



Pile Foundation Prototype Execution and Applicability for Scandinavia

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Checked by:
Approved by:



AGENDA

1. NABRALIFT INTRODUCTION

- Nabralift Technology
- Nabralift 160m Tower Prototype

2. NABRALIFT FOUNDATION PORTFOLIO

- Foundation Alternatives
- Adaptation to Soil Characteristics

3. NABRALIFT PILE FOUNDATION DESIGN

- Pile Foundation Design Basis
- Cost Savings

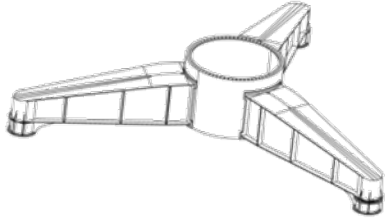
4. PILE FOUNDATION IN COLD CLIMATES

- Advantages

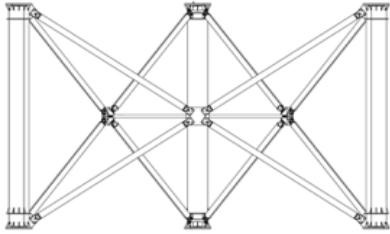
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NABRALIFT® INTRODUCTION Nabralift Description

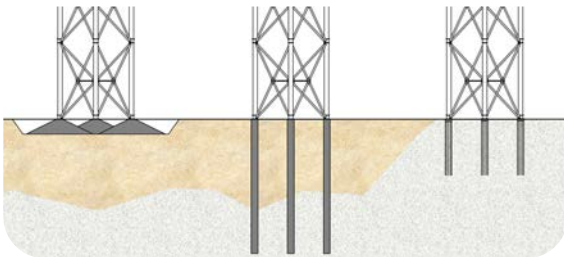
Tower Transition



Framed Structure



Foundation





1

NABRALIFT® INTRODUCTION

Nabralift Description

Video

1

NABRALIFT® INTRODUCTION Nabralift Description



Ultra Low Cost

Foundation / Tower Components

Logistics / Assembly



Minimum Logistics

Sized for Standard Containers

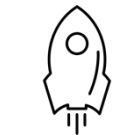
Optimum Packaging



Self Erection

No Large Cranes

Low Occupation of Small Cranes



Fast Assembly

Self-Erection in 3 days / Prefab Found.

Higher Wind Speeds for Erection



Easy Integration

Soft-Stiff for HH>180m

Standard Interface



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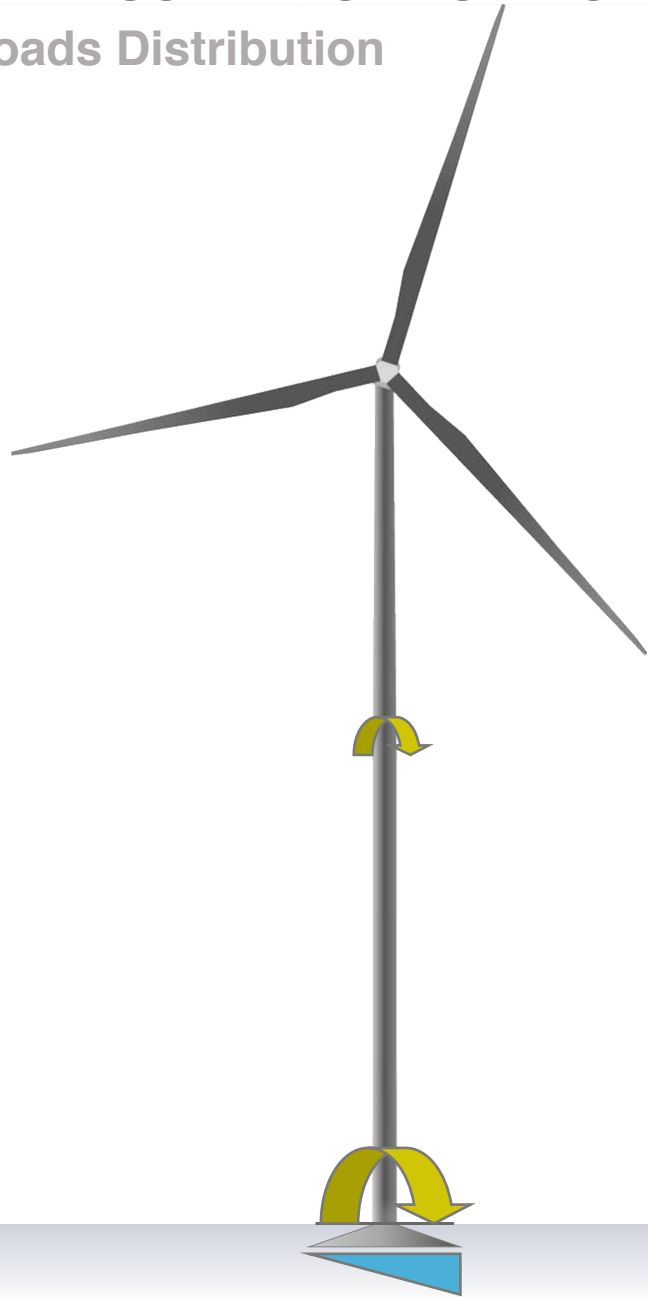
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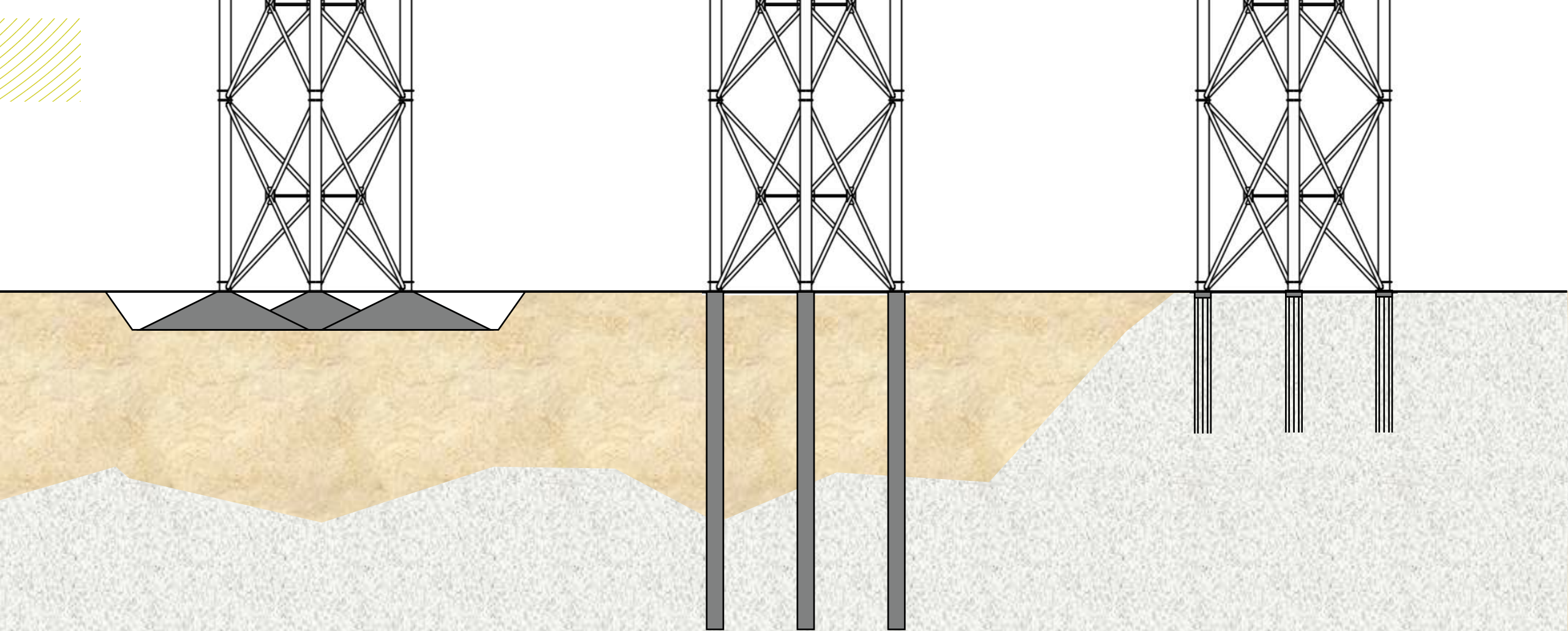
- Advantages



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NABRALIFT® FOUNDATION PORTFOLIO Internal Loads Distribution





Foundation Portfolio



Gravitational Foundation
Standard Wind Solution

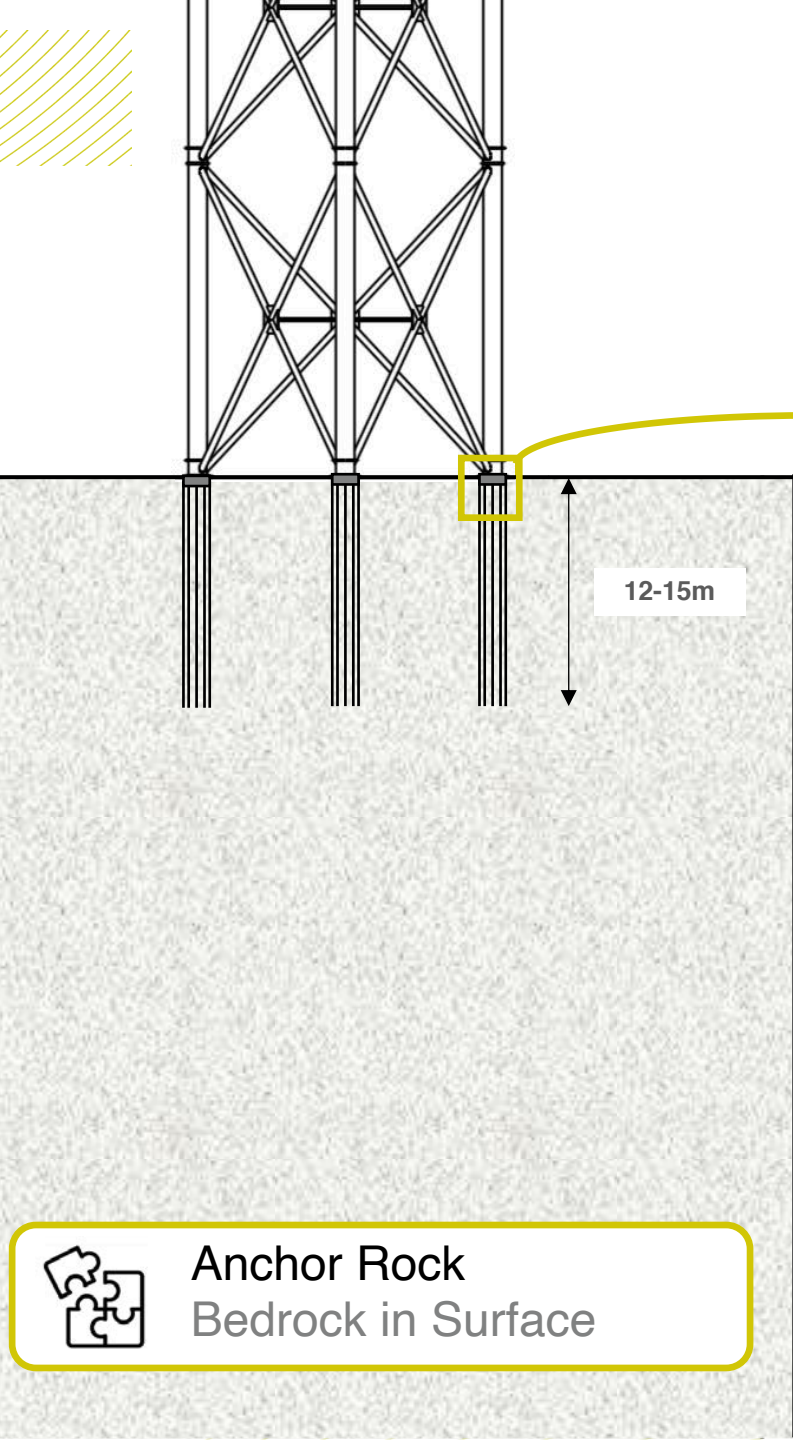


Piled Foundations
Standard Soil



Anchor Rock
Bedrock in Surface

Deep Foundations
Fast & Disruptive Cost



Technology Basis

- Solution for Wind Turbines
- Optimized for Nabralift



Fast Solution

1 week / foundation

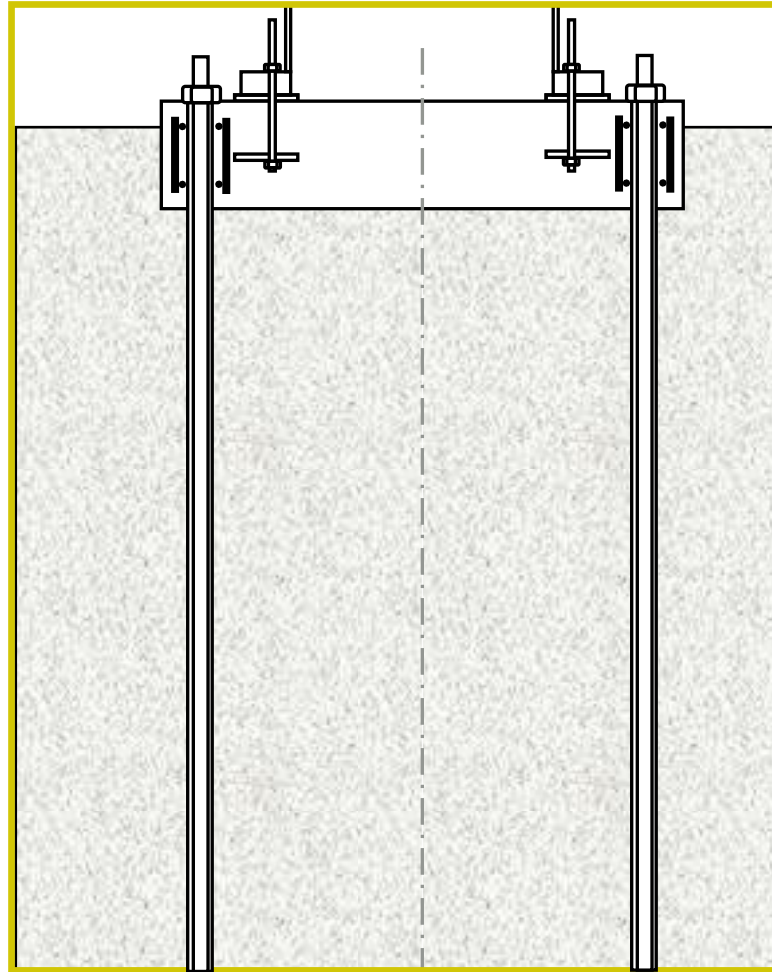


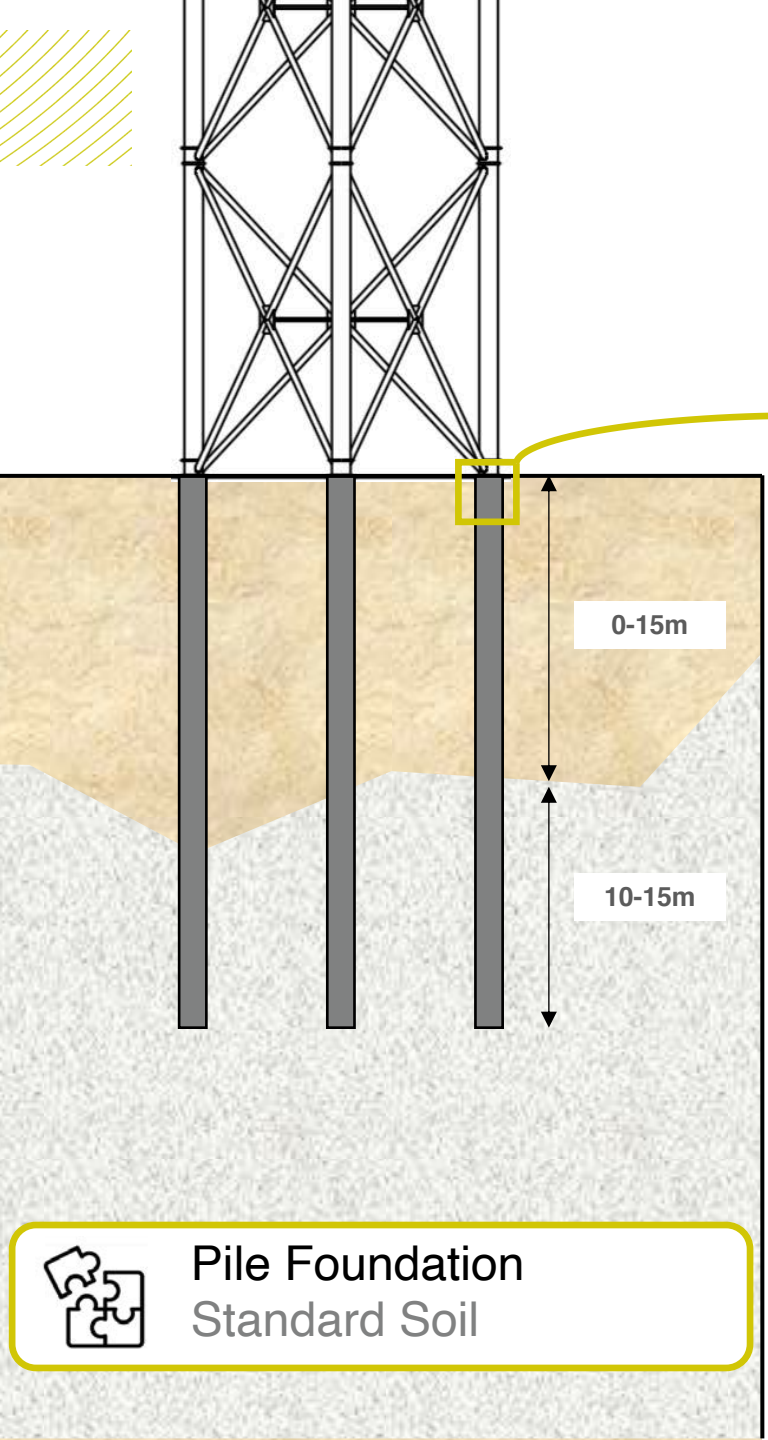
Minimum Cost for Hard Rock

-50% vs wind rock found.



Anchor Rock
Bedrock in Surface





Technology Basis

- Design: offshore jackets
- Process/Cost: civil works



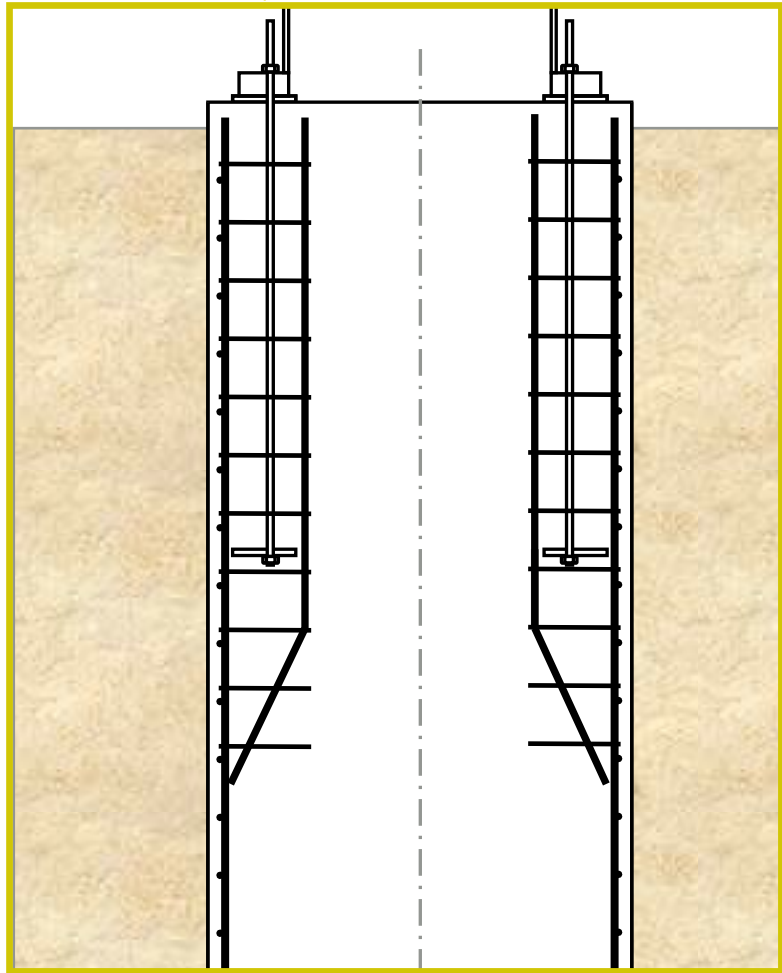
Fastest Solution
4 days / foundation



Minimum Cost
-60% vs std wind foundations

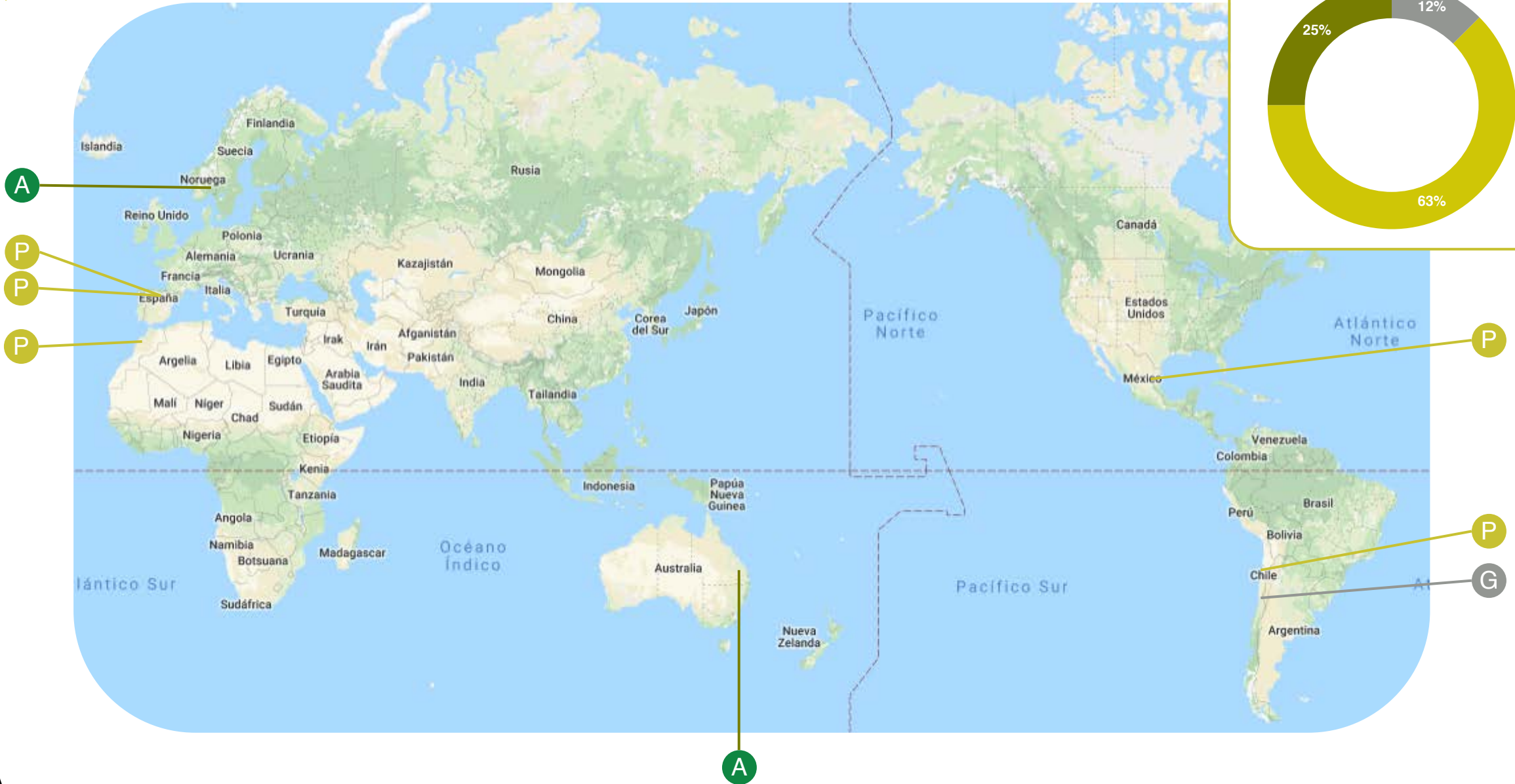
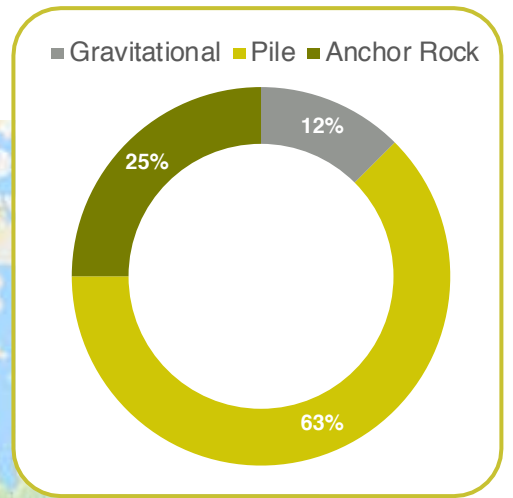


Pile Foundation
Standard Soil



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NABRALIFT® FOUNDATION PORTFOLIO Applicability as per Real Geotechnical Studies





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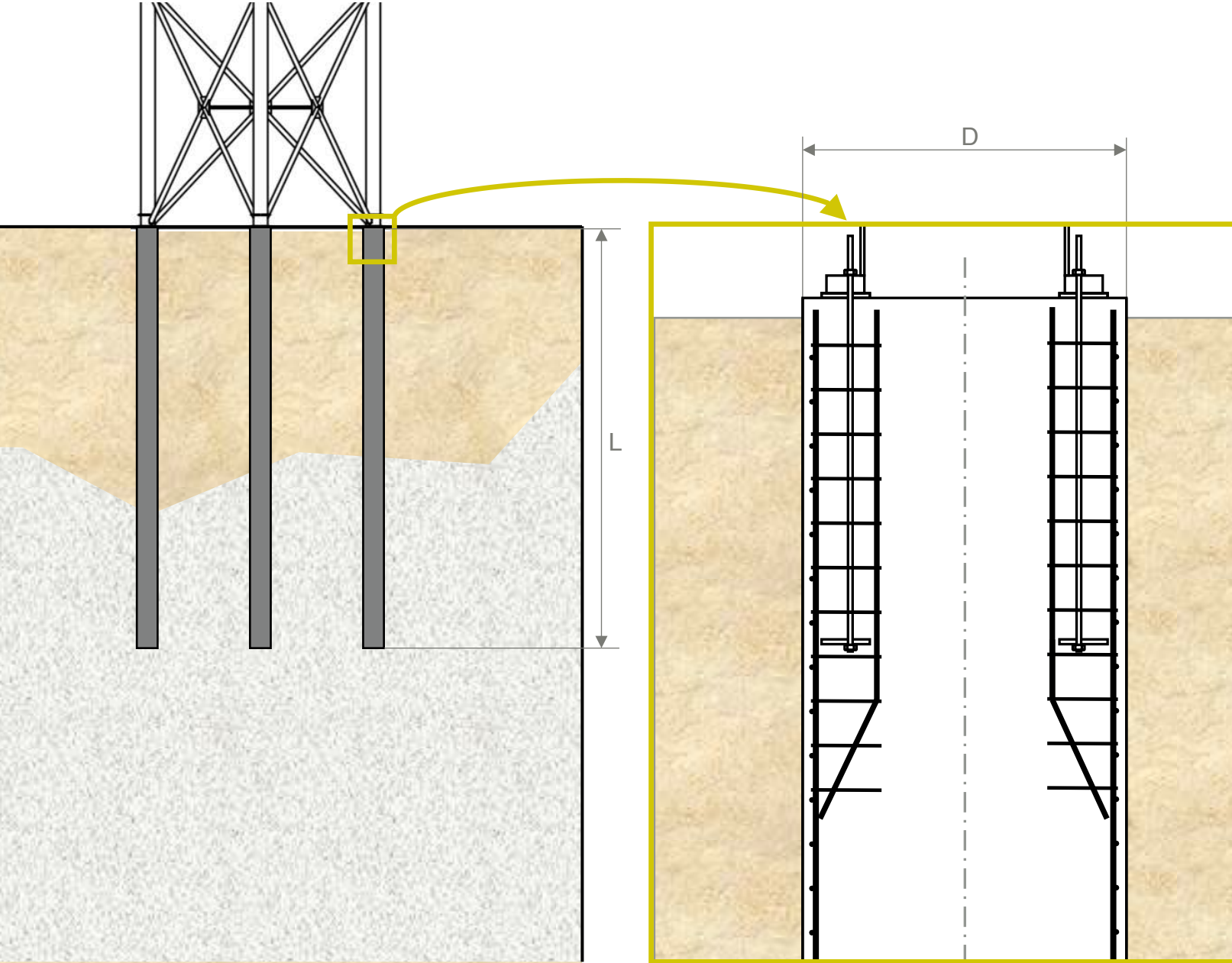
- Pile Foundation Design Basis
- Cost Savings

4. PILE FOUNDATION IN COLD CLIMATES

- Advantages

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NABRALIFT PILE FOUNDATION Pile Foundation Design



Pile Design (4MW-160m)

Diameter (D)	1.5m
Depth (L)	5MPa Rock 20m
	10MPa Rock 15m
	15MPa Rock 15m

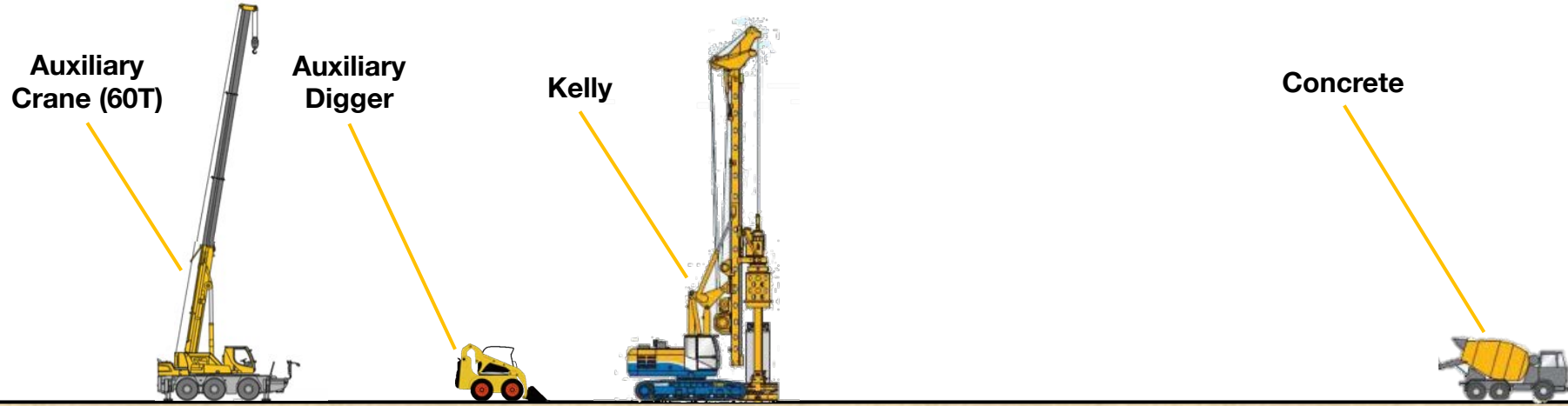
Pile Part List (10MPa Rock)

Concrete	80m ³
Reinforcement Steel	21T
M36 Bolts (1.5m)	132ud
Anchor cage plates (250kg)	6ud

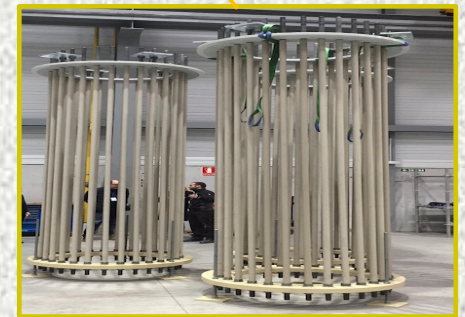
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NABRALIFT PILE FOUNDATION MANUFACTURING PROCESS

Materials & Equipments



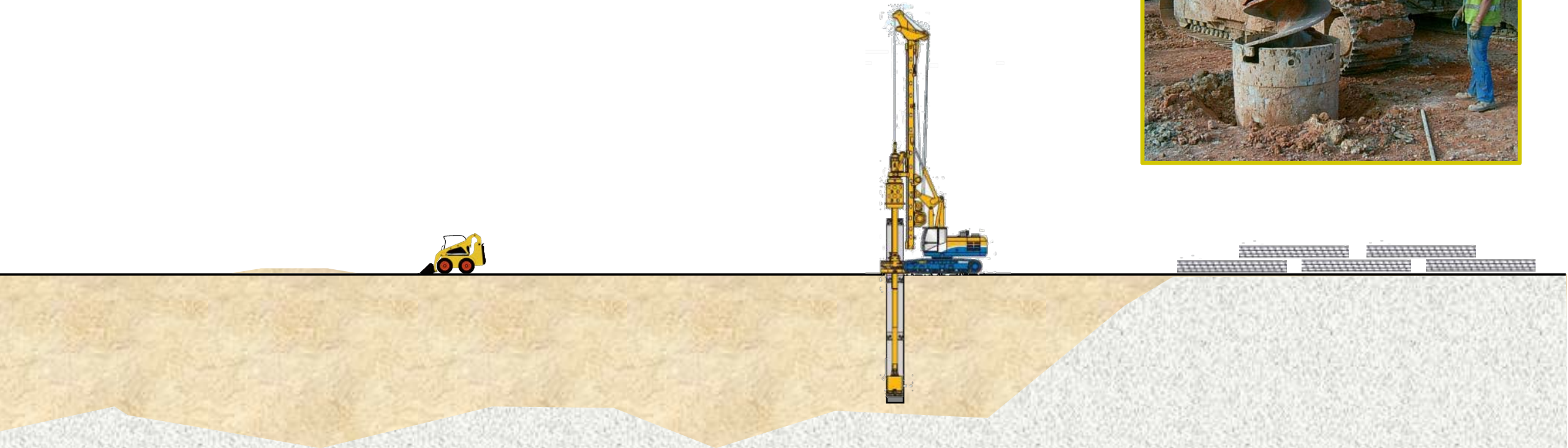
Pile Reinforcement



Bolt Cages

3

NABRALIFT PILE FOUNDATION Pile Foundation Manufacturing Process



1.-Drilling

5MPa Rock

6h

10MPa Rock

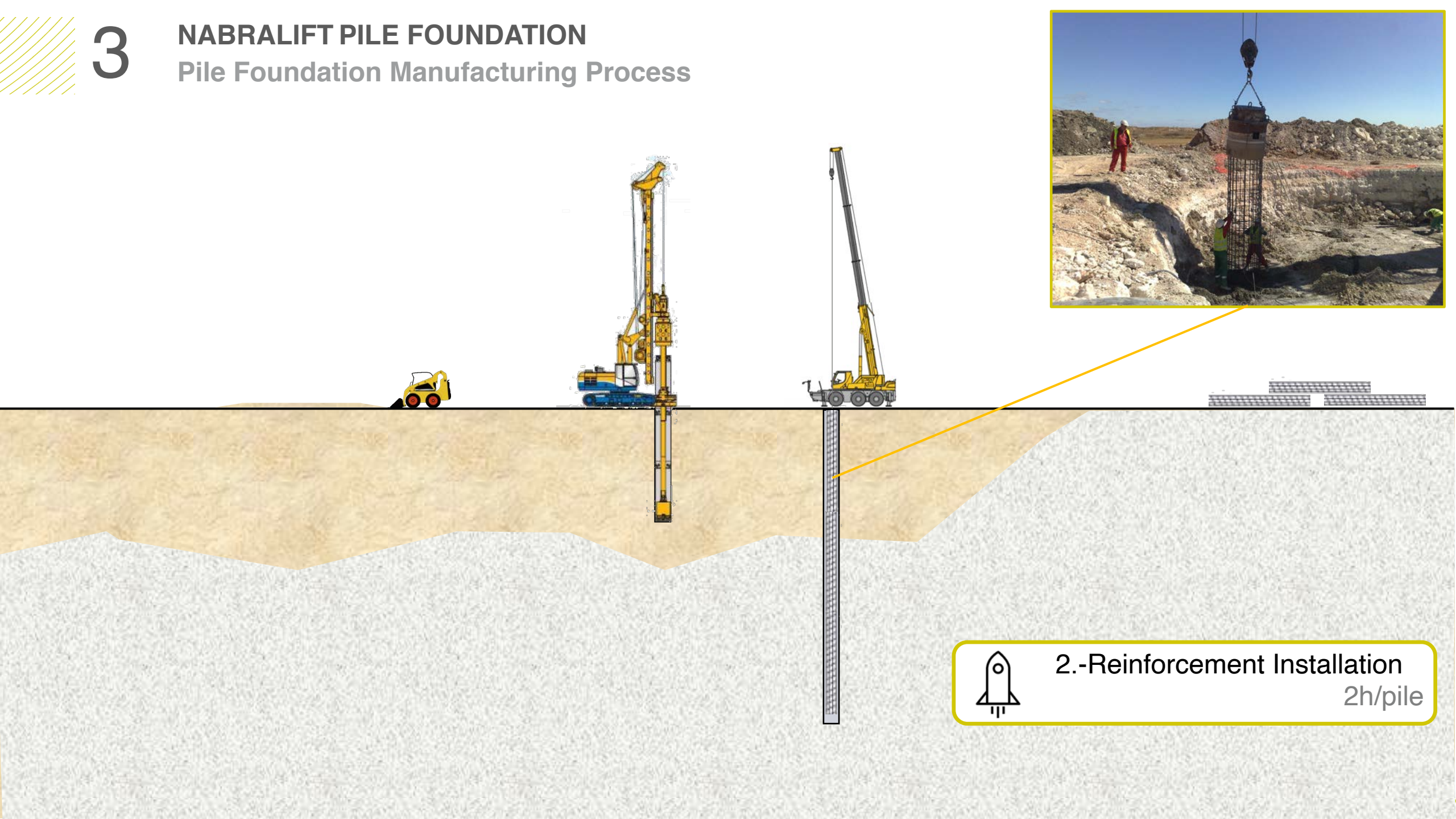
8h

15MPa Rock

15h

3

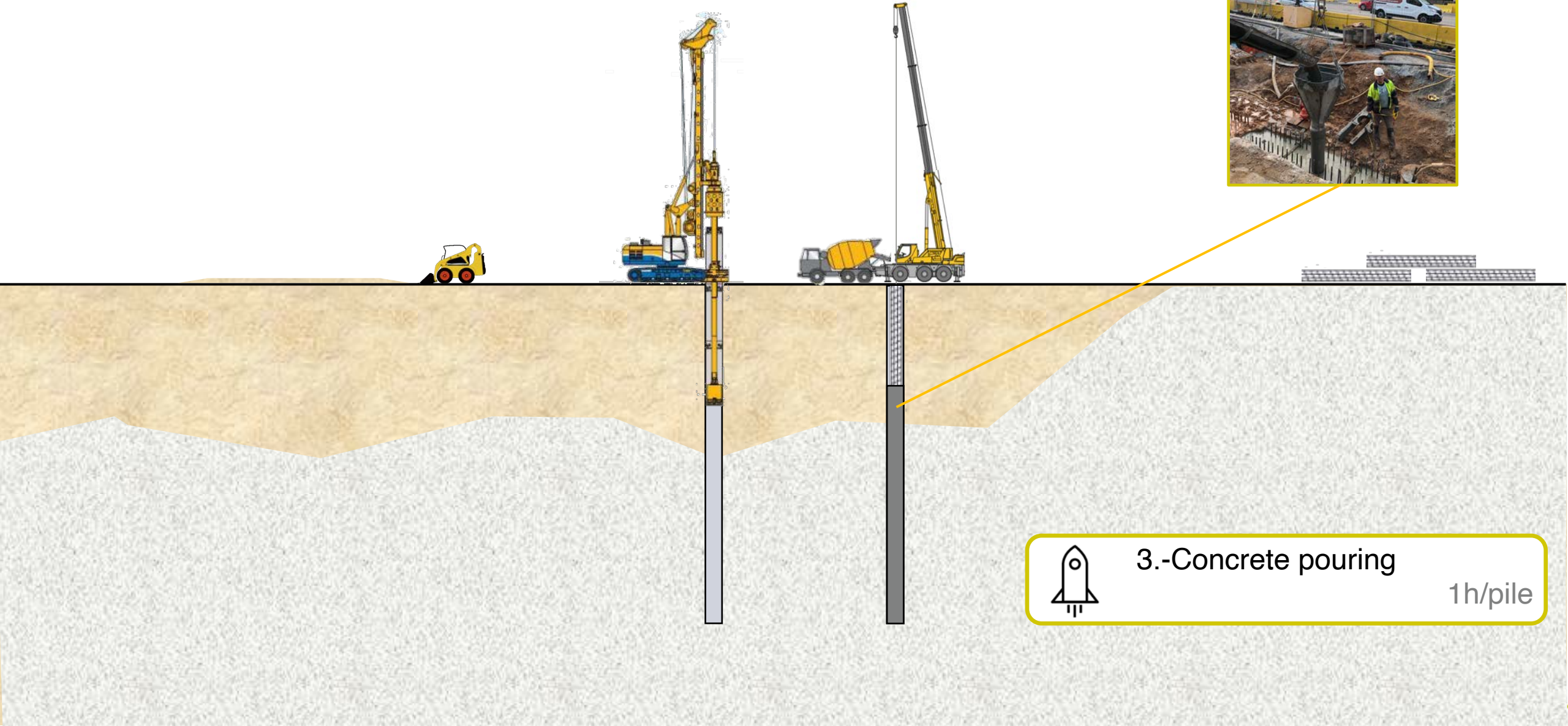
NABRALIFT PILE FOUNDATION Pile Foundation Manufacturing Process



2.-Reinforcement Installation
2h/pile

3

NABRALIFT PILE FOUNDATION Pile Foundation Manufacturing Process



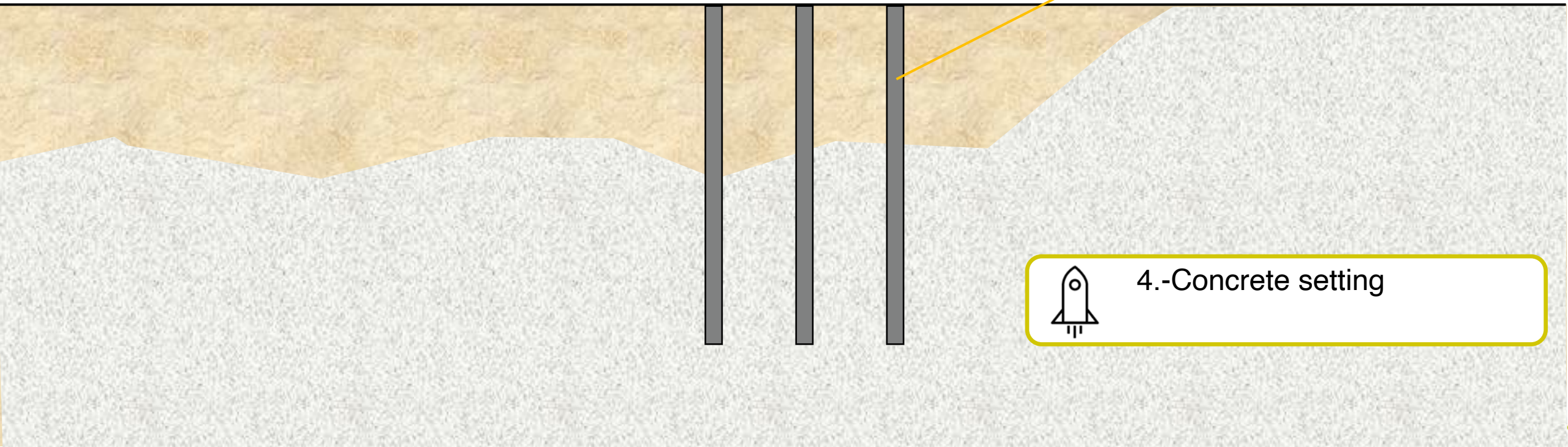
3.-Concrete pouring


1h/pile



3

NABRALIFT PILE FOUNDATION Pile Foundation Manufacturing Process



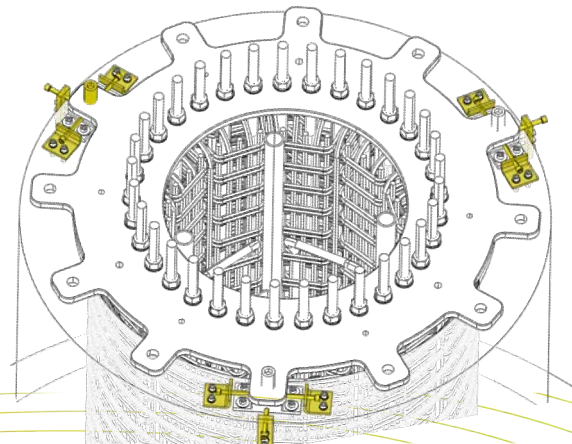
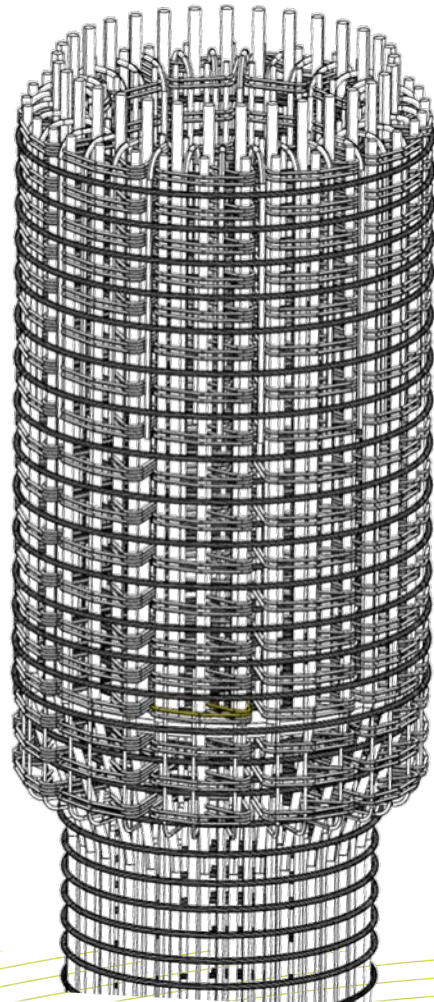
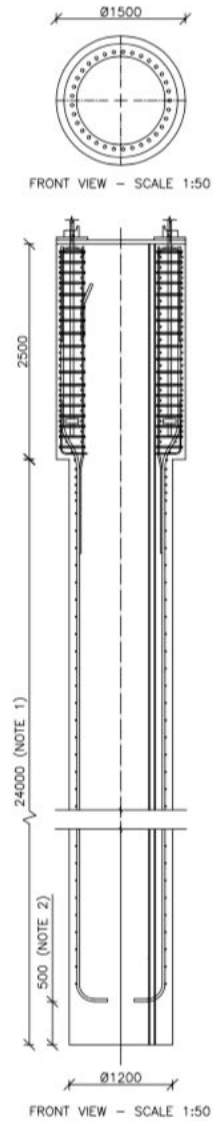
 4.-Concrete setting

FIRST PILE FOUNDATION



3

ONGOING PROJECTS FIRST PILE FOUNDATION



Pile Design (3.6MW-144m)

Diameter (D)	1.2m
Depth (L) 4MPa Rock	24m

Pile Foundation Part List

Concrete	81m ³
Reinforcement Steel	25T
M36 Bolts (1.5m)	99ud
Anchor cage plates (250kg)	6ud

Detailed Design in Collaboration with

























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4. PILE FOUNDATION IN COLD CLIMATES

- Advantages

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PILE FOUNDATION IN COLD CLIMATES

Advantages





Nabralift® pile foundation only requires 80-100 m², so heating the concrete is a real possibility



Nabralift® pile foundation only requires 1 hour per pile, increasing the operational frame

Working with the most reliable partners



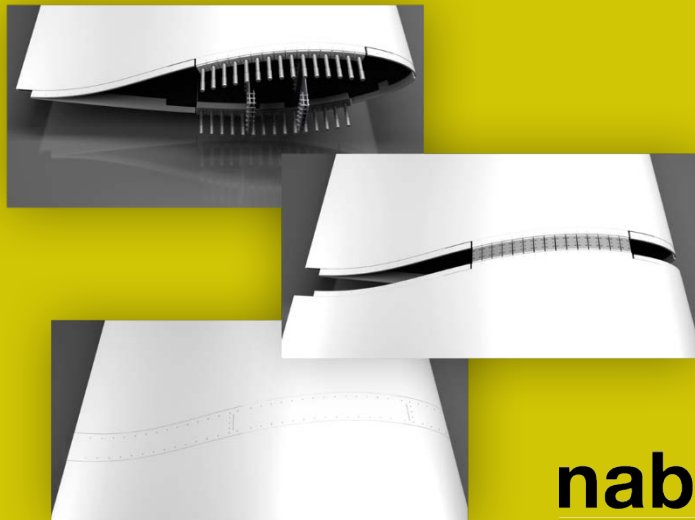
NABRAWIND

ADVANCED WIND TECHNOLOGIES

Thanks for Your Attention

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nabralift[®]
self-erecting tower