Detailed Design & optimisation of Monopile Foundations for the Kentish Flats Project

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Project Director

RAMBØLL Windpower

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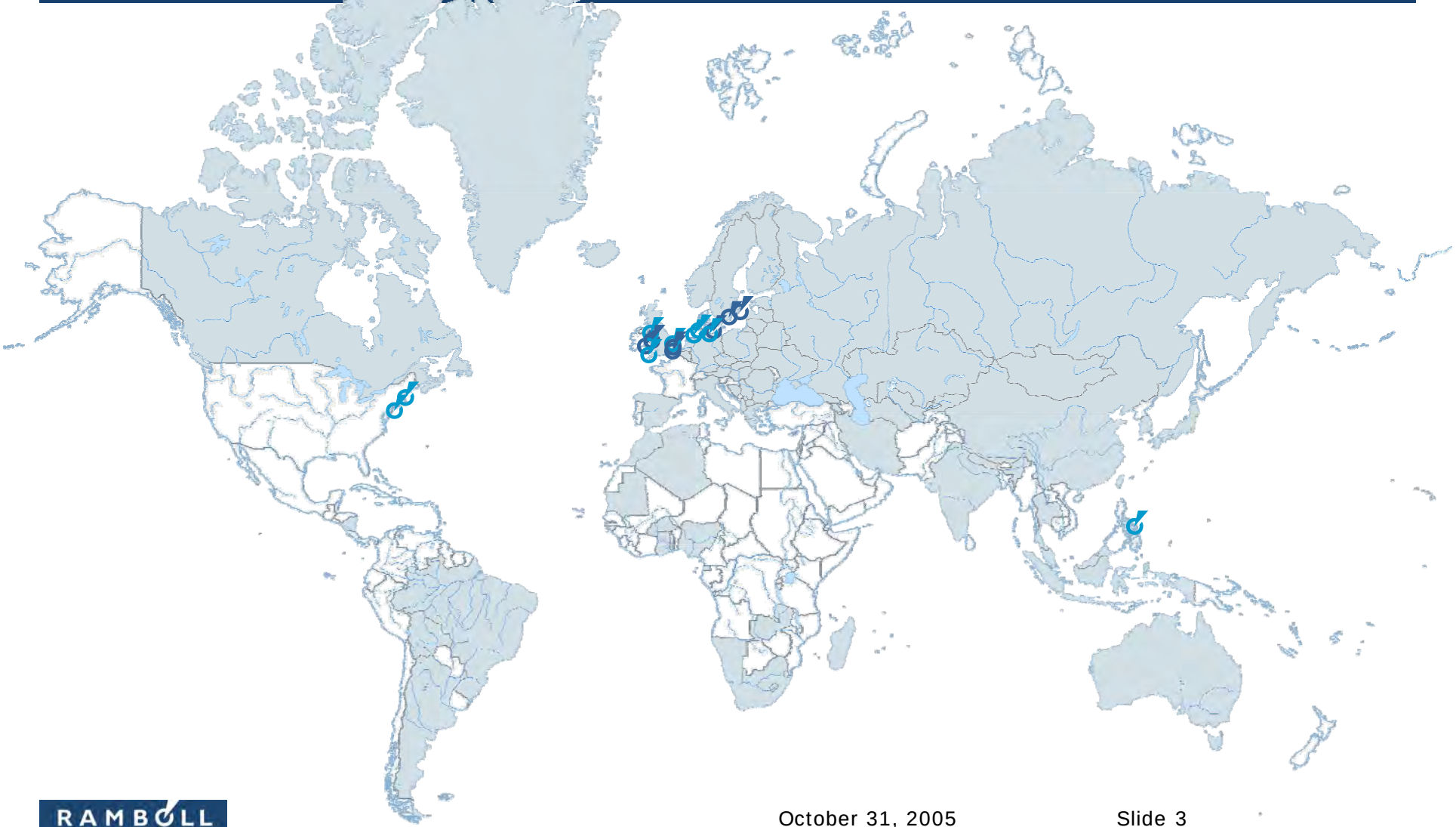
Presentation Outline

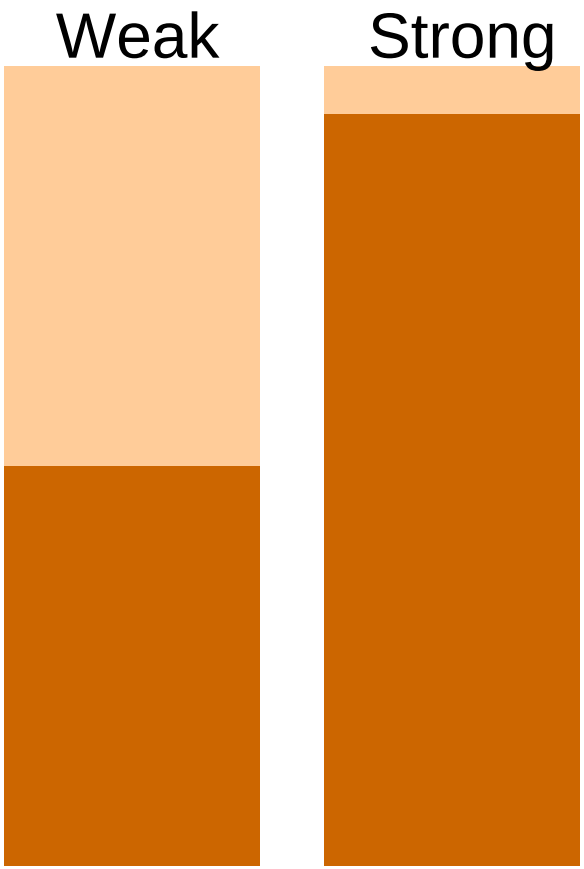
- Individualised Design – A Case Story
- Kentish Flats Offshore Wind Farm
- Design Optimisation by Advanced Analyses

World Wide Offshore Wind Projects

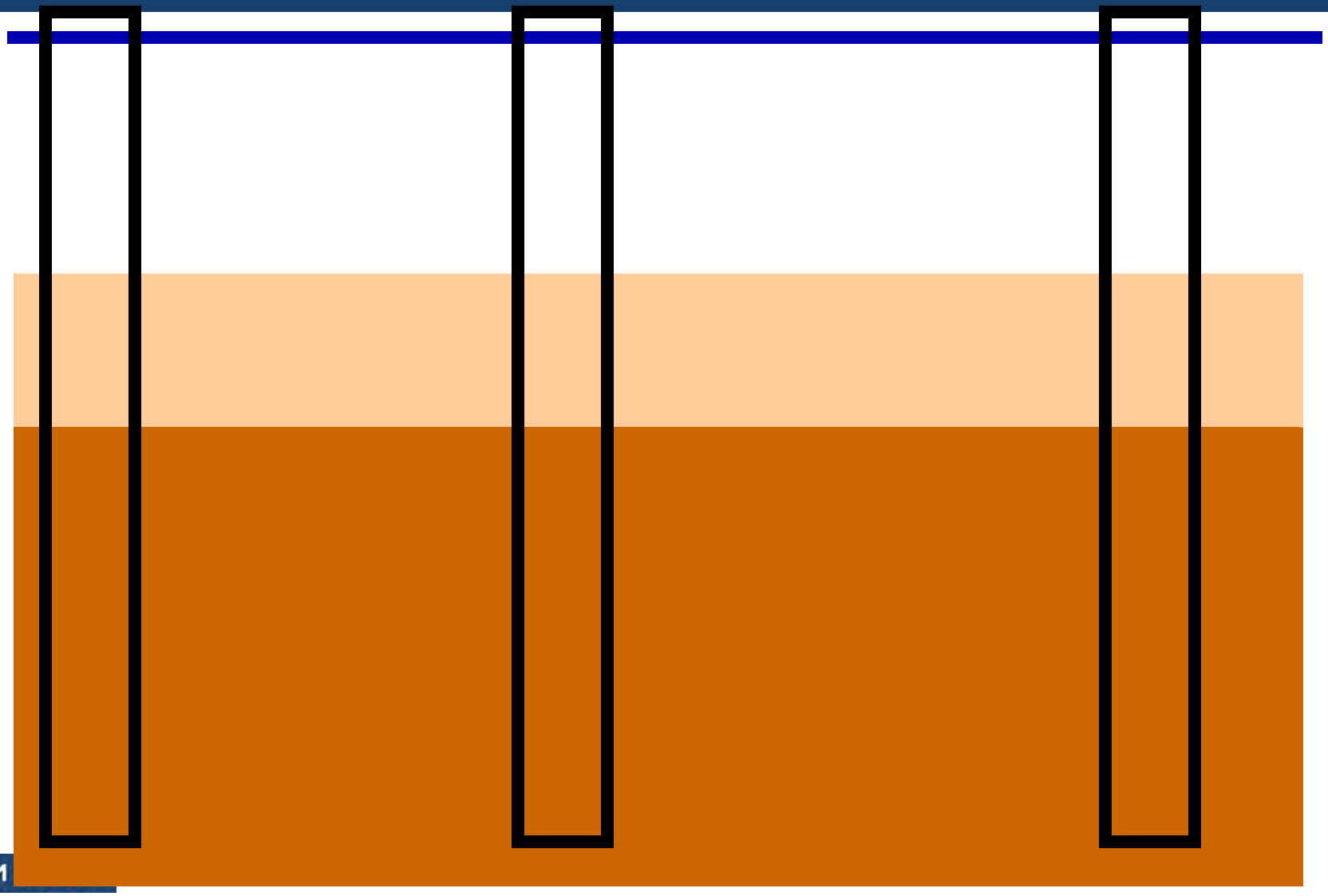


Case Story - Site Conditions

- Water Depth range from 10 to 20m
- Max. Wave Height 13m
- Two Boreholes at opposite corners of site performed.



Interpreted Conditions -> Design



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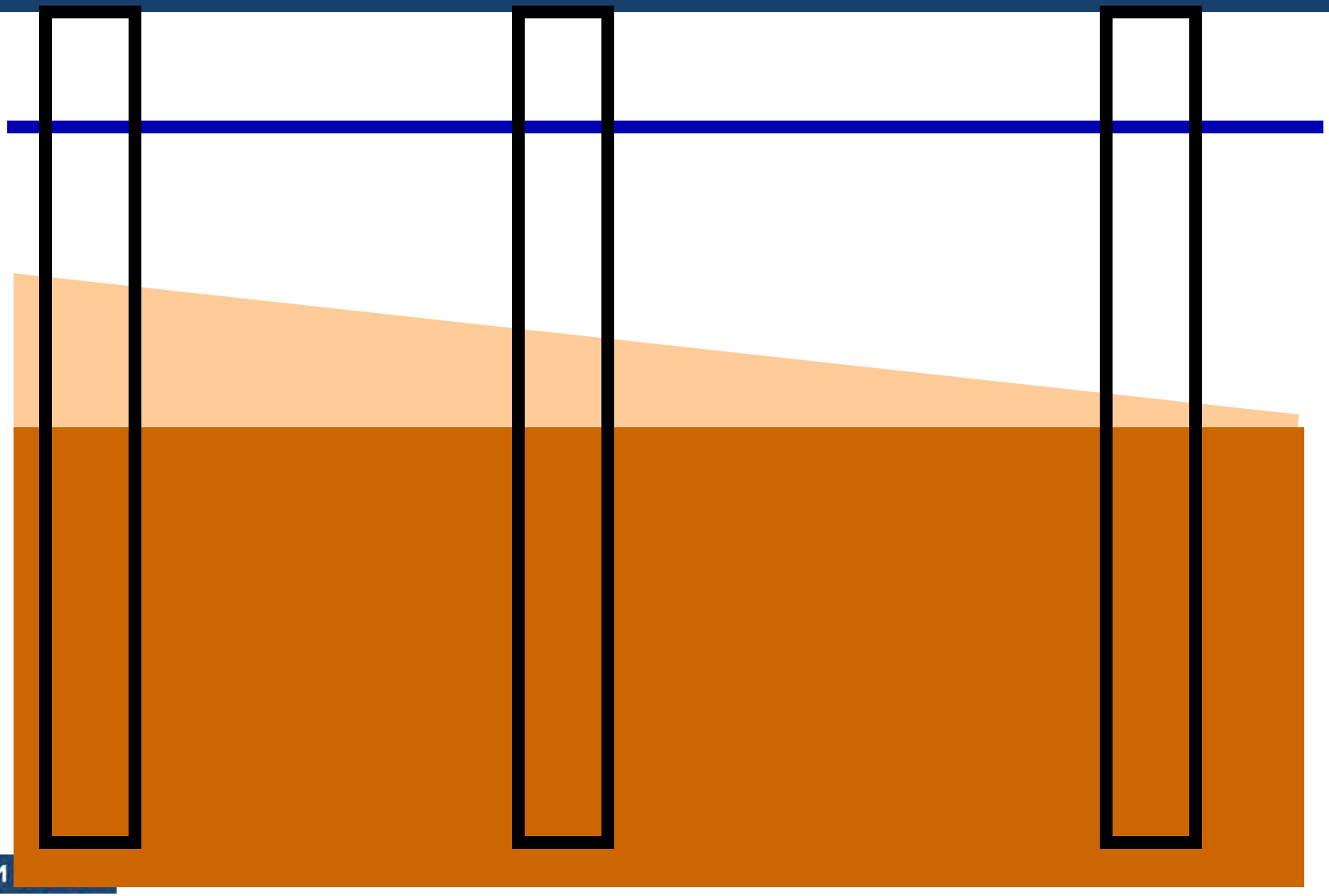
Actual Cond. -> Conservative Design



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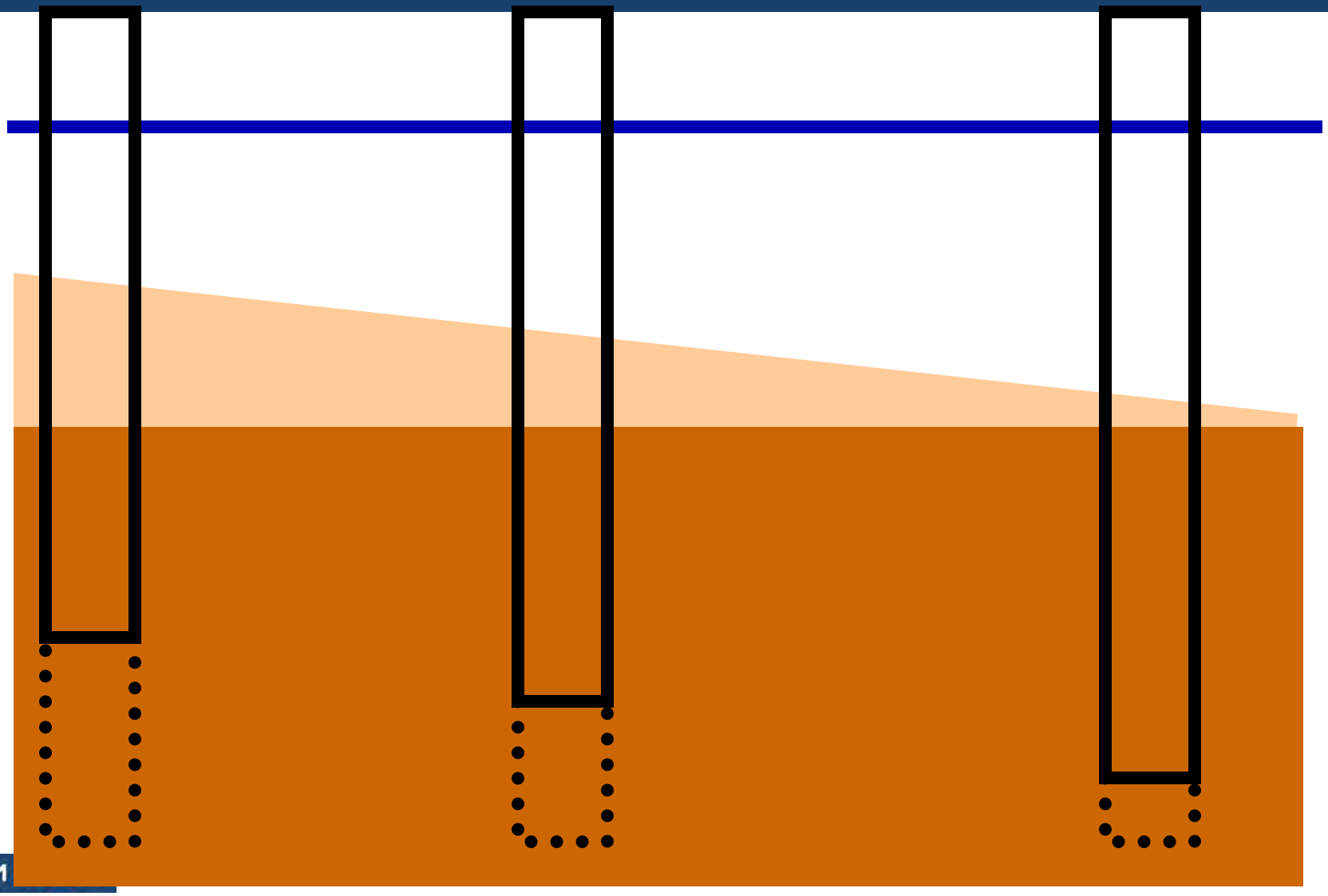
Actual Cond. -> Optimum Design



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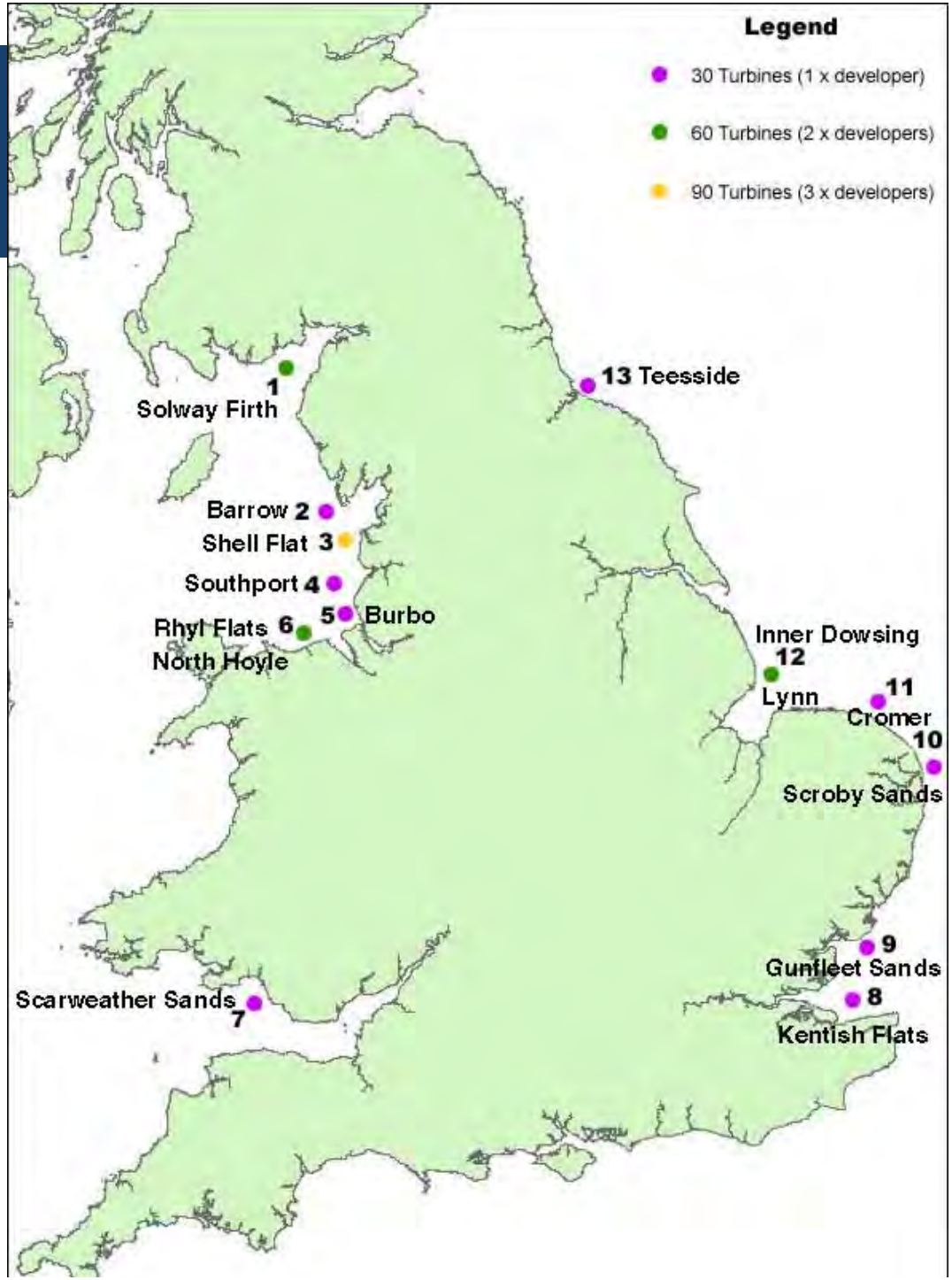
Kentish Flats Location



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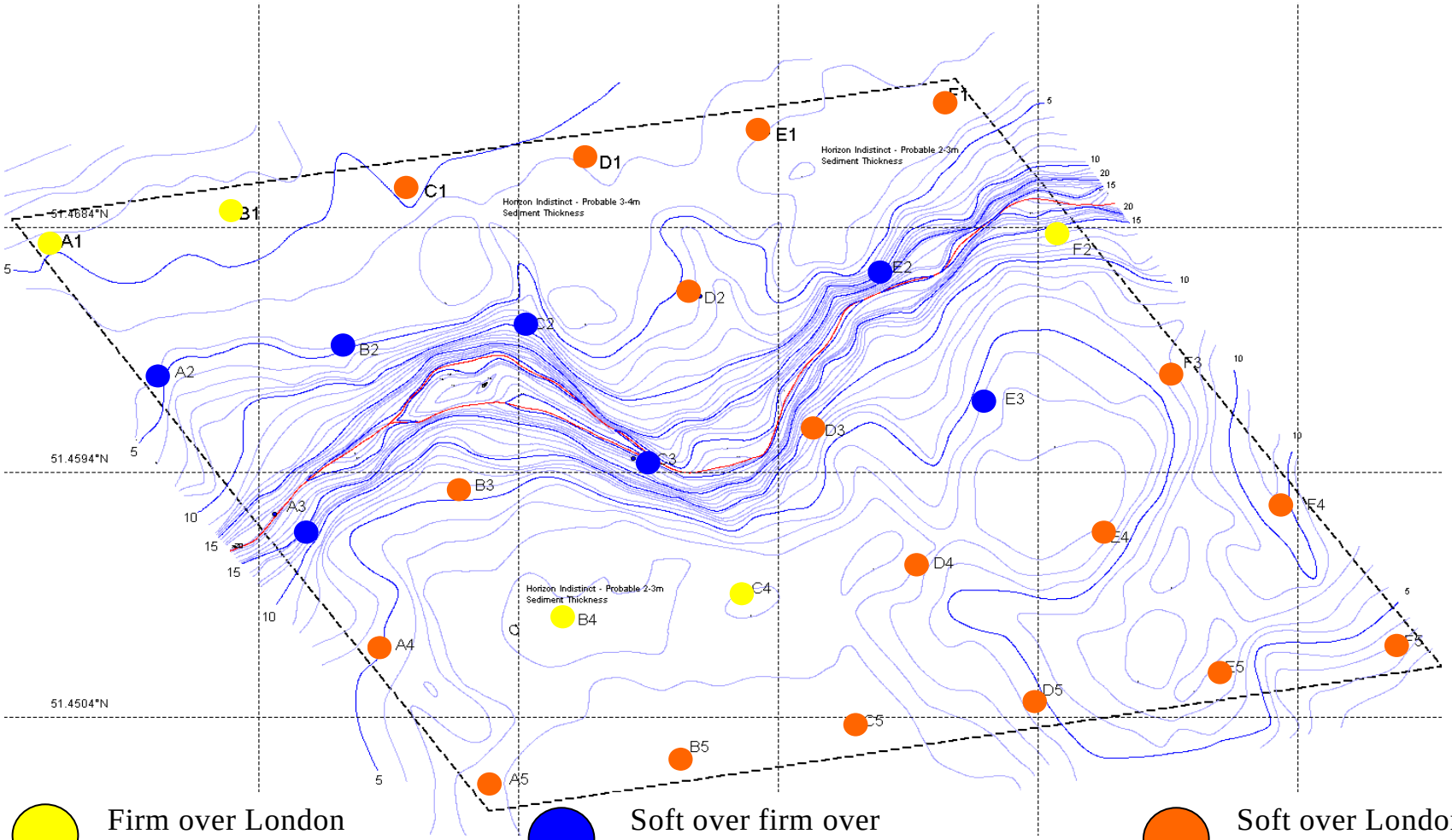
Soil Conditions



Firm over London Clay (FL profile)

Soft over firm over London Clay (SFL profile)

Soft over London Clay (SL profile)

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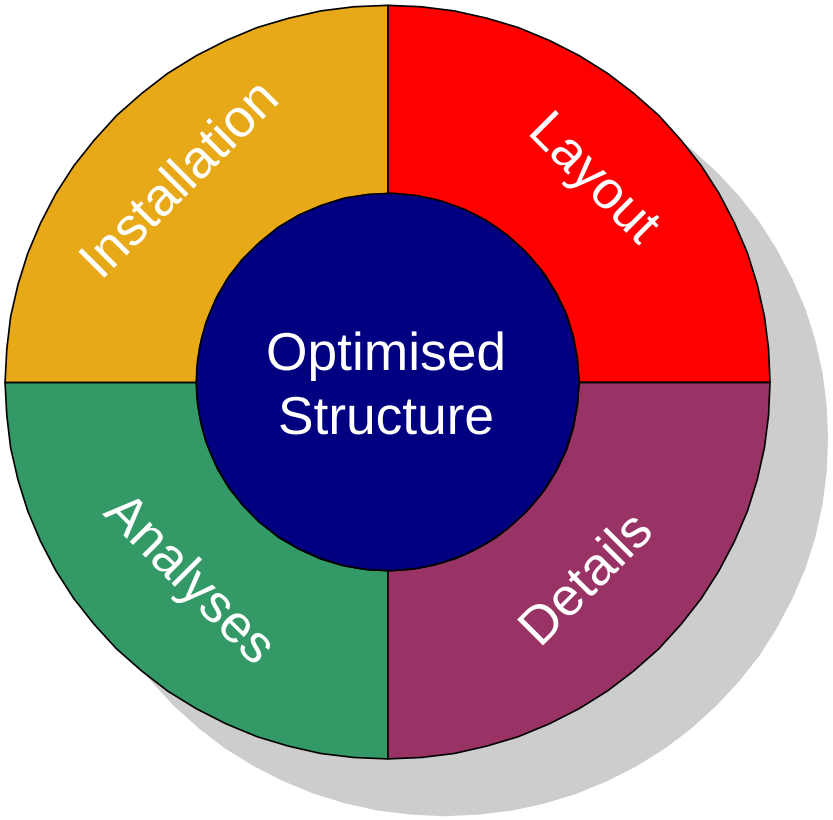
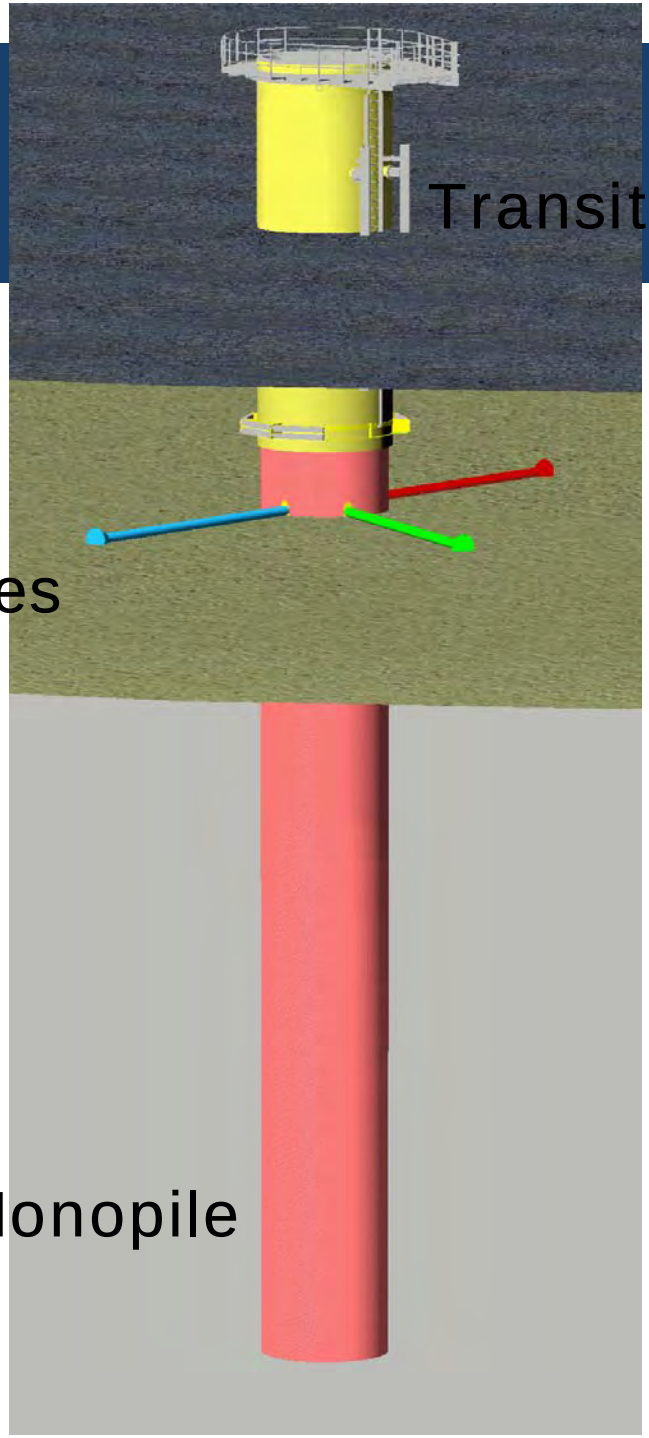
The optimal foundation structure



Monopile



Extreme Event Analysis

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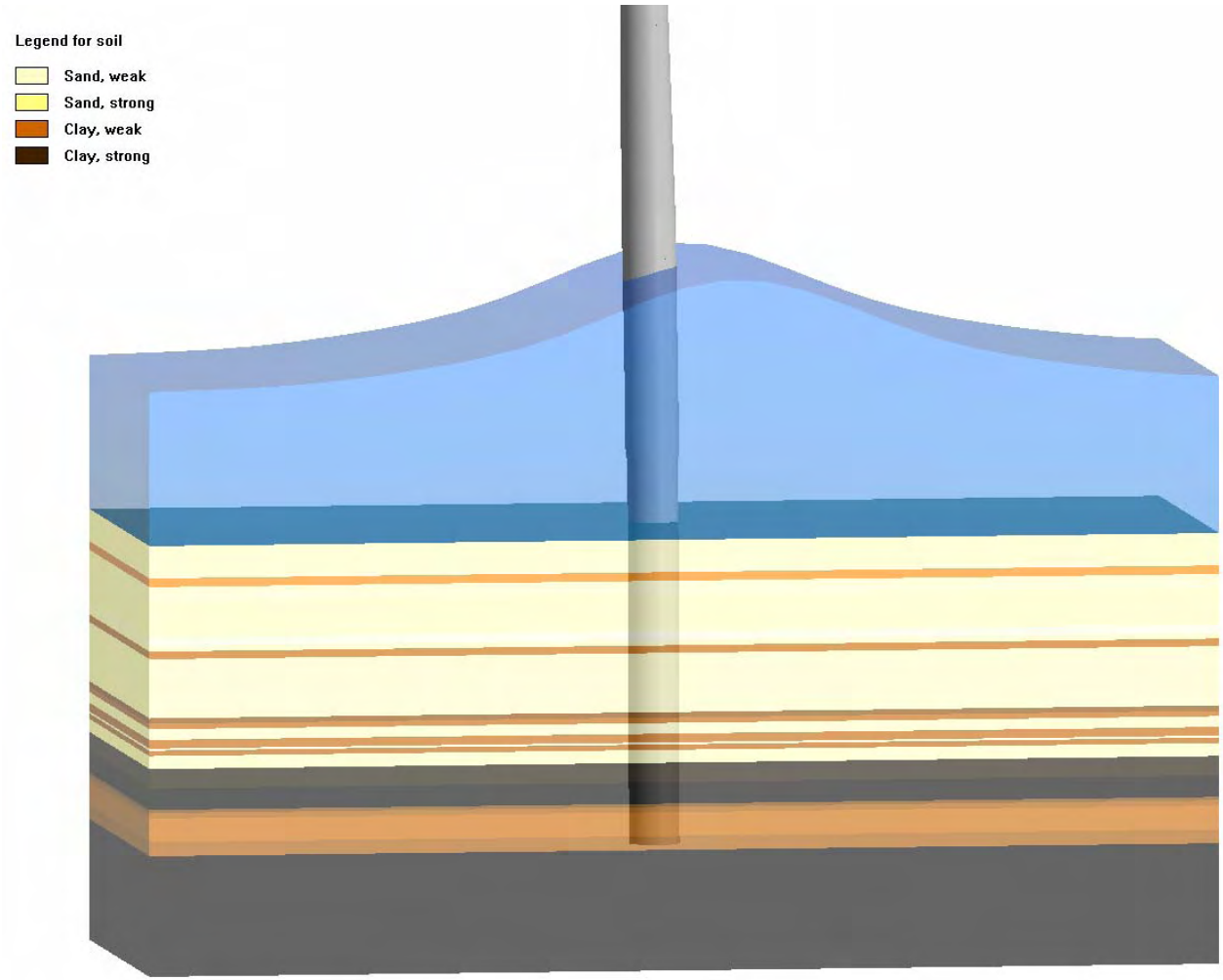
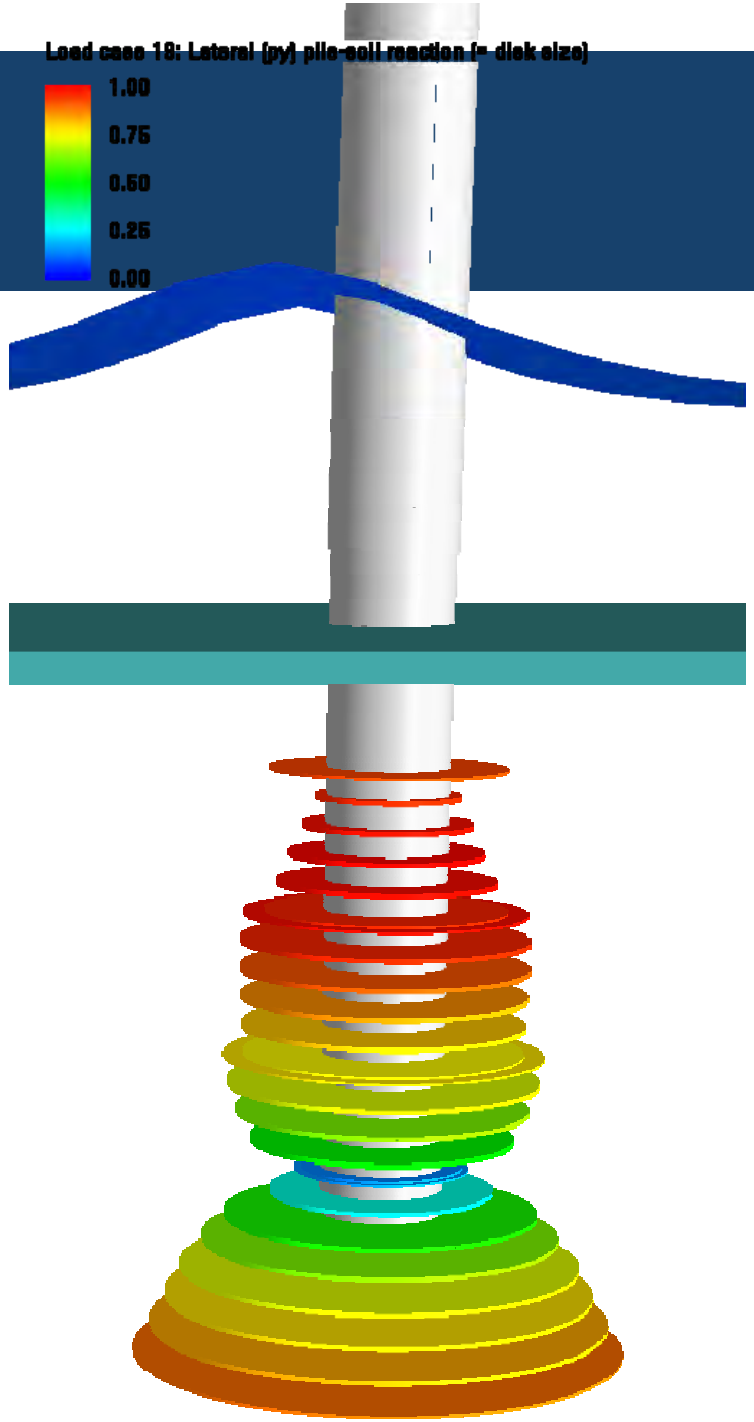
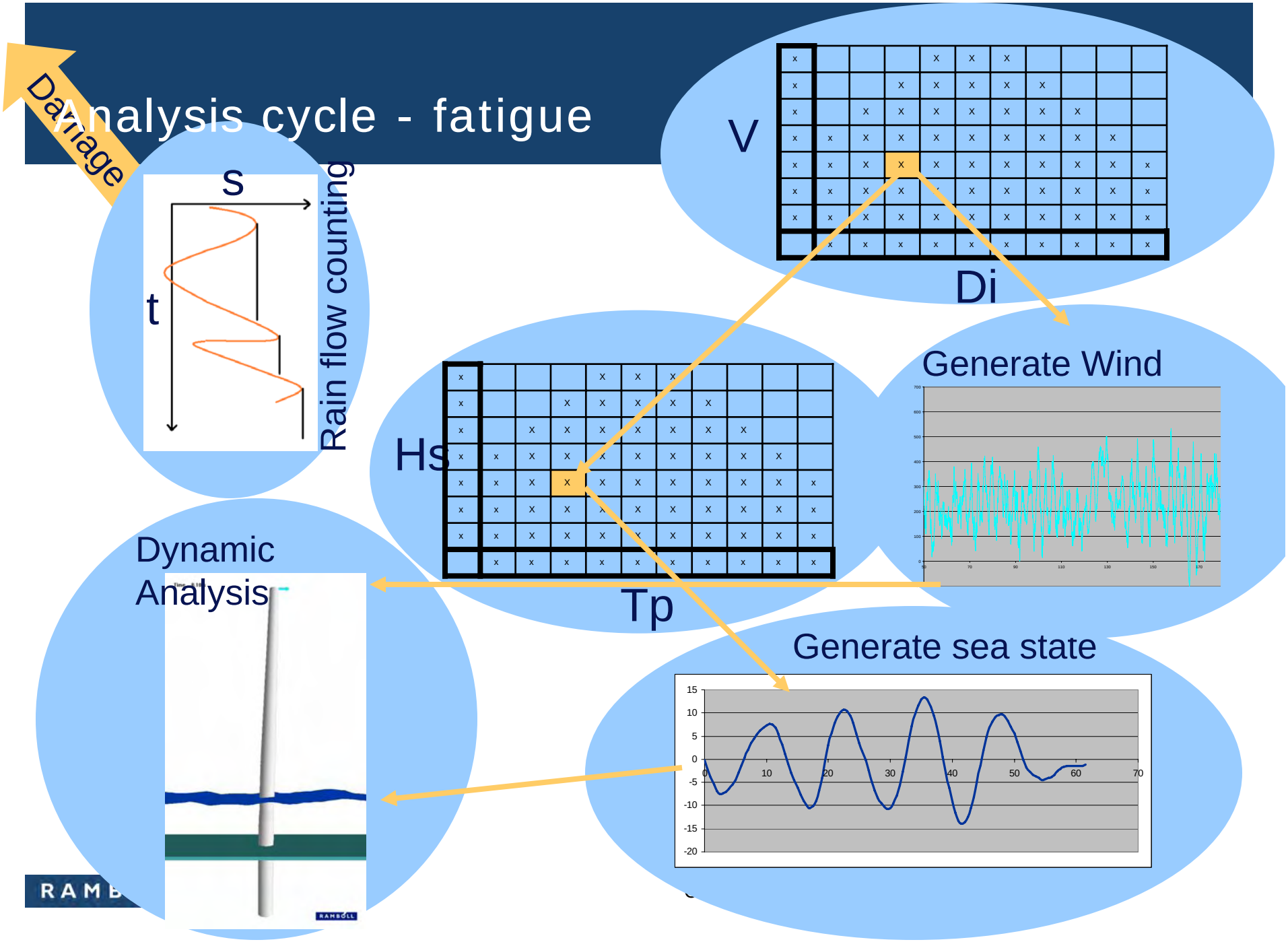
Soil Model



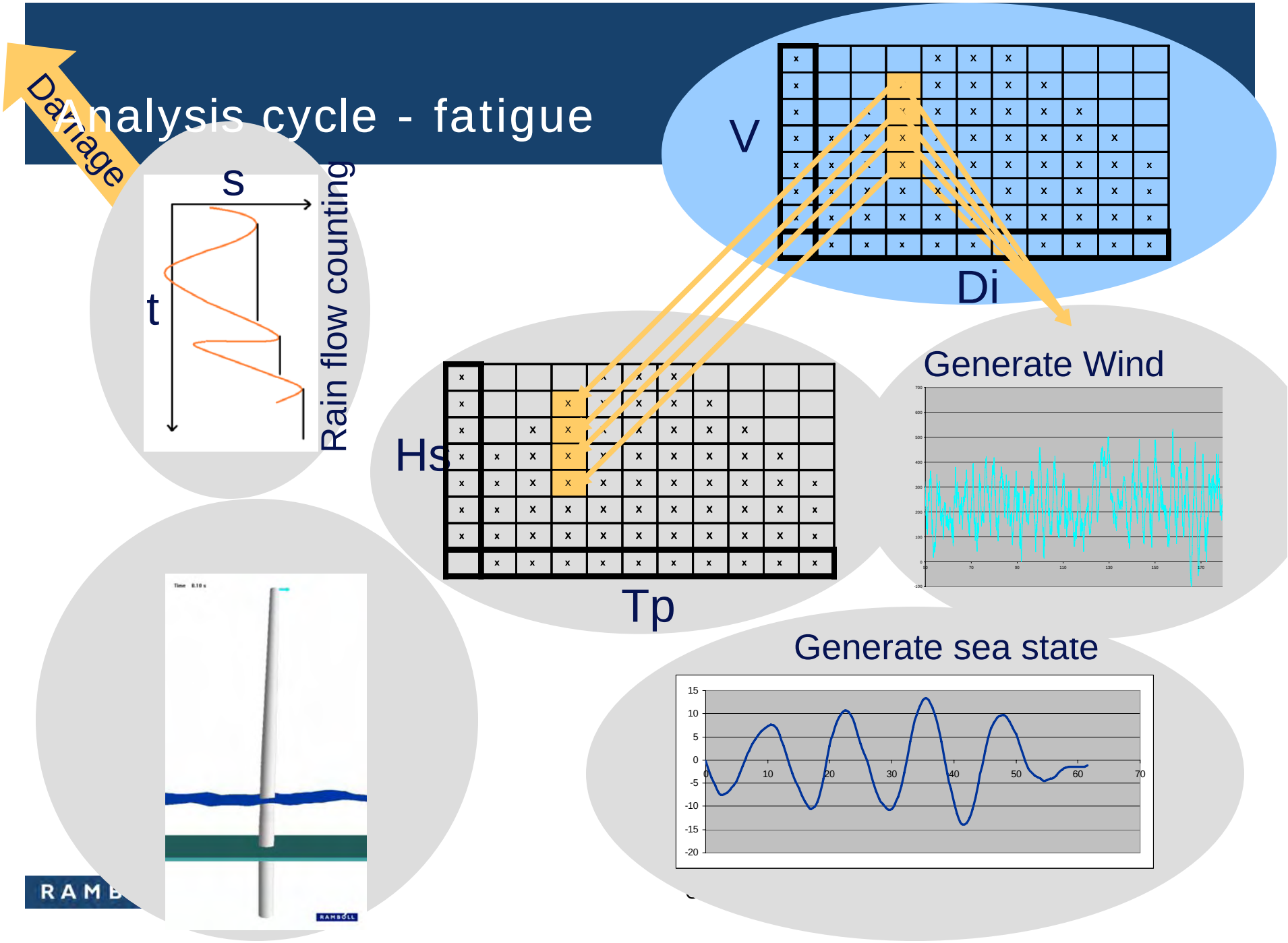
P-Y Reaction


Load case 18: Lateral (py) pile-soil reaction (= disk size)
1.00
0.75
0.50
0.25
0.00

Analysis cycle - fatigue



Analysis cycle - fatigue



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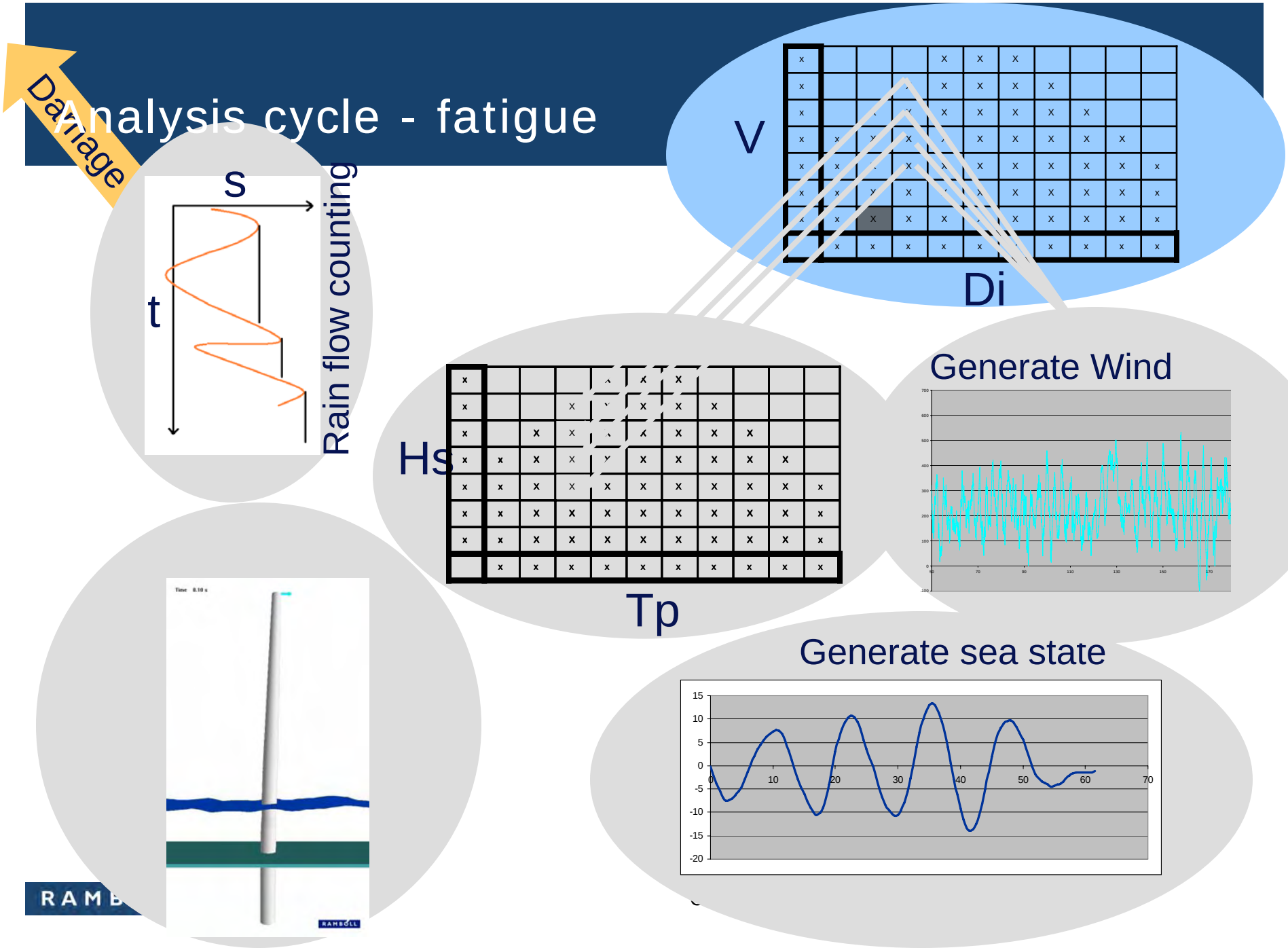
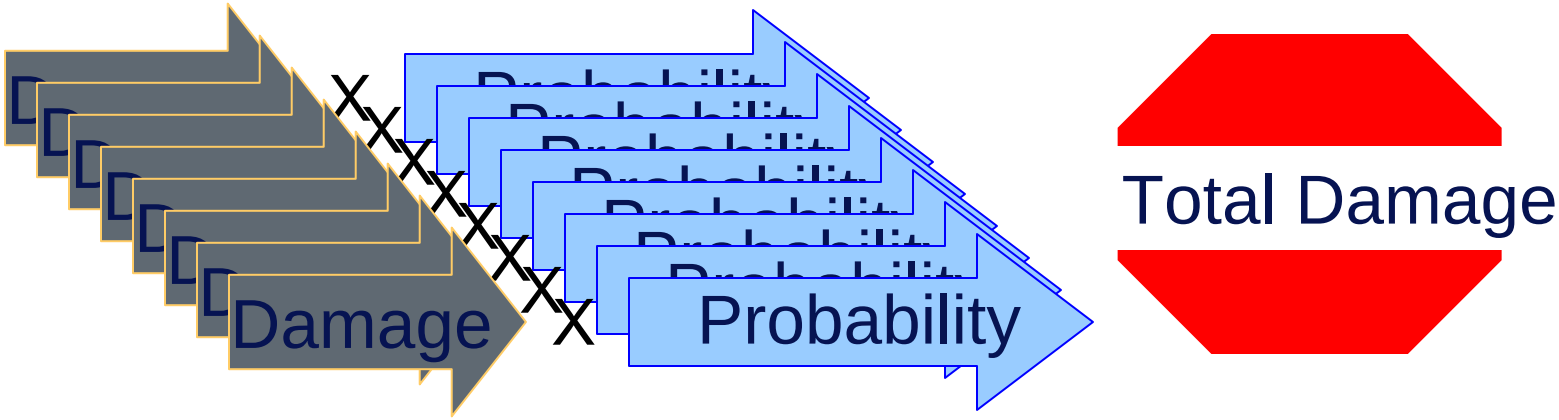
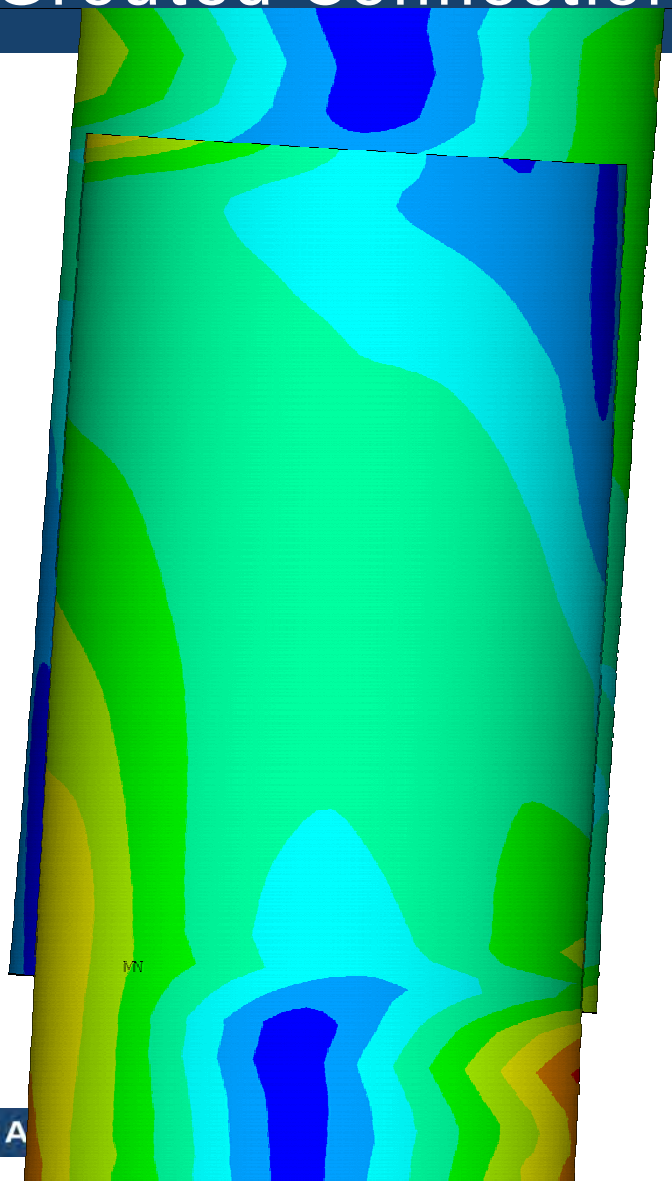
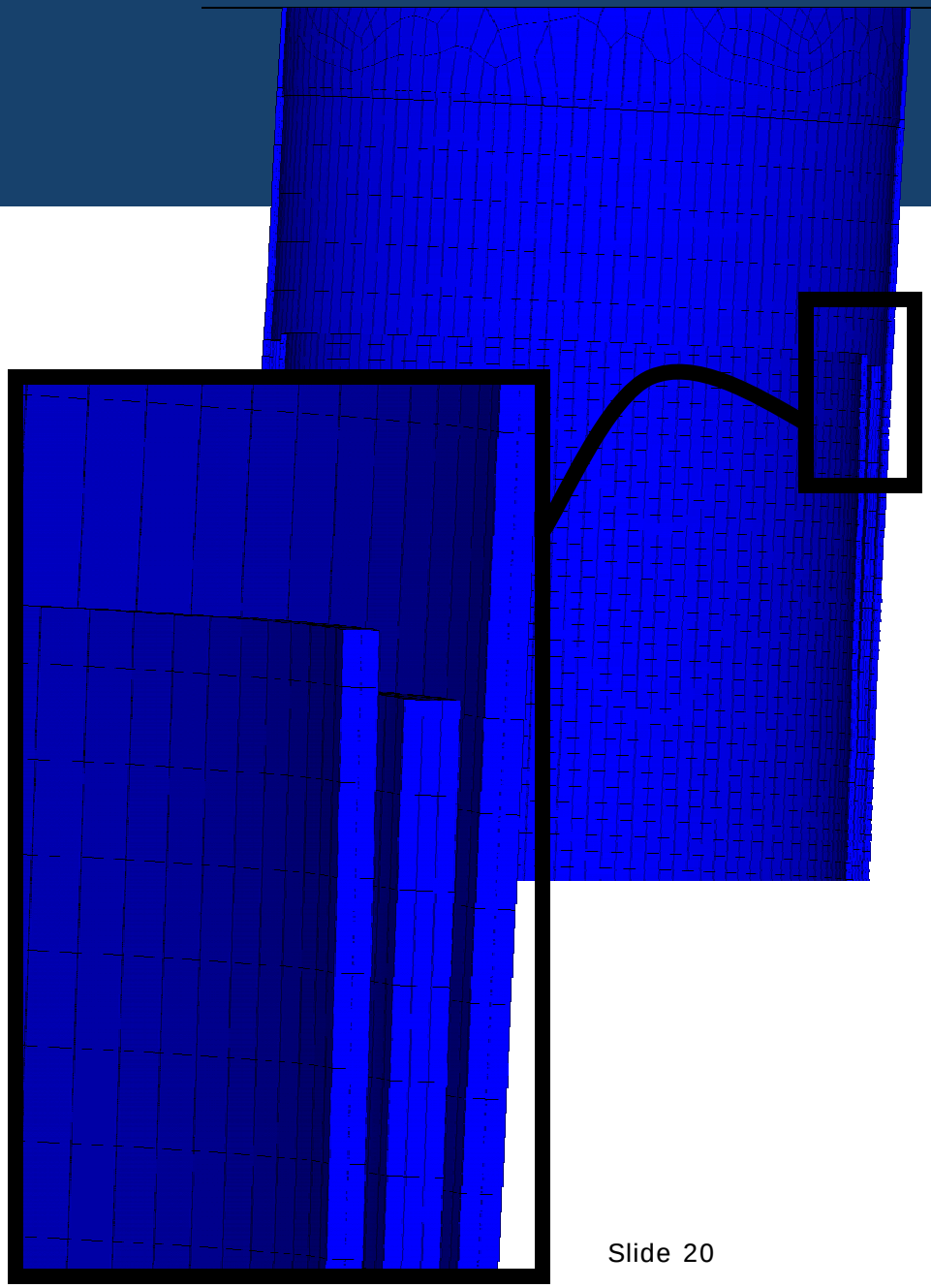


Analysis cycle - fatigue



Grouted Connection





Installation

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Pile Upending

Kentish Flats – Pile Driving

Photos by courtesy of Elsam.

Transition Piece is positioned on top of the Pile

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Kentish Flats

Photos by courtesy of Elsam.

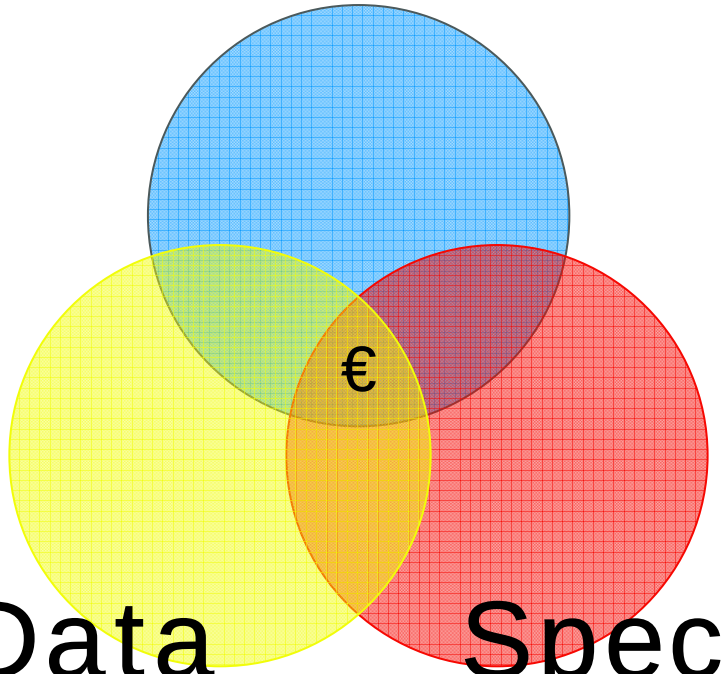
Kentish Flats

Photos by courtesy of Elsam.

Power Production

Conclusions

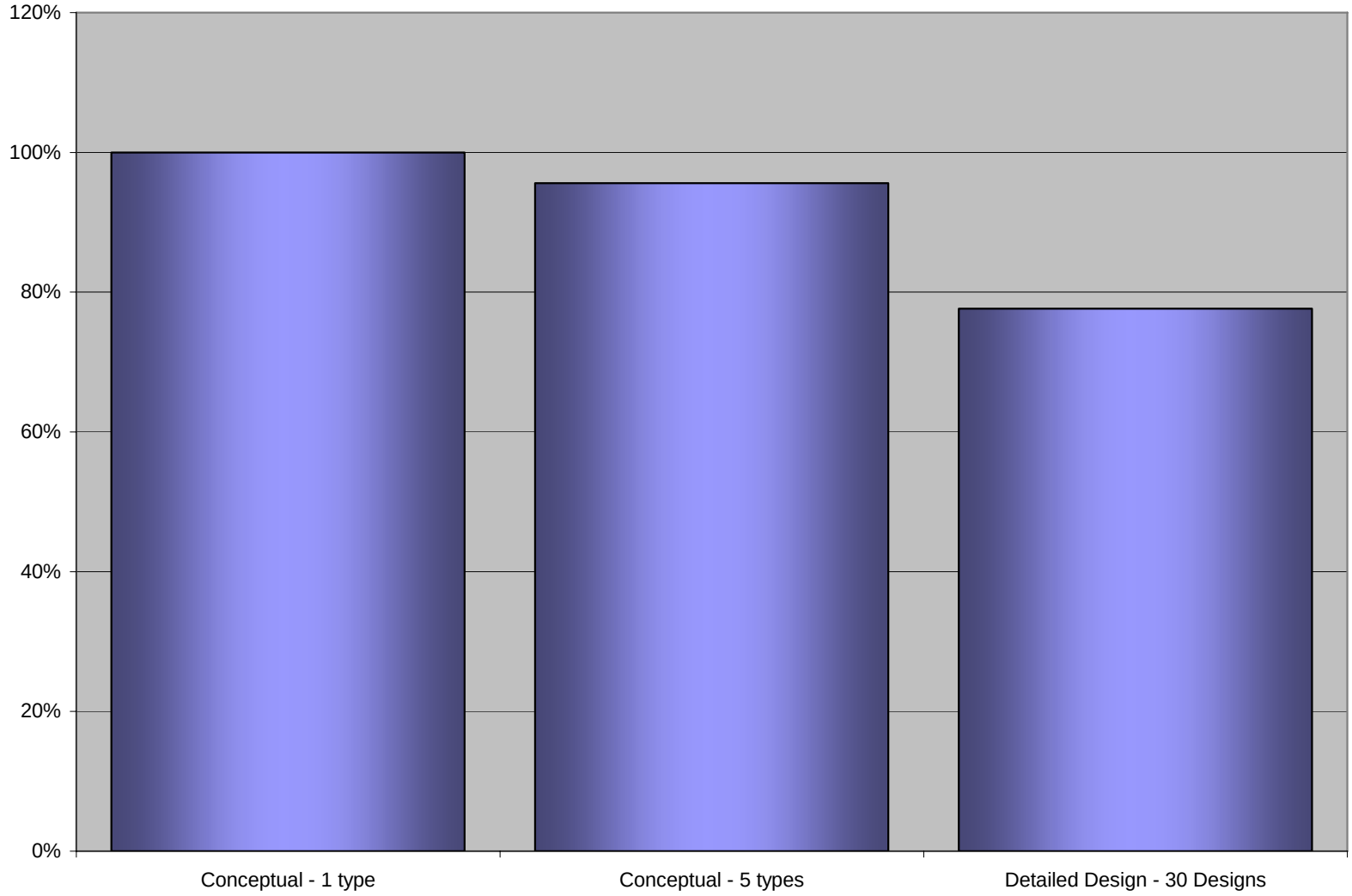
Advanced Analysis



Detailed Data

Specific Design

Relative Effect of Design Variants



Conclusions

- 30 Individual Monopiles were successfully designed, certified, fabricated and installed in 10 months.
- Substantial cost savings were obtained by a combination of advanced analyses and individualised design.