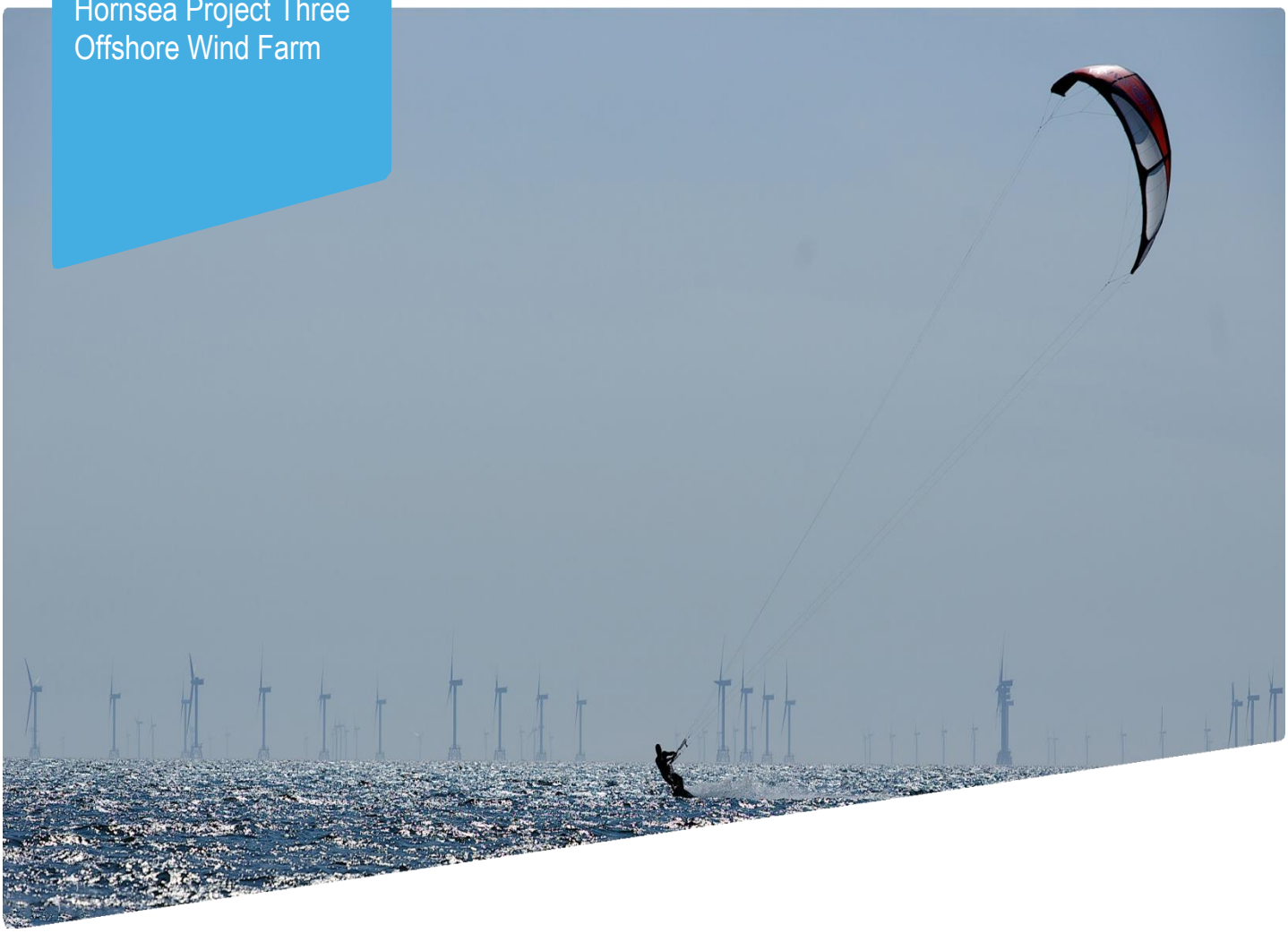
Hornsea Project Three
Offshore Wind Farm



Hornsea Project Three

Offshore Wind Farm

Applicant's Response to the SoS' Minded to Approve Letter
Appendix 7: Updated Response to Norfolk Boreas Deadline 16 Submission - Technical Note

Date: September 2020

Hornsea 3
Offshore Wind Farm

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Appendix 7: Updated Response to Norfolk Boreas Deadline 16 Submission - Technical Note

Revision History

Version	Date	Author	Context
Rev A	6th May 2020	Paul Zanna	Comments addressed
Rev B	22th July 2020	Aidan Fisher	Comments addressed
Rev C	18th August 2020	Aidan Fisher	Comments addressed
Rev D	23rd September 2020	Aidan Fisher	Working week revised to 5 days with text / Appendix A amended accordingly
Rev E	30th September 2020	Aidan Fisher	NV traffic figures updated in line with DL16 SoCG

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London, SW1P 1WG

Front cover picture: Kite surfer near a UK offshore wind farm © Orsted Hornsea Project Three (UK) Ltd., 2018.

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Abbreviation

Abbreviation	Definition
AADT	Annual Average Daily Traffic
ATC	Automatic Traffic Counter
CRF	Congestion Reference Flow
DfT	Department for Transport
HGVs	Heavy Goods Vehicles
LPA	Local Planning Authority

1. Introduction

1.1 This document with accompanying appendices and plans is prepared as part of the Hornsea Project Three Offshore Wind Farm (hereafter referred to as Hornsea Three) and focusses on the potential impact of the scheme on the village of Cawston, Norfolk, particularly in connection with the construction vehicles and the delivery of cable sections 9 & 10 (to the West of the village).

1.2 Whether this is approached simultaneously or in a staggered manner, the construction of cable sections 9 & 10 to the West of the village of Cawston will result in some traffic impact, but as noted previously, this impact will be temporary.

1.3 In March 2019 Create Consulting Engineers prepared a 'High Street, Cawston – Highway Intervention Scheme' (HIS) document. This document set out a series of measures proposed to be introduced through the village of Cawston, to mitigate the localised impact of the HGV traffic associated with the construction of Hornsea Three alone and cumulatively with the Norfolk Vanguard and Boreas schemes which utilise the same route for access.

1.4 A wide range of activities are associated with the construction of Hornsea Three, of which HGV movements associated with the transportation of cable drums form only a minor component of overall levels of traffic generation (see 2.6).

1.5 In January 2020, Royal Haskoning, as part of the Boreas DCO inquiry, produced 'Technical; Note Revised Cawston Highway Intervention Scheme' on behalf of Vattenfall which was produced in response to the Action Point 1 from Issue Specific Hearing 3 of the Norfolk Boreas Limited DCO Examination. The Vattenfall document sets out an alternative mitigation scheme to what was identified in Create's 2019 document, following on from the same principles established.

1.6 In addition, during the Norfolk Boreas Limited DCO Examination, Hornsea Three have been requested to consider, if possible, a refinement of the numbers of planned construction vehicles which would travel along the High Street in Cawston to allow a more accurate picture of the peak construction impact to be considered.

1.7 The purpose of this Technical Note is to refine the construction traffic flow forecasts presented in the original HIS submissions for the Hornsea Three scheme (for a proposed maximum 3.3m diameter cable drum size on links 88 and 89) and provide further, more detailed analysis of daily HGV traffic generation in terms of worse-case forecasts, more typical levels of traffic generation and also an "intermediate" period of HGV traffic generation.

1.8 This note has been updated since the original Boreas DL14 submission. The change reflects the agreement to reduced HGV operating hours through Cawston to 5 days (Monday to Friday, no HGV movements on a Saturday), from the 5.5 day HGV working week specified in the previous version of this technical note. This reduced working week does not apply to non-HGV movements through Cawston and does not change the daily peaks presented throughout this note.

2. HGV Traffic Movements

Traffic Analysis

2.1 Associated with the construction of cable sections 9 & 10, Create previously set out the two-way daily construction traffic numbers for "Link ID 89: B1145 in Cawston" which considered Hornsea Three (HOW03) construction traffic, and also the traffic figures associated with Norfolk Vanguard to derive and account of cumulative impact.

2.2 Further details are presented in Table 2.1.

Table 2.1 Summary of Daily Two-Way Traffic Movements at Cawston – Maximum Cumulative

Hornsea Three Link	2022 Base		HOW03 Construction		Norfolk Vanguard		Maximum Cumulative Traffic	
	Total	HGVs	Total	HGVs	Total	HGVs	Total	HGVs
Link ID 89: B1145 in Cawston	3,477	127	370	127	276	112	646	239

Note: Figures in Table 2.1 are derived from Table 3.1 of Appendix 7 to Deadline 4 - HGV Haul Road Reduction Report, with the Norfolk Vanguard figures DERIVED from DL16 SoCG.

2.3 The figure of 127 two-way HGVs is a *combined* Hornsea Three total figure, and a maximum that should not be exceeded for a primary peak/secondary peak or during the 'average' periods. This figure represents a worse-case scenario that cables sections 9 & 10 would be constructed simultaneously, whereas in reality these works would be staggered.

2.4 Staggering these construction works has now been considered and agreed by Hornsea Three. This extends the duration, albeit at a lower traffic level, that HGVs will travel through Cawston.

2.5 Associated with the construction of cable section 9, in isolation, are a maximum of 62 daily two-way HGVs, and for cable section 10, in isolation, 65 two-way HGVs (rounded). These figures represent more realistic levels of HGV traffic generation associated with the staggered construction of each cable section along "Link ID 89: B1145 in Cawston". This level of HGV traffic generation should only take place during the peak period of construction activities.

2.6 To provide further insight, as part of this Technical Note the HGV traffic generation figures for the construction of cable sections 9 & 10 associated with Hornsea Three have been broken down further into constituent components for the following construction activities:

- Temporary Site Compounds;
- Site facilities and equipment;
- Fencing and temporary Roadway construction along cable route;
- Trench Construction;
- Tile loads;
- Cable and ducting deliveries;
- TT (HDD / Thrust Bore) Sites;

- Drainage Pipe;
- Link Boxes.

2.7 Only cable sections 9 & 10 were considered in this exercise, given that these are the only two sections for which construction requires HGV traffic to pass along the B1145 directly through the village centre of Cawston.

2.8 Taking account of the Hornsea Three HIS it was confirmed a 3.3m diameter cable drum size would be the largest diameter drum to travel through Cawston, the resultant HGV traffic has been broken down into total deliveries in monthly and weekly figures, assuming a working week for the scheme is 5 days, and a working month is 20 days.

2.9 The duration of the construction of each cable section (in days) has also been taken from the original transport submission for the Hornsea Three scheme which equates to 133 days and 114 days respectively for cable sections 9 & 10.

2.10 While the overall construction of cable sections 9 & 10 would occur over a longer period, it is expected that the "cable and ducting deliveries" activities particular to cable sections 9 & 10 would take place during a condensed period of approximately six months if constructed simultaneously, or over approximately 11 months when staggered.

2.11 However, there could be a period of "overlap" between the construction of these two cable sections. While the overall construction of cable sections 9 & 10 when staggered would take approximately 11 months in total, an intermediate period of HGV two-way traffic generation would occur roughly centrally within this period during months 5-6 whereby there would be a "spike" in traffic generation.

2.12 Nevertheless, the level of daily traffic generation would still not exceed the figure of 127 two-way HGVs (i.e. that figure presented in aforementioned HGV Haul Road Reduction Report that in turn replaced the figure presented in the original Transport Assessment prepared to accompany the original Hornsea Three Development Consent Order submissions).

2.13 The comprehensive suite of spreadsheet outputs based on those figures included in the aforementioned HGV Haul Road Reduction Report (see Appendix A) provide a detailed account of the resultant implications for traffic movements through the village of Cawston on a monthly basis.

2.14 The HGV numbers presented have been broken down and calculated using the prescribed cable drum diameter size of 3.3m confirmed as the largest drum which would travel along the B1145 to the cable section access points.

2.15 All calculations have been derived from the original data (Table 2.1 above) and are considered to be the best estimate of maximum HGV traffic generation at the time of production of the report that accompanied the original submissions.

2.16 From the overall two-way HGV movement figures, only those associated with 'cable and ducting deliveries' are affected by the metres of cable that can be carried by each load.

2.17 The capacity of the drum size is estimated to be as follows and the specification of the vehicle is provided in Appendix B.

- 3.3m 1,167m of cable per drum (estimated maximum value)

2.18 Taking into account the traffic movements using a 3.3m diameter cable drum size the overall two way HGV movements for the simultaneous and staggered construction method scenarios are shown in Table 2.2 below.

Table 2.2 Summary of Daily Two-way HGV Traffic through Cawston for 3.3m dia. cable drum

Cable sections 9 & 10	Total month daily two-way HGV movements on B1145										
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
Simult'us	**127**	**121**	**121**	**117**	**122**	**123**					
Staggered	**67**	**65**	**65**	**65**	**68**	**127**	**56**	**56**	**56**	**59**	**60**

2.19 Taking this assessment and profiling into account the Hornsea Three scheme is able to confirm the following for cable sections 9 & 10.

- Primary peak does not exceed 127 daily HGV movements: Duration: 1 month
- Secondary peak: 68 daily HGV movements: Duration: 1 month
- Average over remaining period: 62 daily HGV movements Duration: 9 months
- Cable drum maximum diameter size 3.3m

3. Summary and Conclusions

3.1 Previous submissions for the Hornsea Three scheme have forecast that the construction of the two cable sections 9 & 10 to the West of Cawston could generate up to 127 two-way HGVs along Link ID 89: B1145 in Cawston.

3.2 The figure of 127 two-way HGVs was stated as a maximum (rounded) figure, and a maximum that should not be exceeded for a primary peak/secondary peak and average periods. This figure represents a worse-case scenario on the basis that cables sections 9 & 10 would be constructed simultaneously.

3.3 Associated with the construction of cable section 9 in isolation are a maximum of 62 daily two-way HGVs, and 65 two-way HGVs for cable section 10. These figures represent more realistic levels of HGV traffic generation associated with the staggered construction of each cable section along "Link ID 89: B1145 in Cawston". This level of HGV traffic generation should only take place during the peak period of construction activities.

3.4 Even during the "overlap" between the construction of these two cable sections, the level of daily traffic generation would still not exceed the figure of 127 two-way HGVs.

3.5 The cable for sections 9 & 10 would be delivered on cable drums with a maximum diameter of 3.3m due to the presence of two bridges with a 44 tonne limit as well as limited highway width as previously confirmed in the HIS presented by Hornsea Three.

3.6 Hornsea Three confirms the following maximum HGV traffic flows and durations:

- Primary peak does not exceed 127 daily HGV movements: Duration: 1 month
- Secondary peak: 68 daily HGV movements: Duration: 1 month
- Average over remaining period: 62 daily HGV movements Duration: 9 months
- Cable drum maximum diameter size 3.3m

3.7 This summary Technical Note pertains only to the construction of cable sections 9 & 10 and the on-road route referred to as "Link ID 89: B1145 in Cawston" and does not relate to any other cable sections or links associated with the Hornsea Three scheme.

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Appendix A - Traffic Spreadsheets

Construction Vehicle Movements by Cable Route Section	Section 8	Section 9	Section 10	Total
Temporary Site Compounds				
% compound surfaced				
area (m^2)	0	0	1,800	**1,800**
m3 stone required - depth	0	0	540	**540**
Tonnes stone - t/m3	0	0	972	**972**
HGV loads - t/load	0	0	49	**49**
Removal of compounds	0	0	49	**49**
2-way HGV moves	**0**	**0**	**194**	**194**
Site facilities and equipment				
assume no HGVs for compound set up proportional to compound areas	0	0	2	**2**
Welfare (water, food, etc) assume proportional to compound areas	0	0	18	**18**
Removal of equipment etc.	0	0	2	**2**
2-way HGV moves	**0**	**0**	**43**	**43**
Fencing and temporary Roadway construction along cable route				
Length (metres)	4,370	1,935	1,660	**3,595**
Fencing - m/HGV	44	19	17	**36**
width - m	12	12	12	**24**
depth - m	0.5	0.5	0.5	**1**
Cubic metres stone for roadway	26,220	11,610	9,960	**21,570**
Tonnes stone - t/m3	47,196	20,898	17,928	**38,826**
HGV loads - t/load	2,360	1,045	896	**1,941**
Geogrid for underlaying stone - m2/HGV	1	1	0	**1**
Misc HGVs eg, culvert pipe, temp metal roadway sections - /km	22	10	9	**19**
Removal of Roadway	2,360	1,045	896	**1,941**
2-way HGV moves	**9,486**	**4,201**	**3,605**	**7,805**
Trench Construction				
trench width (average) - m				
depth - m				
No. cables per trench				
No. trenches				
Cable dia				
tiles per HGV / tiles to cover trench width				
Volume of stabilised backfill in cubic metres per trench	7,743	3,428	2,941	**6,370**
m3 backfill	46,457	20,571	17,647	**38,218**
Tonnes backfill	76,654	33,942	29,118	**63,060**
HGV loads	3,833	1,697	1,456	**3,153**
Tile loads	107	48	41	**89**
Wall support proportional to length of trenches - loads	9	4	3	**7**
Removal of excavated material				**0**
2-way HGV moves	**7,897**	**3,498**	**3,000**	**6,498**
Drainage Pipe				
Volume of stabilised backfill in cubic metres per trench (m3)	2,193	971	833	**1,804**
trench width at bottom (m)				
Trench depth (m)				
Pipes per trench				
Tonnes backfill - t/m3	3,618	1,602	1,374	**2,977**
HGV loads	181	80	69	**149**
Removal of excavated material	181	80	69	**149**
2-way HGV moves	362	160	137	**298**
Link Boxes				
Volume per trench m3	18	18	18	**36**
Total No. of Link Boxes on corridor	1,131	16	14	**30**
HGV loads - m3/HGV	189	3	2	**5**
2-way HGV moves	377	5	5	**10**
Transition Pits		only for landfall (not applicable for Cawston)		
Cable and ducting deliveries				
m of Cable	78,660	34,830	29,880	**64,710**
Number of cable drums - m/cable roll	127	56	49	**105**
HGV loads	127	56	49	**105**
m of ducting	78,660	34,830	29,880	**64,710**
Number of duct loads	105	47	40	**87**
2-way HGV moves	464	206	178	**384**
TT (HDD / Thrust Bore) Sites				
HDD Site Preparation	125	89	89	**178**
HGV movements per HDD				
HDD Site Reinstatement				
HGV movements per HDD	107	76	76	**152**
Factor 101 to 120 HDDs				

Construction Vehicle Movements by Cable Route Section	Section 8	Section 9	Section 10	Total
Major HDD works	0	0	26	**26**
Total Major HDD 2-way HGV Movements	231	165	191	**357**
Minor HDD works	166	119	95	**214**
HGV movements per HDD				
Total Minor HDD 2-way HGV Movements	139	139	163	**302**
2-way HGV moves	**370**	**304**	**354**	**659**
Construction period Duration - Days	**300**	**133**	**114**	**247**
Construction period Duration - Weeks	**60**	**27**	**23**	**49**
Construction period Duration - Months	**14**	**6**	**5**	**12**
TOTAL HGV DELIVERIES	**18956**	**8374**	**7517**	**15,891**
Monthly HGV Deliveries	1,327	1,322	1,385	**2,707**
Weekly STAFF Deliveries	316	315	330	**645**
Daily HGV Deliveries	63	63	66	**129**
TOTAL STAFF MOVEMENTS	**9,180**	**4,118**	**3,539**	**7,657**
Monthly STAFF Deliveries	3,841	2,944	2,668	**5,612**
Weekly STAFF Deliveries	919	704	638	**1,342**
Daily STAFF Deliveries	167	128	116	**244**
TOTAL MOVEMENTS	**28,136**	**12,492**	**11,056**	**23,548**
MONTHLY MOVEMENTS	5,168	4,266	4,053	**8,319**
WEEKLY MOVEMENTS	1,234	1,019	968	**1,987**
DAILY MOVEMENTS	230	191	182	**373**

Daily Material Movements per Month

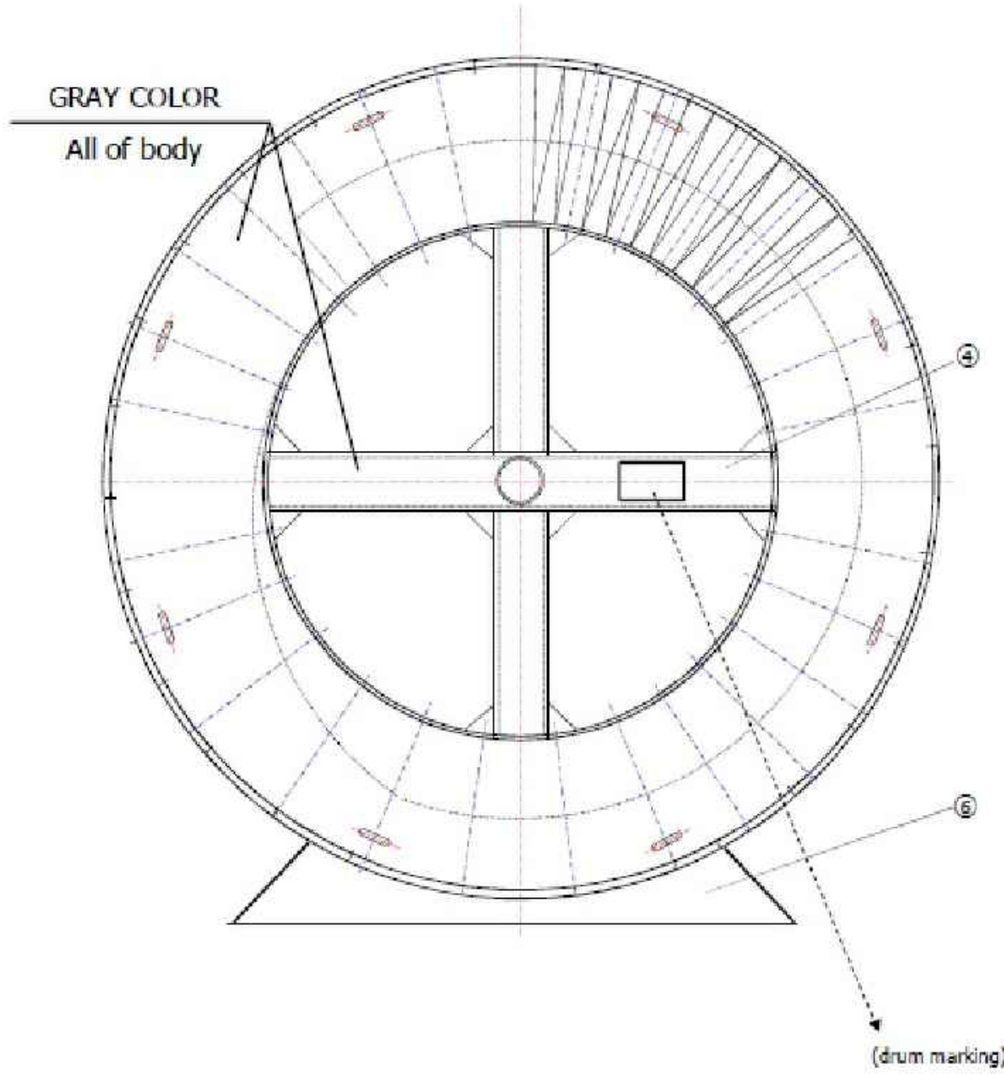
Simoultaneous Construction					Months																																					
Activity	**Total HGVs**	**Duration (months)**	**Duration (days)**	**Notes**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**
Temporary Site Compounds	97	2	46	Includes installation and removal															2					2																		
Site facilities and equipment	29	2	46																1					1																		
Fencing and temporary Roadway construction along cable route	3,902	6	138	Includes installation and removal															28	28	28	28	28	28																		
Trench Construction	3153	6	138	activity suspended during winter															23	23	23	23	23	23																		
Tile loads	89	5	115	activity suspended during winter															1	1	1		1																		
Cable and ducting deliveries	143	5	115	n/a															1	1	1		1																		
TT (HDD / Thrust Bore) Sites	240	6	138	n/a															2	2	2																				
Drainage Pipe	149	3	69	Includes installation and removal																		2	2	2																	
Link Boxes	5	3	69	activity suspended during winter								0									0	0	0																		
Total monthly daily HGV movements					**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**58**	**55**	**55**	**53**	**55**	**56**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total monthly daily HGV movements + 10% contingency					**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**63**	**60**	**60**	**59**	**61**	**62**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total monthly daily two-way HGV movements					**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**127**	**121**	**121**	**117**	**122**	**123**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

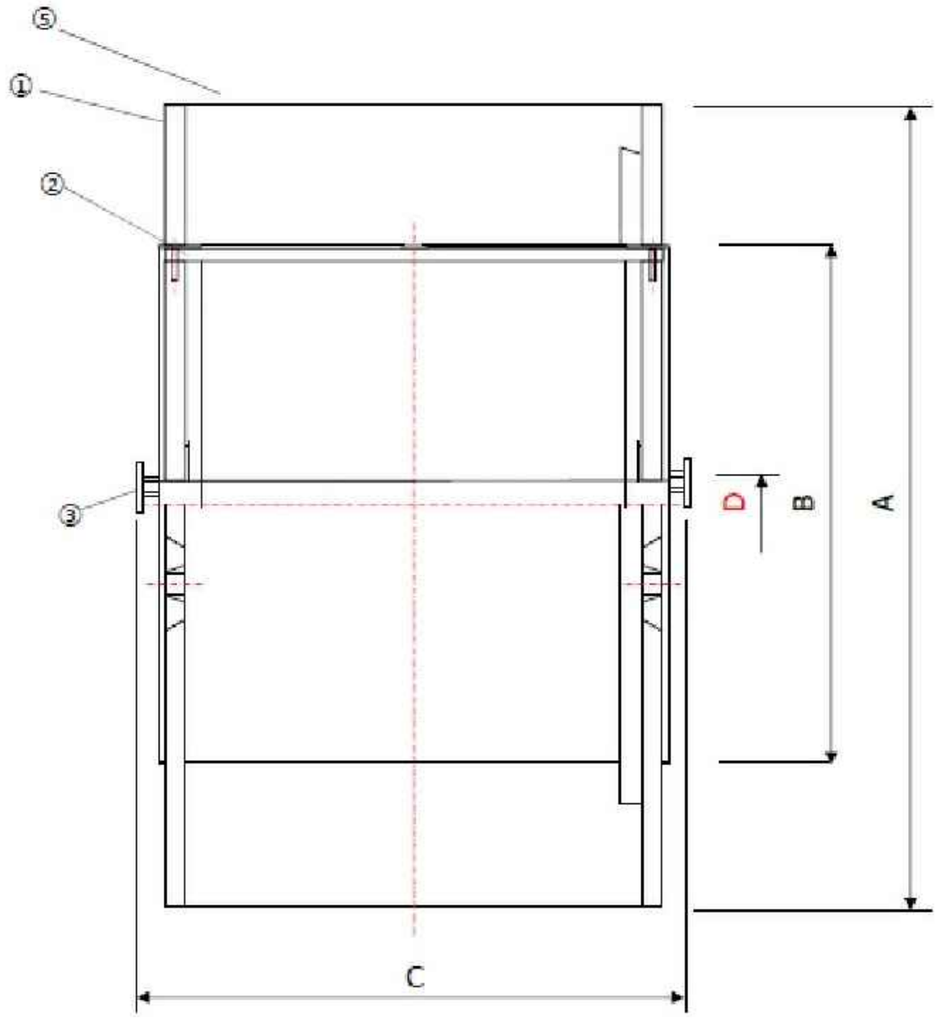
Daily Material Movements per Month

Staggered Construction

Activity	Section 9 HGVs	Section 10 HGVs	Duration per section (months)	Duration (days)	Notes	Months																																				
						0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Temporary Site Compounds	0	97	2	46	Includes installation and removal														0	2				0	2																		
Site facilities and equipment	4	25	2	46															0	1				0	1																	
Fencing and temporary Roadway construction along cable route	2,100	1,802	6	138	Includes installation and removal										15	15	15	15	15	28	13	13	13	13	13																		
Trench Construction	1697	1456	6	138	activity suspended during winter										12	12	12	12	12	23	11	11	11	11	11																		
Tile loads	48	41	5	115	activity suspended during winter										0	0	0	0	0	0	0	0	0	0																			
Cable and ducting deliveries	77	66	5	115	n/a										1	1	1	1	1	1	1	1	1	1																			
TT (HDD / Thrust Bore) Sites	119	121	5	115	n/a										1	1	1	1	1	1	1	1	1	1																			
Drainage Pipe	80	69	3	69	Includes installation and removal										1				1	2				1	1																		
Link Boxes	3	2	3	69	activity suspended during winter													0	0	0			0	0	0																		
Total monthly daily HGV movements						**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**31**	**30**	**30**	**30**	**31**	**58**	**26**	**26**	**26**	**27**	**27**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total monthly daily HGV movements + 10% contingency						**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**34**	**33**	**33**	**33**	**34**	**64**	**28**	**28**	**28**	**29**	**30**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total monthly daily two-way HGV movements						**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**67**	**65**	**65**	**65**	**68**	**127**	**56**	**56**	**56**	**59**	**60**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Appendix B– 3.3m Cable Drum Specification Plan





No.	Description	Material
1	Flange	Steel
2	Barrel	Steel
3	Lift Ring	Steel
4	Spider	Steel
5	Lagging	Steel
6	Stopper	Steel Sheet

Part	Dimension (Approx.)
A (Length)	3300mm
B (Barrel dia.)	1990mm
C (Width)	3020mm
D (Spindle dia.)	205 (+5)
Gross Weight	23,290 kg

REV	DATE	AMENDMENT DETAILS	DRAWN	APPROVED

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PROJECT: HORNSEA 3 OFF-SHORE WIND FARM	DATE: 20.08.20	DRAWING STATUS: INFORMATION	
	SCALE(S): N.T.S.	DESIGNED: AF / DRAWN: AF	
DRAWING TITLE: 3.3M CABLE DRUM SPECIFICATION		CHECKED: PZ / APPROVED: PZ	
	JOB No: 1554		
CLIENT: ORSTED	DRAWING No: 03/510	REVISION: -	

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DO NOT SCALE ORIGINAL SHEET SIZE - A3 Landscape