

2012/13 Undergraduate Research Grant Scheme – Executive Summary

Project title:

Model testing for the optimum arrangement for multi-pod foundation supported wind turbines

University:

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Project summary:

Offshore wind turbines have become the new source of renewable energy in the UK. It started almost a decade ago and now, the UK has become the leader of offshore wind power with the highest number of offshore wind turbines in current operation.

While monopiles have been the dominant foundation type for shallow foundations, due to economic and technical limitations, monopiles are not suitable for deep water foundations. Symmetric and asymmetric multi-pod foundations which are supported on shallow foundations are used for deep waters.

In this study scaled tests were conducted on monopile and multi-pod foundations, where they were subjected to dynamic loading up to 50,000 cycles on test bed of sand. While the results for monopiles demonstrated a single natural frequency response, the multi-pod foundation showed two closely spaced natural frequencies which corresponds to the rocking of the structure in two orthogonal planes. Upon cyclic loading, in sand, the natural frequencies began to converge.

Furthermore a scaled tripod, with pile foundation structure, was also tested for up to 10,000 cycles. Unlike other tested multi-pod shallow foundations, this structure showed only a single natural frequency response. This corresponds to long pile foundations which are much more rigid and hence rocking of the structure in orthogonal planes either do not exist, or is very minimal.

A new mechanism to provide dynamic loading for the scaled models was created. Currently an actuator is used to provide this cyclic loading, however being an external body; it has certain limitations and boundary conditions. Dynamic tests were performed on scaled structures using both mechanisms to compare the different outcomes with each other. Test results showed similar trend.