PIANC French Section

PIANC Mediterranean Days

and Conference «Port of the future» by Cerema

25 to 27 october 2023 in Sete France

Extreme events and importance of their identification: the study case of Salerno Port

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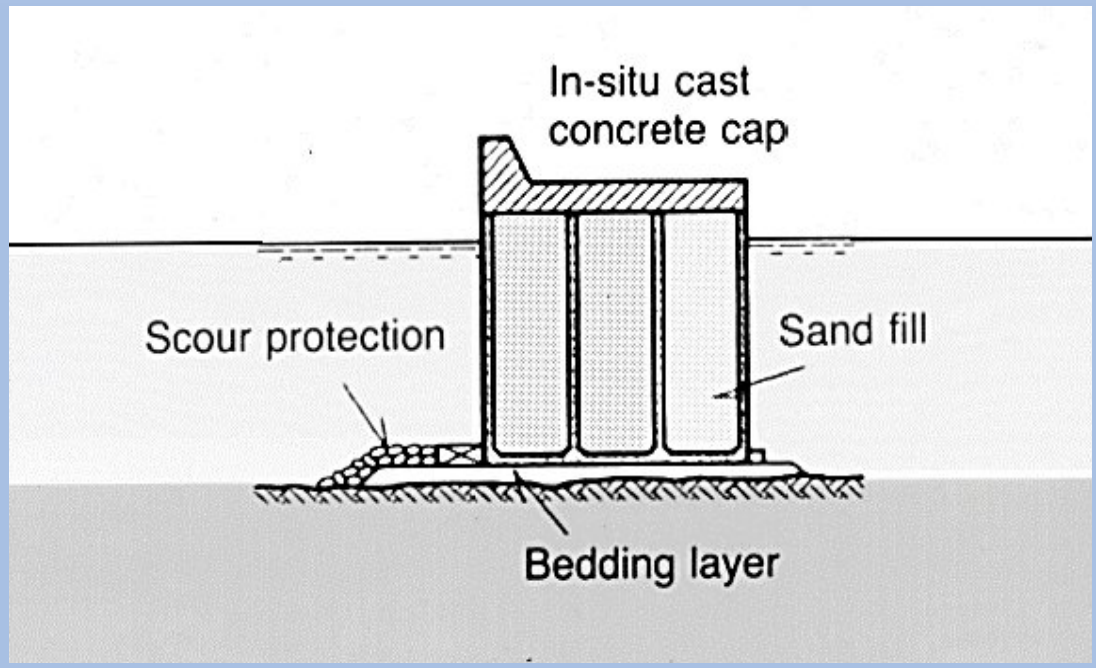
WAVE IMPACTS ON VERTICAL STRUCTURES

Genova port (Italy)

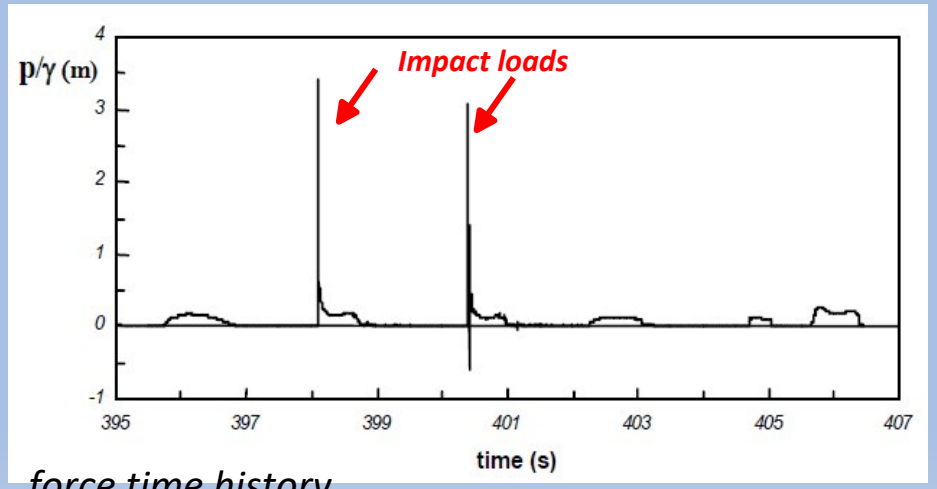
Napoli port (Italy)

Type Section



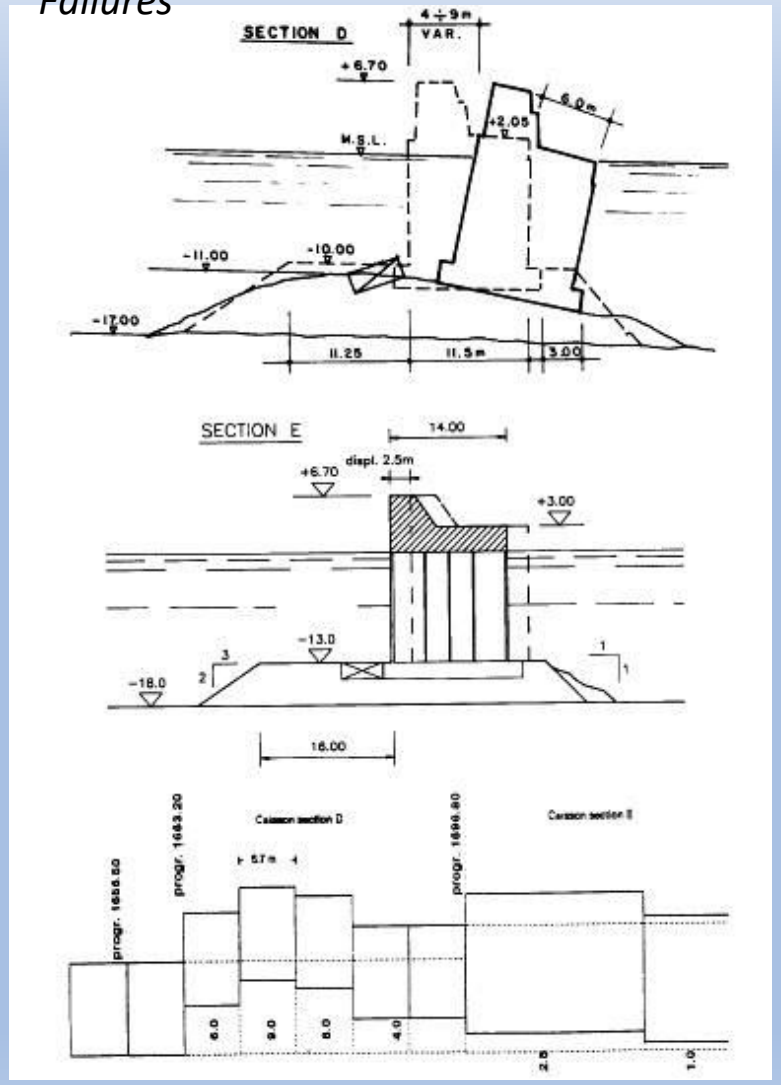
WAVE IMPACTS ON VERTICAL STRUCTURES

Breaking waves on vertical breakwaters



force time history

Failures



essential need for precise analysis to prevent **reconstruction scenarios**, which, in the case of vertical structures, would involve **costs that are likely 2 to 3 times** greater than the original construction ones

WAVE IMPACTS ON VERTICAL STRUCTURES

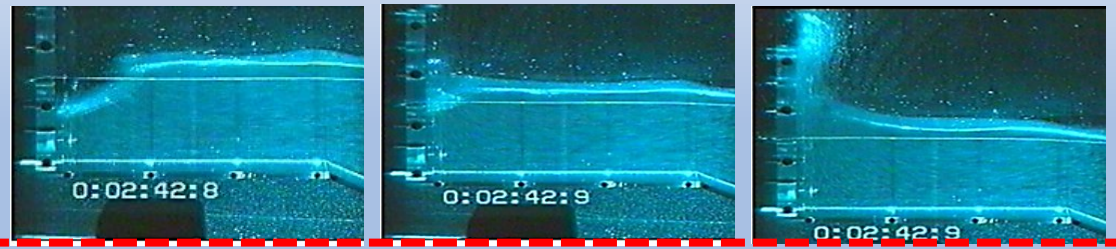
Laboratory Studies (Calabrese & Vicinanza, 1999)

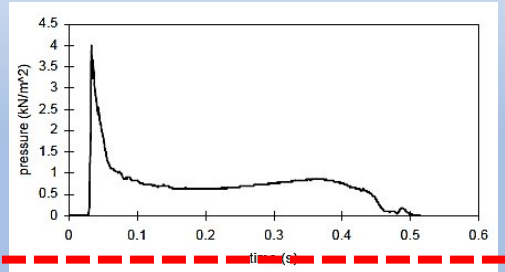
UPWARD DEFLECTED

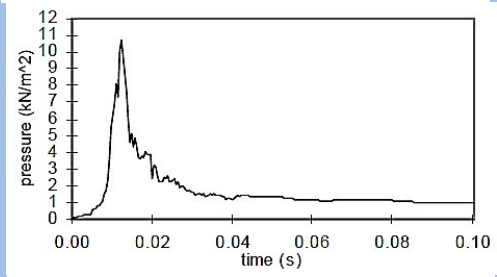
PLUNGING FLAT FRONT

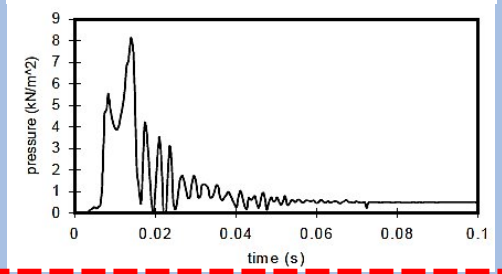
WELL DEVELOPED PLUNGING

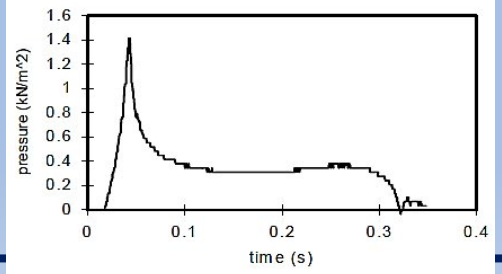
BROKEN







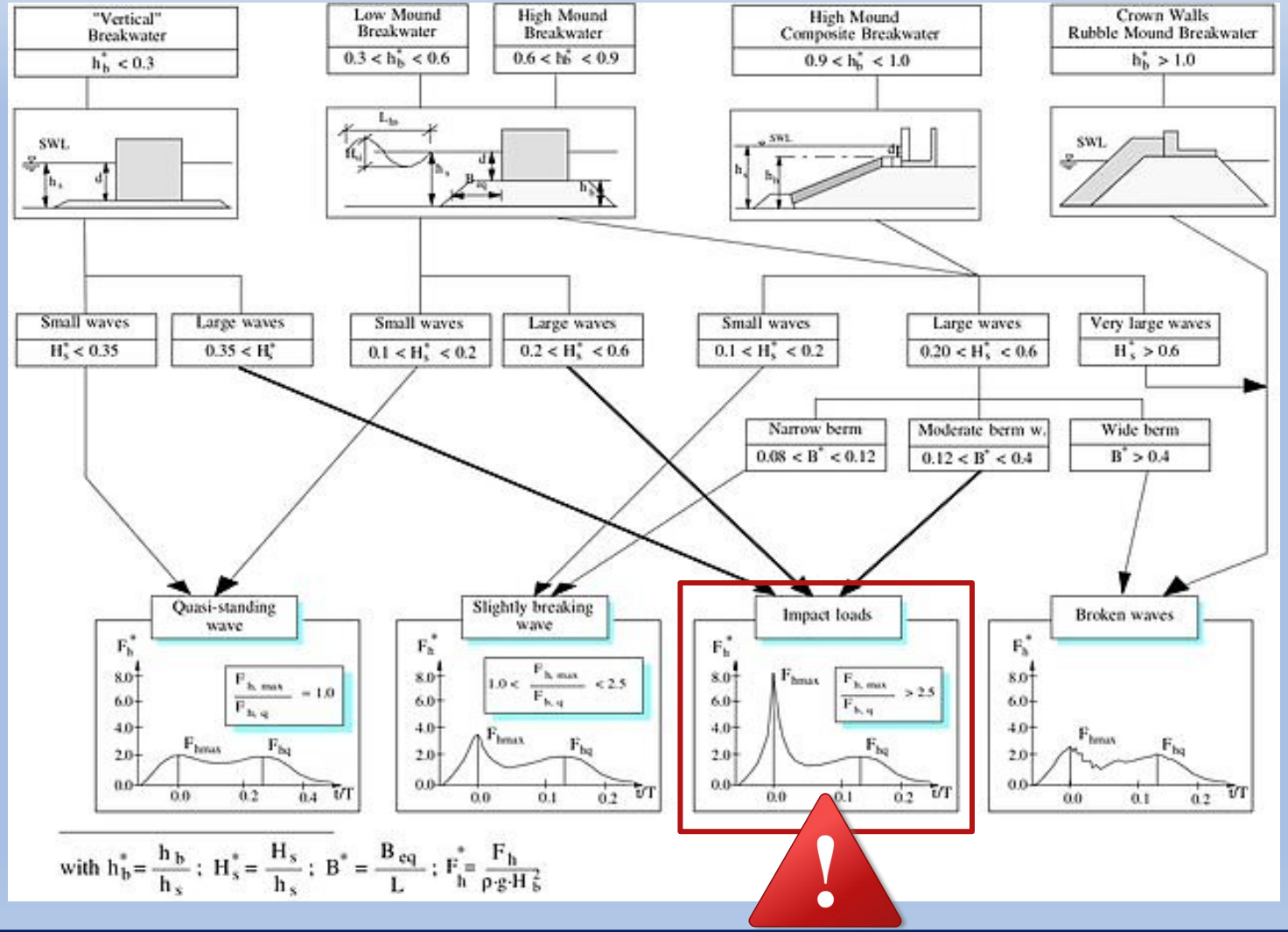




Wave impacts

EXISTING TOOLS FOR WAVE IMPACTS ON VERTICAL STRUCTURES

PARAMETER MAP (Kortenhaus and Oumeraci, 1998)

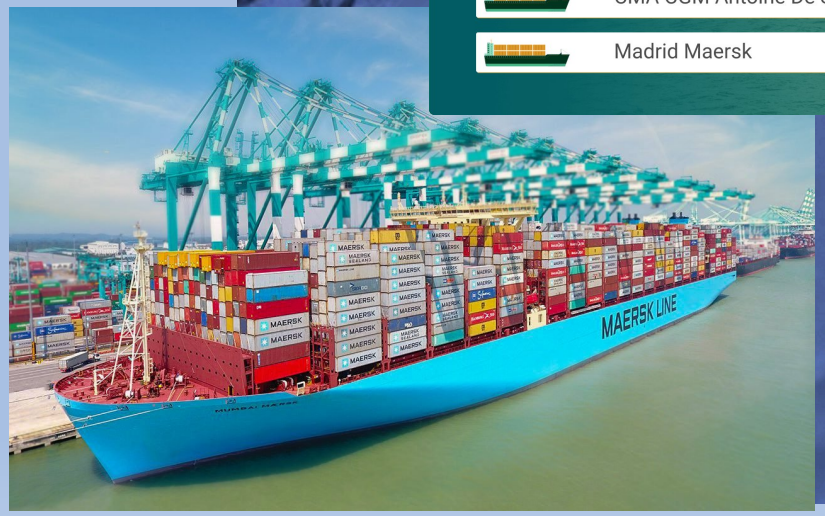


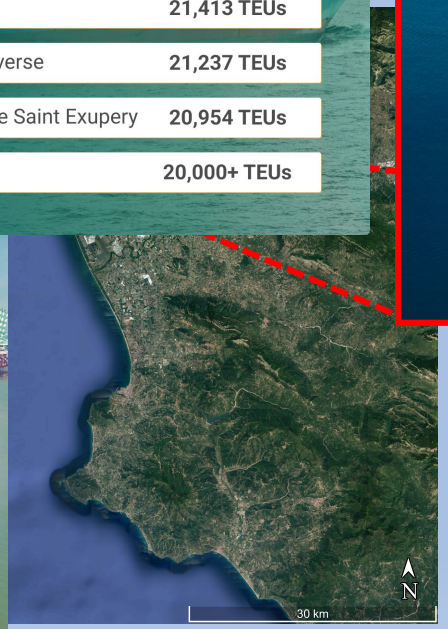
for peculiar cases, it is conceivable that predictions may necessitate reliance on either **physical or numerical models**

SALERNO PORT ADAPTATION PROJECT

Largest mega container ships in 2022

Ever Ace	23,992 TEUs
HMM Algeciras	23,964 TEUs
HMM Oslo	23,792 TEUs
MSC Gulsun	23,756 TEUs
MSC Mina	23,656 TEUs
CMA CGM Jacques Saadé	23,000 TEUs
OOCL Hong Kong	21,413 TEUs
COSCO Shipping Universe	21,237 TEUs
CMA CGM Antoine De Saint Exupery	20,954 TEUs
Madrid Maersk	20,000+ TEUs





FUNCTIONAL TECHNICAL ADAPTATION OF THE PORT

SALERNO PORT ADAPTATION PROJECT

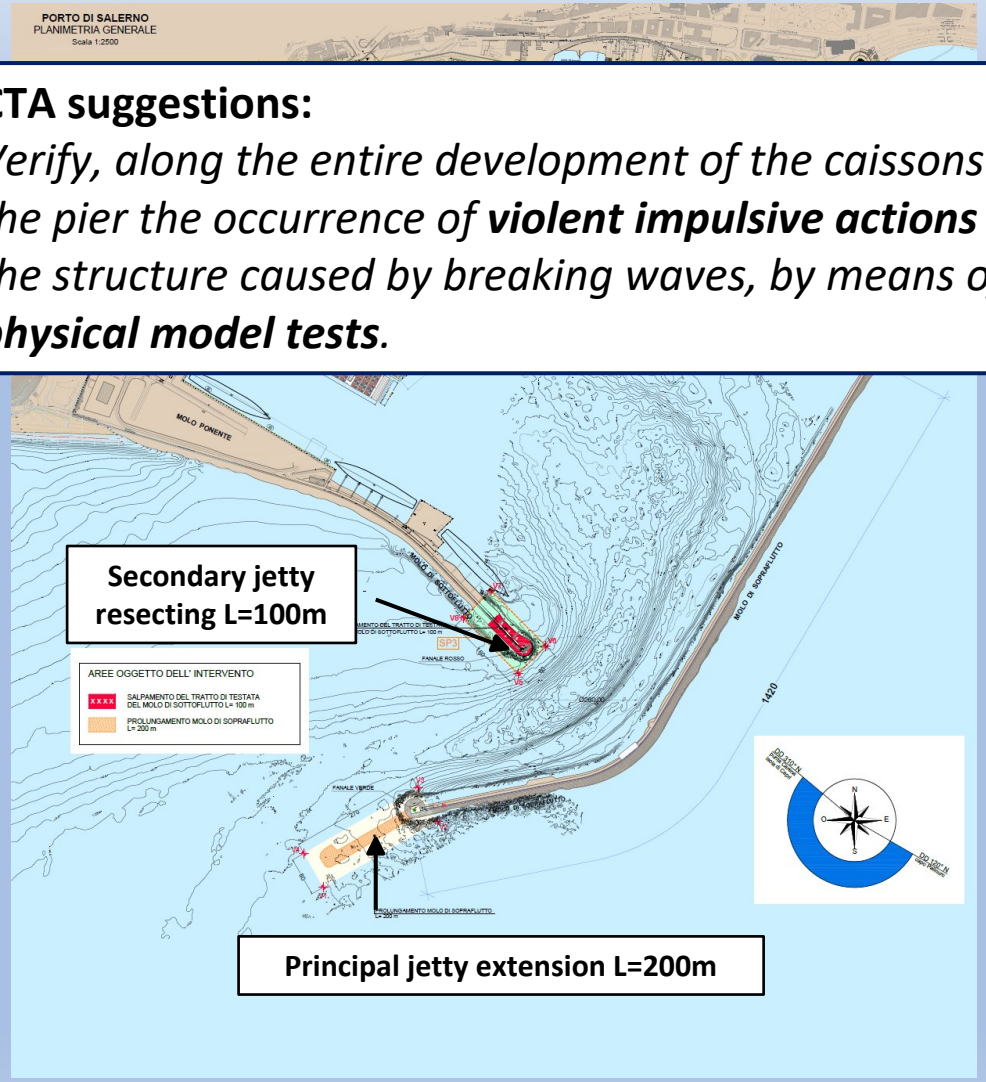
FUNCTIONAL TECHNICAL ADAPTATION OF THE PORT

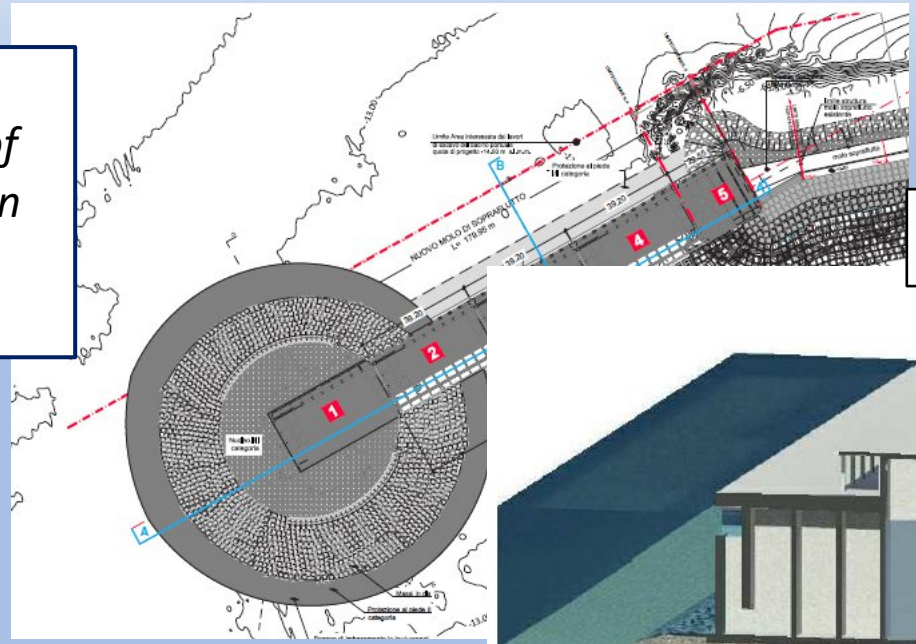
excavation of the seabed in the harbour basin and the harbour access channel

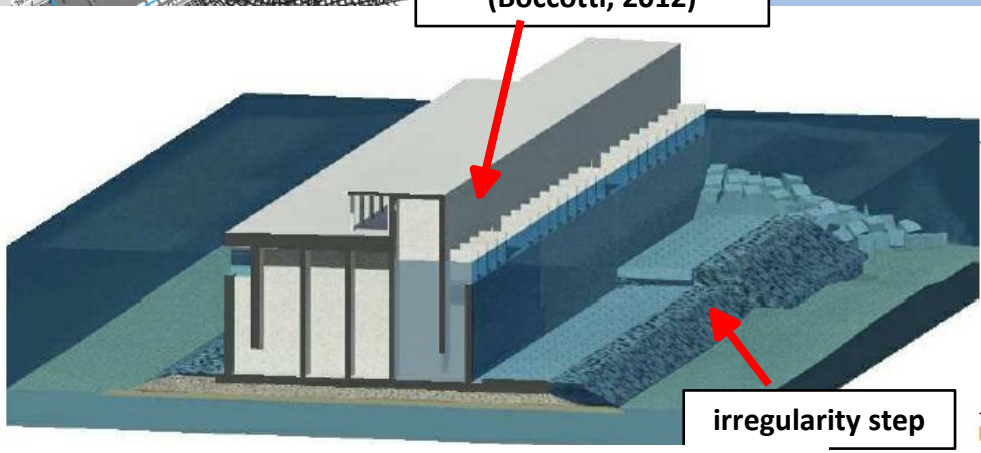
modification of the port mouth

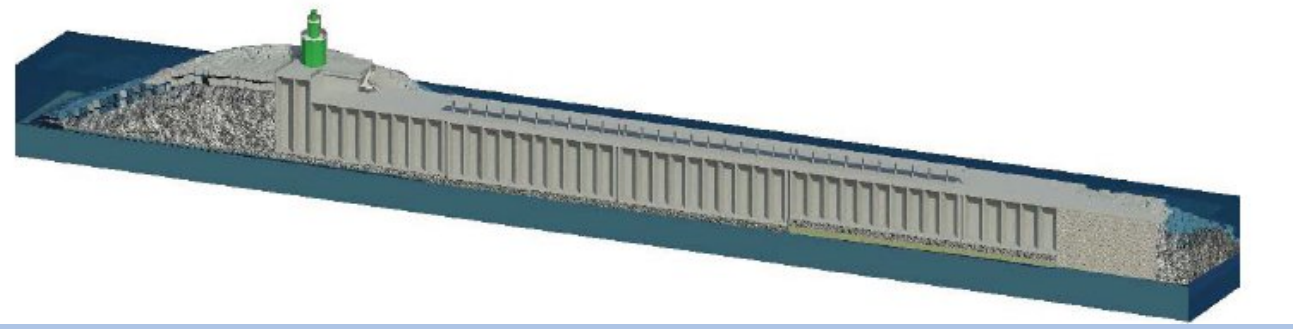
SALERNO PORT ADAPTATION PROJECT

CTA suggestions:
Verify, along the entire development of the caissons of the pier the occurrence of ***violent impulsive actions*** *on the structure caused by breaking waves, by means of* ***physical model tests****.*









THE EXPERIMENTAL CAMPAIGN BY HR WALLINGFORD

HR Wallingford

the study aimed to determine:

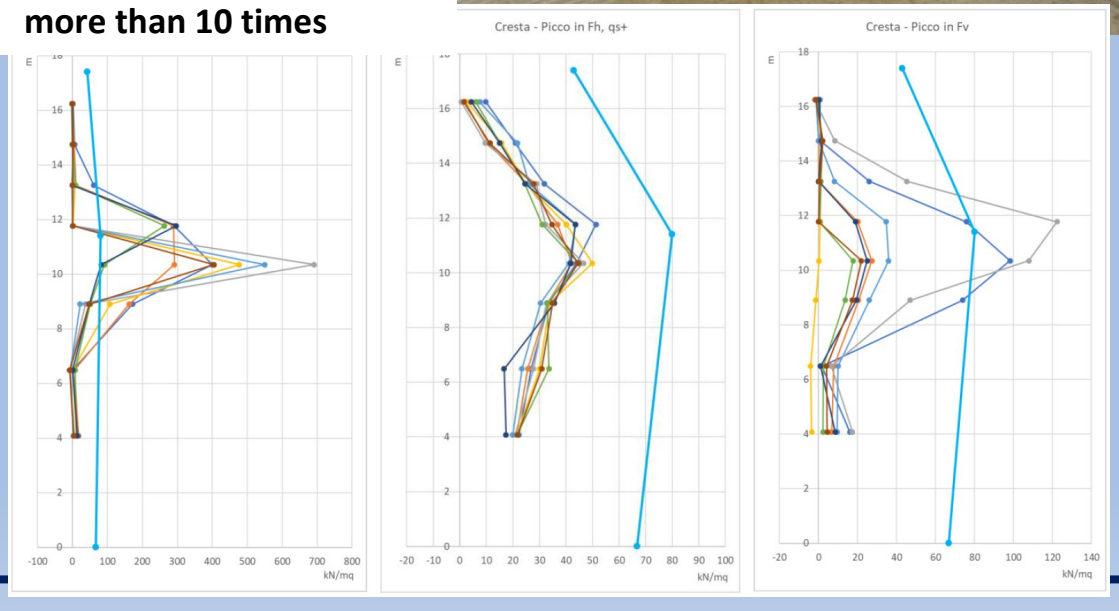
1. the **wave actions on the REWEC3® caissons**, particularly focusing on evaluating the conditions of **impulsive pressure** that can occur along the front face of the structure, especially on the partitions exposed to the direct wave motion;
2. the **reflection coefficient** of the new REWEC3® caisson structures.
3. the **hydraulic stability** of the extension against waves, specifically concerning the stability of the foot protection blocks and the stones composing the toe-protecting berm;
4. the **overtopping flows** at key positions along the structure;
5. the **wave diffraction** within the dredged channel at the head of the structure.

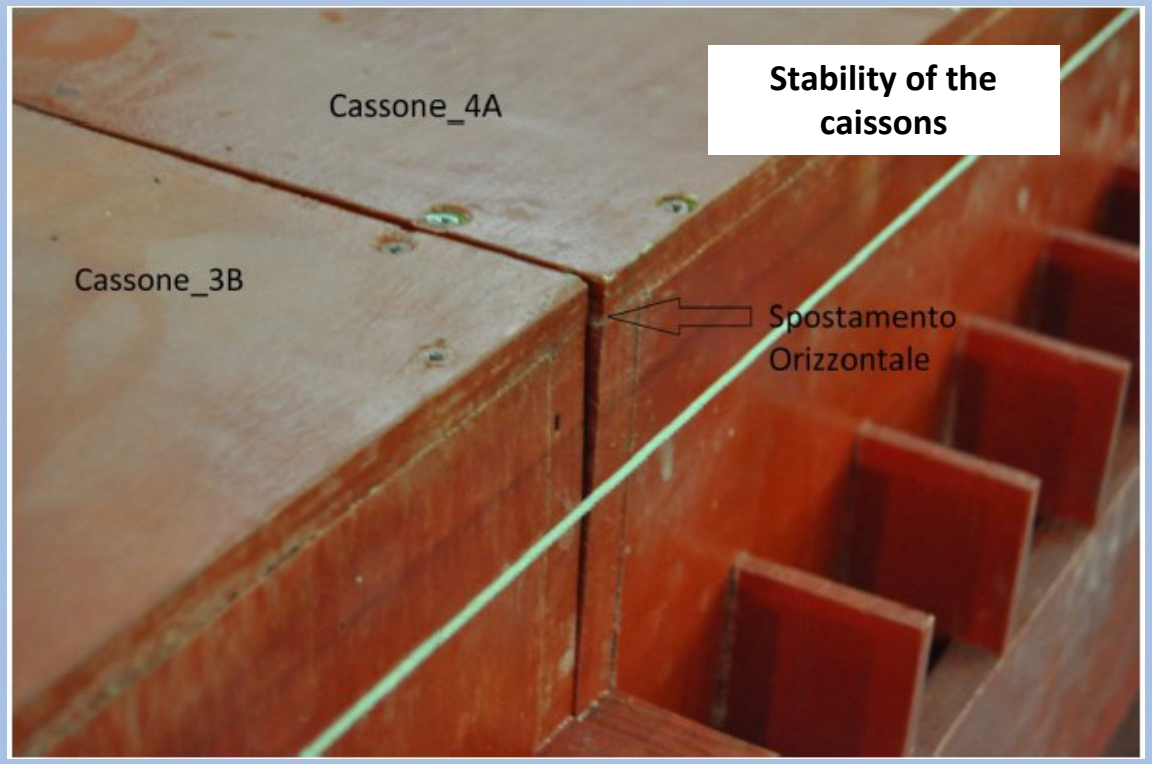
THE EXPERIMENTAL CAMPAIGN BY HR WALLINGFORD

RESULTS…

critical issues at the irregularity step

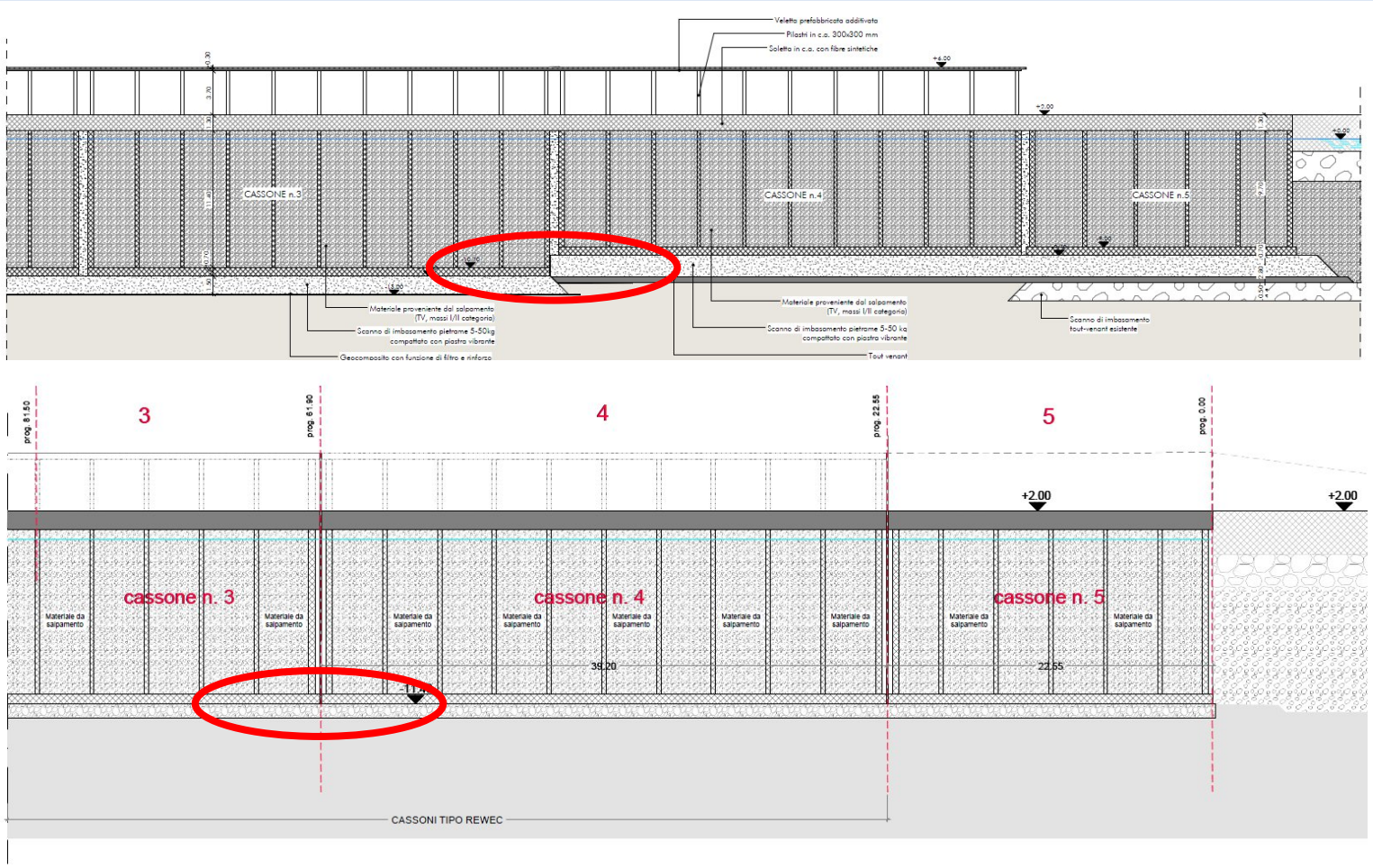
peak pressures values exceed those by literature formulas by more than 10 times



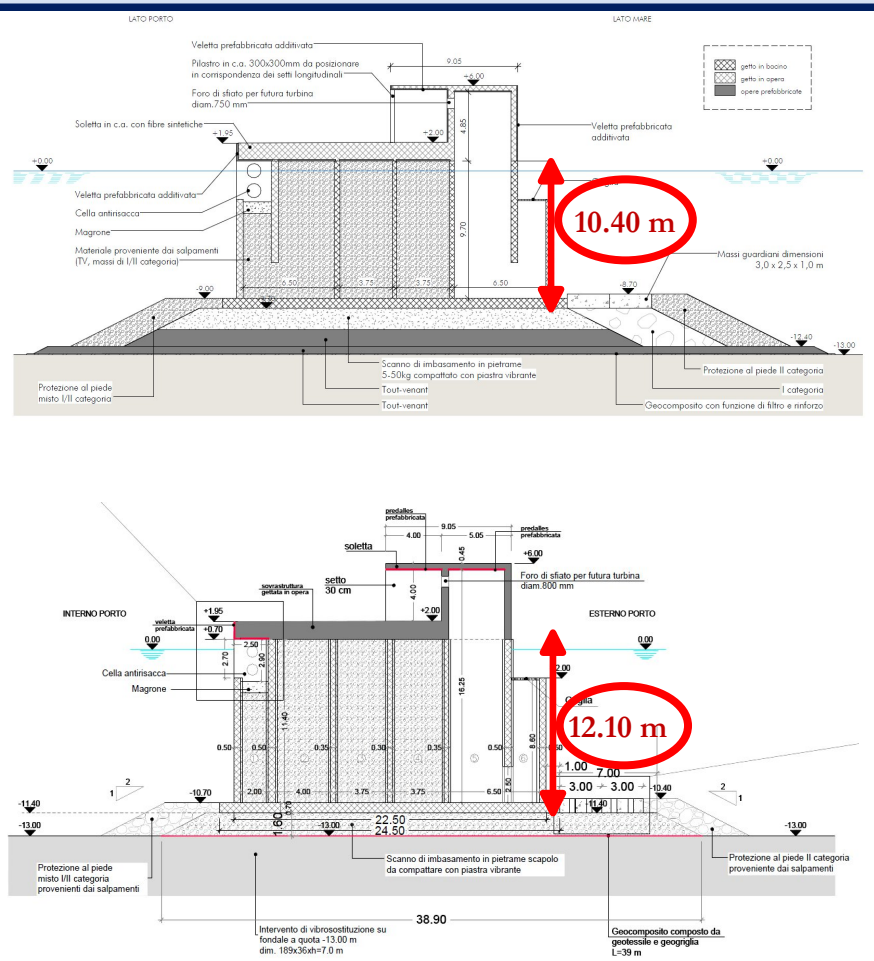


Stability of the caissons

PROJECT ADJUSTMENTS

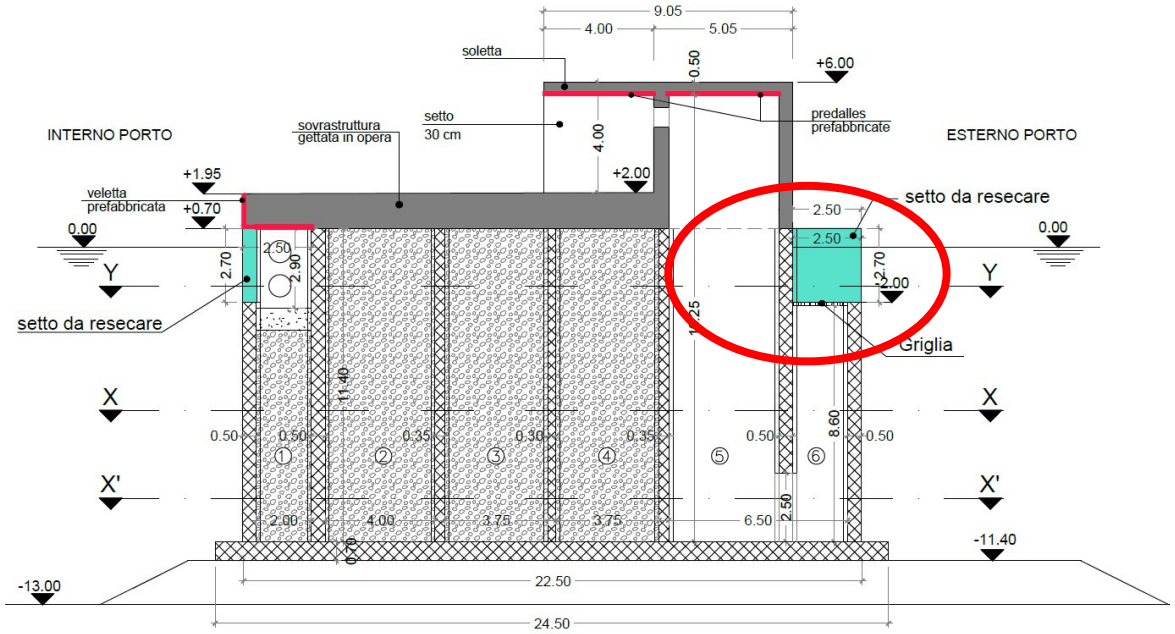


Leveling of the seabed area for the placement of 5 uniform-depth caissons at -13 meters below sea level, with a uniform base at -11.40 meters below sea level.

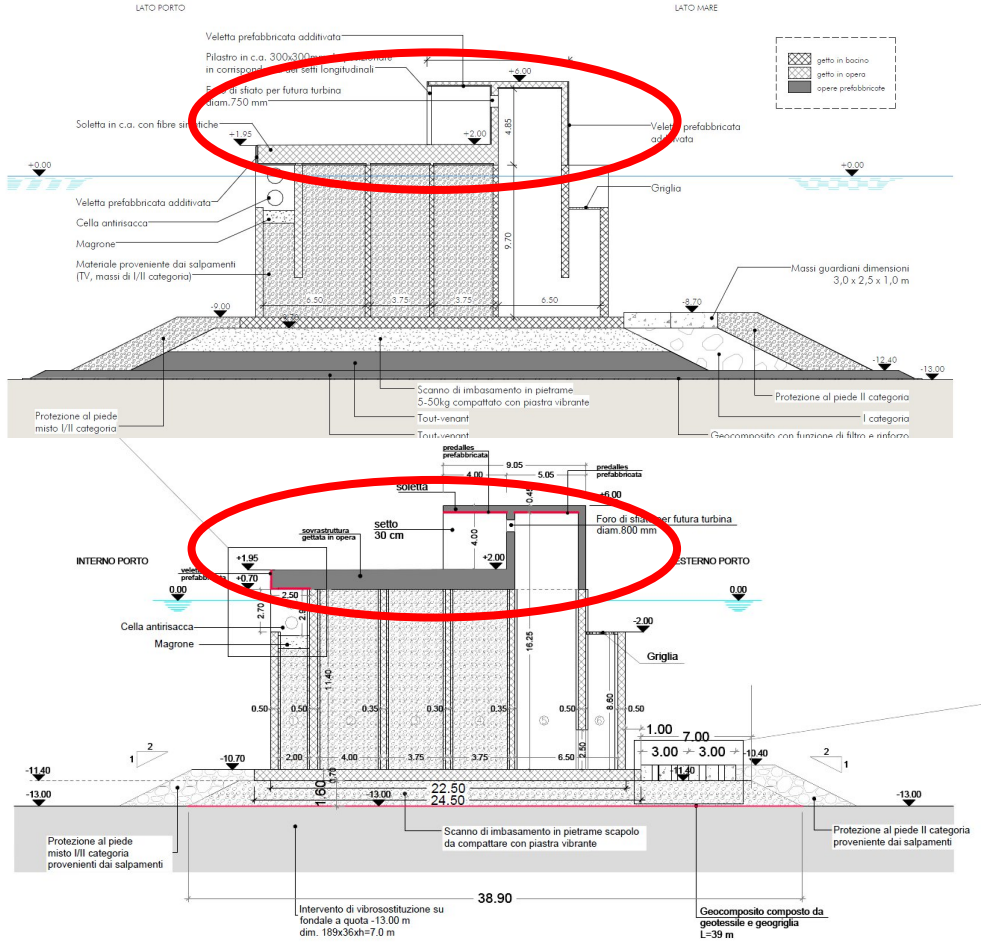


Extension of caissons No. 4 and No. 5 to match, in terms of height, the constant base at -11.40 meters below mean sea level.

PROJECT ADJUSTMENTS



Resection of the partitions of the caissons located at the REWEC cells to reduce the vulnerability of the structure.



Increasing reinforcements in the most heavily stressed sections to account for the stresses resulting from impulsive actions.

in 2019 the works for the adaptations of the port mouth started

"best practice case study" for the students at the University of Federico II in Naples

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