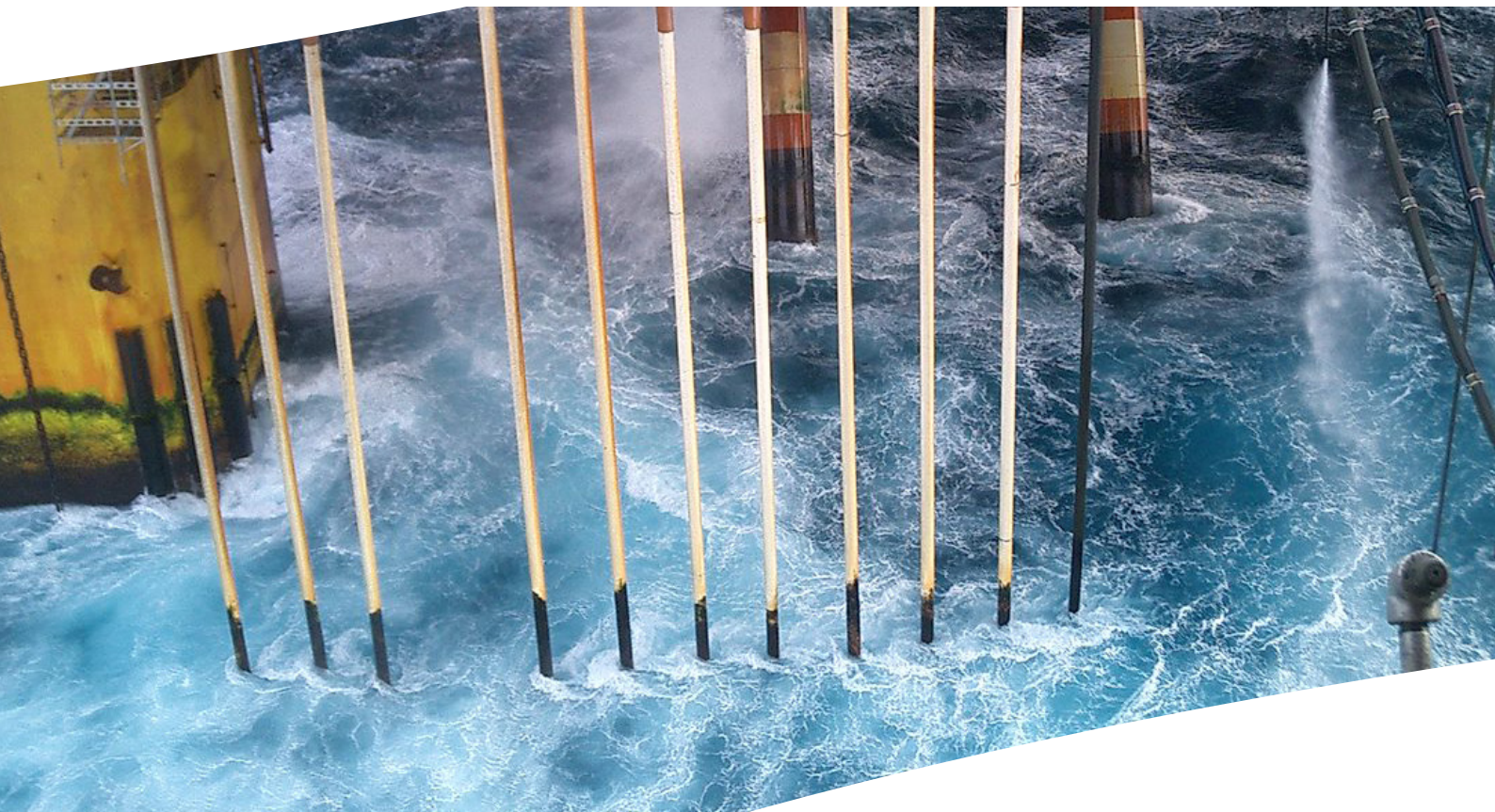


# Structural Assessment of Flexible Pipes

*Reduce operational downtime and identify reserve capacity*

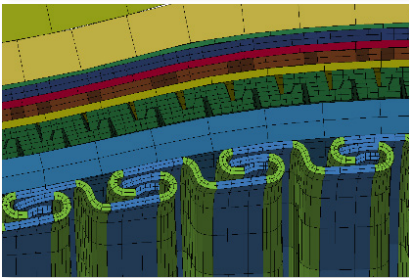
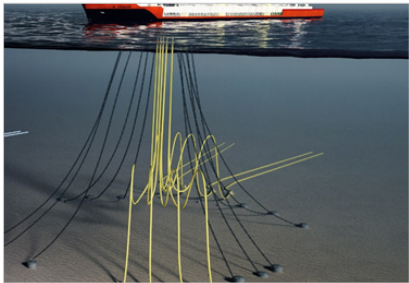
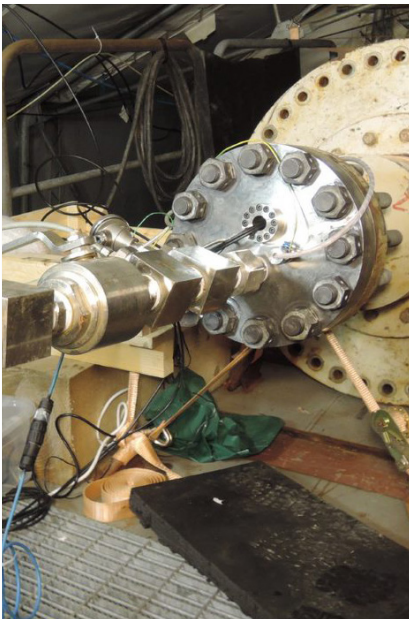


*4Subsea is a leading expert on structural assessment and advanced analysis of flexible pipe damages and failures. We help operators maintain safe operation and reduce operational downtime. 4Subsea develops and refines analytical tools and methods based on extensive accumulated experience.*

4Subsea offers a wide range of engineering services related to risers and flowlines, umbilicals and power cables. We cover all life cycle phases, starting with technology development and conceptual design through FEED and detailed design, procurement, construction, installation, operation, and decommissioning.

## KEY DELIVERABLES

- Structural capacity of flexible pipes, considering anomalies by performing advanced finite element analysis (2D & 3D fully non-linear)
- Modelling as-built geometry and material with observed damages
- Planning and execution of full- and small scale test of flexible pipes
- Planning, execution and evaluation of material tests
- Root cause investigation
- Operational feed-back



## Advanced Finite Element Analyses

4Subsea uses capabilities within finite element analyses (2D and 3D) and experience with operation and damage investigation of flexible pipes to provide expert advice for flexible pipe incidents.

- Impact
- Over bending
- Buckling
- Carcass collapse
- Bore blockage
- Thermal induced axial load

## Tools

- Detailed FE analysis using MARC
- 2D model and axis symmetric modelling
- 3D model for validation and non-axi symmetrical cases

## Structural Assessment

- Advisory services
- Capacity estimates
- Blockage position
- Material properties/ageing issues
- Cross section interlayer geometry/friction
- Operational history, pressure & temperature scenarios
- Basis for risk assessment
- Operational guidelines

## Validation by Testing

4Subsea has unique experience with full- mid- and small scale testing and validating of established guidelines and FE analysis. This includes material tests, carcass tests and in total six full scale tests of bore blockage in recovered full length flexible risers and flowlines.

- Planning and execution of full scale test
- Small scale test - material
- Data for validation of FE analysis



4Subsea is a leading provider of technology and services that help operators optimise energy production from subsea oil & gas fields and offshore wind farms. We combine domain expertise with data analytics and digital services to maximise lifetime of assets, reduce operational cost and optimise future projects through data-driven design.

The company was established in 2007 and clients include the major energy operators as well as the large suppliers of sub-sea equipment. 4Subsea is headquartered in Asker, Norway with additional offices in Bergen, Kristiansand, Stavanger, Rio de Janeiro, and Aberdeen. 4Subsea is a company in the Subsea 7 Group. More info at [www.4subsea.com](http://www.4subsea.com).

**4Subsea - Share ideas, move forward**

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