THE NEW BREAKWATER OF THE PORT OF GENOVA (ITALY)

Enrico Pellegrini, Webuild S.p.A, e.pellegrini@webuildgroup.com
Andrea Isola, Fincantieri Infrastructure Opere Marittime S.p.A. andrea.isola@fincantieri-infrastructure.it
Davide Palmigiano, Fincosit srl, d.palmigiano@fincosit.it

THE SECOND DEEPEST BREAKWATER IN THE WORLD

The new breakwater for the port of Genova, in Italy, is going to be seated in 50m of water depth. It is going to be the second deepest vertical breakwater in the word. The new breakwater will allow expansion of the port and the entrance of the larger container ships. It is going to be built some 400m further offshore in respect to the exiting one. The existing breakwater will be demolished, and the material re-used in the construction of the new breakwater.

THE REASON FOR A NEW BREAKWATER

The actual configuration of the port is limiting the access to ships with a length lesser than 250/270m having a turning basin of maximum 550m of diameter. Moreover, the navigation channel inside the port, along the Sampierdarena' berths is reduced to 150m in width.
The new configuration of the port layout will allow ships up to 400m in length to enter the port as a new turning basing of 800m of diameter will be reproduced as well as a 310m wide approach channel. A separate entrance for the larger ships will be also provided in order to keep separate the cruise lines form the commercial ships.

THE CONTRACT AWARDED BY THE CONTRACTOR

The Consortium "PerGenova Breakwaeter", a joint venture between: Webuild SpA (40%); Fincantieri Infrastructure Opere Marittime SpA (25%); Fincosit srl (25%) and SIDRA (10%), on the 23rd of November 2022 awarded an EPC contract to design Phase A+B and construct Phase A of the project. Ramboll UK lmtd and F&M Ingegneria SpA were the selected designers.
The Lump Sum amount is 843mnl€ and the completion date is the 30th of November 2026.

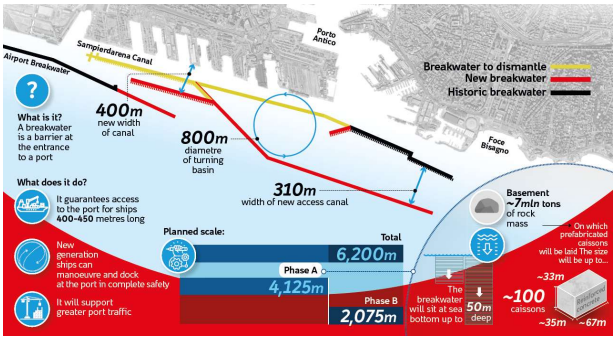

Figure 1 - The main data of the project

THE SCOPE OF THE WORK

The scope of the work is:
- Final design (Progetto Esecutivo)
- Soil improvement of the foundations on the seabed
- Construction of the new breakwater with cellular caissons
- Demolition of part of the existing breakwater
- Re-positioning of the recovered armour units
- Reuse of materials coming from demolition
- Dredging of port seabed
- Relocation of underwater pipeline (Aquarium & IRETI)
- Environmental monitoring

THE PROJECT PROPOSED

The Consortium attention was immediately turned to the adoption of every possible improvement on the technical and environmental aspects. First of all, with respect to the typological section proposed in the Preliminary Design (PFTE), an in-depth analysis of the foundations of the cellular caissons was proposed. This improvement allowed a considerable saving (a few million tons) in the supply of stone material and therefore a greater safeguard of the territory. On the other hand, the size of the cellular caissons was increased in height, thus allowing an increase in the volume of the internal cells which can be used for the permanent storage of materials coming from maintenance dredging of the port seabed, from the demolitions of the old breakwater and/or from other excavation works in the surroundings of Genoa.

GIANT CONCRETE CAISSONS

Due to the great depth, the selected type of breakwater is a vertical wall made with large concrete cellular caissons founded on a rouble mound. Caissons have dimensions up to 68m (L) x 30m (W) x 33m (H).

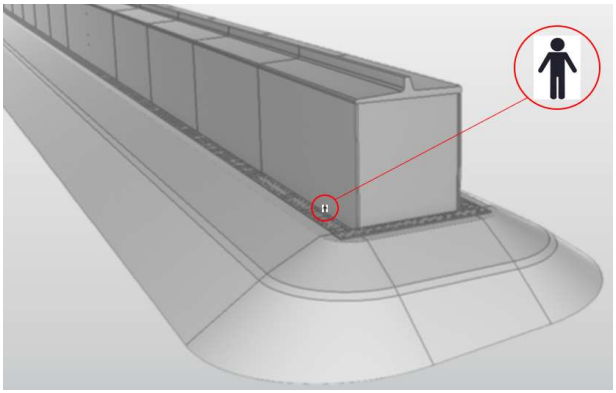
Figure 2 - Size of the structure compared to size of man

Caissons are prefabricated on purposely designed floating docks with a technique tested in Italy for decades which has seen the production of thousands of cellular caissons.

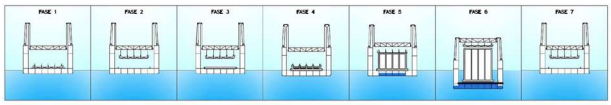
Figure 3 - Typical sequence of construction on floating dock

Figure 4 - Caissons construction on Company floating dock

A CONSISTENT SOIL IMPROVEMENT

70.000 stone columns are being installed on the sea bed with a diameter of 1.1m on a grid 2m x 2m under the path of the breakwater. The “wet top feed” method is being applied.

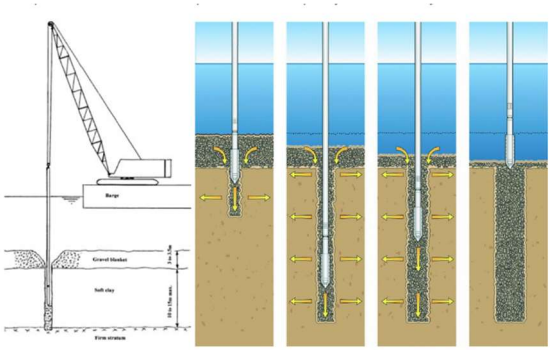

Figure 5 - The “wet Top Feed” method adopted

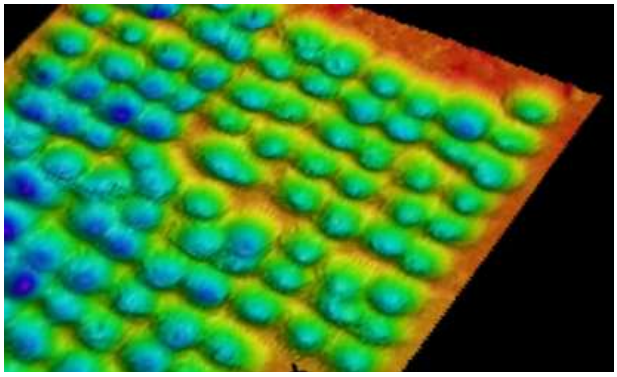

Figure 6 - View of the seabed after stone columns installation

A NEW CONCEPT FOR THE CROWNWALL

In order to reduce the forces acting on the structure due to the pressure of the waves, a recessed crown wall was introduced with the aim of delaying the impact of the wave crest from the pressure on the lower part of the wall, temporally offsetting the two actions. A preliminary shape was modelled in the Laboratory of the University of Roma Tre and a subsequent refinement was tested in the laboratory of HR Wallingford.

Figure 7 - Physical model 3D of the main section

RE-USE OF THE MATERIAL

All the material produced by the demolition of the existing breakwater will be re-used in the construction of the new breakwater. This approach will save about 5M tons of material to be extracted from the quarries.

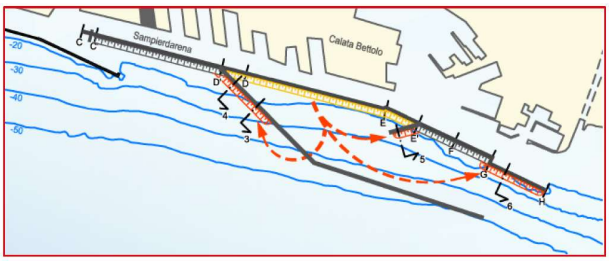

Figure 8 - The plan for re-use of the material

MONITORING OF LOCAL FAUNA

Transects are carried out along which the marine mammal sighting activity takes place, recoding the information on field cards and making use of photo identification and tracking techniques.

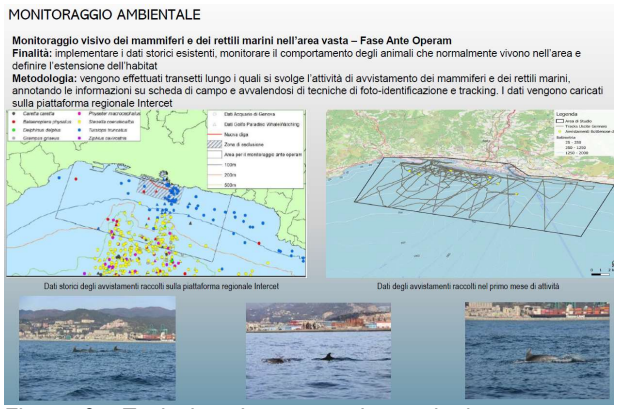

Figure 9 - Typical marine mammals monitoring

ACKNOWLEDGEMENTS

Design by: JV between Ramboll UK lmtd & F&M Ingegneria SpA