CASE STUDY

Well Hopping, West of Shetland

AS | MOSLEY
OFFSHORE SIMULATION

BACKGROUND

In 2020, an operator was planning an intervention campaign West of Shetland on multiple wells within the same field. Due to the water depth at the field, retrieval of the workover riser intervention system would be a lengthy process and add significant time and cost to the campaign. AS Mosley was asked to investigate the possibility of transiting the vessel between all wells in the campaign with the full riser system suspended.

CHALLENGE

The environmental conditions West of Shetland are some of the worst in the world, with high seastates and very strong currents. This is combined with a mono-bore workover risers' predisposition to high levels of Vortex Induced Vibration due to the small diameter of the pipe. Furthermore, as the vessel transits the velocity acts as an additional slab current on the riser which greatly exacerbates the VIV problem.

It was important to establish operating envelopes for vessel transit that would prevent structural overload of the riser and avoid excessive fatigue damage. Furthermore, the resulting operability had to ensure a significant time saving for the transit process compared to retrieving the workover system between wells. The maximum permissible vessel transit velocity had to be assessed for all possible seastates and current load combinations

The total number of load combinations required careful technical management to reduce time and costs without reducing the accuracy essential for safe operations of the riser system.

SOLUTION

In order to meet the challenges presented, AS Mosley undertook strength and fatigue analysis for the riser system during vessel transit. This took full account of wave action, current and vessel velocity including the effects of VIV.

The load combinations considered for the assessment were broken down into two categories as follows:

1) Environmental - waves and currents
2) Operational – vessel transit velocity

A range of environmental wave and current load combinations was applied to the riser system. For each load combination, the relative vessel transit velocity was increased gradually. The relative vessel transit velocity limit was then established for each environmental load combination by restricting the structural loads induced on the riser system and preventing over-utilisation. Similarly, the vessel velocity limit relative to the current was verified based on the resulting induced VIV fatigue damage. This was accomplished considering an additional background damage component from the environmental wave and current loads. The damage due to the environment was added to the damage resulting from the relative vessel velocity.

This approach conservatively accounted for the environmental loads for all vessel headings. The vessel velocity limit was established by comparing the total damage during transit to a permissible damage based on the requirements for normal operations.

RESULTS

The results of the strength and fatigue analysis were combined and rationalised to establish overall vessel transit speed limits in relation to current strength and seastate. The rationalisation process was carried out in full discussion and agreement with the customer. From this allowable vessel transit speeds could be tailored to the environmental conditions, improving operability. The operation was carried out in spring 2020 with no incidents and significant savings in vessel time.