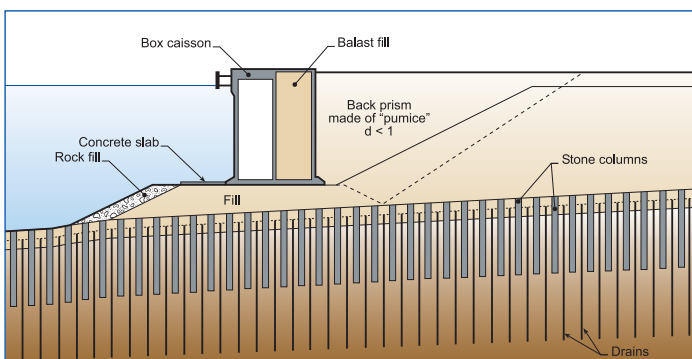
it to install the formwork. The caissons were built on a platform supported by a system of 8 no. 600 tonnes jacks. Once the reinforced concrete apron was poured, the cells were concreted using sliding sections of formwork. As the concrete dried, the jack-supported platform was lowered into the water.

- The caissons were towed from the temporary storage area by a 760 hp tug controlled by deballasting. They had a draught of 8.90m. They were secured alongside a GPS-positioned barge and controlled ballasting of the reinforced-concrete cells of each caisson enabled them to be positioned at the required level.

- The caisson cells were placed on the subgrade and partially filled with 0.1 - 100 kg material, using a grab and a barge-mounted crane. Caisson settlement was monitored by topographical survey.

- The individual caisson cells were then sealed by precast concrete slabs, each weighing 11 tonnes.

- An initial filling phase was carried out behind the quay wall caissons using volcanic material (pumice) of a density less than 1 to contain the pressure exerted by the earth. The final stage involved finishing work on the structures (seals between caissons, reinforced-concrete apron, installation of equipment, riprap, etc.)



Cross-sectional view of the breakwater

Cross-sectional view of quay wall