2H offshore

Measurement-Based Wellhead Fatigue JIP

40 years of monitoring data analyzed to improve drilling riser, wellhead and conductor fatigue predictions.

The assessment of riser, wellhead and conductor fatigue life is one of the most important aspects of drilling system integrity assurance. However, analytical parameters related to hydrodynamics, vortex induced vibrations (VIV) and conductor-soil interaction are still not fully understood. To obtain acceptable fatigue life, subsea engineers are having to take costly measures such as the installation of strakes around the riser joints, improvements of fatigue details at welds and connectors, vessel upgrades and more. A reliable set of analytical parameters would lead to improved accuracy in riser, wellhead and conductor fatigue estimates, and could prevent these costly, often unnecessary, equipment upgrades.

Objective

This joint industry project (JIP) will provide a measurement-based foundation for drilling riser system modelling to ensure that riser, wellhead and conductor fatigue damage is more accurately assessed for a variety of riser systems.

Field Data

To date, we have collected more than 40 years of drilling riser and conductor field measurements for a total of 18 operators and drilling contractors in 9 different regions with water depths varying from 80 m to 2,150 m.

Region	Clients	Projects	Water Depths (m)	Vessel Types
Gulf of Mexico	4	15	900 - 2,150	Semi, Drillship
Brazil	2	2	950 - 1,700	Drillship
North Sea	12	17	80 - 450	Semi, Drillship
Australia	4	6	100 - 850	Semi
Faroe Islands	1	1	450	Drillship
Mozambique	1	1	650 - 1,550	Drillship
Suriname	1	1	1,500	Drillship
Vietnam	1	1	850	Drillship
Caspian Sea	1	1	80-250	Semi

Scope & Methodology

Riser and wellhead monitoring has been widely used to support drilling operations and facilitate decision-making during extreme and unusual offshore events. The measurements can be used to understand the level of accuracy present in the up-front analysis model and calibrate it for better fatigue prediction. We propose that the JIP includes the following activities for a range of pre-selected water depths and riser configurations:

Riser Wave Response Calibration

Structural damping, hydrodynamic drag and added mass coefficients will be calibrated by comparing measured and analysis riser response.

Soil Model Calibration

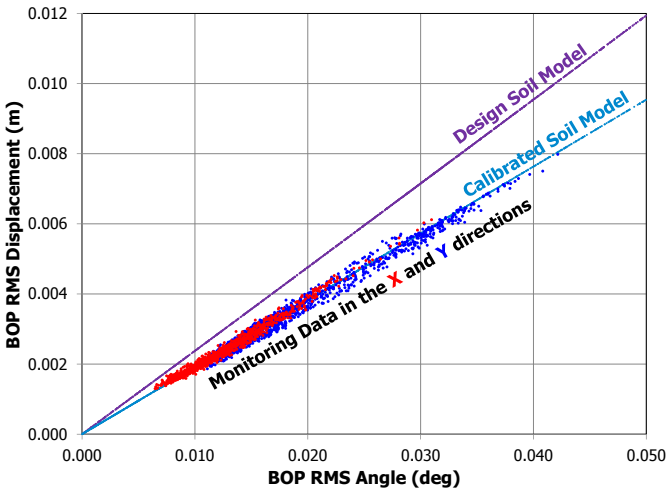
The soil model verification will be performed by comparing the BOP stack motions from monitoring data with that from analysis.

Riser VIV Response Calibration

During high current events, measured VIV peaks will be compared with riser modal frequencies and amplitudes.

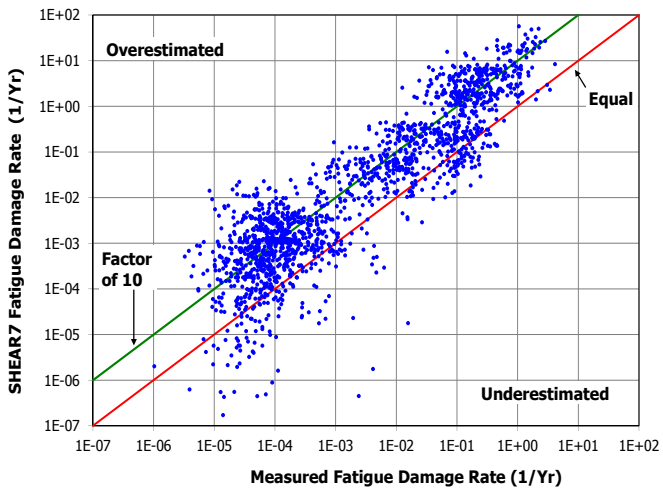
Special Cases

Straked buoyancy, staggered buoyancy, high current (>4 knots), tethered BOP, completion with tall subsea stack (Tree+BOP+LMRP).



Field data showing unrealistic design soil model

"Soil Model Assessment for Subsea Wellhead Fatigue using Monitoring Data", B. Mercan, Y. Chandra, M. Campbell, M. L. Ge, OTC, May 2017



VIV model calibration showing conservative assumptions for analysis

"An Approach To Include Observed VIV Likelihood In Drilling Riser Fatigue Analyses", Tognarelli M, Gabbai RD, Campbell M, OMAE 2009-79443, June 2009.

Benefits

The findings of the project will improve the accuracy of future wellhead fatigue assessments resulting in more reliable, safe and cost-effective drilling operations.

In the longer term, the results will inform future revisions of the riser design codes.

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