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FOUNDATION DESIGN

EXACTING SOLUTIONS TO SUIT YOUR
SITE AND YOUR TURBINE

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FOUNDATION DESIGN

Ramboll is world leader in offshore foundation design for wind turbines. We have currently performed more than 1500 individual designs for over 30 offshore wind farms around the world, totalling more than 50% of installations. The designs are carried out using Ramboll's own state-of-the-art software programme. The software has been developed over the last 25 years and is continuously being updated and supplied with new features and models.

Unique foundation design

Our detailed foundation designs are based on the actual site conditions and the water depth at each turbine's position. This results in unique and individualised foundation designs ranging from monopile or jacket to GBS or an entirely different type of foundation. Compared to a design philosophy using grouping of foundations, our approach can provide our customers with substantial material savings due to the optimised design.

At Ramboll we believe that a professional foundation design requires that all phases in the life cycle of the wind turbine - from fabrication, transportation and installation to operation, maintenance and decommissioning - are taken into account. Furthermore the interaction between the primary and secondary structures must also be considered and forms an integral part of our design services.

Foundation types

There are many possibilities as far as choice of foundation type goes. The turbine foundation can be a steel monopile, a concrete gravity base structure, a steel or concrete tripod, a steel jacket or another concept altogether.

Based on factors such as the choice of turbine and site conditions, Ramboll will carry out the necessary analyses to select the best suited foundation type for your project and assist in all phases of the project development.

Detailed design of foundations

Our design of primary foundation structures includes:

- Extreme event analysis
- Scour development and possible protection system
- Natural frequency of the integrated structure
- Fatigue calculations
- Ship impact simulation
- Geotechnical design
- FEM analysis of details
- Integrated analysis of foundation and wind turbines

Ramboll will carry out the design according to any acknowledged standard required to have the project certified by a certifying authority such as DNV or Germanischer Lloyd, Applied standards may be IEC61400-3 and/or other international codes. Our services also include liaison with a certifying authority.

Furthermore the design is performed in close cooperation with the turbine manufacturer due to the highly complex load characteristics on the turbine and foundation structure.

Selected references

- Klasården (Sweden)
- Kentish Flats (UK)
- Burbo Bank (UK)
- Lynn & Inner Dowsing (UK)
- Robin Rigg (UK)
- Rhyl Flats (UK)
- Nordergründe (Germany)
- Greater Gabbard (UK)
- Walney I & II (UK)
- Bligh Bank (Belgium)
- Thanet (UK)
- Sheringham Shoal (UK)
- Gwynt y Môr (UK)
- Lincs (UK)
- Teesside (UK)
- Anholt (Denmark)
- Amrumbank (Germany)
- Baltic II (Germany)
- Humber Gateway (UK)
- Fife Energy Park (UK)
- Luchterduinen (Netherlands)
- Gemini (Belgium)
- Cape Wind (USA)
- BARD Offshore I (Germany)
- London Array (UK)
- Riffgat (Germany)
- GodeWind II (Germany)
- Dan Tysk (Germany)
- Wikinger (Germany)

WHO ARE WE?

Ramboll is a leading engineering, design and consultancy company founded in Denmark in 1945. Today, we employ close to 10,000 experts and have a significant presence in Northern Europe, India and the Middle East. With almost 200 offices in 21 countries we emphasise local experience combined with a global knowledge base. We constantly strive to achieve inspiring and exacting solutions that make a genuine difference to our customers, the end-users and society as a whole. Ramboll operates within the areas of: Buildings, Transport, Environment, Energy, Oil & Gas, and Management Consulting.

DETAILED DESIGN OF SECONDARY STEEL

Our detailed design of secondary structures includes the following items:

- J-tubes and J-tube supports
- Internal platforms
- External platforms
- Boat landing
- Ladders and intermediate resting platforms
- Sacrificial anodes including supports
- Grout skirt and grouting system

The deliverables related to the design of secondary steel include 3D CAD model, design drawings and design documentation.

