

Extreme Wave Loading on a Jacket Rig

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Tests were implemented on a real offshore jacket structure designed by **WS Atkins** for water depths of 80 m. The steel model scaled 1:28 had 154 structural members and 48 nodes. Different riser configurations were used to change the blockage. Unique measuring equipment was created at **BSHC** or supplied by other project parties.

Subjection of a structure of complex spatial geometry to extreme waves of nonlinear nature results in non-homogeneity of wave field and flow velocities around structure, as well as nonlinear responses at large waves and/or current flow velocities.

Significant change of surface wave height occurs behind the structure at shorter waves, which further increases with imposing current action, due to the interference between incoming and generated waves and hence depending on structure blockage.

Local fluid velocities were measured at different positions in front and behind the structure in still water and waves, by means of a ball velocity meter. Well-expressed wake develops behind the structure, whose characteristics obviously depend on blockage and which change significantly local velocities around structure elements. Main contribution in forming fluid velocities comes from the current, wave distortion influence being slight. Wave length effect can also be considered small. Significant non-linearity in wave drift forces and moments has been detected at resonant frequencies of $(\text{cross measure/wavelength}) = 0.15$. Non-dimensional oscillatory wave forces obviously increase with current celerity and wavelength, but a tendency toward convergence at very long waves is observed. Maximal values of wave loading occurred for a period corresponding to 7 hours in full scale proved to be up to 2.5 times larger than statistically significant values.



Results obtained support correct prediction of structure behaviour in hostile environmental conditions of extreme nature. The high reliability of measurements warrants utilization of collected data as a benchmark for verification and calibration of calculation procedures used in offshore design.

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