Summary of Decisions of the Structural Engineer
SEC 14/2012 held on 19.11.2012

(a) Case 14/2012

Issue: Suction Can Foundation Design and Testing Proposal

Recommendation: *Design*

1. To accept the use of 12m diameter suction can as foundation for an offshore wind turbine with 25 years design life.

2. To accept the following design parameters of soil with a factor of safety (FOS) of 3 adopted for calculating the allowable design capacities under working load:

   Under Static load conditions

   (a) The ultimate shaft friction in clay shall not exceed 0.28 x undrained simple shear strength with a limit of 4.7 kPa and 6.9kPa in the upper and lower marine clay layers respectively.

   (b) The ultimate shaft friction in sand layer shall not exceed $0.4 \times \tan \phi' \times$ effective stress (the β method) with a limit of 31.9 kPa.

   (c) The ultimate bearing resistance on wall tip in sand layer shall not exceed 6000 kPa.

   Under Transient load conditions

   (d) The ultimate bearing resistance on whole base in sand layer shall not exceed $Nc \times sc \times dc \times$ su-tc with a limit of 388 kPa.

3. To accept the use of a cold-formed steel tubular section with thickness of 40mm for the suction can.

Trial Pile

4. To accept the use of the 7m diameter suction can foundation of an existing meteorological mast (met-mast) as a trial pile to verify the static compression capacity of the wind turbine suction can foundation.

5. To accept the use of centrifuge model testing to extend the results of the trial pile to account for the difference in suction can diameter and embedment depth of the two foundations.

6. To accept the use of centrifuge model testing to verify the transient compression and transient tension capacities of the wind turbine suction can foundation.

Proof Test

7. To accept the following verifications as proof test for the wind turbine suction can foundation:

   (a) Verification of the immediate ultimate static compression capacity of the suction can by means of the measured installation pressure.

   (b) Verification of the design soil profile by means of:

      i. the distinct suction pressures for different soil strata as shown in the installation pressure curve;

      ii. predetermined minimum installation pressure;

      iii. post installation cone penetration test (CPT).

   (c) Verification of the total embedment depth by means of inspection by diver or remotely operated vehicle.

Modifications

8. To grant the modification to Building (Construction) Regulations 26(5)(a) to permit the spacing between centres of the suction cans to be 35m which is less than the minimum requirement of one pile perimeter (i.e. 37.7m).

Decision: Members endorsed the recommendation subject to the following conditions:

(a) A quality control scheme for fabrication of the suction can with cold-formed steel plates should be implemented, and corrosion loss of steel section should be considered.

(b) The proposed laboratory centrifuge model testing to be carried out and found satisfactory to the following acceptance criteria:

   i. the settlements recorded from the laboratory centrifuge tests should not exceed the scale down movement predicted.

   ii. the interpreted test results should agree with the design criteria and parameters.

   iii. the actual test procedure and the interpreted test results report were accepted by a specialist consultant independent of the testing laboratory.

   Consent to the commencement of suction can installation would not be given until the interpreted test results report had been submitted and found satisfactory.

(c) Prior to submission of Form BA14 for the foundation works, a performance review should be submitted stating and justifying that the geotechnical design assumptions and soil strengths upon which the foundation works had been based were valid.

(d) Suitable evidence for verification of the as-built conditions (in particular the penetration into sand layer) of each foundation to be certified by the RSE and RSC, and submitted to BD prior to the consent application for the commencement of the construction above the tripod substructure.

(e) The proposed long term monitoring of the structure to be carried out and the monitoring readings, together with a statement confirming the satisfactory performance of the structure and foundation by AP and RSE should be submitted to BD at monthly intervals in the first two years of operation. After the second year of operation, the results should be reported to BD annually.

(f) A review of the performance of the structure and foundation should be carried out and a report to be submitted by AP and RSE to BD within 14 days if the monitoring readings reach or exceed the action levels, or abnormal readings are recorded, or as directed by BD.