Installation of Foundations for Offshore Windturbines at Horns Rev

Ballast Nedam

Content

- Organization
- Mobilisation Buzzard
- Work Cycle
- Foundation Works
- Monopiles, history and future

I assume that the general knowledge on Horns Rev is sufficiently available, not a word on the windfarm itself

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Organization

• Client	Elsam
• Foundations	MTH
• Marine Subcontractor	Mammoet van Oord
• SEP Buzzard	Ballast Nedam

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Mobilization

- SEP Buzzard
  - Dimensions 43,00 x 30,00 x 4,20
  - Draft max. 2,97 m
  - Manitowoc 4100 Ringer Crane
    (200 tonnes at 13 m.)
  - Pile gate
  - Tilting Frame

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Mobilization

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Mobilization

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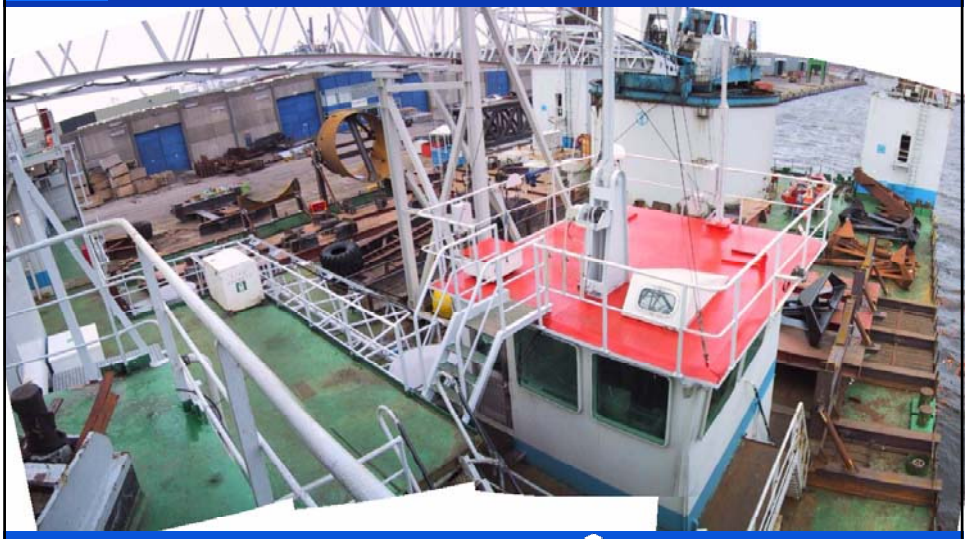
Mobilization



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Work Cycle Buzzard

	Transport	
1	Sailing to Esbjerg	16 hrs.
2	Move alongside and jack up	
3	Load piles and radar reflectors	
4	Jack down, remove moorings and attach tugs	
5	Sailing	
	Piling Cycle 1	
6	Temporary location jack-up	10 hrs.
7	Running anchore wires	
8	Jack down and winch to location	
9	Jack up and preload	
10	Remove sea fastenings	
11	Boom up and attach uppender	
12	Lift pile and transfer to gripper	
13	Attach to hammer, place on pile and remove up end	
14	Piling	
15	Remove hammer and seafasten	
16	Lift and place radar reflector	
17	Sea fasten crane	
18	Jack down and tighten anchore wires	
19	Winch to temporary location	
20	Jack-up at temporary location	
21	Disconnect anchores haul in wires, move anchors	
22	Jack down	

Work Cycle Buzzard

23	Move to temporary location	20
	Piling Cycle 2	
24	Temporary location jack-up	10 hrs.
25	Running anchore wires	
26	Jack down and winch to location	
27	Jack up and preload	
28	Remove sea fastenings	
29	Boom up and attach uppender	
30	Lift pile and transfer to gripper	
31	Attach to hammer, place on pile and remove up end	
32	Piling	
33	Remove hammer and seafasten	
34	Lift and place radar reflector	
35	Sea fasten crane	
36	Jack down and tighten anchore wires	
37	Winch to temporary location	
38	Jack-up at temporary location	
39	Disconnect anchores haul in wires, move anchors	
40	Jack down	

Work Cycle Buzzard

- Optimum 36 hours for 2 piles
- First pile in place 31st of March 2002
- Last pile in place 1st of August 2002
- Total 4 Months, 122 days, average 1,5 day (36 hrs) for each pile
  - Examples
    - Due to weather, period June 22 – July 3 > waves over 1 meter, no production.
    - Period July 4 – July 17 > 16 piles in 14 days

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Foundation Works -Loading Esbjerg

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Foundation Works - Loading Esbjerg

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Foundation Works – Transport to Horns Rev

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Foundation Works - Transport to Horns Rev

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Foundation Works - Transport to Horns Rev

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Foundation Works - At Horns Rev

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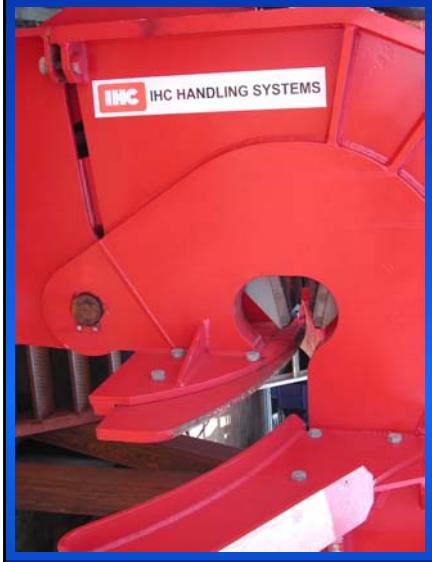
Foundation Works – Pile Gripper



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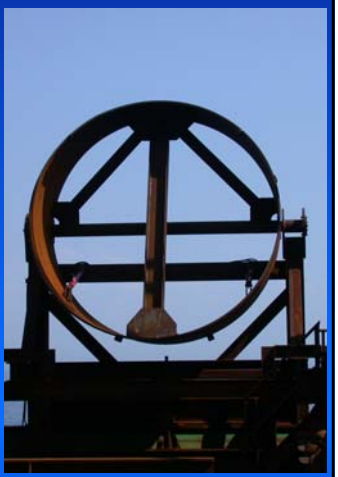
Foundation Works – Tilting Frame



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Foundation Works – Pile Gate

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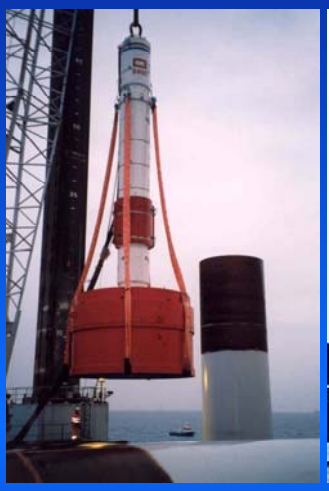
Foundation Works - Piling



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Foundation Works – Short Impression

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Foundation Works – Radar Reflector

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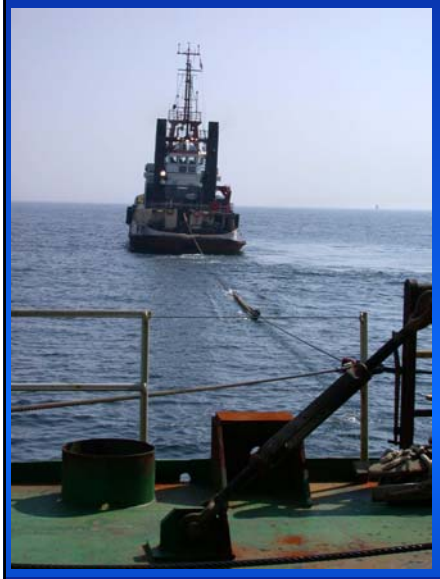
Foundation Works – To the next foundation



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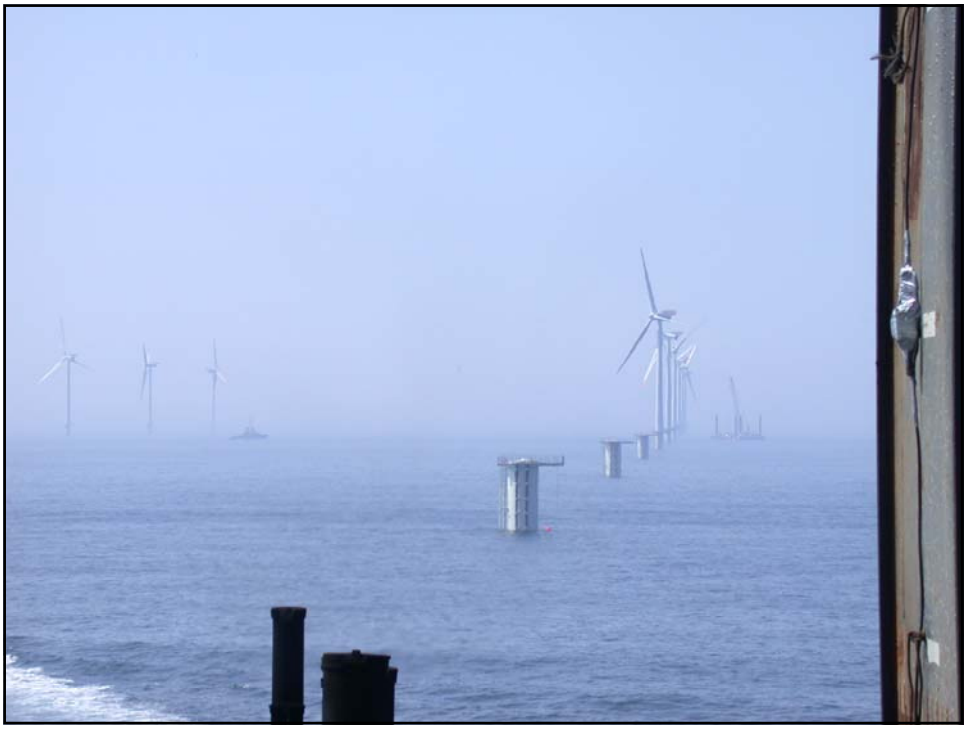
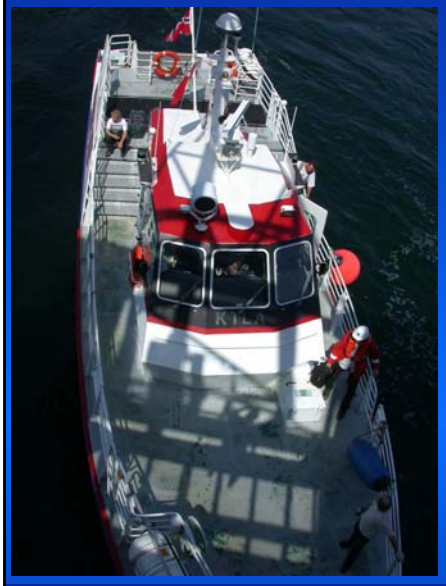


Foundation Works – Back Home



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Monopiles, history

Monopiles, the future

	6MW		
	CD-20	CD-35	
Tripod and piles (3)	388	525	
Suction bucket and tripod	606	-	
Monopile	591	775	
- concrete monopile	-	2400	
- excl. scourprotection	733	917	
	Equipment	Activities	
Tripod and piles (3)	+	-	+ / -
Suction bucket and tripod	+ / -	+ / -	+ / -
Monopile	+	+	++
- concrete monopile	-	+ / -	-
- excl. scourprotection	+ / -	+	+

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