

Species=

Phoenix canariensis

Data input=

Height palm=	14,15 m
Diameter at 1m=	60,48 cm
Diameter 1 crown=	7,08 m
Diameter 2 crown=	7,67 m

Environment=

Altitude=	50,00 m
Terrain factor=	0,28 (enclosed in the city)

Results=

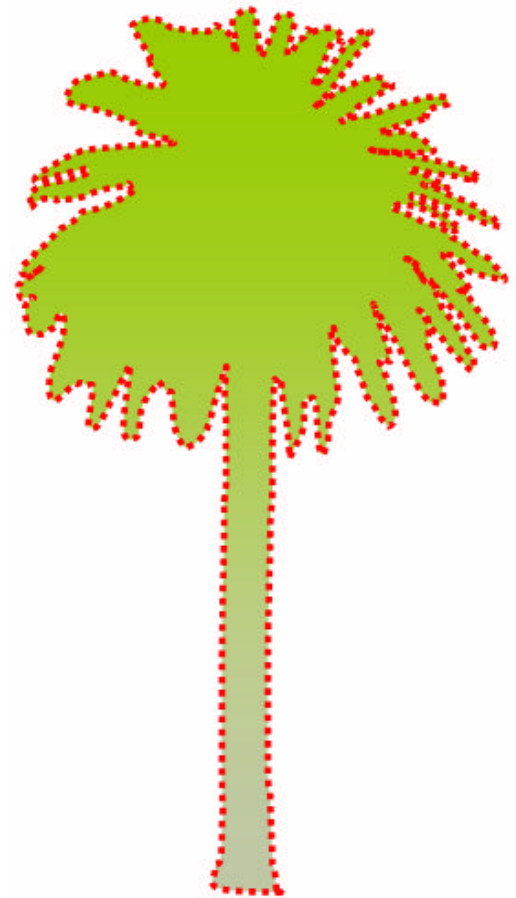
Wind load analysis for palms

Wind-impacting area=	46,87 m*m
(Ellipse formula, thus hypothetical)	
Hypothetical C_w =	0,20
Wind load=	4,77 kN

Safety=

	301,40 %
V=	175,42 km/h

Natural frequency= 13,35 Hz



A brief resume of the principles of this proposal:

The goal of this proposal is not to offer a solution for the safety assessment of palms, but only to expose reflections of the author regarding this subject.

The combination of the following components supports this proposal for the safety calculations of palms:

1. Wind load analysis in palms
2. Safety calculations based on Euler buckling
3. Real MOE measured on the stem of the palm, both of damaged and sound (control) cross-sections, by means of Young's modulus sensors and gently pulling the palm (for trees, see Peltola et al., 2000)
 The different MOE obtained in the palm are employed in the safety calculations of the same palm.
4. Natural frequency of the stem
5. The bending theory of a beam is **not** employed, since the stem and fibres of palms might not obey this theory.

Employed methods:

Wind load analysis and safety calculations: see the paper of this author listed here below.
 Measurements of the modulus of elasticity: see Peltola et al., 2000

Note:

Both the C_w value and the vertical crown area are not known and were estimated, and therefore the results presented here are purely hypothetical. Nevertheless, the important information is the combination of employing the real MOE of the cross-sections, in safety calculations based on Euler buckling. For the safety calculation, also the wind load in the crown is estimated and the natural frequency of the stem calculated.

Peltola H., Kellomäki S., Hassinen A., Granander M. 2000. Mechanical stability of Scots pine, Norway spruce and Birch: an analysis of tree-pulling experiments in Finland. Forest Ecology and Management 135, 143-153. Elsevier.

Sterken P., 2005. Comparison of Euler buckling, natural frequency and bending fractures. University and Research centre of Wageningen <http://library.wur.nl/gkn/>