Memorandum

VENTUS

Title: Transportation of Turbine Components for the Taumatatotara Wind Farm

Date: 3 July 2020

No.	Item	Comment
1	**Introduction** - This component transportation memorandum is to support a change of conditions application to increase the turbine height within the existing land use consent. The proposed increase in turbine tip height measured from the existing ground level is from 110m to 172.5m for turbines numbered 1 to 11. The remining consented turbines 12 to 22 will be deleted from the project – refer Appendix 1 for the site layout.	
.	**Consented Turbines** The consented turbines allowed for 110m tip height which results in a practical diameter of 100m with a 10m ground clearance. Turbines that were previously available include the Vestas V90 and GE100, Gamesa 97m machines. The existing consent allows for the transportation of these turbines, subject to conditions to protect the condition of WDC roads. More detailed information on the Vestas V90 machine is given in Appendix 2.	
3.	**Proposed Turbines**. Some detailed information on a typical larger machine option (Vestas V136) is given in Appendix 3. Note that finalization of the machines chosen to be constructed will occur after consents are granted. Looking at the three key components in comparison to the consented turbines: **Nacelle** Whilst heavier in total, modern nacelles are fabricated to be transported dissembled should weight prove to be a constraint for bridges and passes. The power train is modular and can be removed from the nacelle. The V90 combined weight is 83tonne The V136 nacelle only is 66tonne **Tower** The tower sections are produced at the same diameter as older turbines but with thicker steel walls. To limit weight the tower sections are generally shorter. The bottom (wide) sections for the V136 are comparable at 14m long x 4.2m diameter compared to 13.4 long x 4.2m long for the V90. So, there is a very marginal change within this turbine manufacturer. **Blades** Typically the key constraint for transport in this case we will increase from nominally 49m to 69m blades (allowing 2 m for the hub connection within the rotor diameter). Three change points have occurred in blade transport since 2008 (the original consented issuance year): 1. Two-piece blades 2. Narrow design 3. Cantilevered transporters At this stage we propose to utilize 2 and 3 above. The V136 blades by way of example are 4.3m wide which is easily manageable on the existing roads.	

	TWF will import specialized trailers or self-propelled transporters such as that shown in Appendix 4. To date these type devices have been used in NZ once in Auckland on the Newmarket viaduct construction. They are valid and robust means for transporting long (but relatively light) loads. The benefit to mobility is the ability to lift the blades on an angle to make it possible to navigate narrow corners.	
4.	**Summary** - The consented wind farm anticipates further studies to understand the detailed effects on the public roads – which are anticipated to be from the Port of Tauranga to Taumatatotara Road. These provisions assume no further RMA consents being required, notably earthworks along the public road. The change in turbine component metrics will not change this situation.	

Appendix 1 – Site Layout

Appendix 2 – Vestas V90 dimensions

Appendix 3 – Vestas V136 dimensions

4.2 Technical data on the drive train on a TUFD

Mk	L [mm]	L_w [mm]	CG [mm]	H [mm]	W [kg]
2C/3A	7230	3500	*)	3200	59000
3B	7230	3500	*)	3200	62000

Table 4-2: Weight, dimensions, and CG of the drive train on a TUFD

*) See Figure 4-3, p. 4, and Figure 4-4, p. 4.

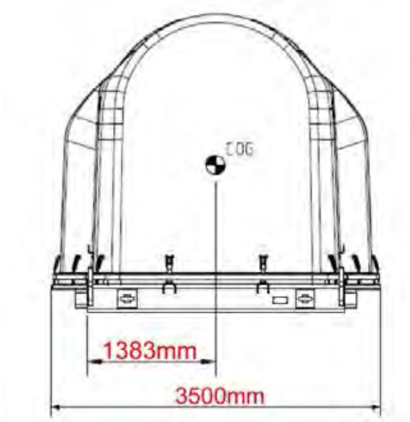

Figure 4-3: Dimensions of the drive train on a TUFD (end view)

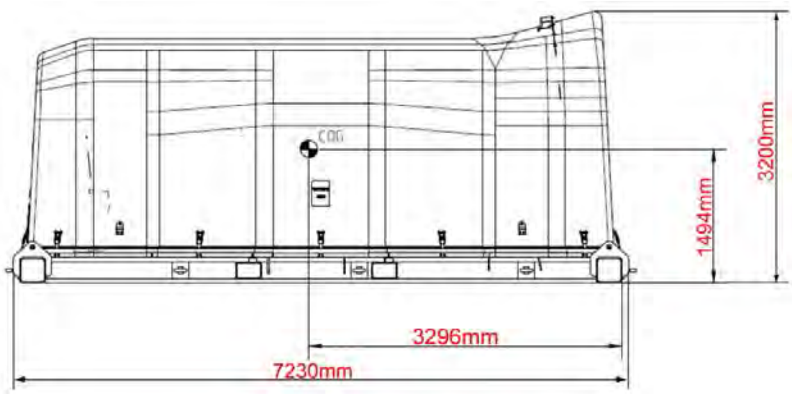

Figure 4-4: Dimensions of the drive train on a TUFD (side view)

4.3 Technical data of drive train for installation

Mk	Drive train type	L [mm]	L_w [mm]	CG [mm]	H [mm]	W [kg]
2C/3A	Winergy PZAB3530 and ZFWP EH921	6784	3140	*)	2501	52500
3B	ZFWP EH922	6784	3140	*)	2501	55000

Table 4-3: Weight, dimensions, and CG of drive train for installation

*) CG varies according to the drive train configuration of the wind turbine type in question. All lifting configurations have separate lifting equipment which is calculated for each CG variant. See 2 Reference documents, p. 2.

4.2 Blade in MBF frames

4.2.1 Blade in flat position in MBF frames

L [mm]	L_w [mm]	L_{cg} [mm]	H_{cg} [mm]	H [mm]	W_t [kg]	W_r [kg]	W [kg]
66788	4040	19160	*)	3625	6654	10330	14600

Table 4-3: Approximate weight, dimensions, and centre of gravity of a 67 m blade in flat position in MBF frames

**) CG is approximately in the centre line.*

Figure 4-2: 67 m blade in flat position in MBF frames

4.2.2 Blade in upright position in MBF frames

L [mm]	L_w [mm]	L_{cg} [mm]	H_{cg} [mm]	H [mm]	W_t [kg]	W_r [kg]	W [kg]
66788	3625	19160	*)	4040	6654	10330	14600

Table 4-4: Approximate weight, dimensions and centre of gravity of a 67 m blade in upright position in MBF frames

**) CG is approximately in the centre line.*

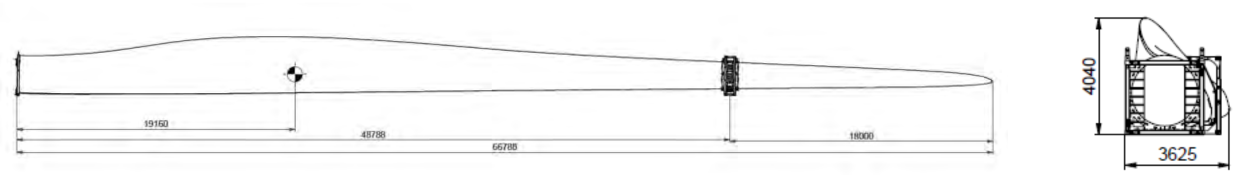

Figure 4-3: 67 m blade in upright position in MBF frames

4.1.3 Technical data for a 3.3/3.45 MW nacelle with 10 kV : 6000 transformer

Weight [kg]	L [mm]	H [mm]	L_W [mm]	$H_{TC\ TS}$ [mm]
65579	12861	3417	4000	210

Table 4-5: Dimensions

L_{COG} [mm]]	H_{COG} [mm]]	L_{W-COG} [mm]	L_{TC-COG} [mm]	H_{TC-COG} [mm]
6422	1277	-33	3061	1067

Table 4-6: Centre of gravity data

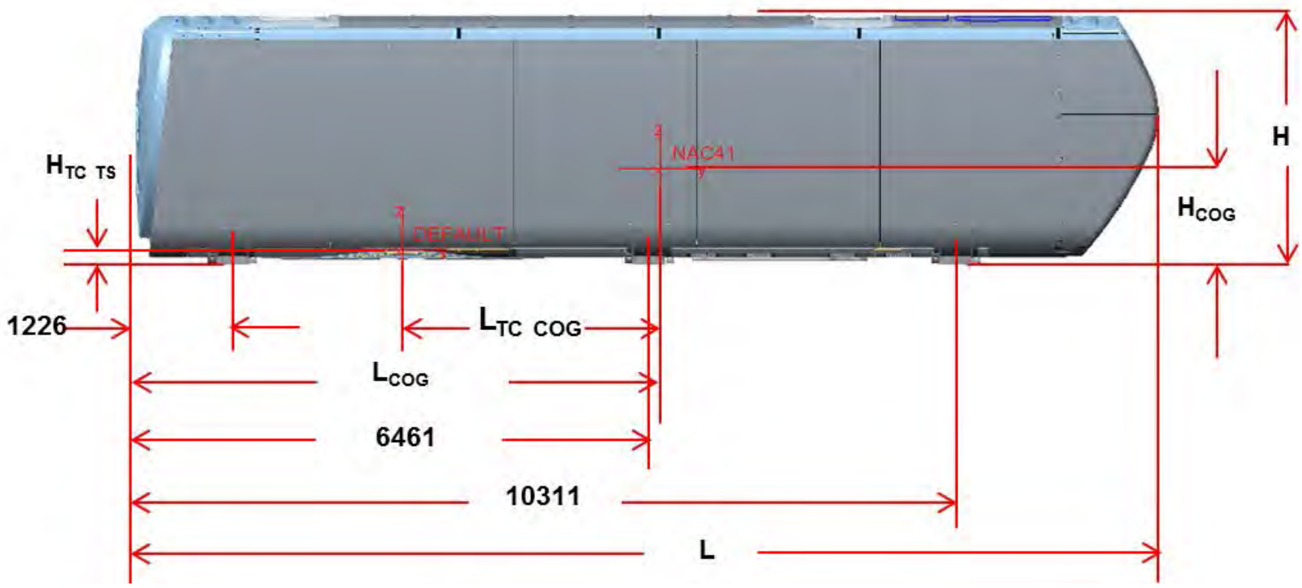

Figure 4-1: Dimensions of nacelle without installed drive train, roof kit, and without CoolerTop®

4.3 US tower (Slim)

4.3.1 Outer dimensions

Component	L	D_A	D_B
Unit of measurement	**[mm]**	**[mm]**	**[mm]**
Bottom section	14500	4200	3938
Second section	21000	3936	3676
Third section	26600	3676	3668
Top section	27000	3667	3258

Table 4-5: Outer dimensions

4.3.2 Weight, reaction, and centre of gravity

Component	W	Reaction		L_{cg}
Unit of measurement	**[kg]**	**R_A [kg]**	**R_B [kg]**	**[mm] [± 100 mm]**
Bottom section	69500	37000	32500	6800
Second section	63000	33500	29500	9790
Third section	57500	30500	27000	12540
Top section	39000	19500	19500	13580

Table 4-6: Weight, reaction, and centre of gravity

Appendix 4 – Specialist Transporters