

FEATURE OF TECHNICAL SERVICE

Subject	Executive design and detailed executive design of the works related to the construction of the wharf of the north pier of the commercial port of Molfetta (Province of Bari)	
Carried out by	SGAI S.r.l. di E. Forlani & C.	
Client	Molfetta Newport Scarl	
Service length	2009 - 2014	
Value of works	€ 63'300'000,00	
Categories value	D.01	€ 38'845'110,41

COMPACTION STAGES - Computational aspects, Simulation and checks

The compaction phases were analyzed in detail, conducting simulations with finite element numerical models, solved with the **PLAXIS and PROSAP calculation code** (to evaluate the stresses on tripods and over-billow banks). The modeling, combined with an accurate geological and geotechnical investigation campaign, allowed the assessment of the phenomena of constipation and settlement. In this way, it was possible to **reconstruct the stress-strain state of the subsoil during the dynamic compaction operations**, thus obtaining a forecast of the consolidation effects, estimating the extent of the settlements and the consolidation times.

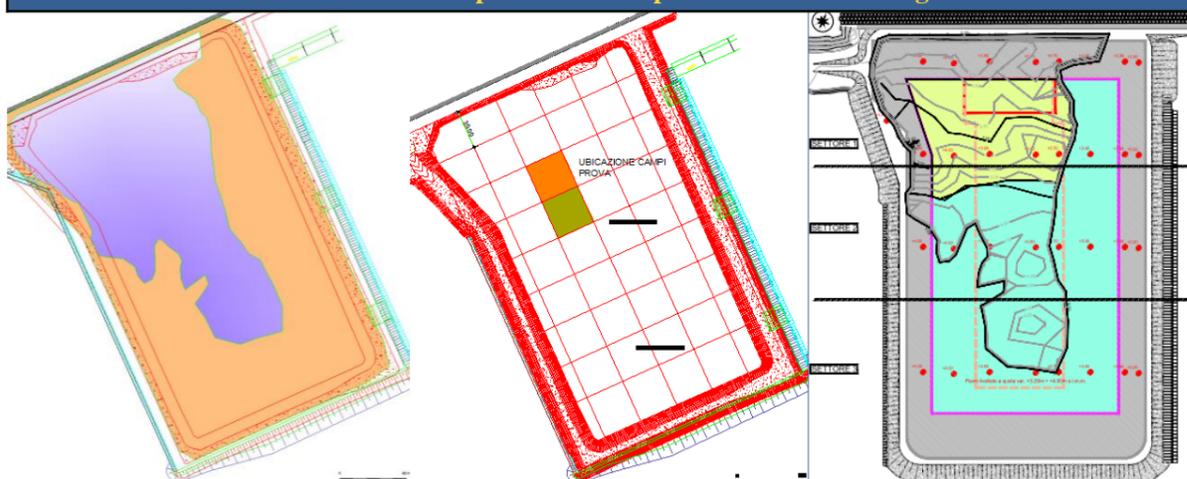
COMMERCIAL PORT OF MOLFETTA - Design issues and their resolution

The new commercial port of Molfetta (BA), once completed, will be the second largest maritime infrastructure in Italy, after the «Mose» in Venice. The expansion of the port includes the construction of different types of docks (on piles and boulders), buildings (maritime station, customs and service facilities), first rain tanks, Ro-Ro yards, the extension of the over-billow pier and dredging.

The major design and execution issues were encountered in **carrying out the supplementary checks**, following the validation of the Executive Project on the basis of the Ministerial Decree of 14 January 2008, **of the North pier and in the planning of the filling and compacting phases with evaluation of the basin settlement**. A preliminary **detailed investigation campaign** was carried out, so that **it was possible to reconstruct the geomorphological and geotechnical framework of the subsoils** present in the intervention area, also assessing the environmental aspects, connected to the characteristics of the wave motion and its influence on the levels of groundwater. The excavation elevations and the volumes of filling material of the basins were assessed through an accurate 3D modeling of the area. The work initially involves the construction of the banks of the new wharf, and then dredging the seabed in the area of competence of the commercial port, up to the elevation foreseen in the project to allow the transit of commercial ships. The filling of the basin was carried out **using the materials obtained by dredging the seabed**, carefully assessing its physical-mechanical characteristics (in particular, the consolidation characteristics). From these studies and from the **geophysical refraction campaign with tomographic response** (based on 2 orthogonal alignments), performed on specific test fields, it emerged the need to proceed with dynamic compaction, so that the rapid and effective consolidation of the material was guaranteed.

The processes were carried out in stages, leveling the area until a basic plan was obtained before compacting the material. The compaction was performed according to an accurate operating scheme, dividing the area into 4x4m meshes, on which two successive phases of dynamic compaction are foreseen. The first phase involves 10 consecutive blows with a 20t hammer and 20m drop height, with subsequent assessment of the settlements, leveling and filling of the craters with lithotype 1 or 3. The second phase involves a variable number of blows (drop height 10m), depending on the results of the previous compaction, and final rolling.

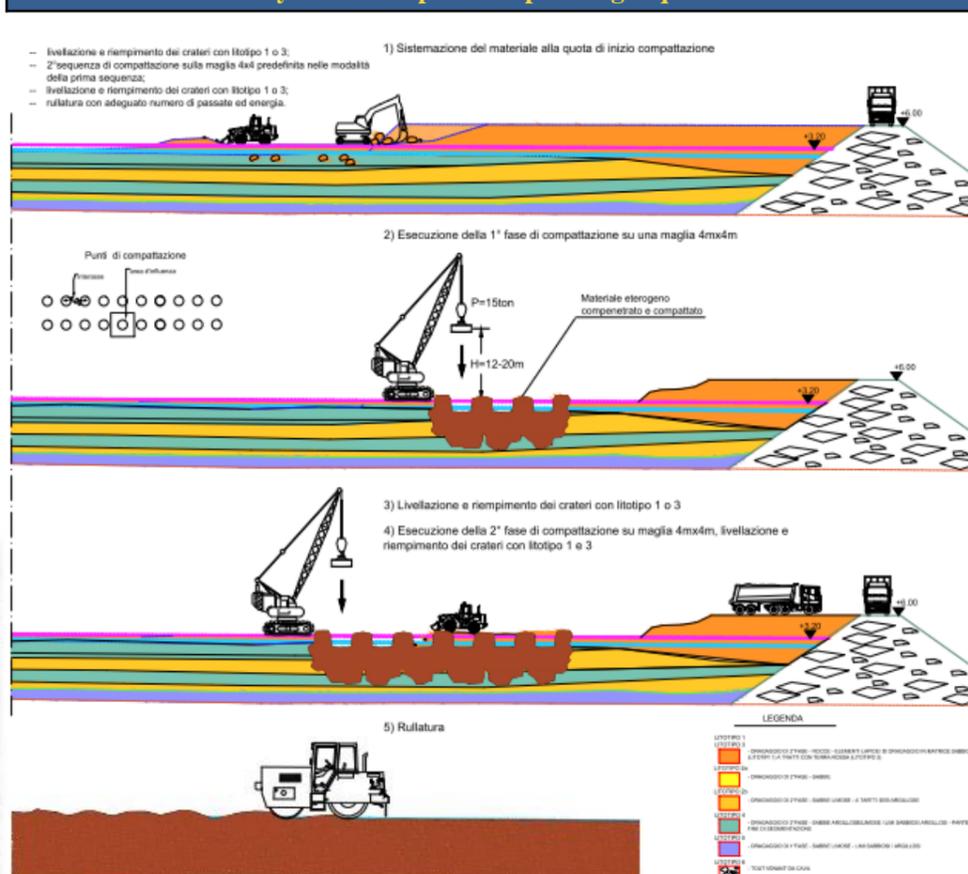
Plan of the filled basin and position of compaction and monitoring test fields



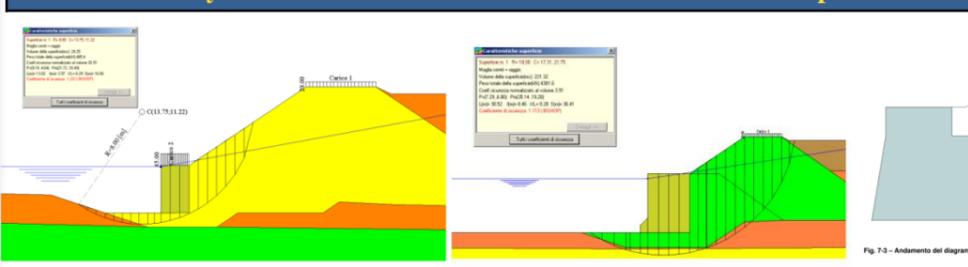
Aerial view of infrastructure at the end of the filling works



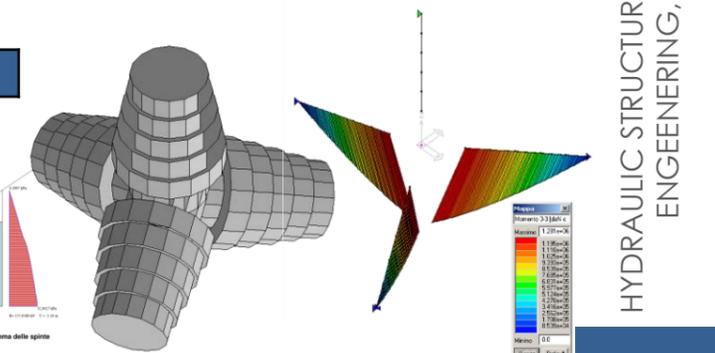
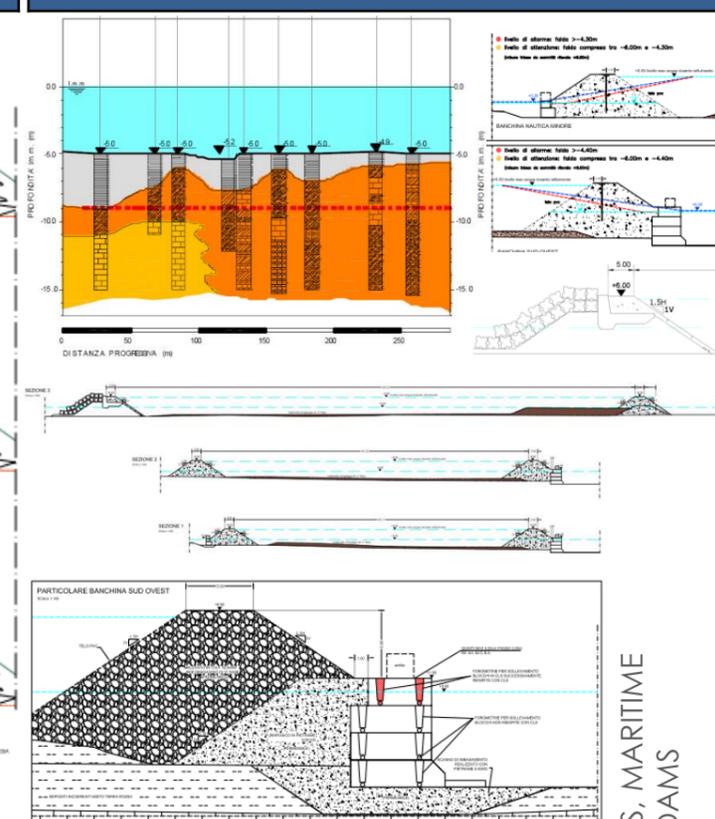
Dynamic compaction operating sequence



Stability checks of over-billow banks and breakwaters tetrapods



Geotechnical model and constructive details



HYDRAULIC STRUCTURES, MARITIME ENGINEERING, DAMS