

Numerical and Experimental Modelling of Plate Anchors for the Foundation of Offshore Platforms

Author: Elena Varela Rodríguez

Director: Jorge Castro González

Codirector: Marina Miranda Manzanares

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Introduction

Introduction

Current situation

The objective is to analyse the behaviour of the interaction soil-anchor of different types of foundations for offshore platforms. There are two active projects:

Analysis of vertical pull-out of plate anchors: numerical modelling and experimental testing

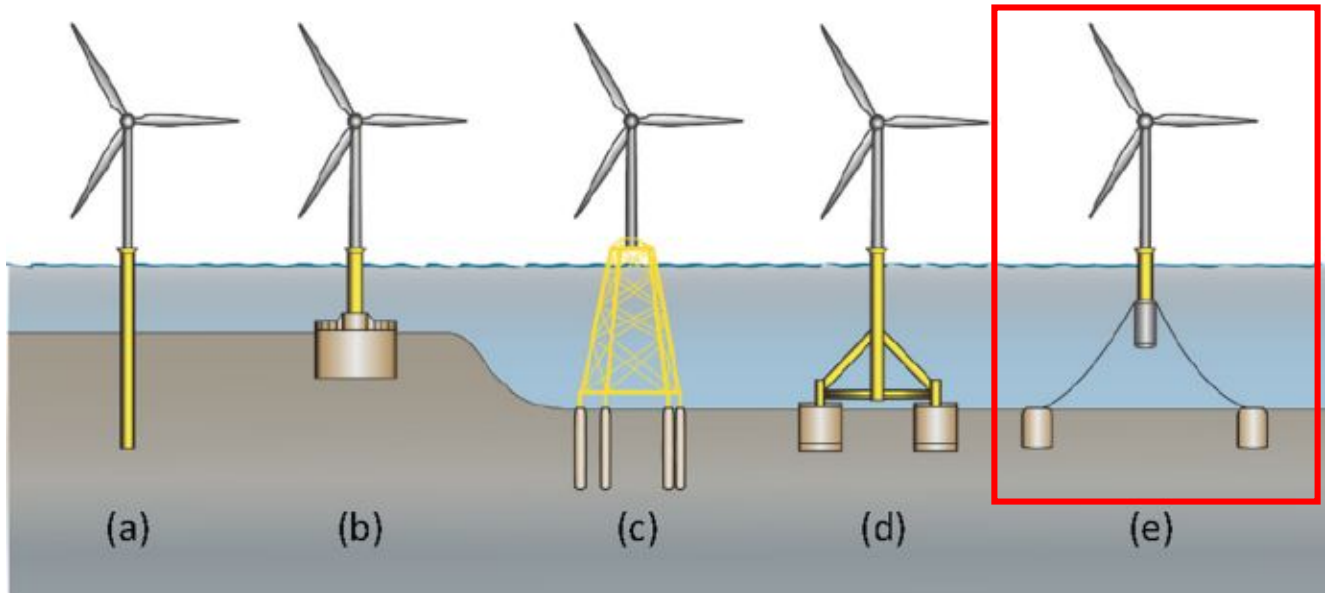
Skills and capabilities

Research projects

SWOT

Future dev.

Conclusions



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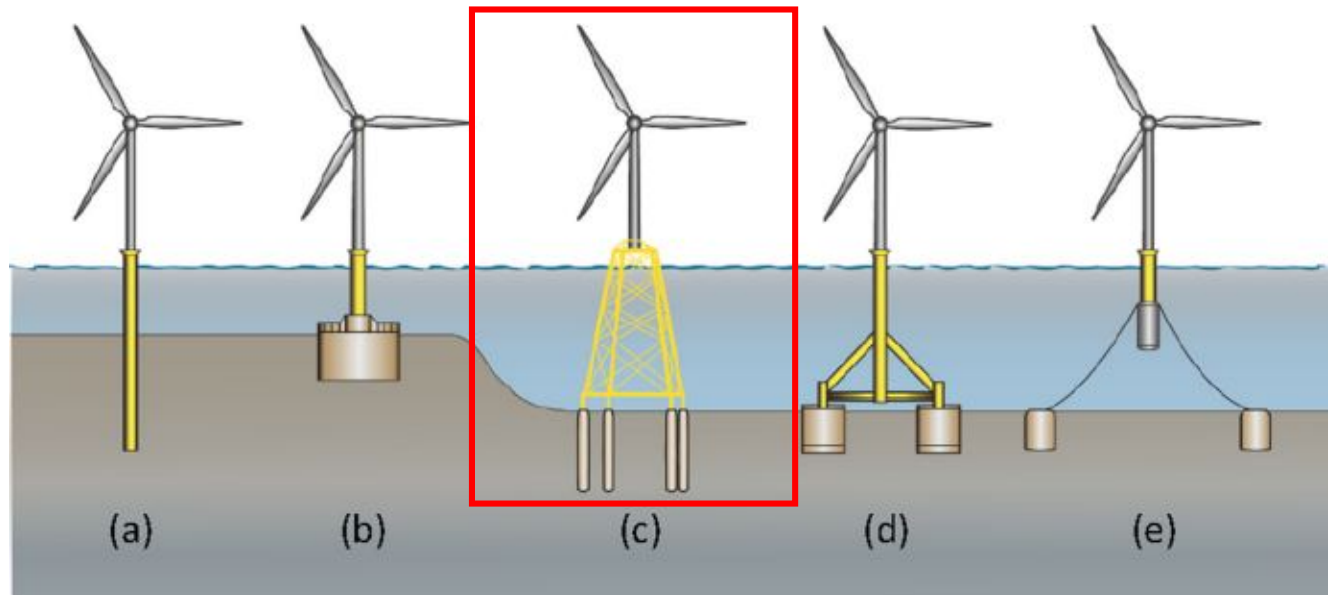
Conclusions

Introduction

The objective is to analyse the behaviour of the interaction soil-anchor of different types of foundations for offshore platforms. There are two active projects:

Analysis of vertical pull-out of plate anchors: numerical modelling and experimental testing

Study of skirt penetration on mud-mats (collaboration with IH Cantabria)



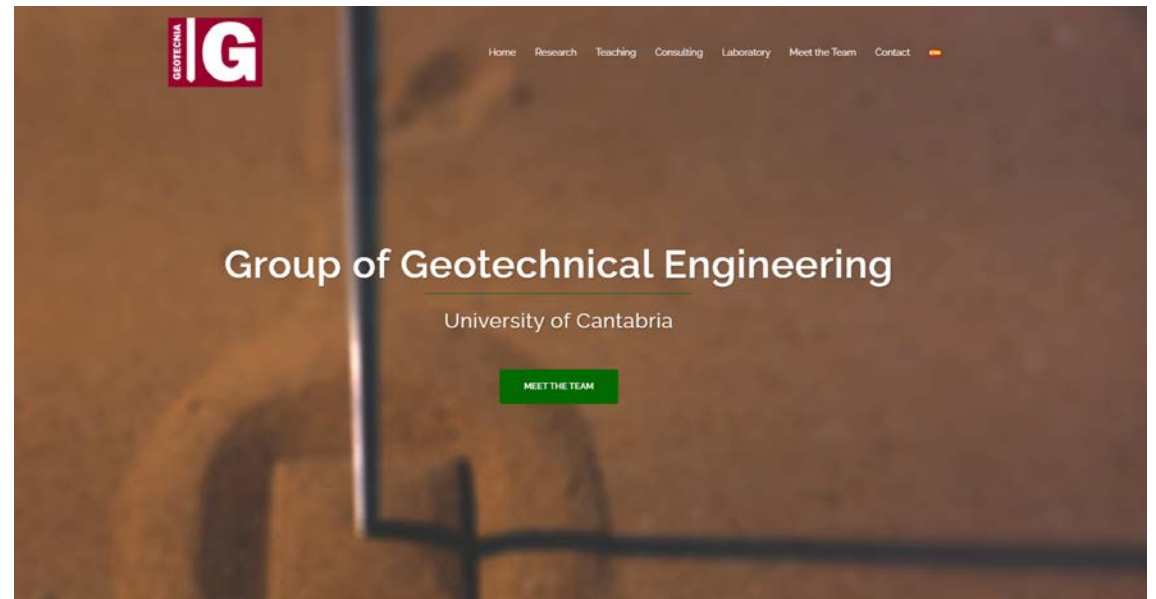
Current situation

Previous research contract:

- State of testing equipment
- Numerical analysis
- Website for the Group of Geotechnical Engineering (www.geotecnia.unican.es)



May 2019
5 month research
contract

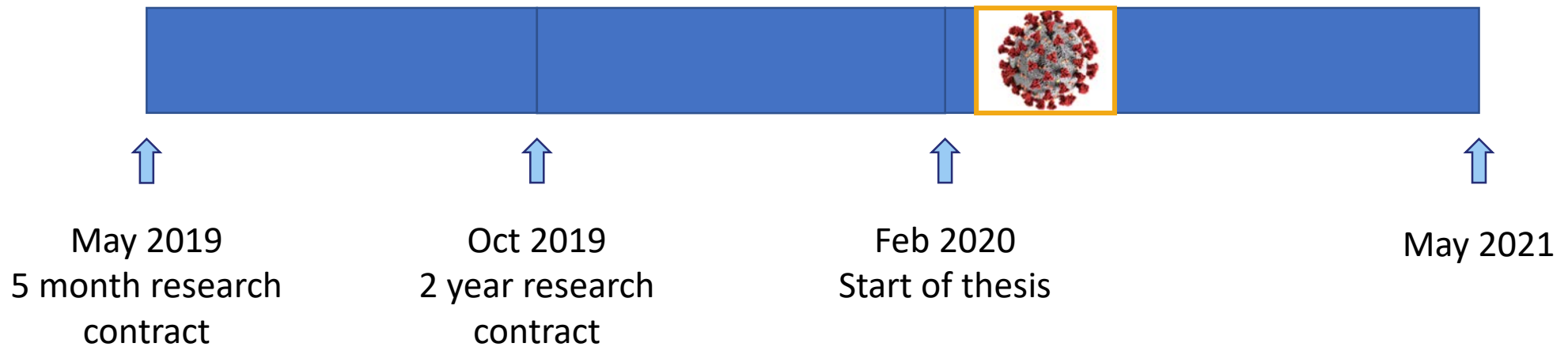


Current situation

Start of thesis: February 2020

- Beginning of experimental testing

Financial support: Research contract with funds from the Spanish Ministry of Economic Affairs and Digital Transformation



- Introduction
- Current situation
- Skills and capacities
- Research projects
- SWOT
- Future dev.
- Conclusions

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Current situation



Skills and capacities



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Conclusions

Skills and capacities

BASIC SKILLS

CB11

Systematic understanding of a field of study and command of the skills and research methods related to the field.

CB12

Skill to conceive, design or create, implement and adopt a substantial process of research or creation.

CB13

Skill to contribute to the enlargement of the knowledge limits through an original research.

CB14

Skill to carry out a critical analysis and assessment and synthesis of new and complex ideas.

CB15

Skill to communicate with the academic and scientific community and with society in general about the scope of knowledge in the ways and languages of common use in the international scientific community.

CB16

Skill to encourage, in academic and professional contexts, the scientific, technological, social, artistic or cultural progress in a society based on knowledge.

CAPACITIES AND PERSONAL ABILITIES

CA01

Cope in context in which there is little specific information.

CA02

Find the key questions to be answered to solve a complex problem.

CA03

Design, create, develop and undertake new and innovative projects in the knowledge scope.

CA04

Work both in teams and individually in an international or multidisciplinary context.

CA05

Integrate knowledge face complexity and formulate judgements with limited information.

CA06

Intellectual criticism and defence of solutions.

Skills and capacities



CB11

Favourable evaluation of the Research Plan throughout the thesis

CB12

Publication in international journals

CA04

International mobility

Introduction



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CB11

PLATE ANCHORS

Experimental vertical pull-out tests:

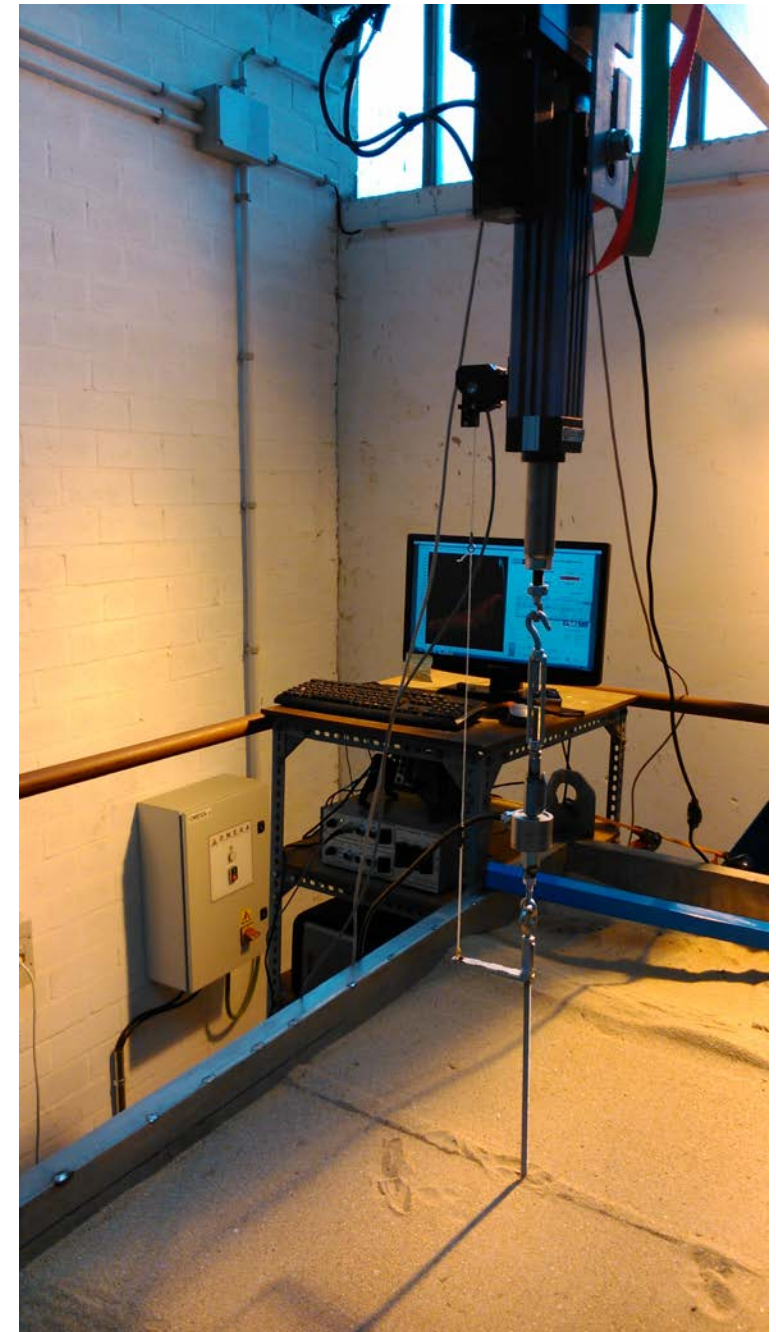
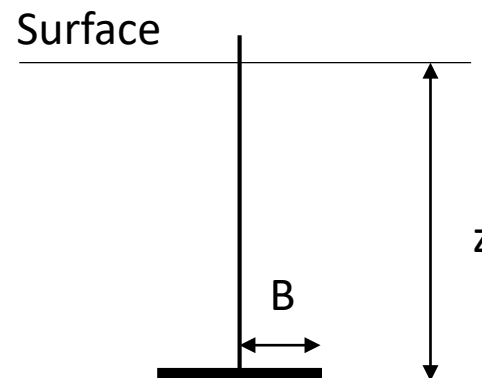
- 4 groups of tests
- Range of depths: $z/B=5$ to 1

	Group 1	Group 2	Group 3	Group 4
Unit weight (kN/m ³)	15.7	16.4	16.6	16.6

CA01

CA03

CA05



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CB11

PLATE ANCHORS

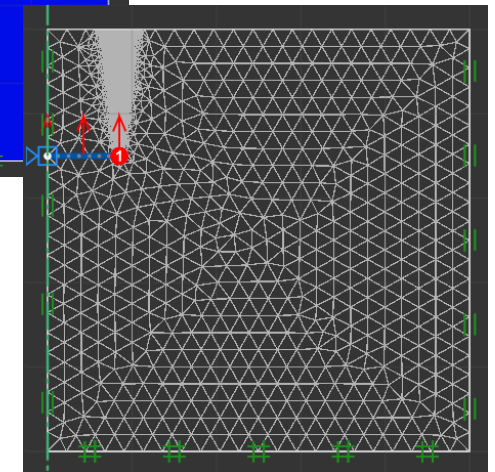
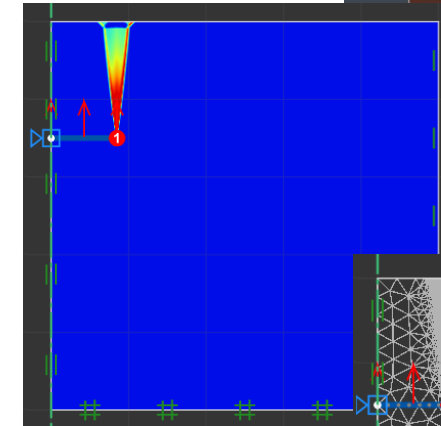
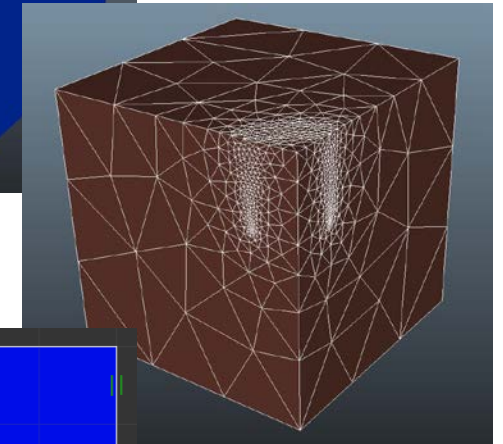
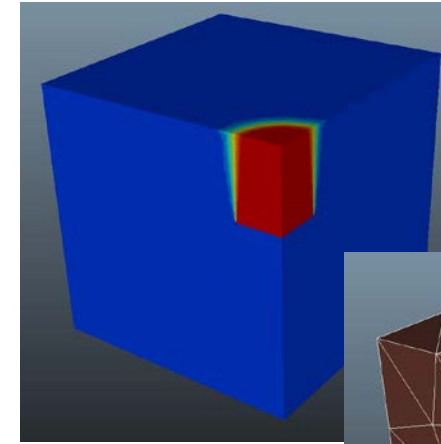
Numerical analysis:

- 2D and 3D
- Range of depths: $z/B=1$ to 100
- Square and circular shapes

CA01

CA03

CA05



Research projects

CB11

SKIRTS

Collaboration with the Hydraulics Institute of Cantabria:

- Objective: to study the penetration and sliding resistance of mud-mats (temporary foundation prior to the installation of piles)

CA01

CA03

CA05



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SKIRTS

Collaboration with the Hydraulics Institute of Cantabria:

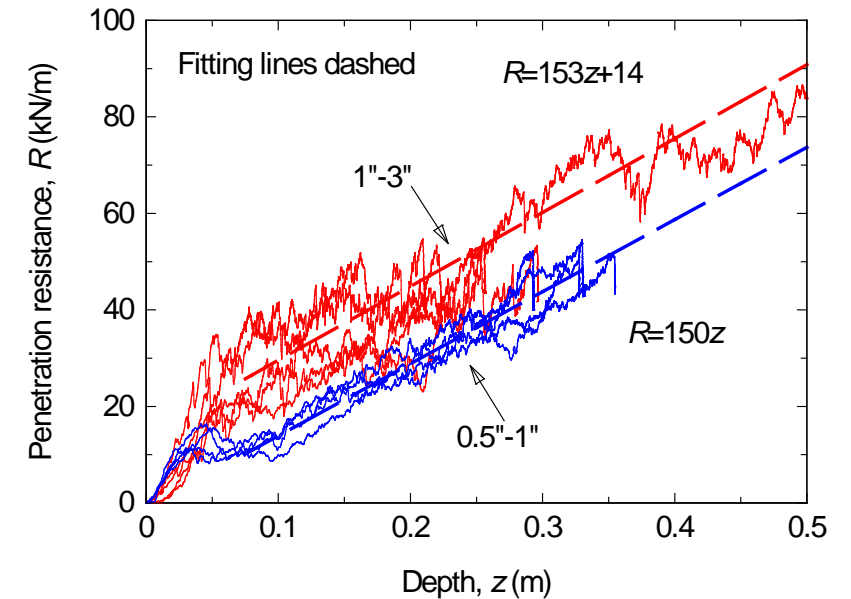
- Objective: to study the penetration and sliding resistance of mud-mats (temporary foundation prior to the installation of piles)
- Experimental testing done:
 - 1:1 scale
 - Skirts: two thicknesses – 15 mm and 80 mm
 - Two gravels – $D_{50} = 25$ mm and 50 mm



CA01

CA03

CA05



Introduction



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CB11

SKIRTS

Laboratory tests done at the Group of Geotechnical Engineering:

- Small-scale tests, similar to the ones done at IH Cantabria
- Various ratios t/D_{50}

CA01

CA03

CA05



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CB11

SKIRTS

Laboratory tests done at the Group of Geotechnical Engineering:

- 5 steel skirts of different thicknesses
- 2 materials: gravel and sand

CA01

CA03

CA05

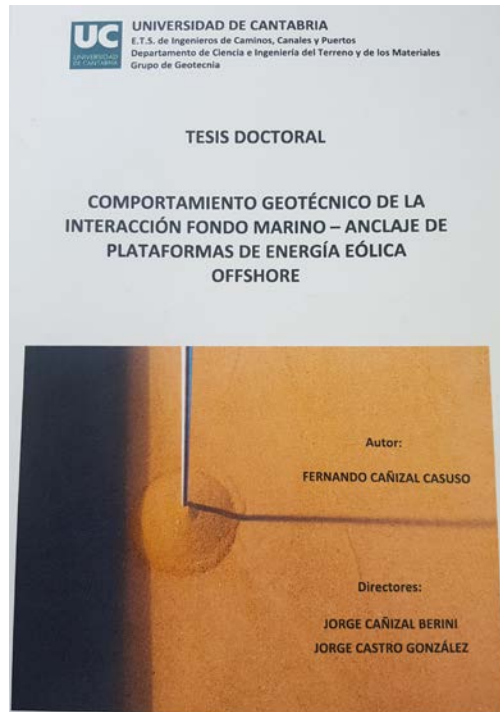


SWOT Analysis



SWOT Analysis

Existing equipment
and test results
(Cañizal F., 2017)



Strengths

Weaknesses

Opportunities

Threats

Introduction

Current
situation

Skills and
capacities

Research
projects

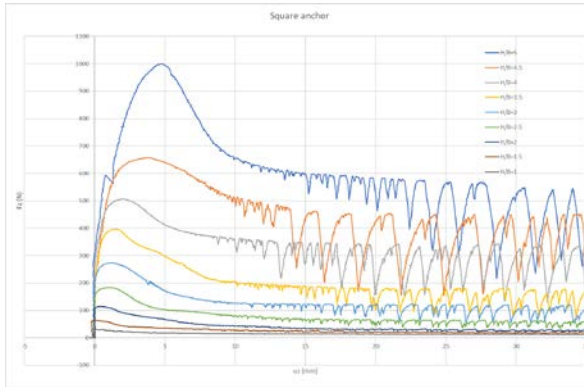
SWOT

Future dev.

Conclusions

SWOT Analysis

Promising results

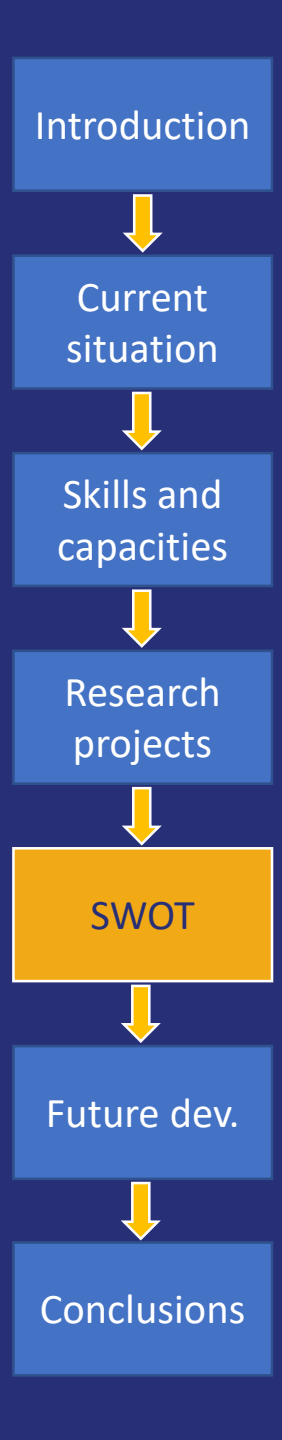


Strengths

Weaknesses

Opportunities

Threats



SWOT Analysis

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Skills and capacities



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SWOT

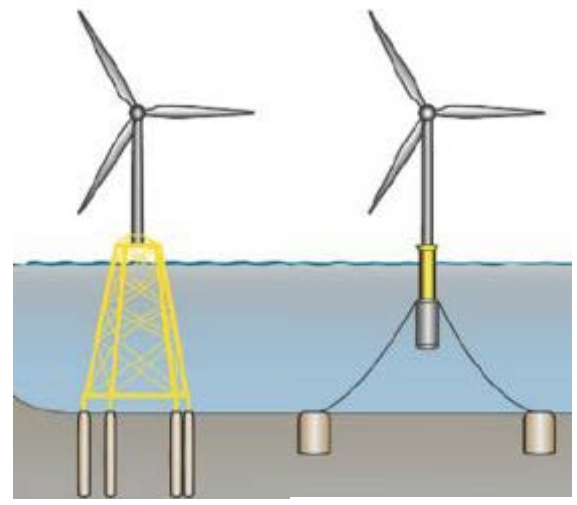


Future dev.



Conclusions

Research of two types of foundations



Strengths

Weaknesses

Opportunities

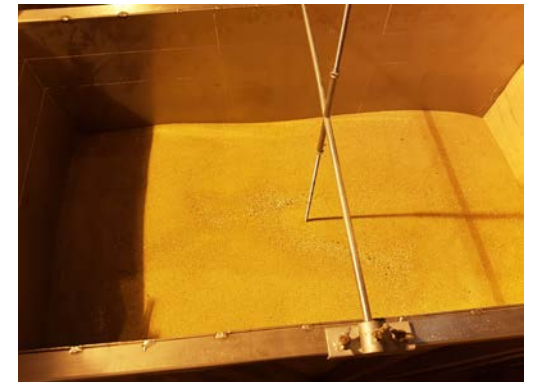
Threats

SWOT Analysis

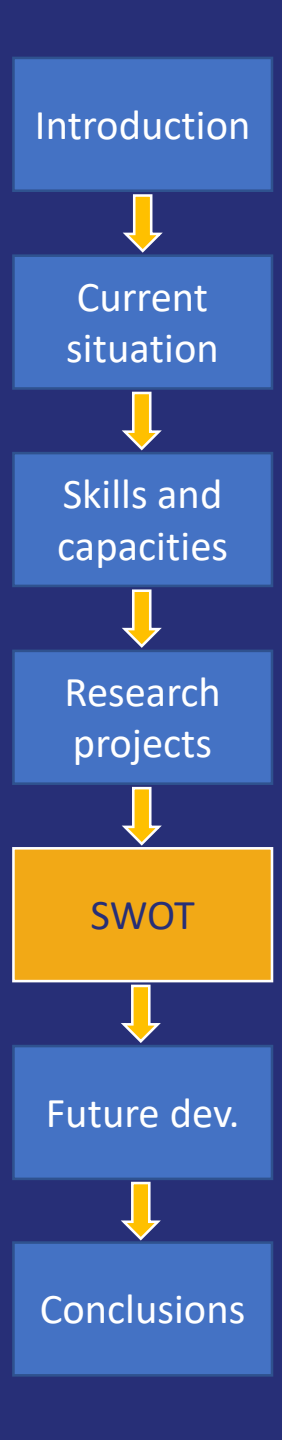


Vertical pull-out tests

- Time and physical effort
- Sand density



SWOT Analysis



Experimental testing:
not much previous
data or publications



SWOT Analysis

Introduction



Current situation



Skills and capacities



Research projects



SWOT



Future dev.



Conclusions

Strengths

Weaknesses

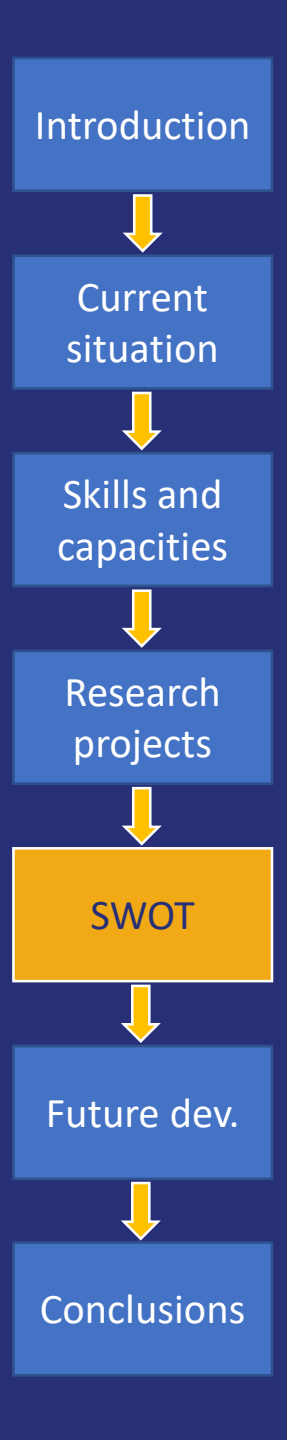
Opportunities

Threats

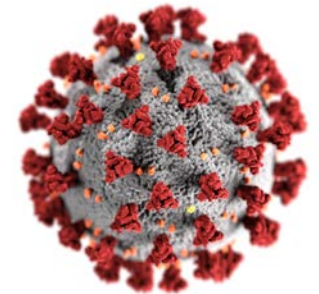
Research project with IH Cantabria led to new laboratory campaign



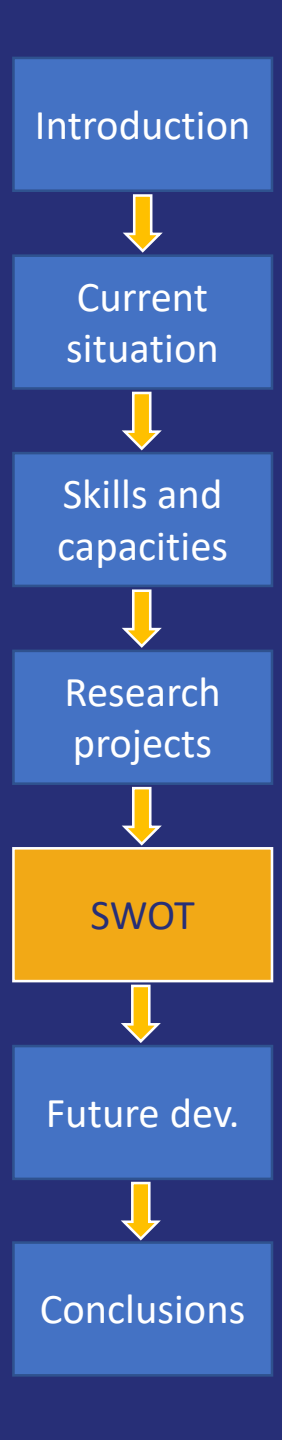
SWOT Analysis



COVID19 lockdowns



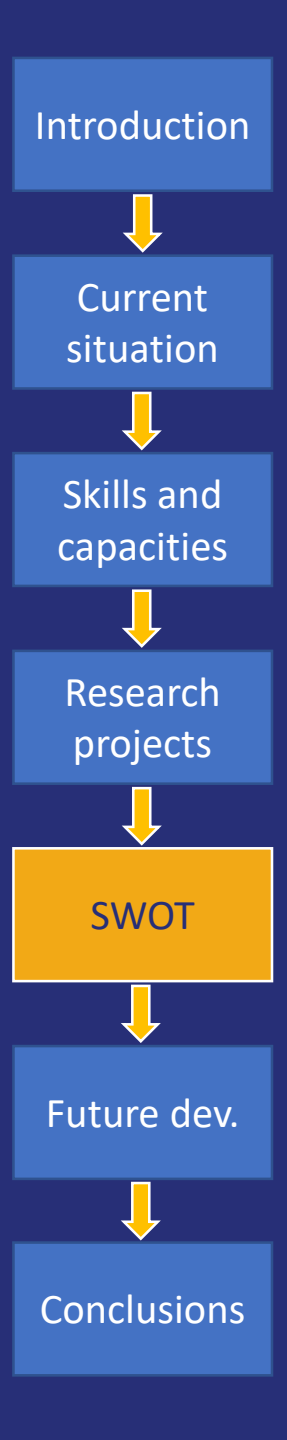
SWOT Analysis



Difficult interpretation of experimental results



SWOT Analysis



Time



Introduction



Current situation



Skills and capacities



Research projects



SWOT



Future dev.



Conclusions

Future development

Laboratory campaigns

Currently preparing the skirt laboratory tests

More repetitions of vertical pull-out tests



Introduction



Current situation



Skills and capacities



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SWOT



Future dev.



Conclusions

Future development

Publications and communications

Two papers under preparation with the collaboration of IH Cantabria:

- *Full-scale tests of skirt penetration resistance in gravel for offshore wind structures*
- *Penetration resistance and sliding capacity of skirted mud mat foundations in gravel for offshore jackets*

CB12

CB13

CB15

CB16

Congresses

- **XI Simposio Nacional de Ingeniería Geotécnica** – Mieres, may 2020 (postponed for 2022). Paper: *Capacidad de tiro de anclas planas en arcilla mediante análisis límite con elementos finitos.*

CA02

Introduction



Current situation



Skills and capacities



Research projects



SWOT



Future dev.



Conclusions

Future development

Publications and communications

Two papers under preparation with the collaboration of IH Cantabria:

- *Full-scale tests of skirt penetration resistance in gravel for offshore wind structures*
- *Penetration resistance and sliding capacity of skirted mud mat foundations in gravel for offshore jackets*

CB12

CB13

CB15

CB16

Congresses

- **XI Simposio Nacional de Ingeniería Geotécnica** – Mieres, may 2022 (postponed for 2022). Paper: *Capacidad de tiro de anclas planas en arcilla mediante análisis límite con elementos finitos*

CA02

International mobility

Currently searching for an appropriate research group and means of funding.

CA04

Future development

Compulsory multidisciplinary training - EDUC

Basic training – almost completed

Advanced training – halfway completed



Introduction



Current situation



Skills and capacities



Research projects



SWOT



Future dev.



Conclusions

Conclusions

- The COVID19 lockdown halted significantly the progress of the experimental tests and delayed the initial work plan. It also delayed the participation in congresses.
- The results of the numerical analyses may lead to a publication.
- The results of the experimental testing done in collaboration with IH Cantabria will lead to two publications.
- The accomplishment of basic and advanced skills is in progress.
- An international mobility is expected, however no precise date or location has been selected.

Thank you for
your attention

