

Use of Wave Tank experiments for the design of Africa's largest port



PORT CENTRE D'EL HAMDANIA – CHERCHELL, ALGERIA



Client:



EPC

Entreprise Portuaire de Cherchell

Cost of services:

€ 9.300.000 (70% Ramboll / 30% Antea)

app. 10% to Algerian subcontractors)

Period:

2018-2019

Goal:

- deep water port (> 15m)
- container vessels > 21,500TEU & 400m long
- 6.33 Million TEU/year
- 25.7 Million Tonnes bulk /year
- 24 quays (6.678m length)
- 283Ha quay and port terrain
- 350Ha logistic zone



JOINT VENTURE – ORGANIGRAM



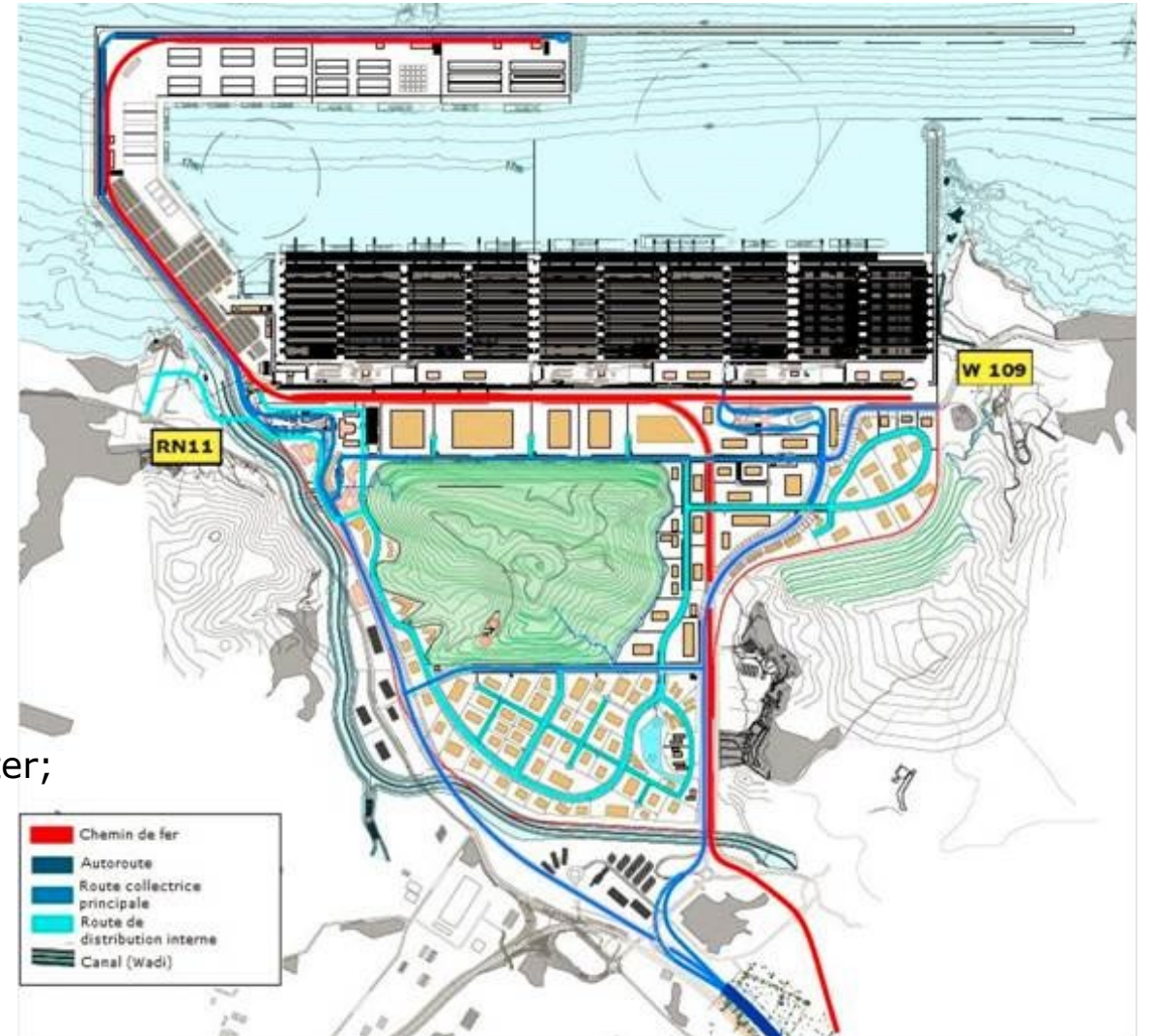
- Ramboll
- AnteaGroup
- Sub-contractors
 - Hamburg Port Consulting
 - Laboratoire d'Etudes Maritimes (Algeria)
 - Flanders Hydraulics Research
 - UGhent – Maritime Technology Division
 - Laboratoire Central des Travaux Public (Algeria)
 - UA – Departement Transport & Ruimtelijke Economie
 - independent experts



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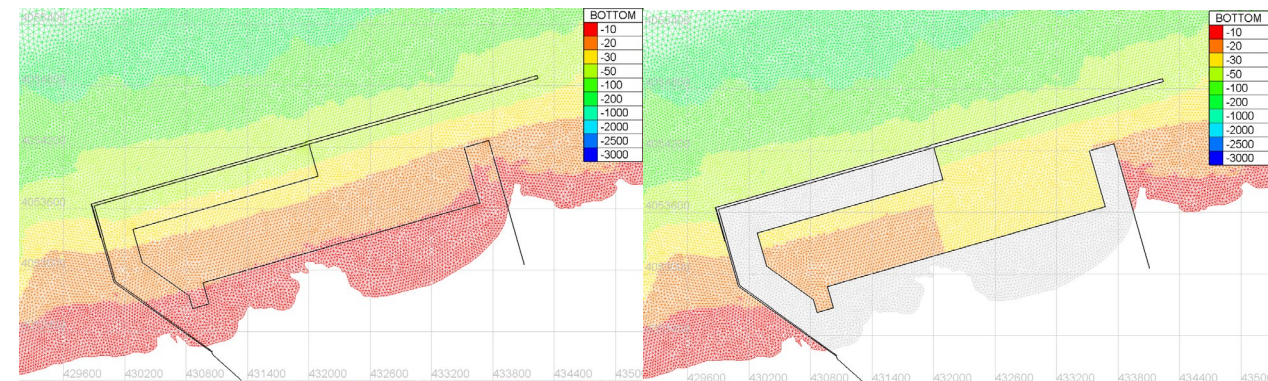
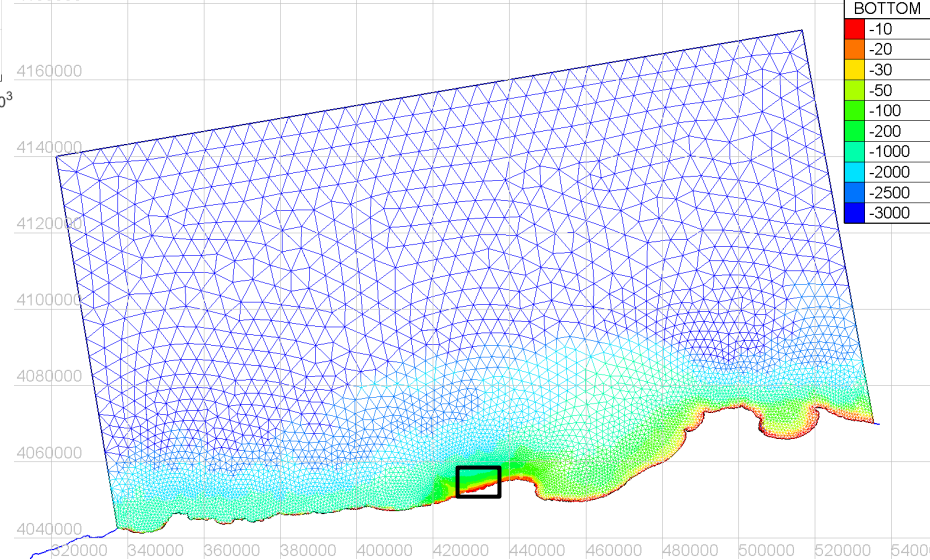
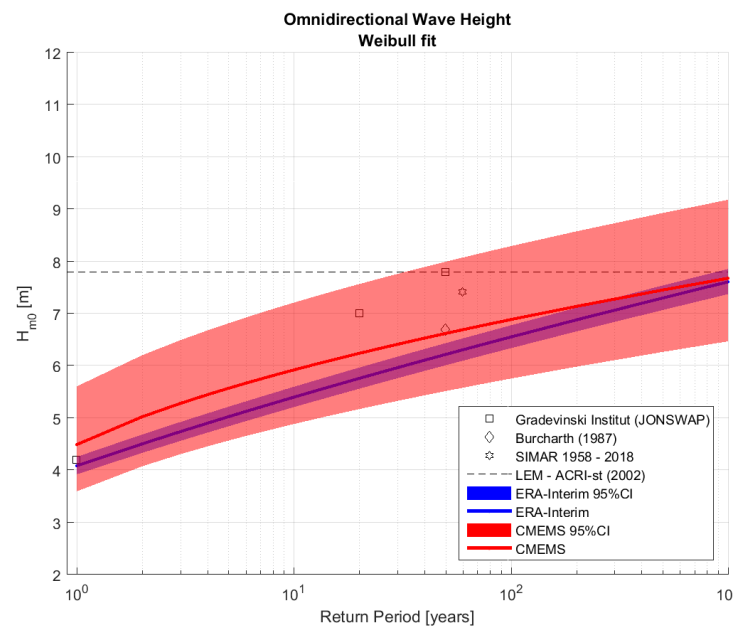
Type of services :

- Assessment of concept design
- Developed design
 - Hydraulic Design
design waves and waterlevels, breakwater revetments and layers, wadi diversion, ...
 - Soil balance
dredging, rocks & quarries, landfill, erosion/sedimentation, ...
 - Design Port & Logistic Zone
 - Networks
drinking water, sewerage/drainage, treated water; electric & data network
 - Waste Water Treatment
 - Environmental Impact Assessment



NUMERICAL MODELLING

- Extreme Value Analysis analysis on 39year ERA-Interim and 10year CMEMS validation against observations
- Wave propagation → TOMAWAC
- Currents and water levels → Telemac2D + TOMAWAC (ocean currents, tides, waves)
- Sediment dispersion → Telemac2D + TOMAWAC + SISYPHE
- Tsunami → Telemac2D
- Harbour Agitation → ARTEMIS



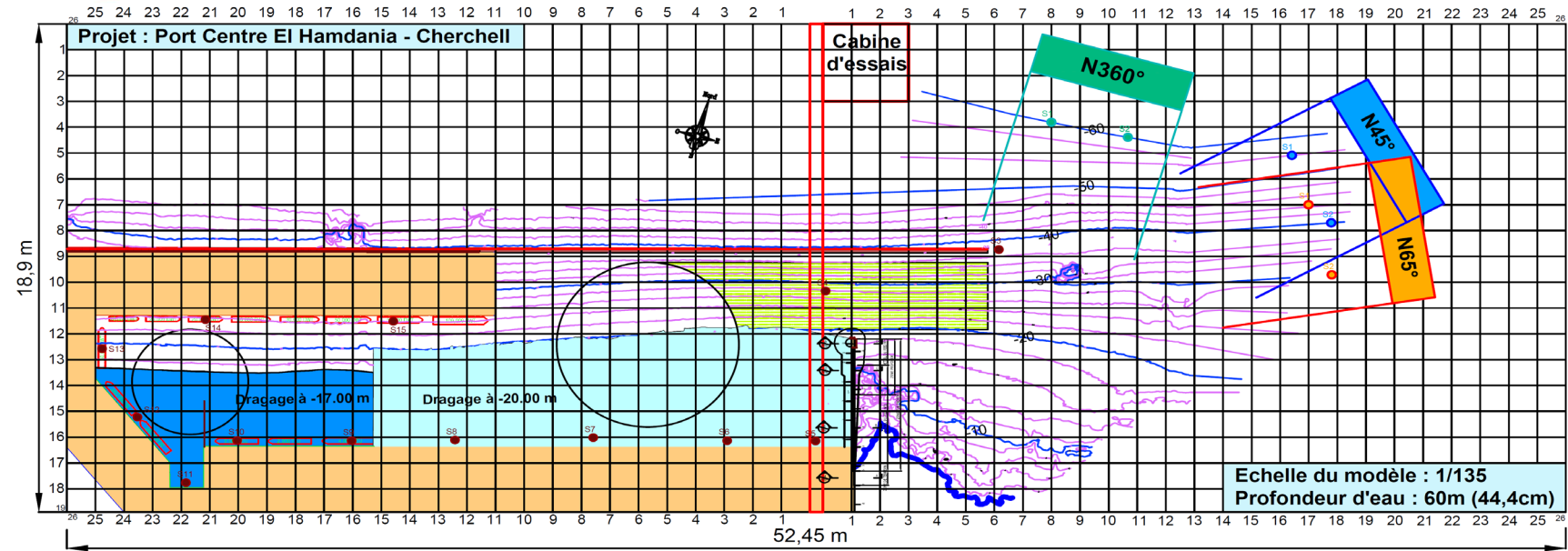
PORT AGITATION & MOORING

- Basin:
52.45m x 18.9m x 1.0m
- Scale: 1/135
- hydraulic wave paddle
(5.5m width wave front)
- 15 gauges
- yearly return wave



Etude d'agitation et de tenue des navires à quai
sur modèle réduit physique en bassin à houle (3D)

ENTREPRISE PORTUAIRE DE CHERCHELL
Client : Groupement Ramboll/Antea group



Période de retour	Houle annuelle		Niveau d'eau (ZH)
	Hs (m)	Tp (s)	
Nord 360°	3,5	10,2	+1,44m
	3,5	10,2	-0,84m
Nord 45°	2,8	9,4	+1,44m
	2,7	9,4	-0,84m
Nord 65°	2,5	9,4	+1,44m
	2,4	9,4	-0,84m
	2,5	9,4	+1,78m*
	2,4	9,4	-0,5m*

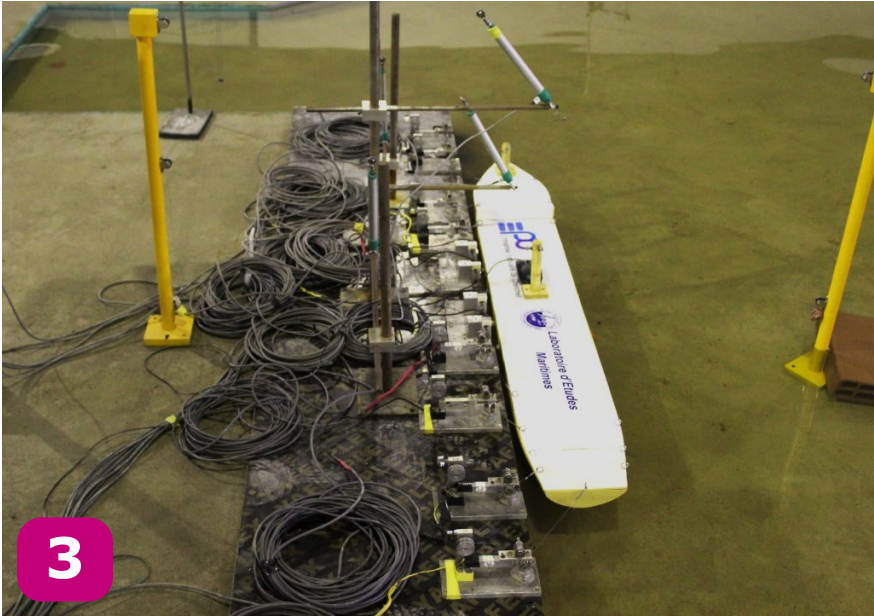
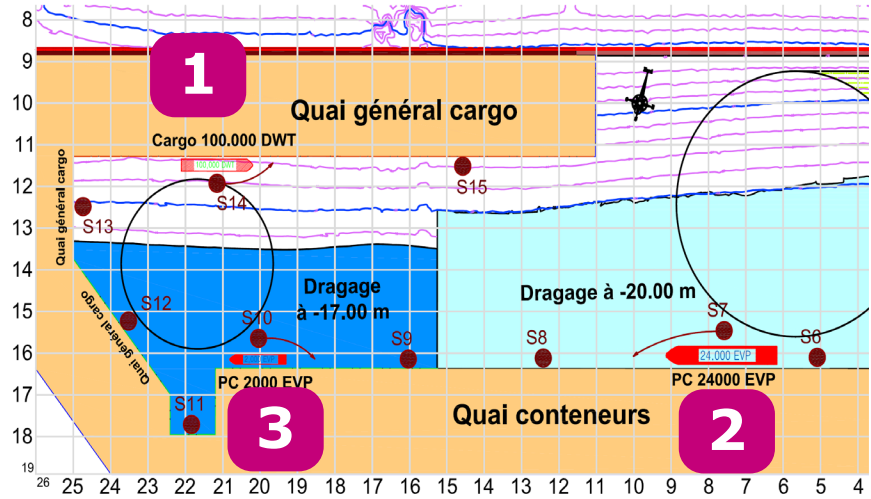


RAMBOLL

anteagroup

PORT AGITATION & MOORING

- Basin: 52.45 x 18.9 x 1.0m
- Scale: 1/135
- yearly return wave
- wind force on ship
- 3 vessels:
 1. 100,000 DWT Cargo
 2. 24,000 TEU
 3. 2,000 TEU

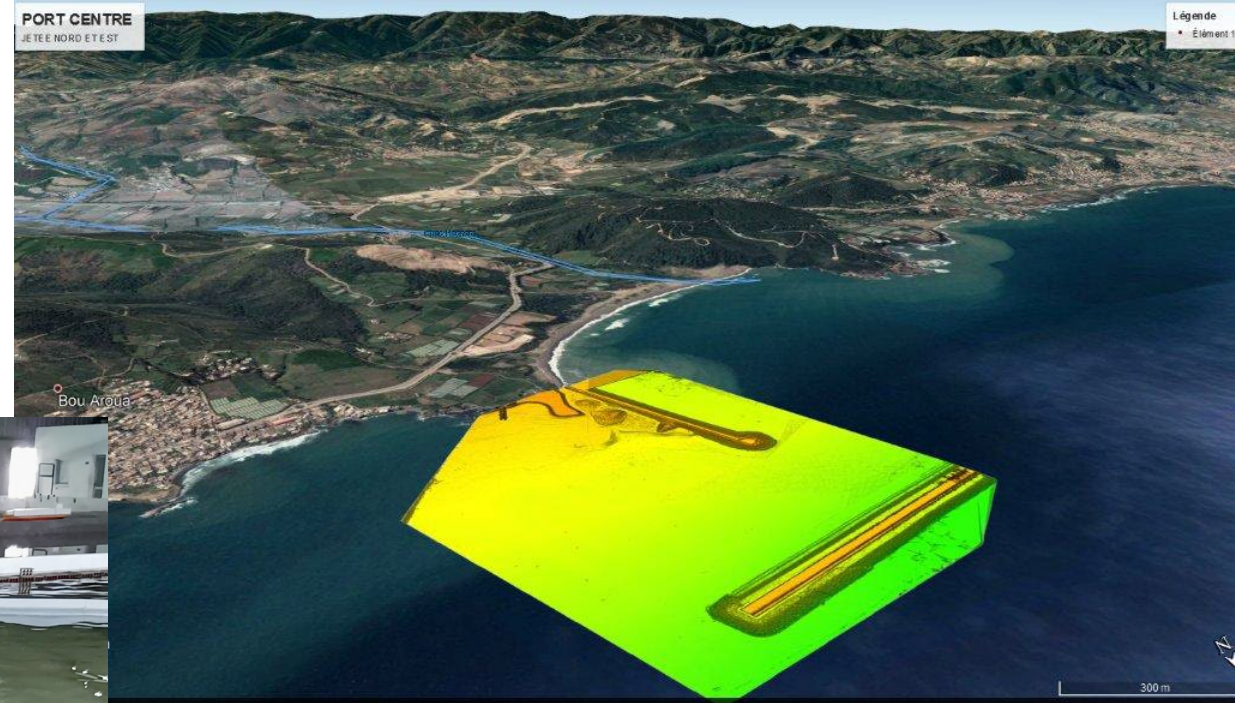
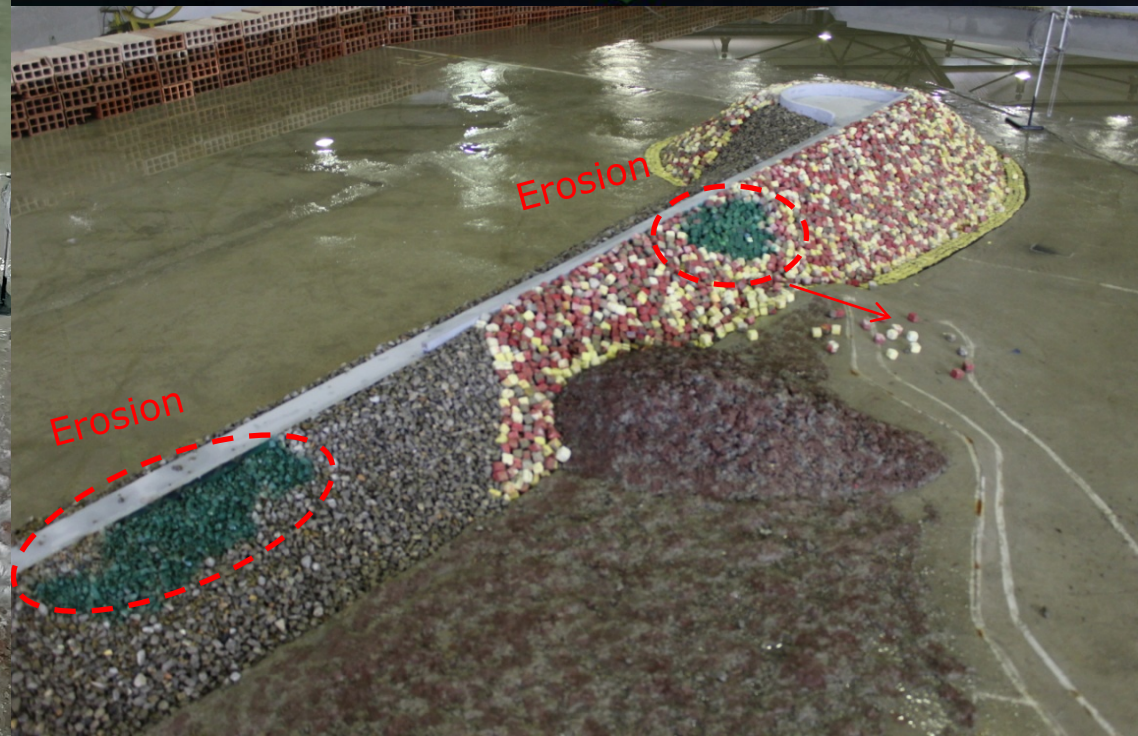
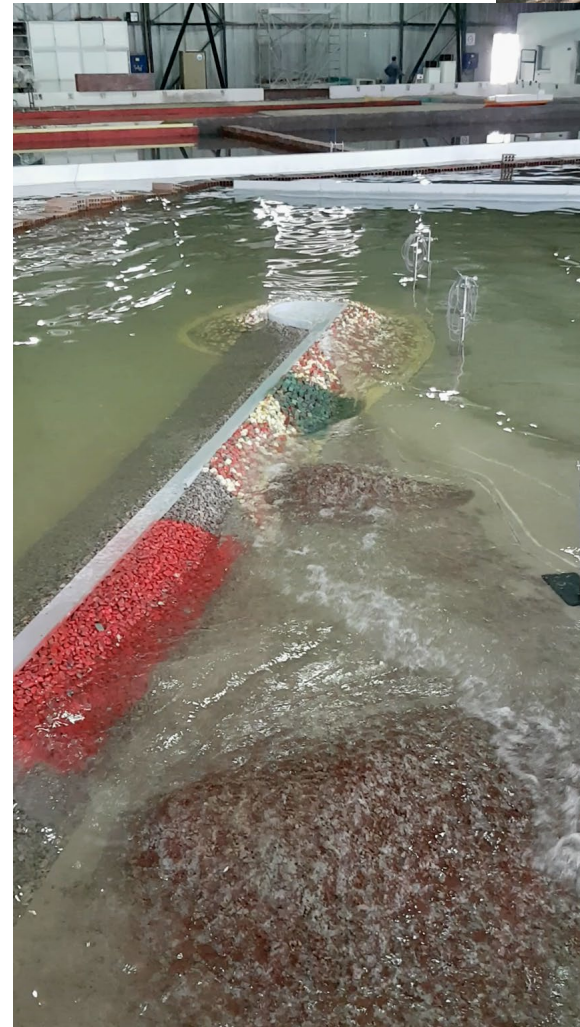


BREAKWATER STABILITY & OVERTOPPING

Optimisation of the easterly revetment

- Basin: 26.0 x 17.0 x 1.0m
- Scale: 1/85
- 100year return wave

Direction	Nord 360°		Nord 45°	
	Hs (m) à l'ouvrage (Digue Nord)	Tp (s)	Hs (m) à l'ouvrage (Digue Est)	Tp (s)
Test n°:1 (40%)	3.04	8,44	2,04	6,74
Test n°:2 (60%)	4.56	10,49	3,06	8,47
Test n°:3 (80%)	6.08	12,10	4,08	9,90
Test n°:4 (100%)	7.60	13,38	5,10	11,11

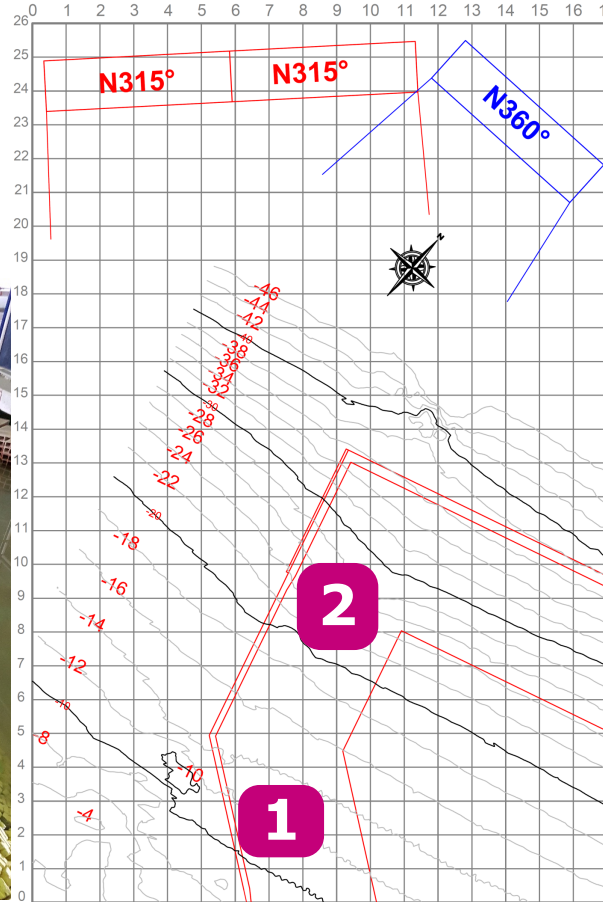
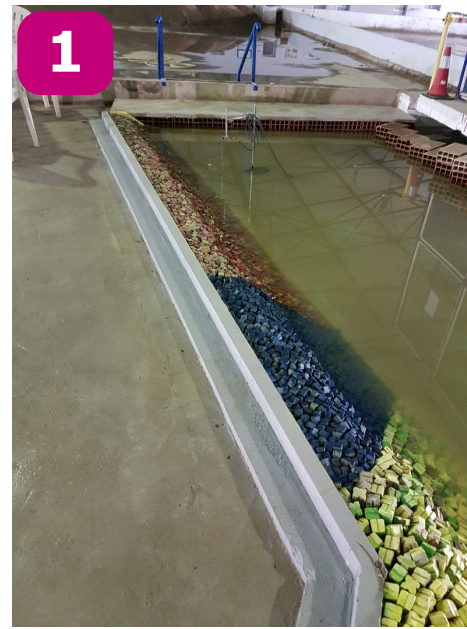
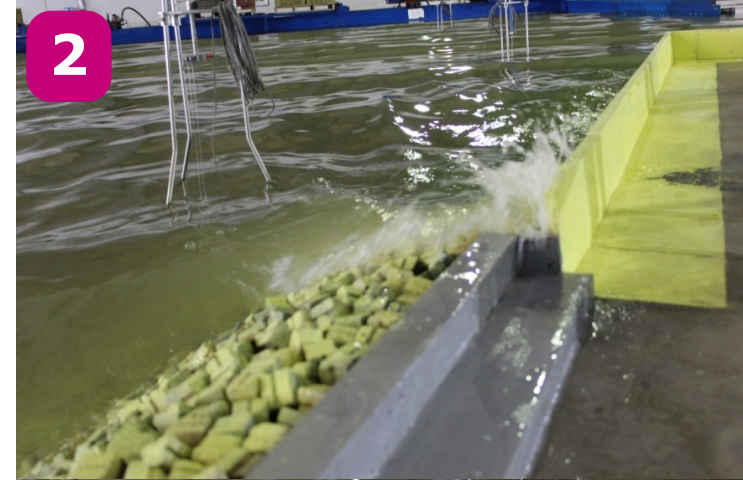


BREAKWATER STABILITY & OVERTOPPING

Optimisation of the westerly breakwater:

1. Reduction of armour layer block size
2. Design of transition from caisson breakwater to revetment

- Basin: 26.0 x 19.0 x 1.0m
- Scale: 1/85
- 100year return wave



Direction	Nord 360°		Nord 315°	
	Hs (m) à l'ouvrage (Digue Nord)	T _D (s)	Hs (m) à l'ouvrage (Digue Ouest)	T _D (s)
Test n°: 1 (40%)	3.04	8,44	3.12	8,56
Test n°: 2 (60%)	4.56	10,49	4.68	10,63
Test n°: 3 (80%)	6.08	12,10	6.24	12,24
Test n°: 4 (100%)	7.60	13,38	7.80	13,53

Thank you for listening

