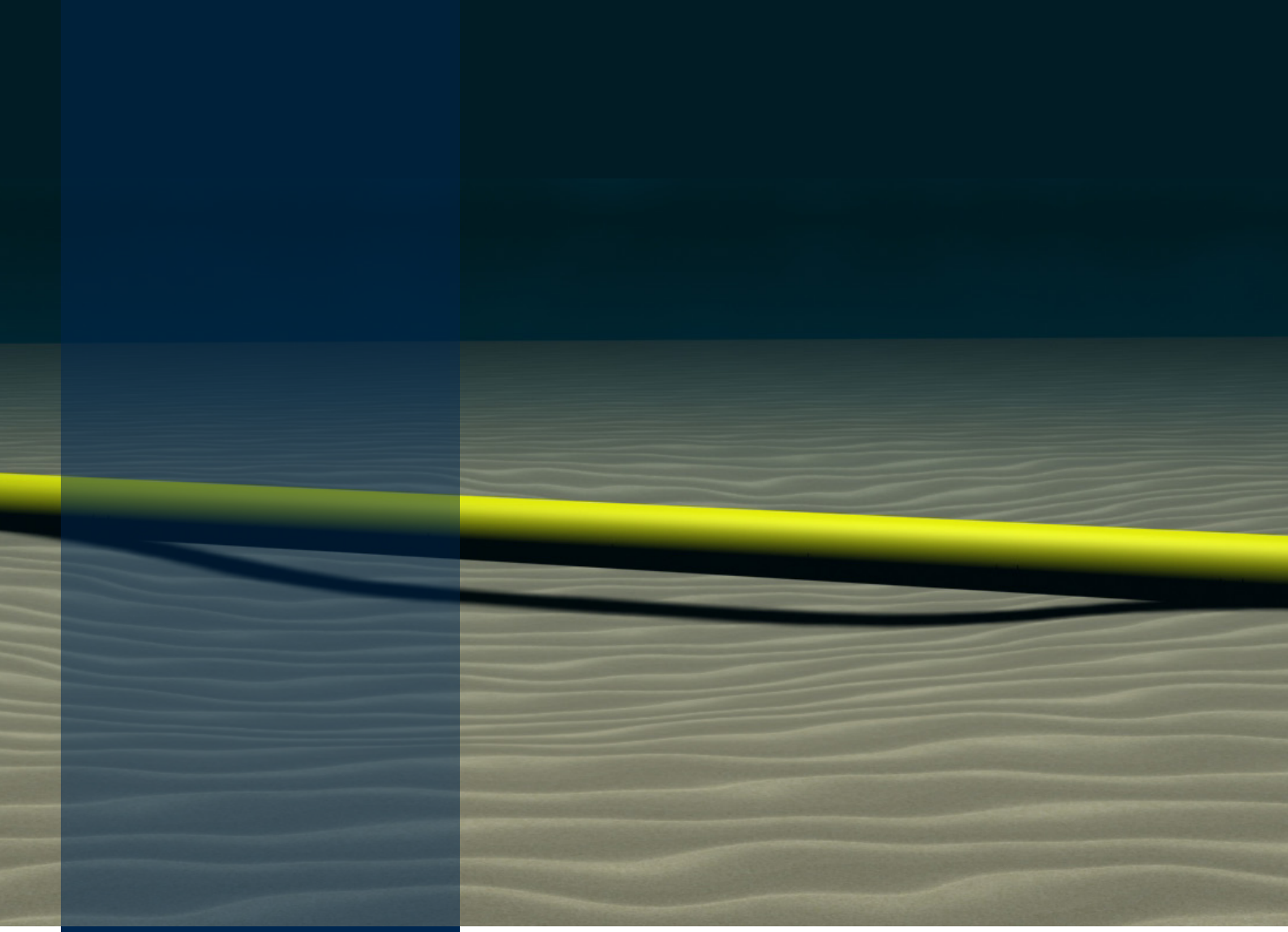


2H offshore

Subsea Flowline Analysis

an ACTEON company

Subsea Flowline Analysis

Buckling & Walking Analysis

2HBuckle is an advanced FEA software suite using ANSYS to analyze lateral buckling and axial walking in the design of HPHT flowlines. This phenomenon is caused by large compressive forces induced on a flowline system once operational. The flowline must be engineered to buckle laterally in a controlled manner such that the strains arising remain within fatigue and ultimate limit states.

Buckling Analysis Features

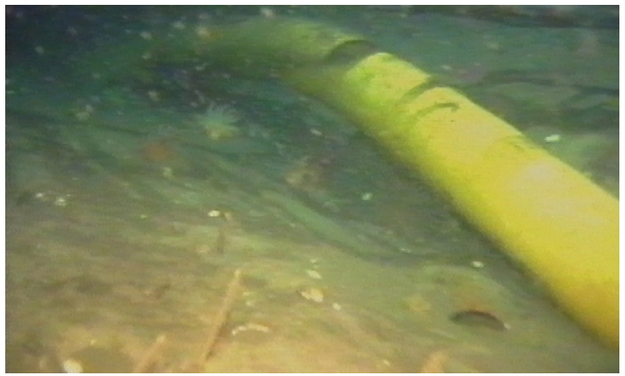
- Simulates the pipeline structure, internal fluid and seabed boundary conditions
- Considers the initial or as-laid shape, and out-of-straightness and elastic-plastic material
- Applies the residual lay tension, temperature, pressure and other loading parameters
- Considers cyclic thermal transients and pressure gradient
- Applies dynamically formed soil berms, trenches for multi-mode buckling
- Optimizes buckle initiators and routing

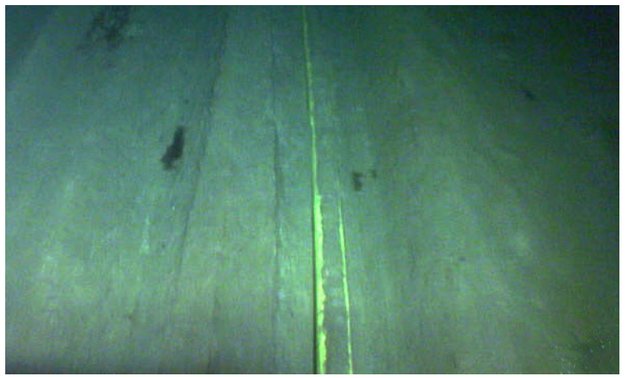
Walking Analysis Features

- Simulates seabed slope/shape/trench
- Simulates cyclic/constant axial tension induced walking
- Considers cyclic temperature gradient induced walking
- Calculates end expansion or reaction forces on end restraints
- Combines with buckling analysis for dynamic axial walking and seabed routing change
- Optimizes anchors and PLETS

Project Experience

- Flowline walking analysis and lateral buckling strength and fatigue analysis for HPHT subsea tieback flowline system in 7,000ft water depth, GoM.
- Flowline walking analysis and lateral buckling strength and fatigue analysis for flowlines in 4,500ft water depth, GoM.





Quality Assurance

Our buckling and axial walking analyses meet the following industry standards:

- DNV-RP-F110 Global Buckling of Submarine Pipelines
- DNV-OS-F101 Submarine Pipeline Systems
- DNV-RP-F105 Free Spanning Pipelines
- DNV-RP-C205 Environmental Conditions and Loads
- DNVGL-RP-C203 Fatigue Design of Offshore Steel Structures
- DNV-RP-F111 Trawl Gear Interference
- DNV-RP-F109 On Bottom Stability

Free Span Analysis

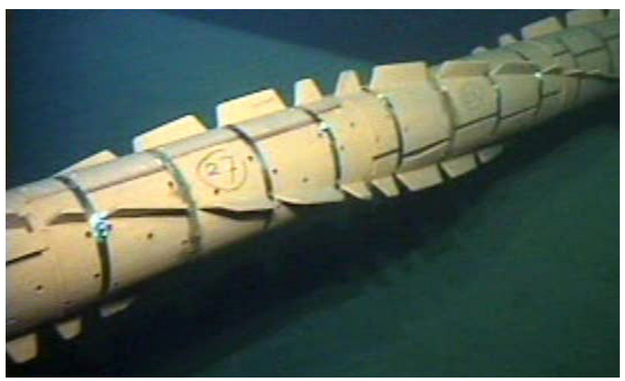
Offshore inspection often reveals free spans in flowlines and pipelines that can occur as a consequence of an uneven seabed and local scouring caused by flow turbulence and seabed instability. Loads on the span include the pipe weight, and wave and current hydrodynamic loads. 2HFreeSpan software checks whether the anticipated free span length is acceptable for static and dynamic loads.

Structural Modelling Features

- Conducts modal analysis to determine modal frequencies and shapes
- Considers initial or as-laid shape and loading history
- Applies residual lay tension, temperature, pressure and other loading parameters

Free Span Analysis Features

- Applies soil properties and environmental conditions - wave, current, directionality
- Conducts extreme stress and local buckling analysis
- Calculates VIV fatigue lives in in-line and cross-flow directions
- Determines max allowable span length



Project Experience

- Anadarko Horn Mountain export oil pipeline free span assessment
- Anadarko Marlin export oil and gas pipelines free span assessment
- Noble Energy Tamar & Yam Tethys subsea tieback pipeline bundle.

Quality Assurance

Our free span analyses meet the following industry standards:

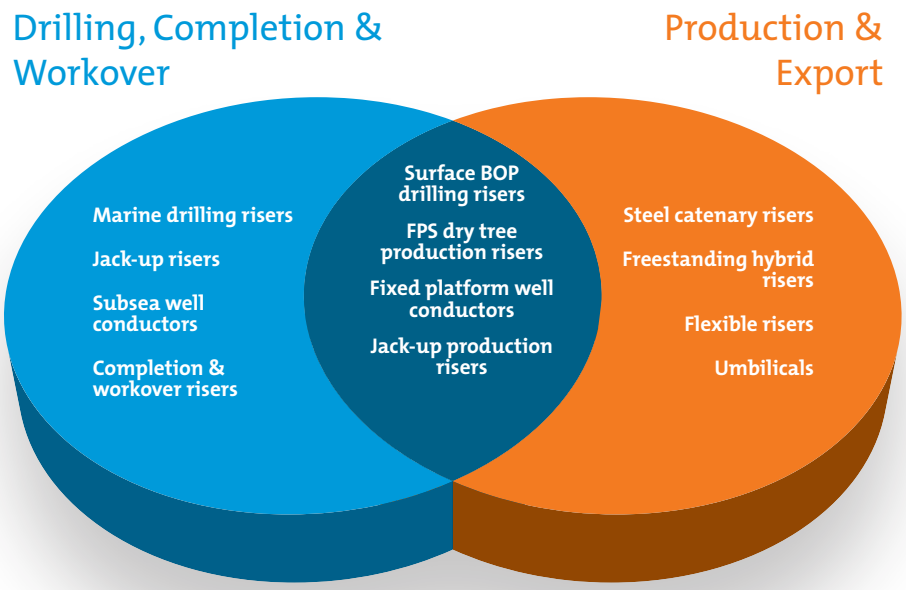
- DNV-RP-F105 Free Spanning Pipelines
- DNV-OS-F101 Submarine Pipeline Systems
- DNV-RP-C205 Environmental Conditions and Loads
- DNVGL-RP-C203 Fatigue Design of Offshore Steel Structures
- DNV-RP-F111 Trawl Gear Interference

About 2H Offshore

2H Offshore is a global engineering contractor specialising in the design, structural analysis and integrity management of riser and conductor systems used in the drilling and production of offshore oil and gas. Our capability and experience covers all types of risers, from shallow water fixed platform conductors, to drilling and production risers used in ultra-deep water.

Areas of Expertise

Our business falls into two primary categories, Drilling, Completion & Workover and Production & Export. Engineering of the risers used in each area of activity has many similarities in terms of the skill sets and experience required to conduct the work, but each area has many unique characteristics requiring specific experience and knowledge of the equipment and operations involved. The scope of each area of activity and overlaps that occur are illustrated below.



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