FEATURE OF TECHNICAL SERVICE

Subject	Executive design of the excavation and filling works in the area in front of the south wharf and the head of the new pier «Salvo D'Acquisto» - Phase D - of the commercial port of Gaeta (Municipality of Gaeta).
Carried out by	ATI - SGAI S.r.l. di E. Forlani & C. (Mandating company, share off 36%), D'Appollonia S.p.A. (Group leader and Mandatory, share off 32%) and Seacon S.r.l. (Mandating company, share off 32%)
Client	Cooperativa Muratori & Cementisti - CMC di Ravenna Soc.Coop
Service length	2008 - 2009
Value of works	€ 24'001'056,53
Categories value	D.01 € 24'001'056,53

COMMERCIAL PORT OF GAETA - Design issues and their resolution

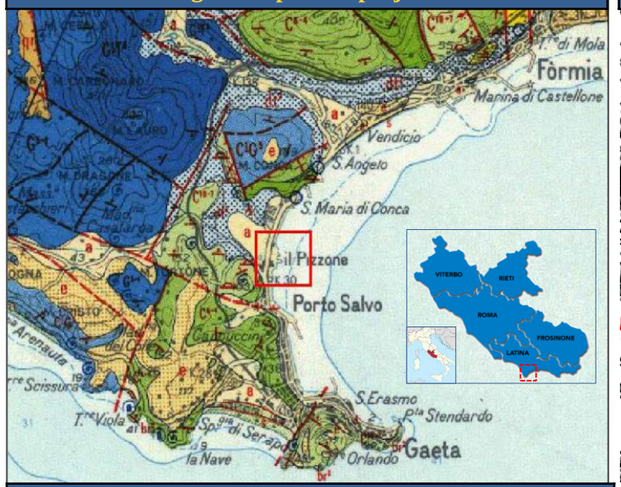
The project consists in the construction of a new wharf in the commercial port of Gaeta. In detail, in the I and II functional part of the project, the dredging, excavation and filling of the area in front of the south wharf and the head of the Salvo D'Acquisto pier are expected to be carried out. The major design and execution issues were encountered in the **sizing and verification of the excavation, drainage and filling stages of the new port area**, for which it was necessary to provide for accurate geological, geotechnical and hydraulic analyzes.

A careful investigation campaign was carried out in advance, so that it was possible to **reconstruct the geo-morphological 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 was carried out in stages, initially providing for dredging the seabed in the commercial port area of competence, up to the elevations foreseen in the project, to allow the transit of commercial ships, and then proceed with the filling of the new port wharf. The filling was carried out **using the excavation materials obtained by dredging the seabed**, carefully evaluating the physical-mechanical characteristics (in particular, the consolidation characteristics). The filling was carried out in stages, previously creating a draining backing on the North pier, with a system for collecting and draining the water up to the pumping and stilling basin. Then proceeding with the laying of draining geogrids, and subsequently with the filling material in several steps, proceeding to the depression of the groundwater by dredging/pumping the two tanks, according to the consolidation times foreseen by the calculation.

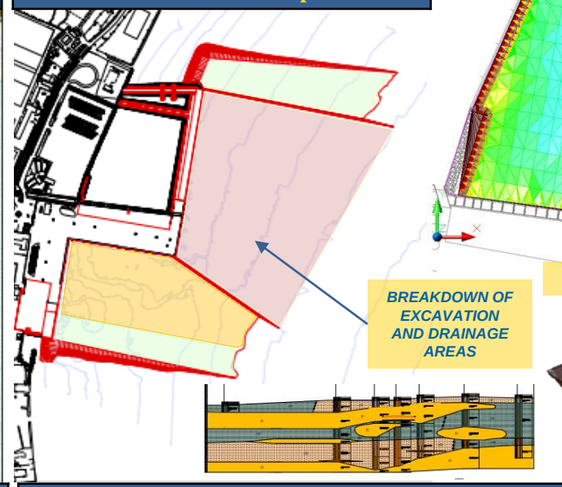
EXCAVATION AND FILLING STAGES - Computational aspects, Simulation and checks

The excavation and filling phases were analyzed in detail, conducting simulations with finite element numerical models, solved with the ***PLAXIS* calculation code**. The modeling, combined with an accurate geological and geotechnical investigation campaign, allowed the accurate evaluation of the under hydraulic pressure and filtration phenomena during the drainage phases. In this way, it was possible to **reconstruct the stress-strain state of the subsoil during the excavation and filling operations**, thus obtaining a forecast of the consolidation effects, estimating the extent of the settlements and the consolidation times.

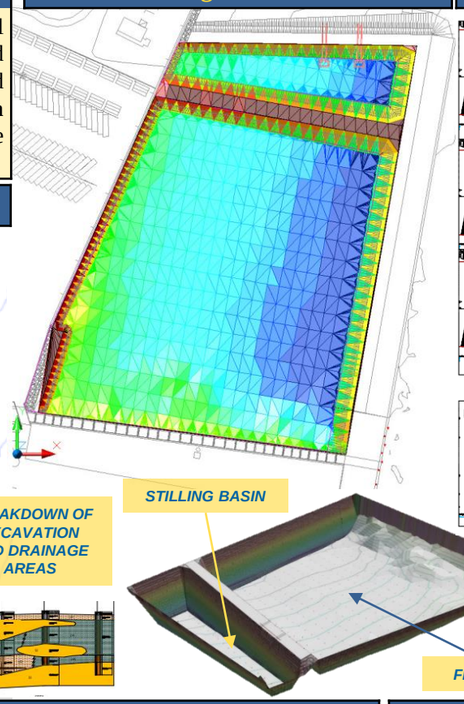
Geological map of the project area



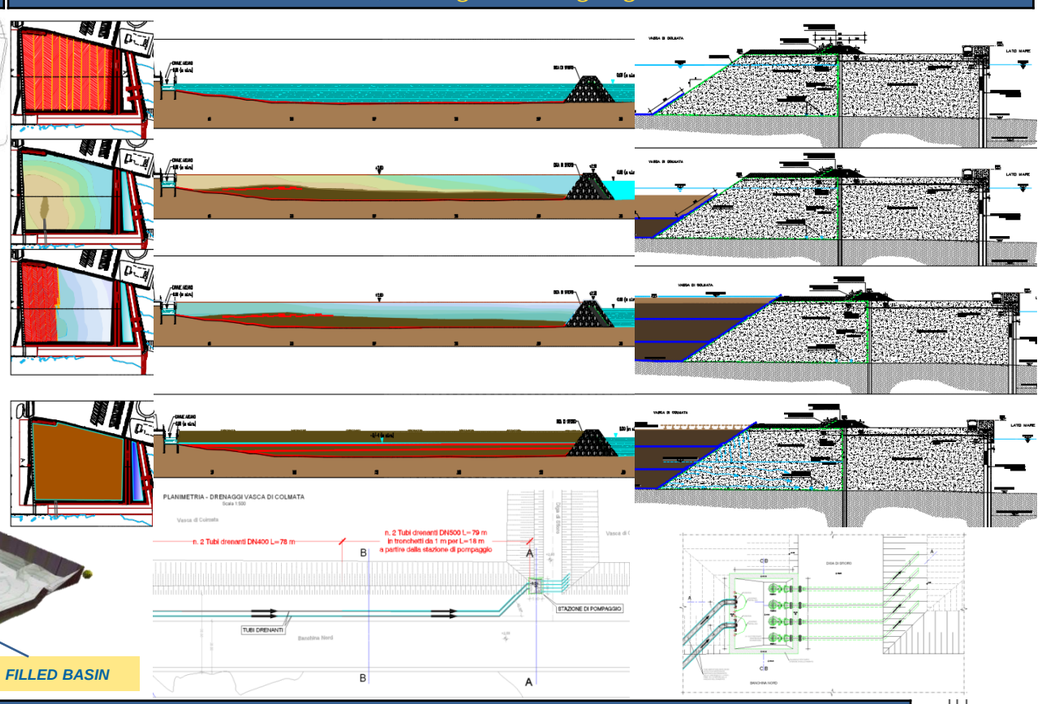
General excavation plan



3D modeling of the filled basin



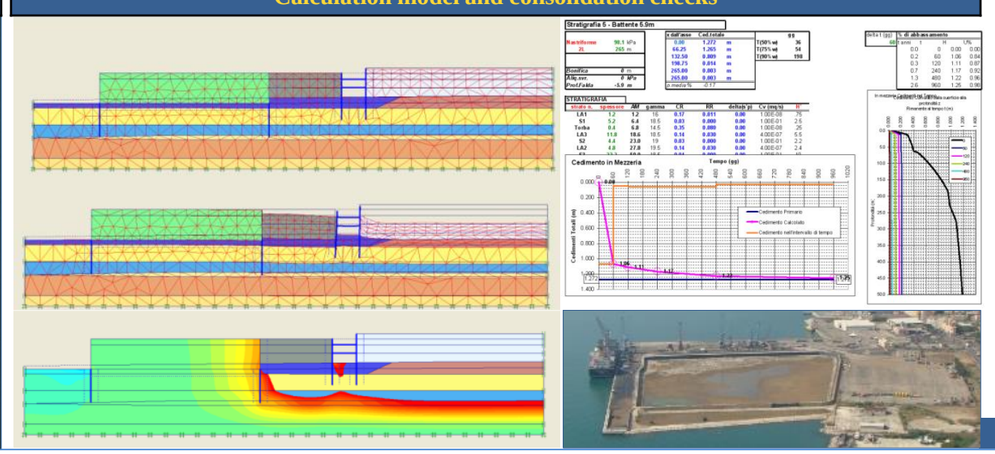
Excavation, drainage and filling stages of the basin



Aereal view of the infrastructure before the works

Aereal view of the infrastructure at the end of works

Calculation model and consolidation checks



HYDRAULIC STRUCTURES, MARITIME ENGEENERING, DAMS