

## V-palms in accordance with Eurocode 1, part 2-4

**Data input=**

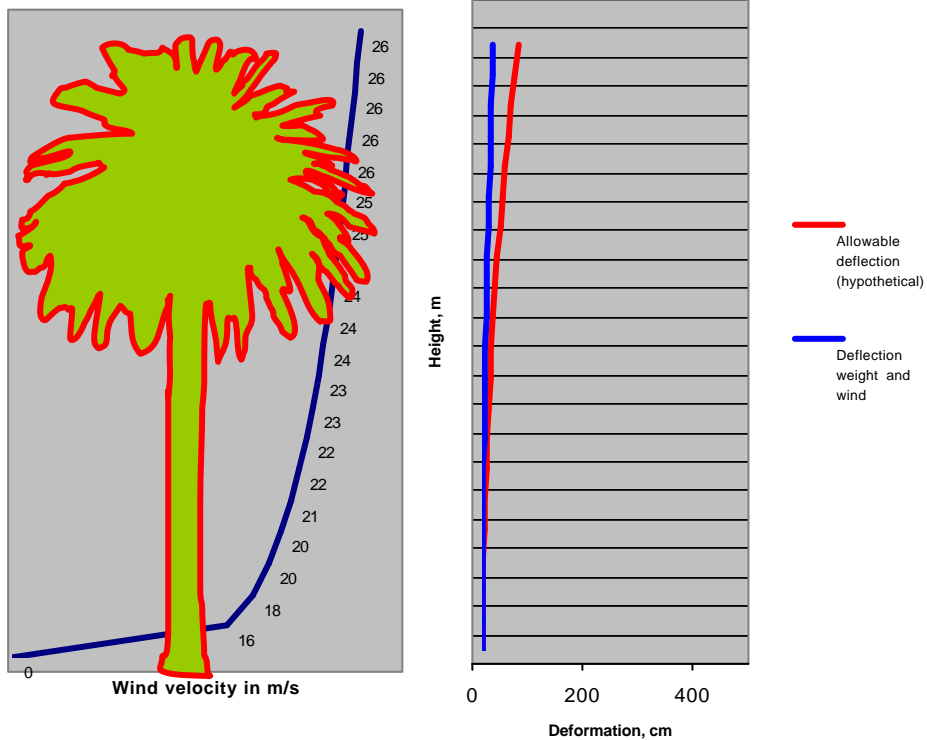
*Palm tree characteristics*

Species=	Phoenix canariensis	
Height palm=	14,15	m
Height trunk=	10,49	m
Diameter trunk=	60,50	cm
Height crown=	7,33	m
Width crown=	7,63	m
Thickness rests of pruned fronds=	0,00	cm
Canopy density=	10,00	kg/m <sup>3</sup>
Weight climber and fruits=	60,00	kg
Aerodynamic drag value=	0,40	

*Environment*

Altitude=	646,00	m
Minimum temperature=	35,00	°C
Expected wind speed for the area=	90,00	km/h
Expected snow thickness=	0,00	cm

### Deformation of the sound stem due to wind and weight



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**Results=**

**Wind load analysis for palms**

Crown area= 43,93 m\*m  
 Streamlining= 60,00 %  
  
 Wind speed= 25,33 m/s  
 at height= 10,85 m

**Wind load= 6,07 kN**  
**596,86 kg**  
 Wind induced bending moment= 65,82 kNm  
 Total bending moment= 67,76 kNm

**Deformation= 0,20 m**

**Dynamics=**

Natural frequency= 13,36 Hz  
**Vcrit\_resonance= 40,40 m/s**  
 Equivalent wind load= 14,89 kN

**GREENHILL\_Elastic stability (buckling)**

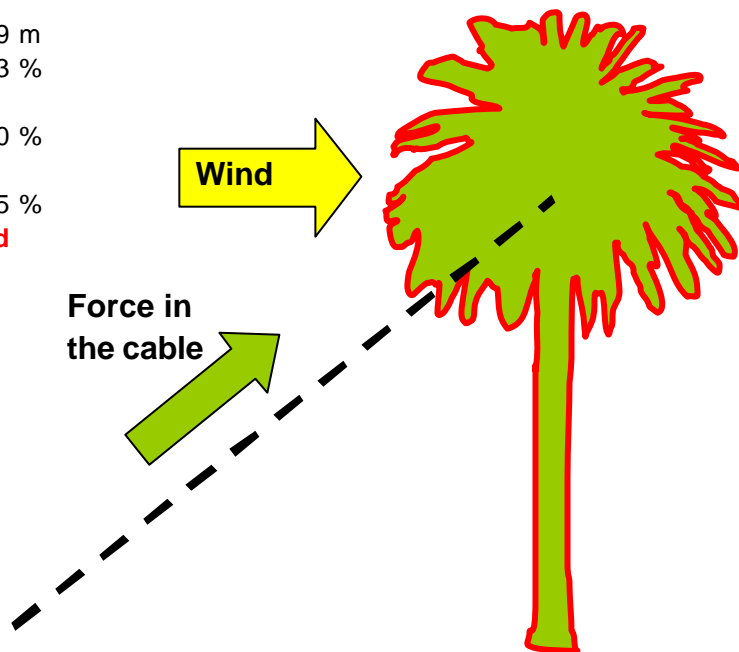
Critical trunk height= 42,89 m  
 Safety factor trunk= 408,83 %  
 (elastic stability, buckling)  
 Safety crown weight included= 155,60 %  
  
 Safety climber's weight included= 152,95 %

**Assumable risk if the palm is sound**

**Cabling analysis**

Installation height= 10,85 m  
 Horizontal cabling distance= 16,00 m  
 Height anchor point= 0,00 m  
 Strength cable= 1000,00 kg

**Safety cable= 129,93 %**  
 (Static calculation, dynamic forces not included!)



Please consult the following publications, in order to interpret correctly wind load analysis for palms:

Sterken P (2006) Prognosis of the development of decay and the fracture-safety of hollow trees.  
 Arboricultural Journal. Vol 29: 245-267  
 Sterken P (2005) A Guide for Tree-stability Analysis. Second and expanded edition.  
 University and Research-centre of Wageningen: <http://library.wur.nl/gkn/>  
 Sterken P (2008) Modelización de la estabilidad del arbolado y palmeras. FORESTA.  
 Asociación y Colegio Oficial de Ingenieros Técnicos Forestales. Nº 38: 59-67.

**Disclaimer:** While every effort has been made to validate the solutions in this worksheet, Peter Sterken is not responsible for any errors contained and is not liable for any damages resulting from the use of this material, nor for any interpretation of the calculations. These calculations are only intended for educational purposes and should only be employed by a professional trained in this method.