Analysis for Running and Installation Of Risers with End-assemblies

Andrew Lennon
Consulting Engineer

Stewart Maxwell and **Jonathan Rawles**
UWG Ltd

Contents of Presentation

1. Statement of problem
2. Example scenario (part 1)
3. Example scenario (part 2)
4. Analysis issues
5. Installation from a fixed platform
6. Installation from a floating vessel
7. Boundary conditions
8. Additional considerations
9. Future developments
10. Conclusions

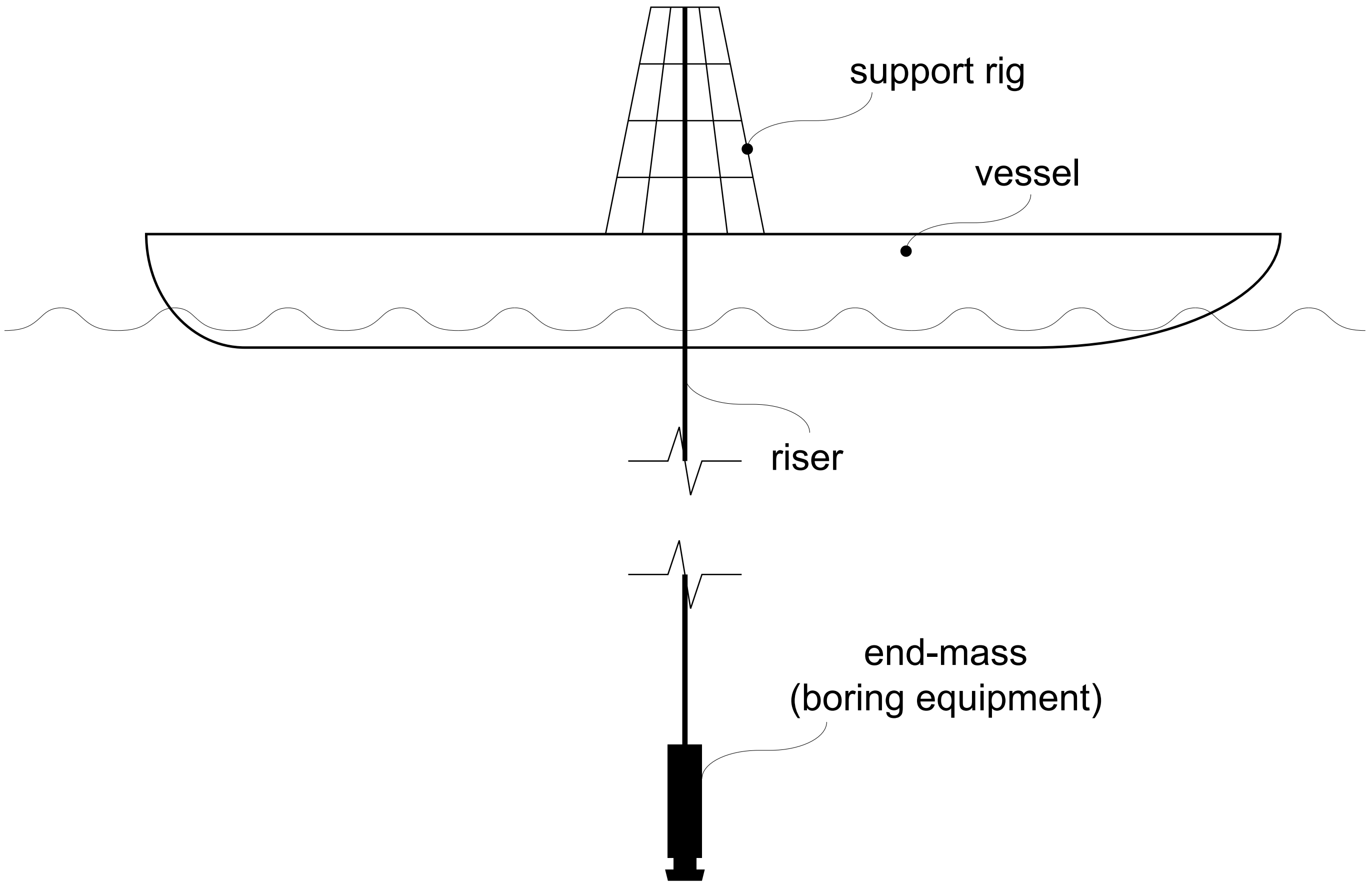
Statement of the Problem

Want to lower equipment into the sea or onto the seabed

What are the loads on the structure?

What are the safe operating limits?

Example



Boring large diameter holes in the seabed (conductors or piles)

ANDREW LENNON
andrew@innealtoir.org
www.innealtoir.org

sales@uwg.co.uk
www.uwg.co.uk

Example

Lowering template onto the seabed using drill collar

Analysis Issues

1. Analysis uses FEA

2. Chose the Flexcom package from MCS

3. Features
   - fully dynamic, three-dimensional
   - geometric non-linearity
     (also material non-linearity if desired)
   - finite rotations
   - choice of wave and current loading
   - choice of boundary conditions
     (including vessel motion)

4. Hydrodynamic loads represented by Morison's equation

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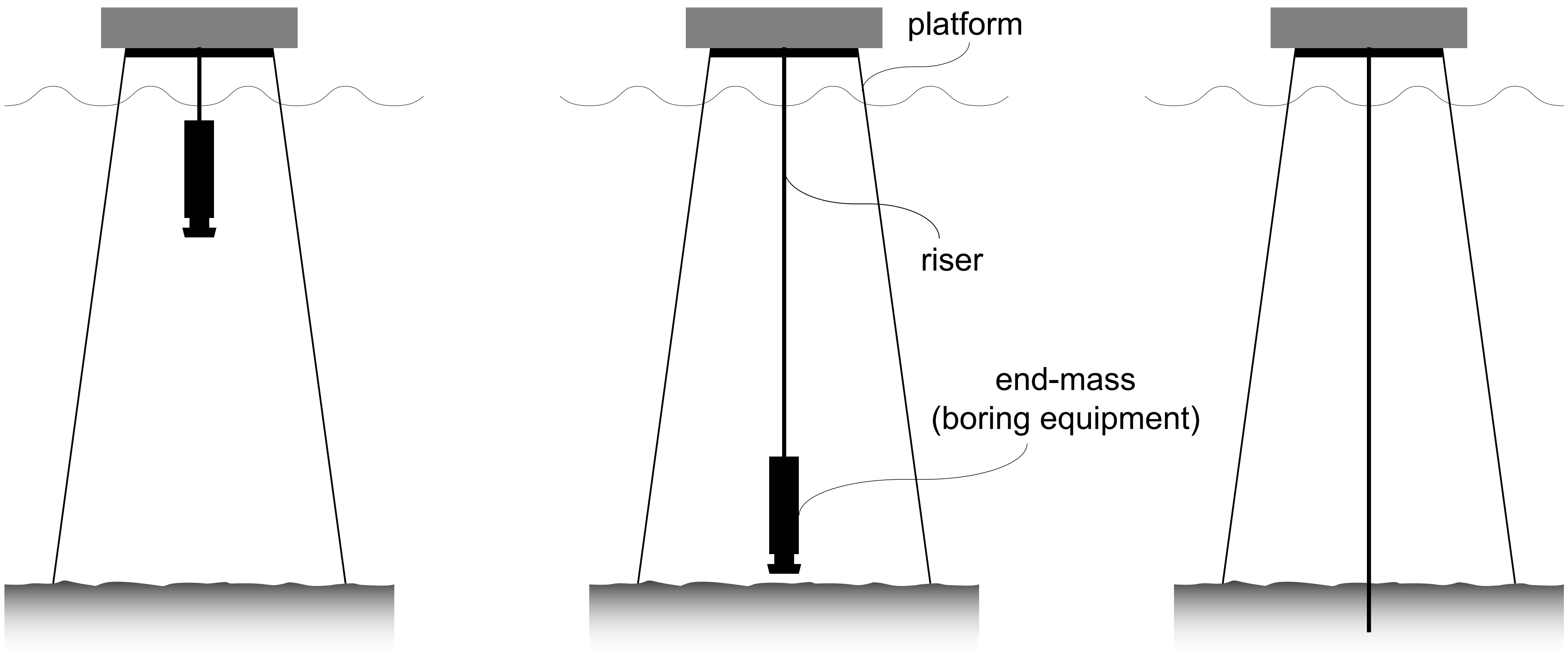
UWG

Installation from a Fixed Platform



Installation stages (1) just below splash zone (2) just above seabed (3) installed

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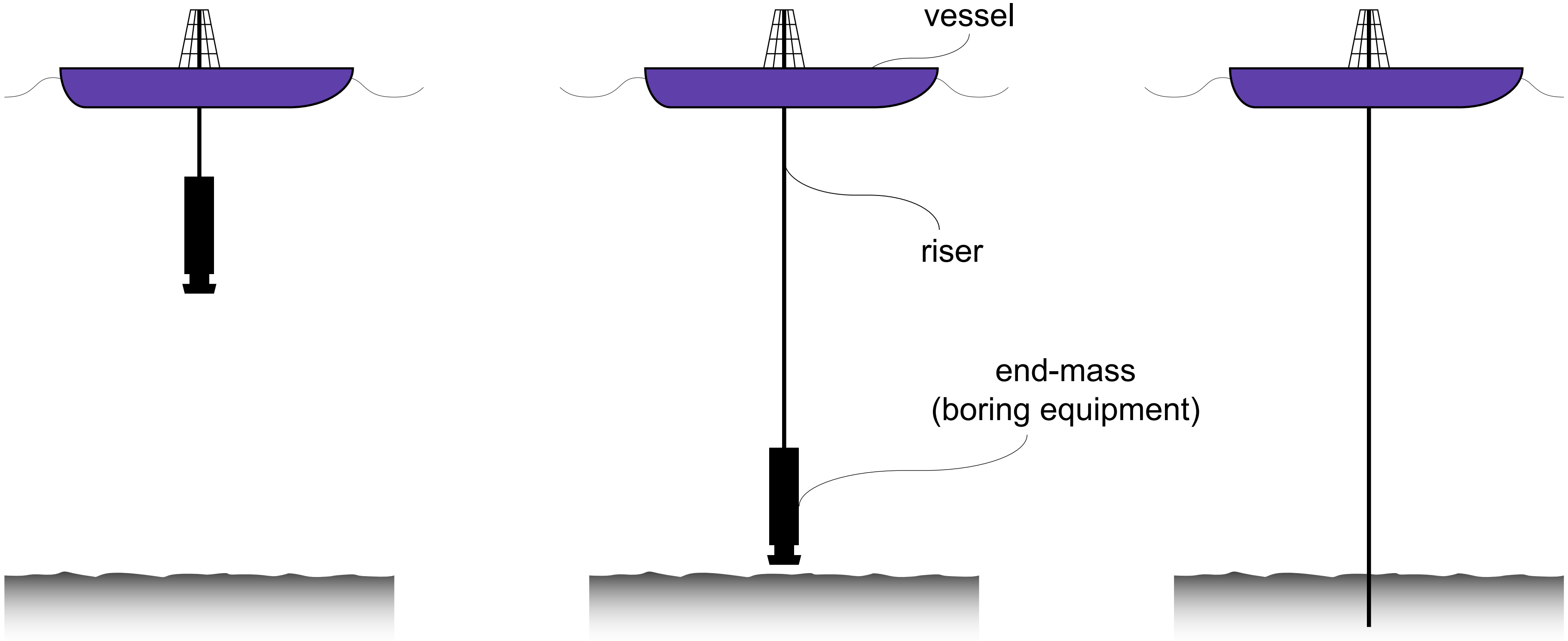
Installation from a Floating Vessel



Installation stages (1) just below splash zone (2) just above seabed (3) installed

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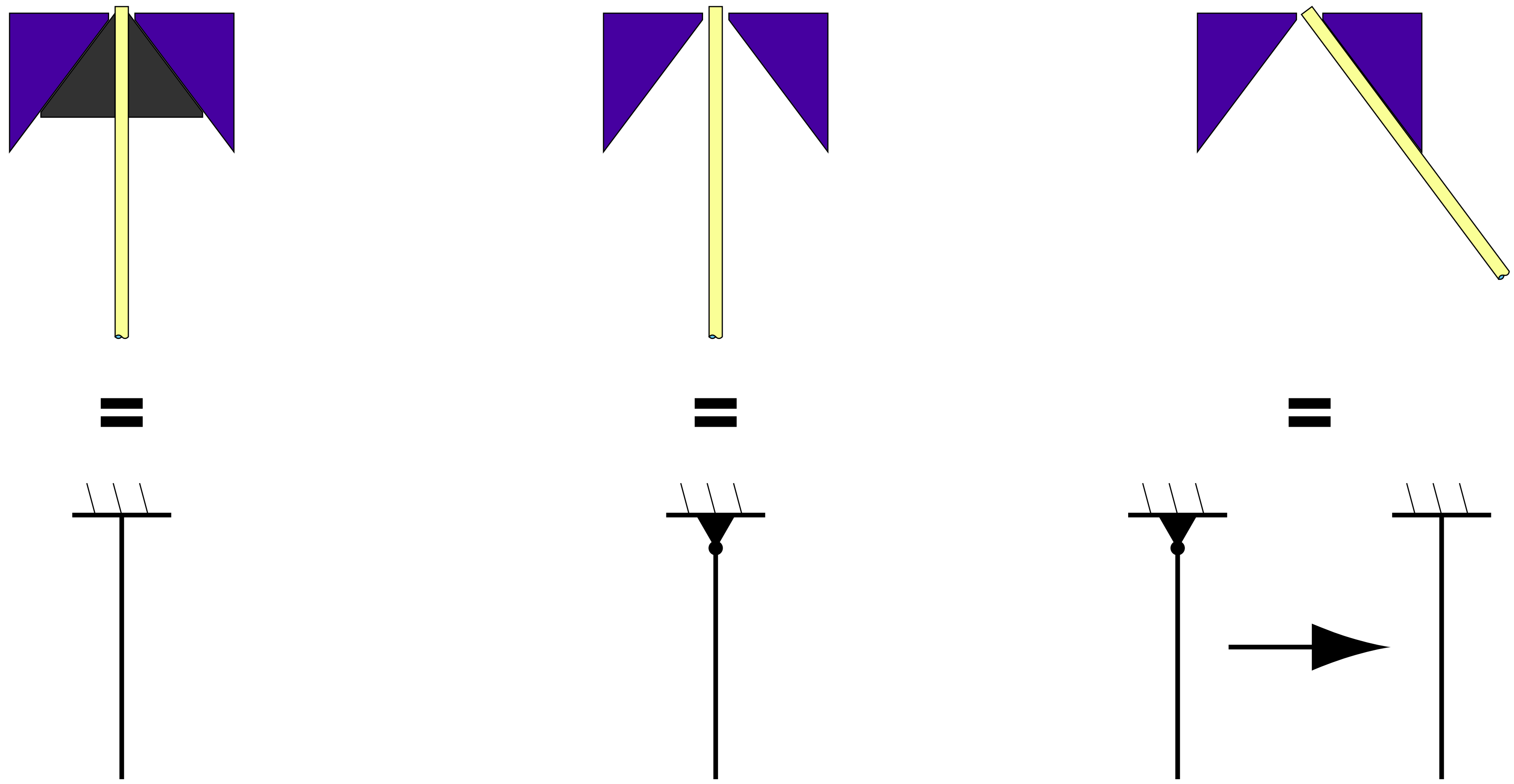
Boundary Conditions



Varying conditions from pinned to fixed

Additional Considerations

1. Quality and quantity of environmental data

2. Effect of compensators and compensator failure

3. Computational considerations
   - keep model simple
   - use single repeatable wave
   - non non-linear material model

4. QA issues

Future Developments

1. Modelling of boundary conditions
   - change at limits of compensators
   - dynamic lowering of riser
2. Wider range of loadcases
3. Scope of analysis

Conclusions

1. Analysis can reduce risk by providing information on limiting environmental loads.
2. Time spent waiting on weather can be reduced by using this information.
3. The cross-section of the end-assembly is significantly larger than the cross-section of the riser and causes a significant increase in hydrodynamic loads on the riser.
4. Riser bending moment can be high when the riser is held fixed at the top.
5. Riser deflections and rotations can be high when the riser is pinned at the top.
6. Motion of floating vessels can generate high bending moment or riser motion if there is a large end-assembly on the riser.
7. Close attention to support conditions is necessary.
8. Careful selection of loadcases is required.