Chapter 4

Civil Works

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4.1 FOUNDATIONS

The design of the standard foundation for the GEW 1.5s turbine with a hubheight of 65 meter is enclosed in the appendix of this chapter. This foundation has standard 12 piles and has the shape of a cross.

For the final engineering and decision which type of foundations will be used, Siemens will do soil investigations at different turbine locations at the dike. From our experience from Slufter 1, we know that there are differences in the soil conditions at different locations. The exact pile-length will be based on the soil investigation. Alternatively we can build for example a cross-foundation with extra piles (16) or a slab foundation. Both types are already engineered and built at Slufter 1.

The foundations will be placed in the dike, with the top of the foundation just below the level of the existing road. The road will be constructed on top of the foundations. If necessary for technical reasons the dike will be broadened with sand at the turbine positions. Depending on the width of the dike and the foundation dimensions it might be possible that parts of the concrete are visible at the lower side of the dike.

Because the width of the dike is relatively small, it could be necessary to protect the foundation against frost. This will be valid mainly for part of the foundation facing the parking side.

Construction of the foundations and pouring of concrete will take place from the public parking at the beach-side / boulevard.

4.2 OTHER CIVIL WORKS

4.2.1 Temporary facilities

During the construction phase the necessary facilities will be at the site. This includes a portocabin for personnel / project management, water as well as electricity from a generator.

4.2.2 Roads

The existing road at the dike needs to be broken down at the 9 turbine locations. During construction this road will be re-routed at the inside of the dike with sand and steel plates.

The permanent road will be build on top of the foundations. During engineering of the foundations this is taken into account. At the foundation drawing the road is shown on top of the foundation.
4.2.3 Dike

As indicated in paragraph 4.2.1 at some locations the dike needs to be broadened in order to be able to place the foundation and the road. This will be done by adding sand sourced from the new foundation positions. We assume that the necessary permission by WEOM and ‘Rijkswaterstaat’ will be given for this.

4.2.4 Small works

For small civil works a local contractor will be hired during the project execution. This includes for example excavation and construction of temporary roads.

The poles on the boulevard side at the nine turbine locations will also be removed during the construction. They will be replaced after completion of the wind park.

4.3 LOGISTICS

The construction of the wind park Slufterdam West calls for a detailed logistical planning. Access to the site will be from the boulevard side. The main works (cranes, concrete pouring) will be done from the boulevard parking and not on the dike. For smaller works and transportation temporary roads at the turbine locations will be and re-routed at the inside of the dike.

During construction / works at the boulevard, signals will be placed at the parking to warn any possible passer-by.

We also refer to the project management (chapter 3 Technical Part) for more details about the logistics and project plan.

4.4 CONSTRUCTION EQUIPMENT

4.4.1 Major equipment

Major equipment needed for the realisation of the wind park include cranes (main crane and support crane), excavation equipment, pile-driver and truck mixers.

Cranes are needed during erection of the turbines. Excavation equipment is needed at different times throughout the project execution for smaller works / temporary roads. To a bigger extent they are needed at the start of the foundation works. The pile driver is only needed at the beginning of the foundation works. Truck mixers are used during construction of the foundations.

For details about the length in days / weeks of the particular items we refer to the preliminary project planning in chapter 8 of the Technical Part.
4.4.2 Fall back plan

Siemens Nederland co-operates with first class suppliers of equipment / components. Siemens has good experience with these companies for multiple projects. The selected suppliers are selected a/o on the company size and the available number and capacity of equipment. This reduces the risk of delays in project execution by the absence of critical construction equipment.
APPENDIX 4.1: FOUNDATION DRAWING (12 PILES)
APPENDIX 4.2: PILE-PLAN
1. Pfändern

<table>
<thead>
<tr>
<th>Druck e/29</th>
<th>Zug c/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>E100</td>
<td>kein Zug</td>
</tr>
<tr>
<td>L100</td>
<td>kein Zug</td>
</tr>
<tr>
<td>Anlage im Betrieb</td>
<td>keine Zug</td>
</tr>
<tr>
<td>Leichtbeton</td>
<td>kein Zug</td>
</tr>
</tbody>
</table>

Der nachweis der Höhe der Tragfähigkeit der Pfähle ist vom Baugrundspezialisten zu erfolgen.

2. Von der Tragfähigkeit ist abzuleiten, ob der vorhandene Baugrund in dem angenommenen Lastfall die erforderliche Last übertragen kann. Es ist der Pfahlkeil zulässig.

3. Einwandfrei wurde für die innere Tragfähigkeit ein Standbeinprogramm "Centrum" Typ 50 benutzt.


APPENDIX 4.3: ANKER
APPENDIX 4.4: ANKER CONSTRUCTION
Draufsicht Kopfplatte

Kopfplatte 100/200/10mm

Draufsicht Ankerring M.1:50

Werkstoffe:
Ankerring und Bolzen: (siehe Blatt 2)
Tragkonstruktion Ankerring: St37-2

Fröhling & Rathjen
Scheibstraße 22
26483 Hamburg
Tel.: 4444444
Fax.: 4444444

Unterschrift:
Antragsteller
Ennen Wind GmbH
Hoisted 5, 48499 Solzberg

Baustellenummer:
Tragkonstruktion
Gestaltung: für den Ankerring
Detail

Maßstab: 1:10
Antrag Nr.: 266/01
Blatt Nr.: 4
Red.: 1
proj.: 1
lie.: 1
Gewindebereich isolieren

Vergußmörtel nach DIN 1045, 6.7.1 und 7.6.5
Mindestdruckfestigkeit f_{uk} 250 - 55 N/mm² bzw. B65

120x Ankerbolzen entspr. DIN EN 24 014-M36x1475-B8
beidseitig 150mm Gewinde, ISO-passend
mit Bitumenanstrich (Schichtdicke mind. 100um) im gewindefreien Bereich
Vorspannkraft, hydraulisch aufgebracht 300kN nach 30 Tagen
Dehnweg = 2,07 mm

240x Scheibe DIN 125-37-300 HV √
DIN 267 Teil 10 T2n
240x Skt.-Matte DIN EN 24 032-M86 √
Gewinde und Mutterkopfauslage M452 geschmiert
Es sind komplett Satz von Ankerstangen, Muttern und Scheiben zu verwenden

Ankerring 350x40
mit 2x60x37

Turbulfußflansch

Montageschablone

OK Sockel

Gewindebereich isolieren
Muttern gegen lösen sichern

B 45

B 35

Fröhling & Rathjen
Ebenthaler Str. 22
26208 Nordenfelde

Zur Stabilisierung des Ankerkorbes
sind unten wie oben jeweils mindestens 10 Gegenmuttern mit entsprechenden
Scheiben vorzusehen

Werkstoff des Ankerkorbes: S355J2G3-Z15
Werkstoff der Anker: Güte 8.8

Muster Nr.: 1:10
Auftrag Nr.: 256/01
Detail Nr.: 2
gez.: RO

Hofstede, 26.02.2001