



Supporting Partner



5 - 8 DECEMBER 2022
DUBAI WORLD TRADE CENTRE

Maritime projects in Dubai – Case study

Gustavo Pereira

5th December 2022



Talks

Geotechnical
& Engineering

Maritime projects in Dubai

Gustavo Pereira – Soletanche Bachy



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Chapters:

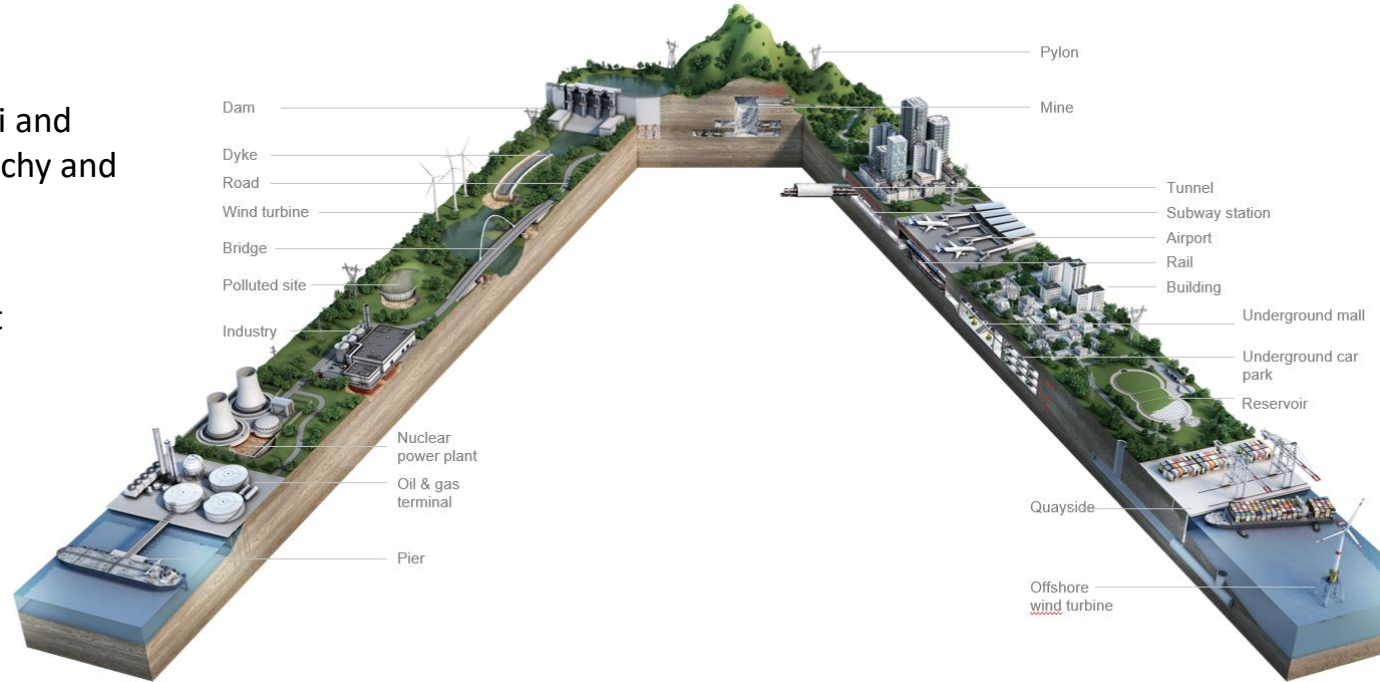
1. Introduction
2. Specificities
3. Past experience
4. Future challenges
5. Closing remarks

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1. Introduction

Soletanche Bachy

- Historical presence in Dubai and UAE through Soletanche Bachy and ZETAS
- ForSHORE brand for all port engineering projects



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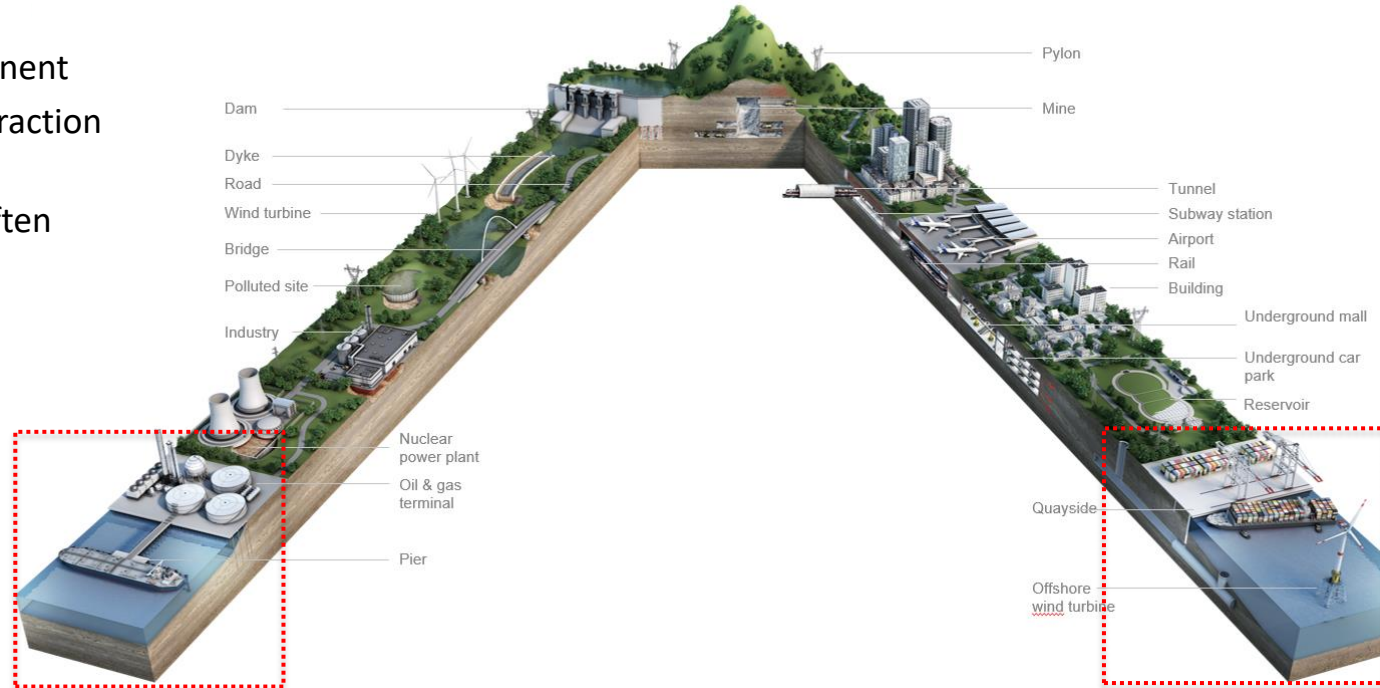


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1. Introduction

Maritime works

- Strong geotechnical component
- Complex soil-structure interaction problems
- Varied mix of techniques often applied (hence complex construction sequences)
- **Geotechnically challenging projects!**



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2. Specificities

Geotechnical context

Typical Dubai geology:

- Marine sediment deposition (Quaternary/Pleistocene sea level change)
- Young, weak rocks: sandstone, calcarenite, calcisiltite... (low UCS)
- Surface sand deposits (often loose)
- Groundwater level close to surface



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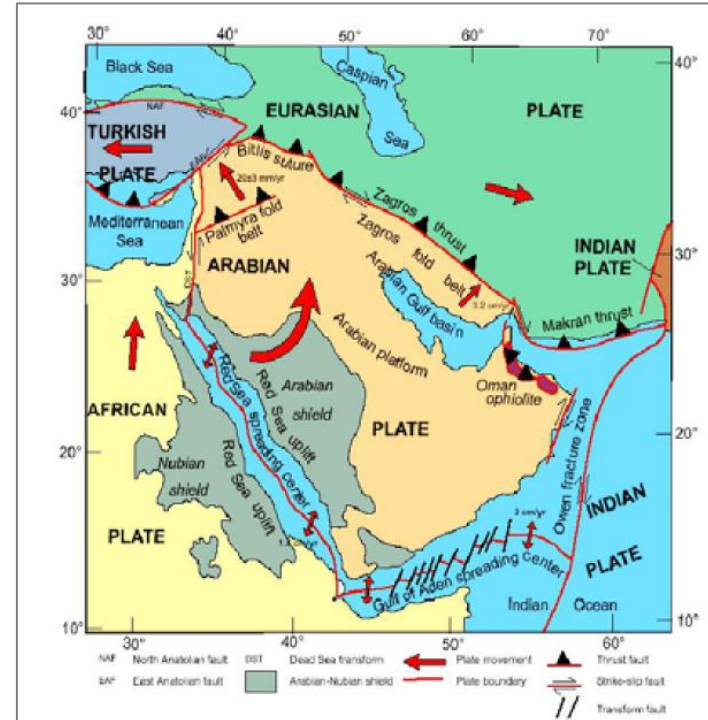
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2. Specificities

Environmental conditions

- Soil aggressiveness (sulphates, corrosion...)
- Thermal effects
- Earthquake: not very high PGA, but... impact on designs is frequent



From Johnson, 1998

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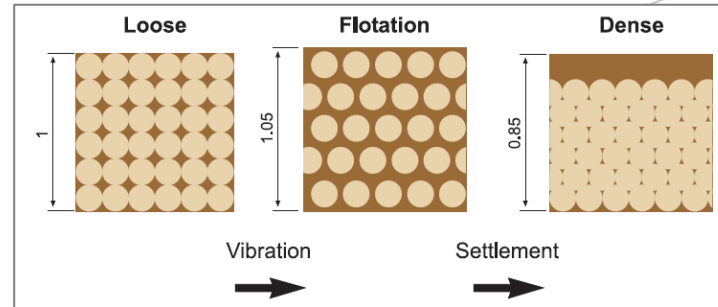
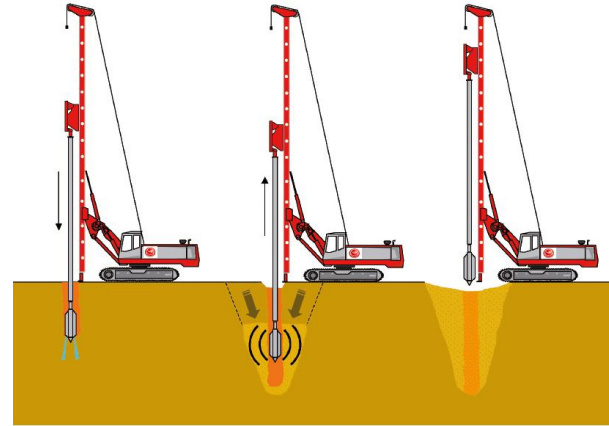
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3. Past experience

Ground improvement & quay walls

Palm Jumeirah, Palm Jebel Ali

- Large scale Ground improvement:
 - Rainbowing (hydraulic backfilling)
 - GI through vibrocompaction :
reduce void ratio -> increase relative density
 - Increase strength & stiffness
 - Decrease liquefaction susceptibility
- -> **Quality Control of GI carbonate sands**



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3. Past experience

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3. Past experience

Ground improvement & quay walls

Diaphragm wall installation

1. Construction of guide walls
2. Pre-excitation (if any)
3. Excavation 1st pass ("piles")
4. Excavation 2nd pass ("piles")
5. "Merlon" excavation
6. Removal of CWS joint
7. Slurry desanding/substitution
8. Installation of cages
9. Concreting



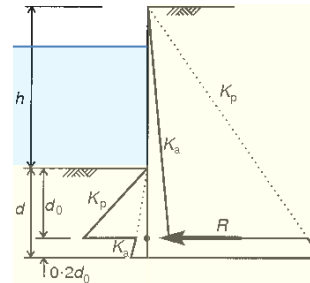
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3. Past experience

Ground improvement & quay walls

Palm Jumeirah

- Central Trunk Underpass
- Canal and Seawalls
- Permanent cantilever Dwalls thickness up to 1200mm
- -> Long term behaviour and serviceability



Adapted from Day, 1999

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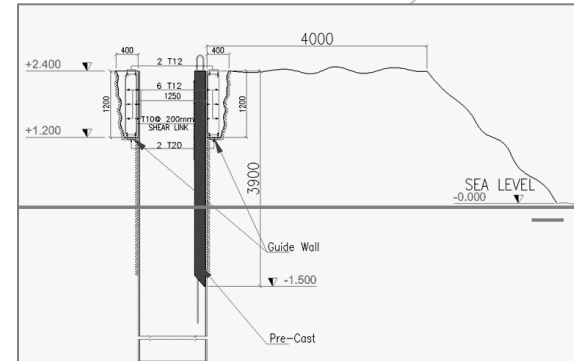
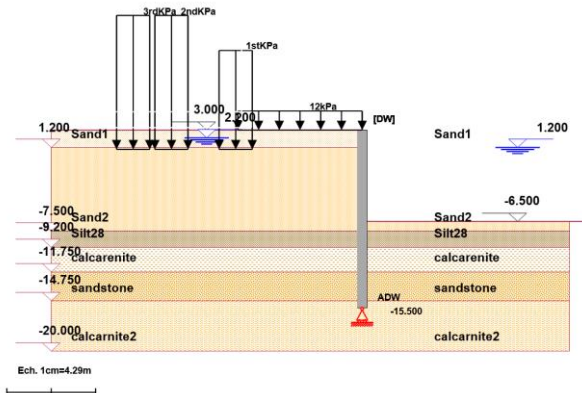
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3. Past experience

Ground improvement & quay walls

New Fishing Port (Abu Dhabi)

- Following previous projects with fascias installed post-excitation (e.g. Palm Jumeirah, Al Raha beach)
- -> **Precast fascia inside Dwall (patented)**



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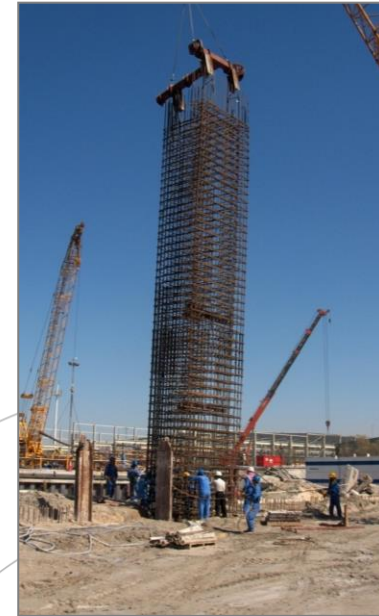
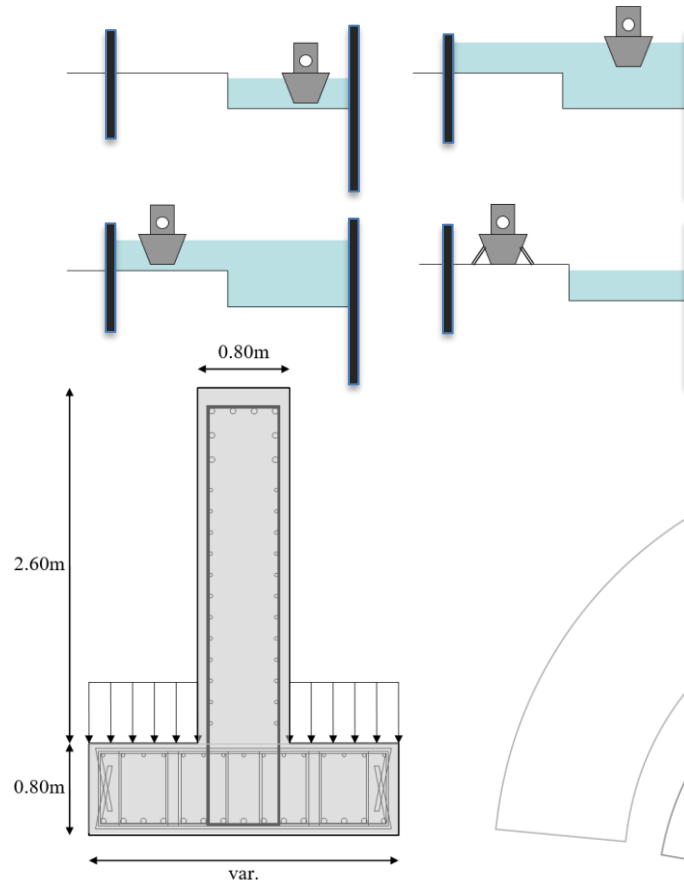
3. Past experience

Ground improvement & quay walls

Safina Shiplift (Dubai Drydocks)

- Vibrocompaction of upper sand
- Anchor piles (against uplift)
- Permanent Dwall alternative solution

- -> Tshape panels for extra bending capacity and stiffness



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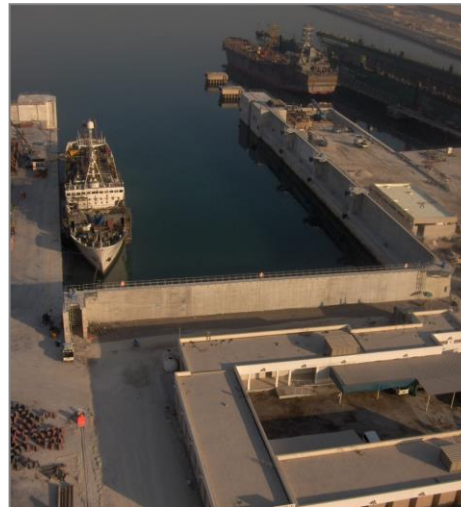
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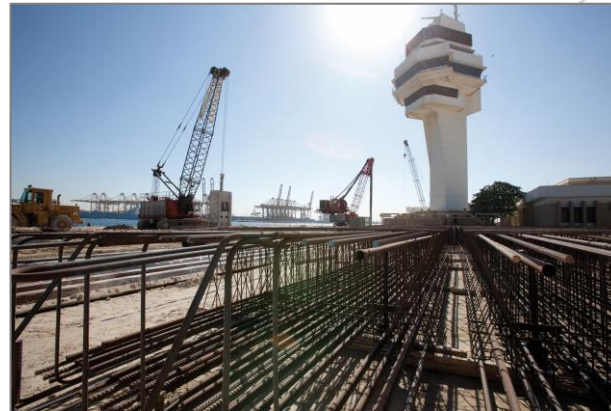
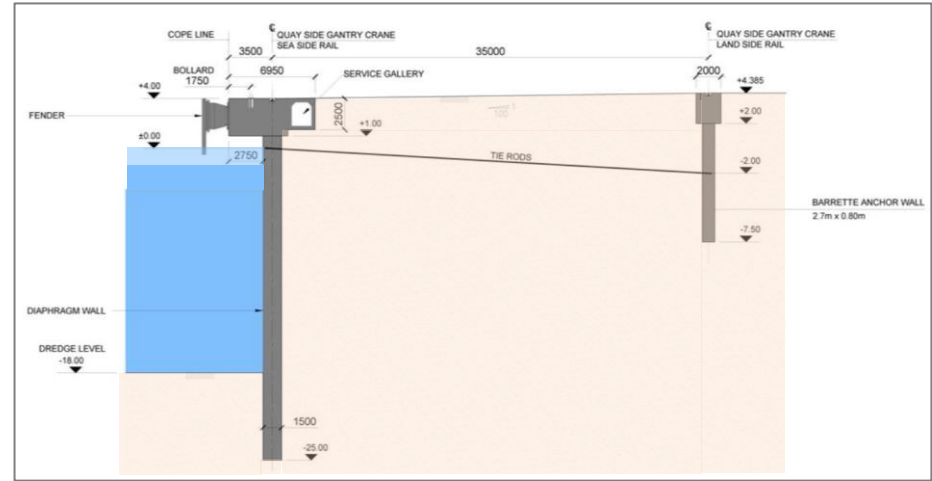
Ground improvement & quay walls

Jebel Ali Container Terminal 3

- Deepwater container quay (-18.0mDMD)
- 33kPa stacking UDL
- Two tiers of seismic events (L1 and L2)
- Vibrocompaction of upper sands
- 1.5m Dwall with 1 level of tiebacks
- -> **discontinuous barrette anchor wall doubles as foundation for rear leg of STS gantry crane**

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3. Past experience

Ground improvement & quay walls

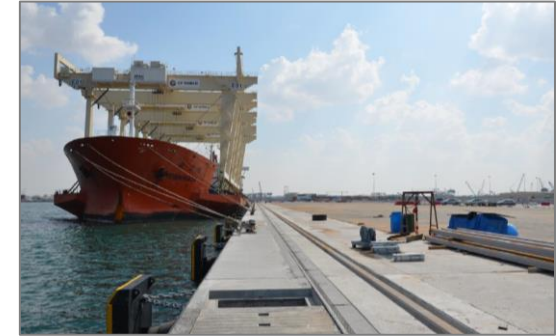
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4. Future challenges

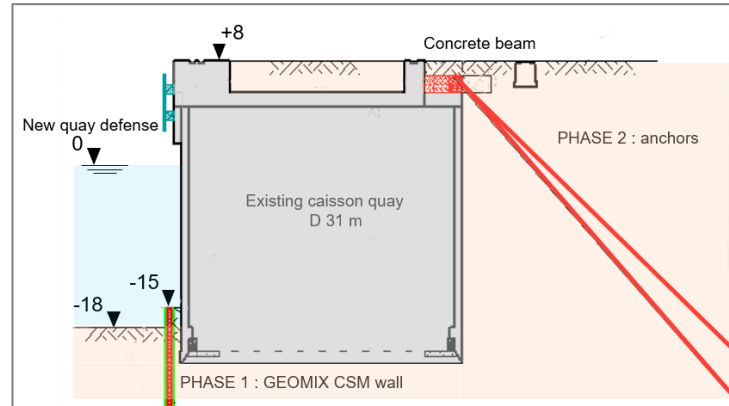
Future proofing of existing quays

Deepening quays:

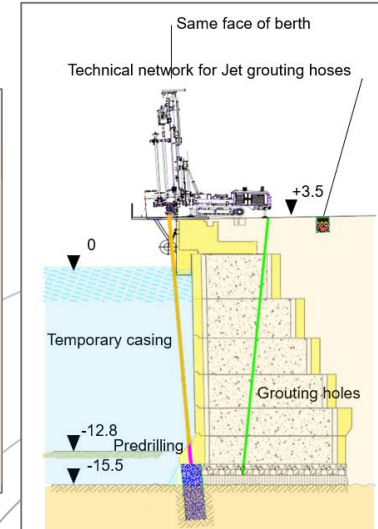
- Deepening quays to increase port capacities:
 - Zeebrugge: 3.0m
 - Reunion Island: 2.7m

Anti-flooding?

Raising quay platforms?



Zeebrugge, Belgium



Reunion Island, France

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4. Future challenges

Sustainable infrastructure

Low carbon solutions EXEGY

- Low CO₂ formulations (for both concrete and grouts) specific for geotechnical works
 - Up to 76% decrease, for Ultra Low Carbon formulations
 - Reduction via alternative binding agents
- Dispelling preconceptions (tech and \$)



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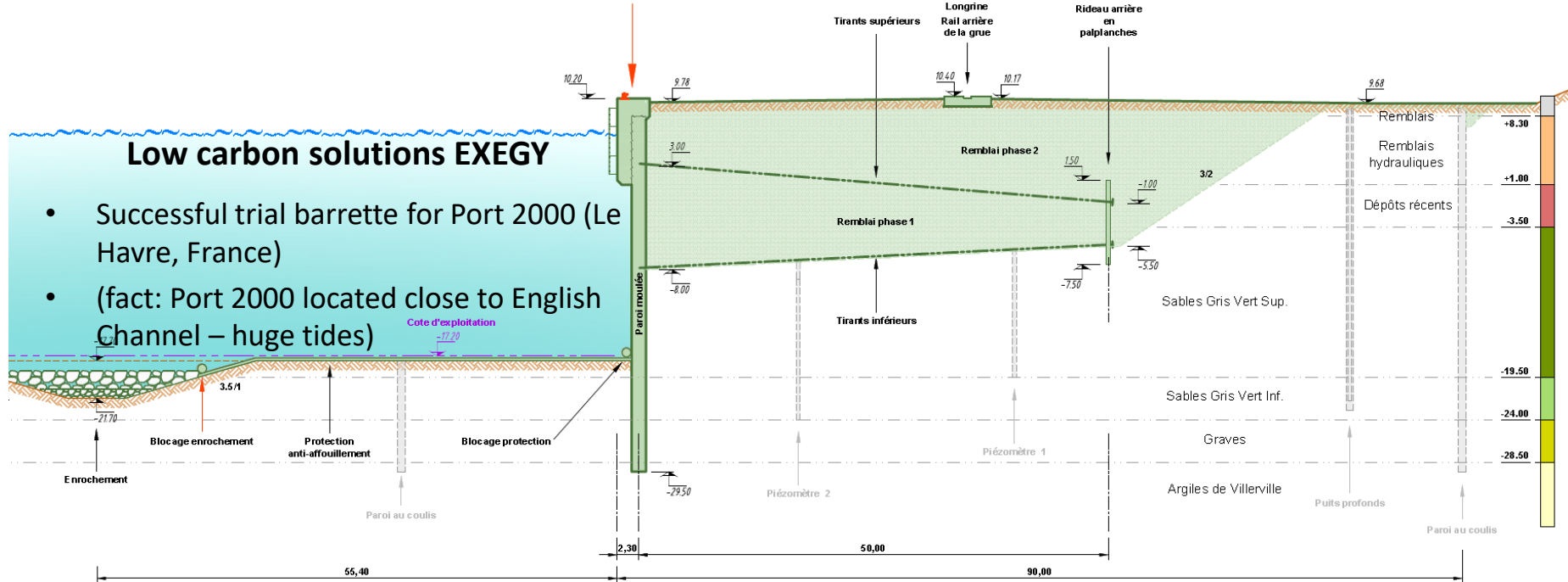
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4. Future challenges

Sustainable infrastructure

Low carbon solutions EXEGY

- Successful trial barrette for Port 2000 (Le Havre, France)
- (fact: Port 2000 located close to English Channel – huge tides)



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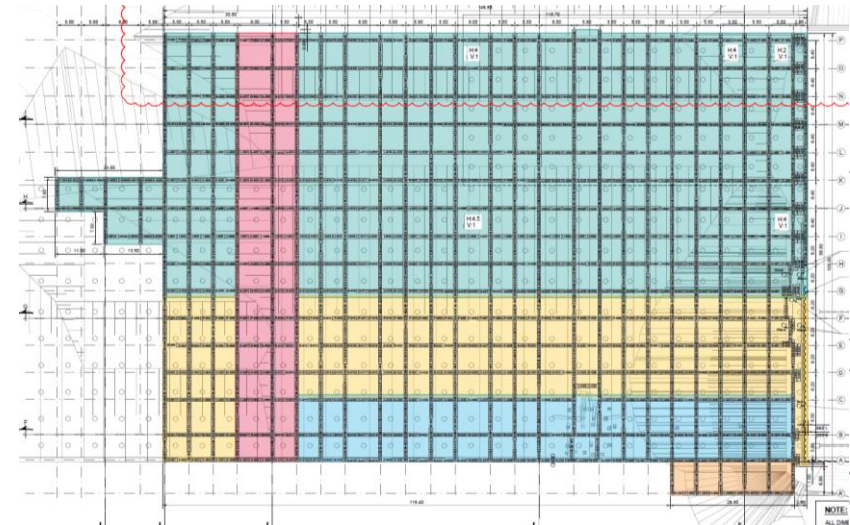
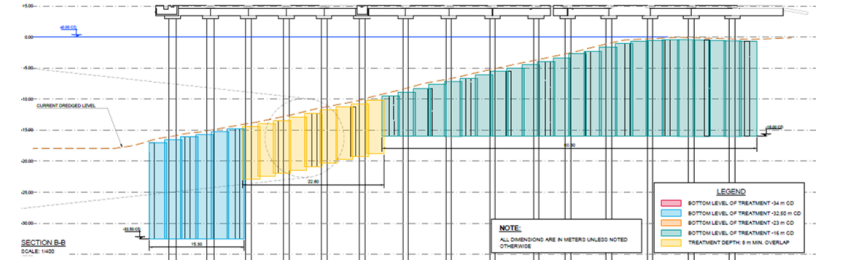
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4. Future challenges

Sustainable infrastructure

Soil as substitute for aggregates

- Maritime CSM (cutter soil mixing)
 - Large scale implementation in Hong Kong Airport's 3rd runway
 - Ongoing LatAm project for underwater slope stabilisation

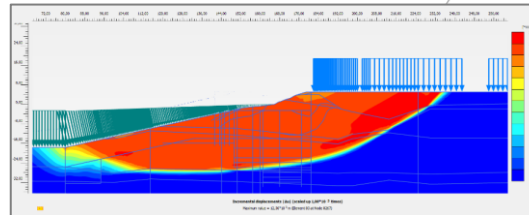
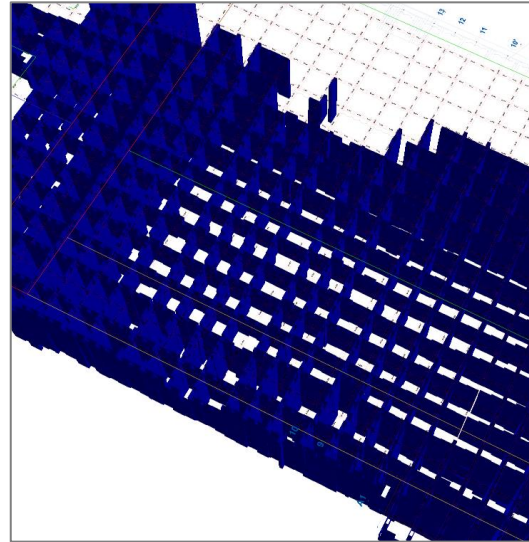


4. Future challenges

Sustainable infrastructure

Soil as substitute for aggregates

- Maritime soil mixing in very seismic (up to $PGA=0.6g$) LatAm project:
 - Seismic slope stability
 - Post-seismic slope stability
 - Liquefaction mitigation
 - (static stability, static settlement limitation)



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4. Future challenges

Green energy

Offshore windfarms

- Offshore windfarm foundations
- Quays for offshore windfarms
 - Very high platform loading (up to 300kPa, e.g. Port La Nouvelle)



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5. Closing remarks



Maritime works – a Geotechnical Engineer’s playground

Dubai maritime references as landmarks for SB group’s innovation and best practice

A challenging future, but a technically interesting one!



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