ITEG MEETING MILAN 17-18 OCTOBER 2015

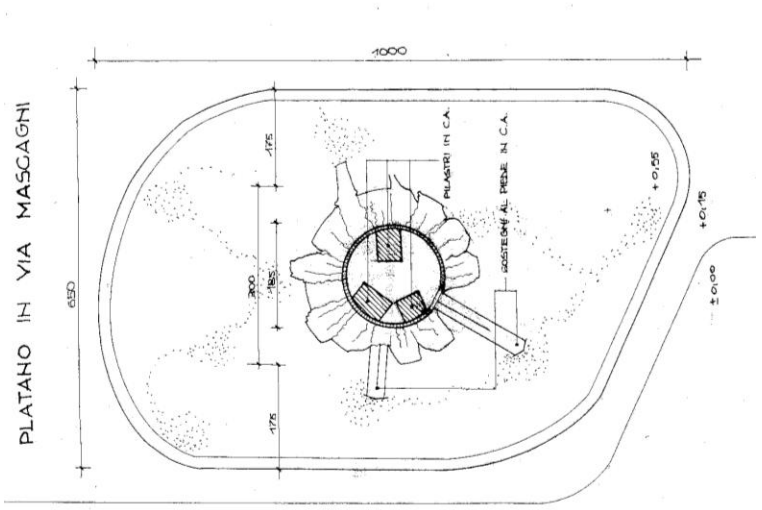
Some important steps in the application of TSE in Italy

Alessandro Pestalozza Dendrotec
Dario Guzzi Dendrotec

Platanus perhybrida
Via Mascagni Milano

One of the most large and beautiful tree of our City

twenty years ago heavy excavations and construction works were realized under and close to the root system



VTA inspection

- This tree was “sentenched to death “ because the average t/r ratio was under 0,33.

Resistograph profiles

profilo	posizione	punto	verso	T	r	t/r
3739	Colletto	N	S	15	109	**0,14**
3740	Colletto	NE	SW	16	109	**0,15**
3741	Colletto	E	W	24	109	**0,22**
3742	Colletto	SE	NW	34	109	0,31
3743	Colletto	S	N	36	109	0,33
3744	Colletto	SW	NE	32	109	**0,29**
3746	Colletto	W	E	28	109	**0,26**
3747	Colletto	NW	SE	13	109	**0,12**
3748	Fusto	N	S	12	84,5	**0,14**
3749	Fusto	E	W	25	84,5	**0,29**
3750	Fusto	S	N	29	84,5	0,34
3751	Fusto	W	E	15	84,5	**0,18**

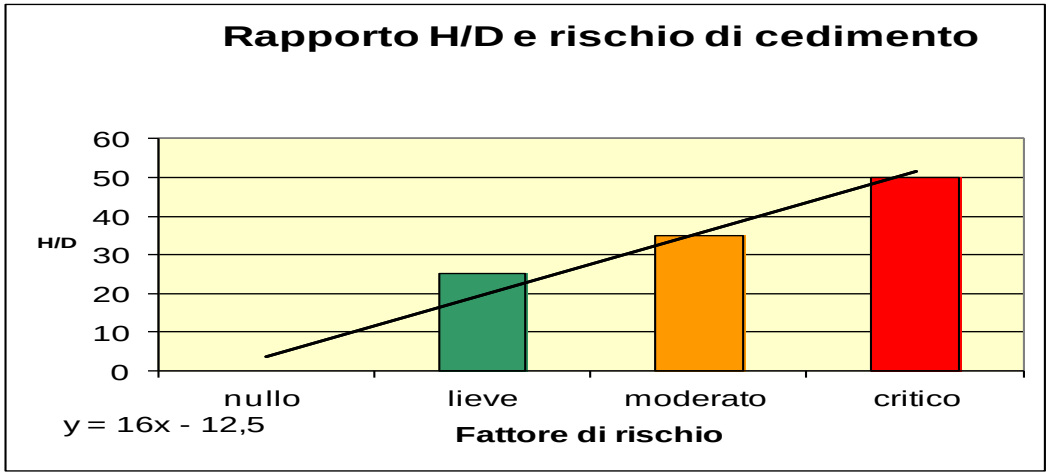
Toghether with SIA and Comune di Milano, Dendrotec adopted this tree. The goal was to find a solution using a Modren Arboricoltural concept. TSE is a modern approach because it use all technique and instrument in a “olistic” way in the problem solving process

New VTA inspection

Tree Higt = 22,5 m
BDH = 1,87 m

H/D RATIO = 12

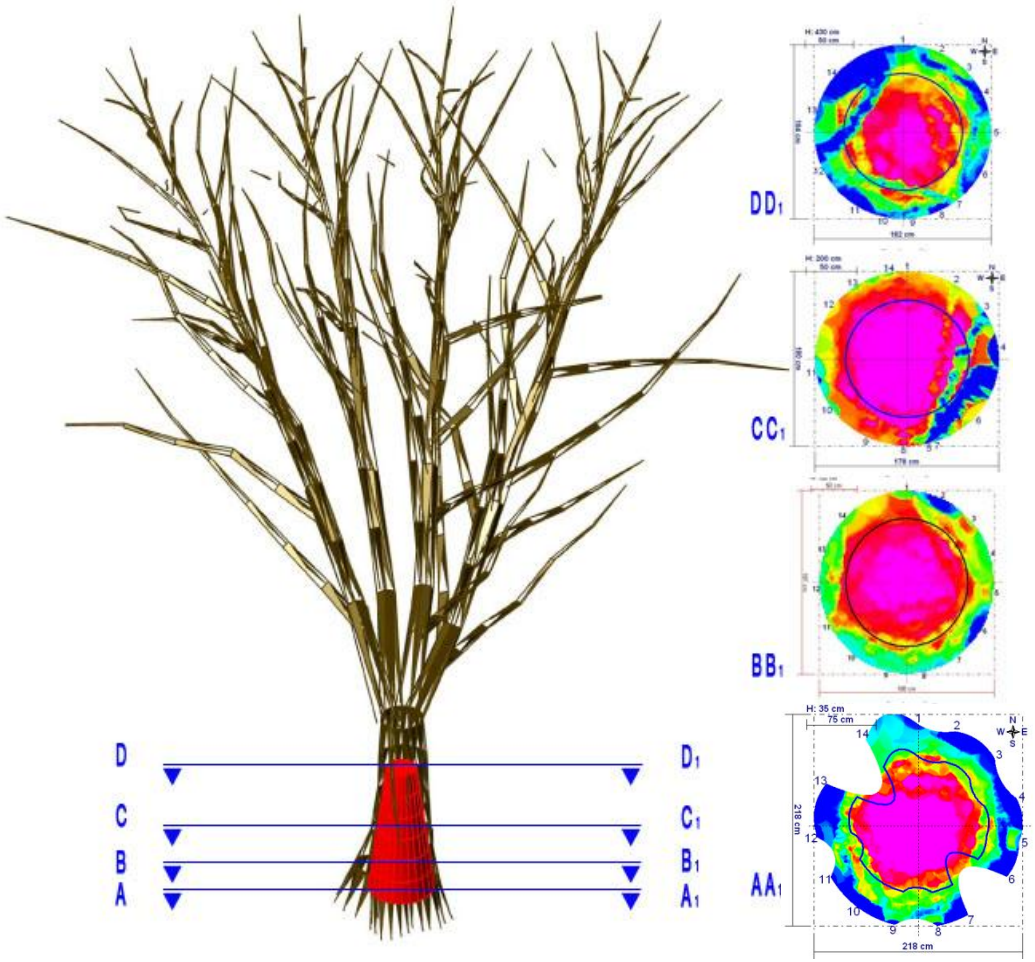
Rapporto H/D			
0	25	35	50
nullo	Light	moderate	critical



Important basal cavity

Presence of 4 codominant branches without included bark

Tomographical tests performed at different hight



Revealed a conical cavity
Larger at the stem base
And smaller going up

Each step was also tested with a small amount of drilling test made with a Resistograph.

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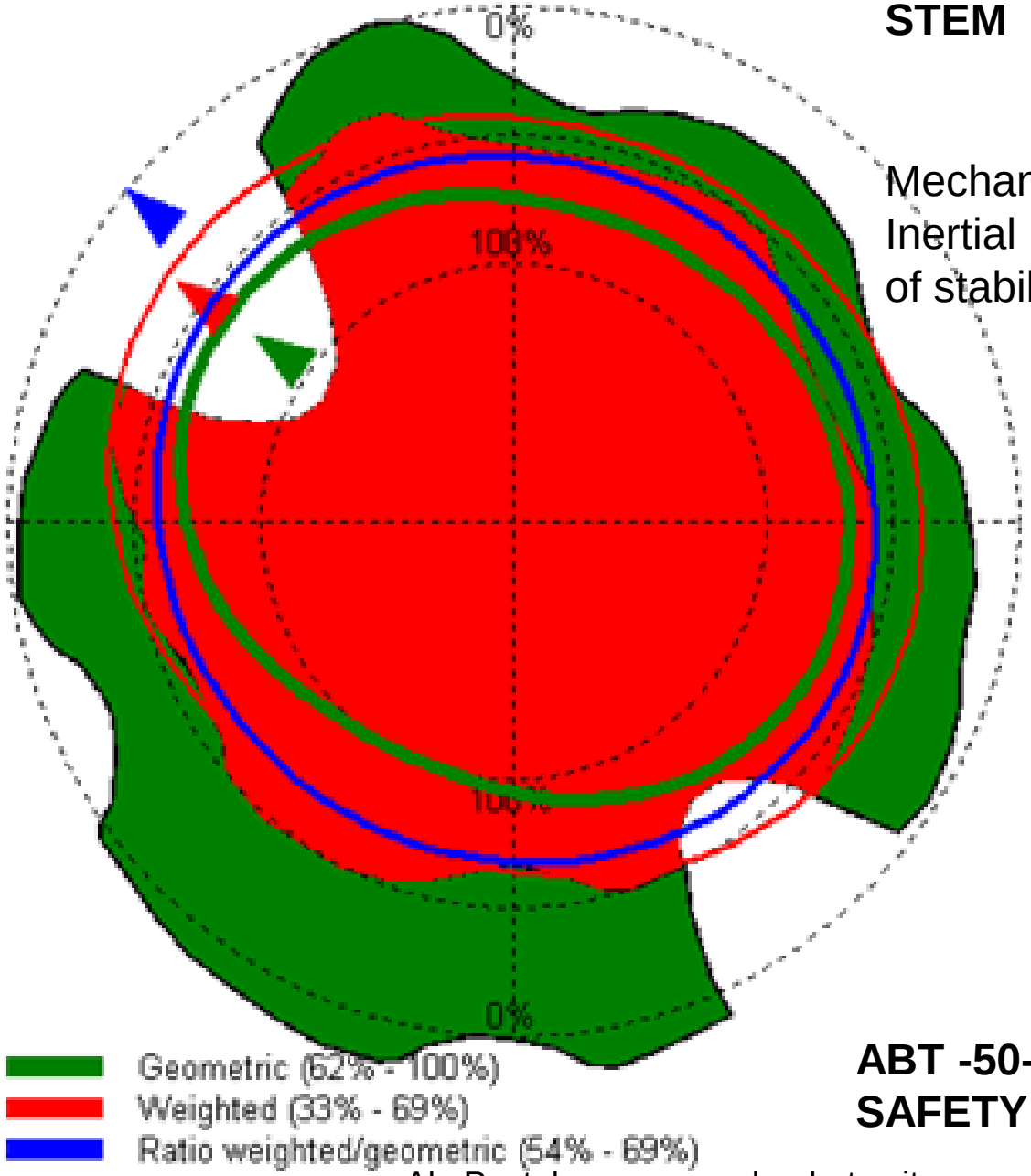
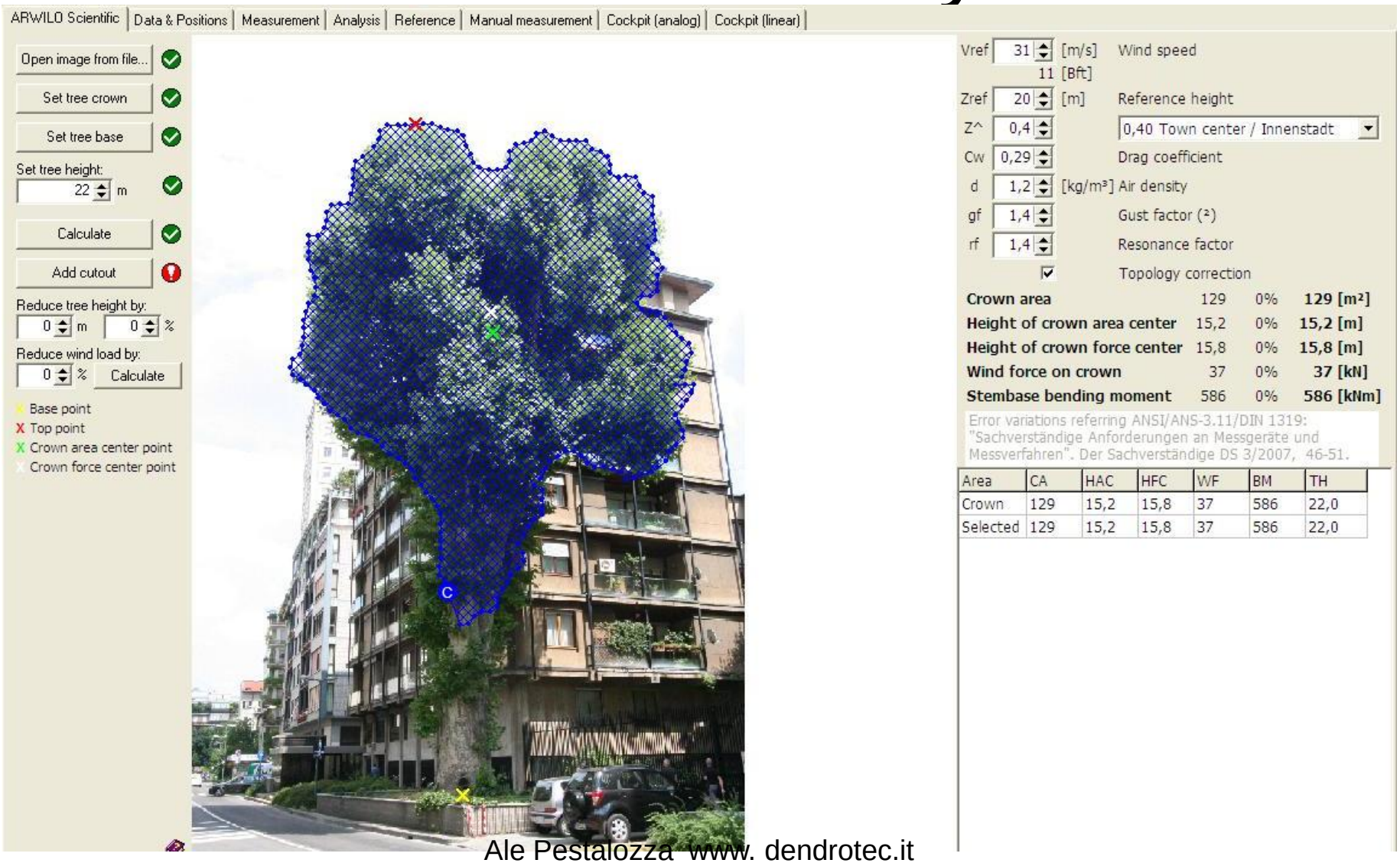
STEM RUPTURE



Mechanical study based on Inertial moment revealed a loss of stability from 46 to 31 %

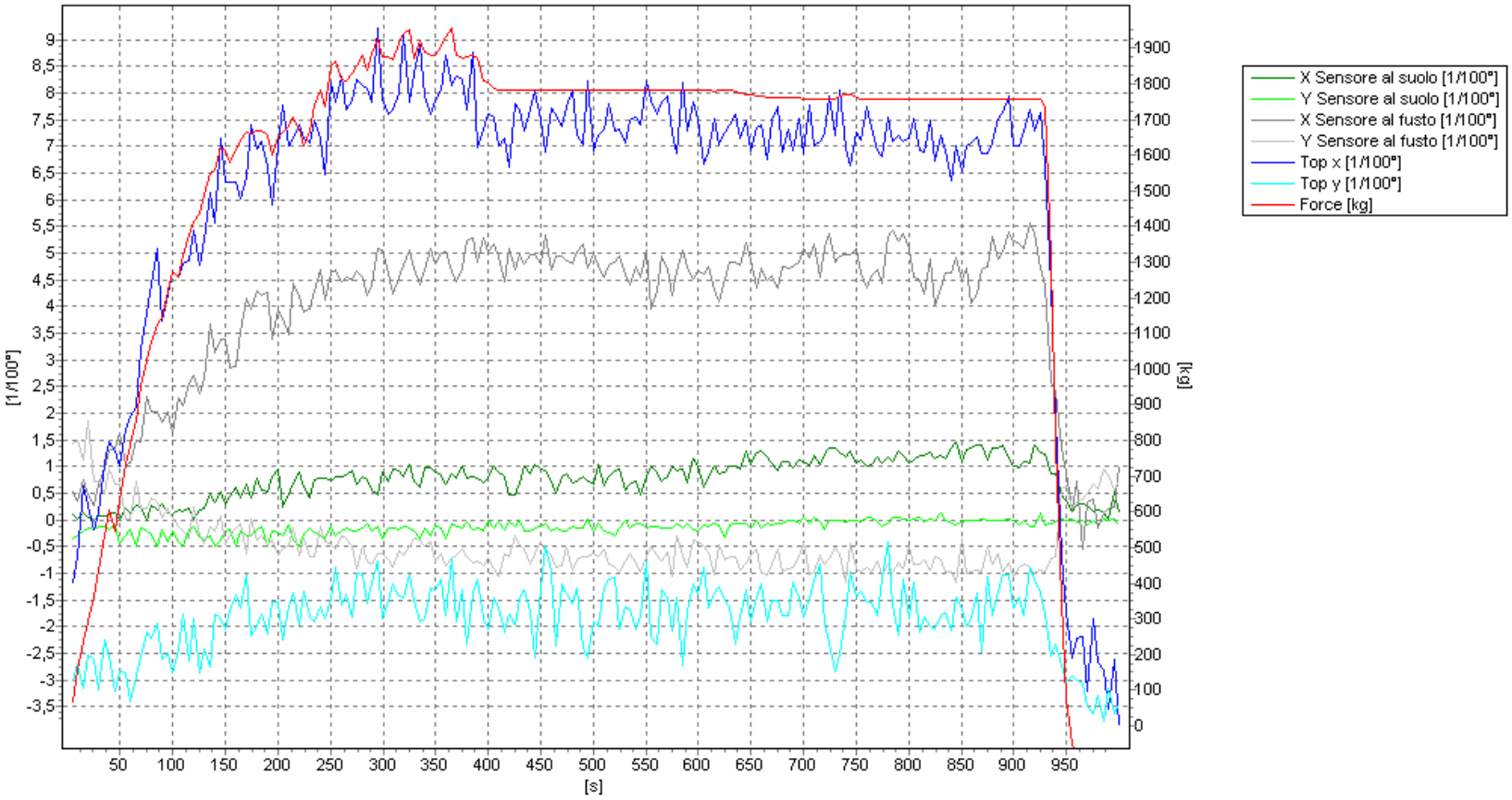
ABT -50-60 % OF THE BASIC SAFETY FACTOR

Wind Load Analysis



Pulling Test

2009 EST performed in two different direction



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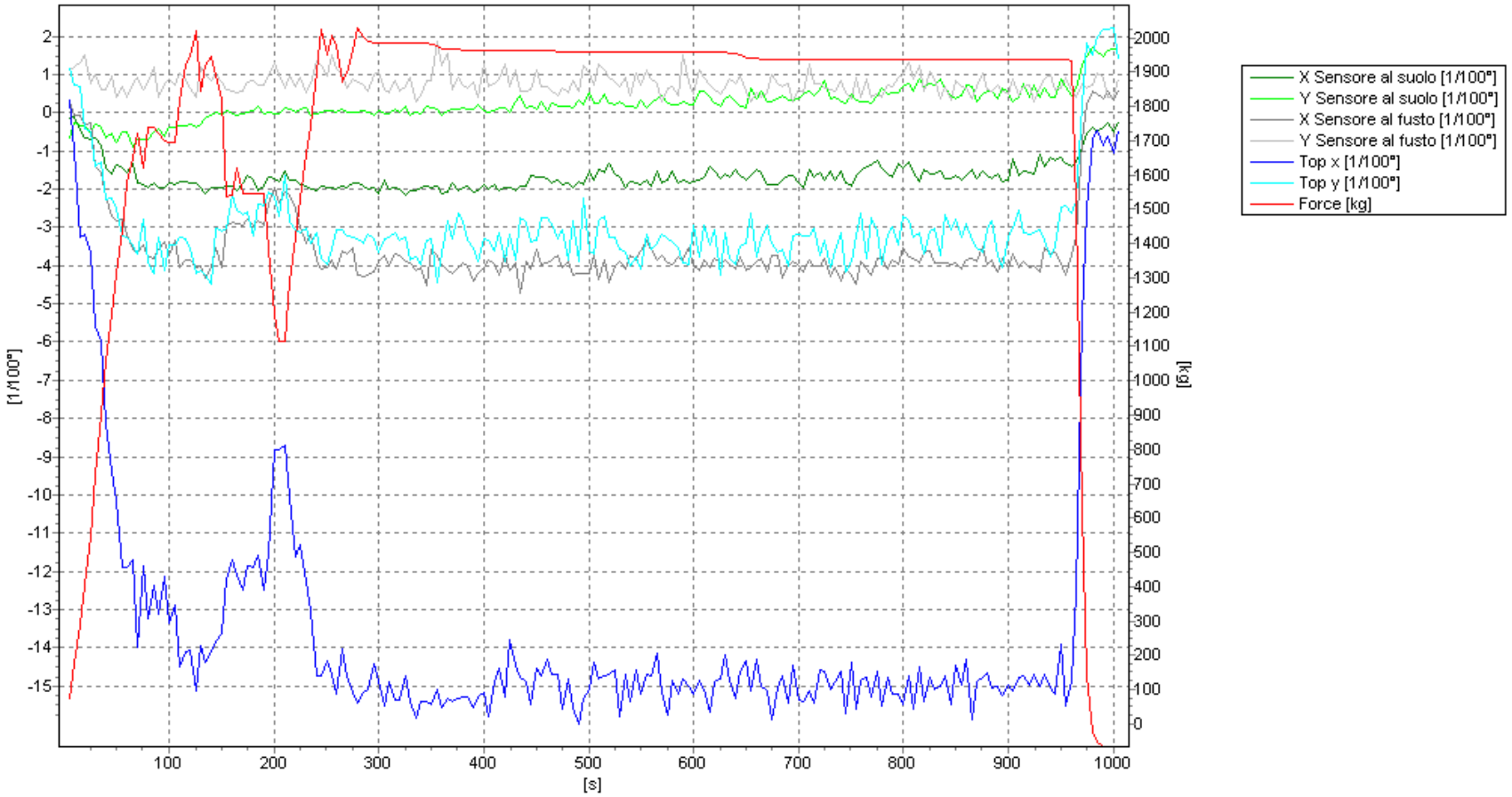
2009 WEST



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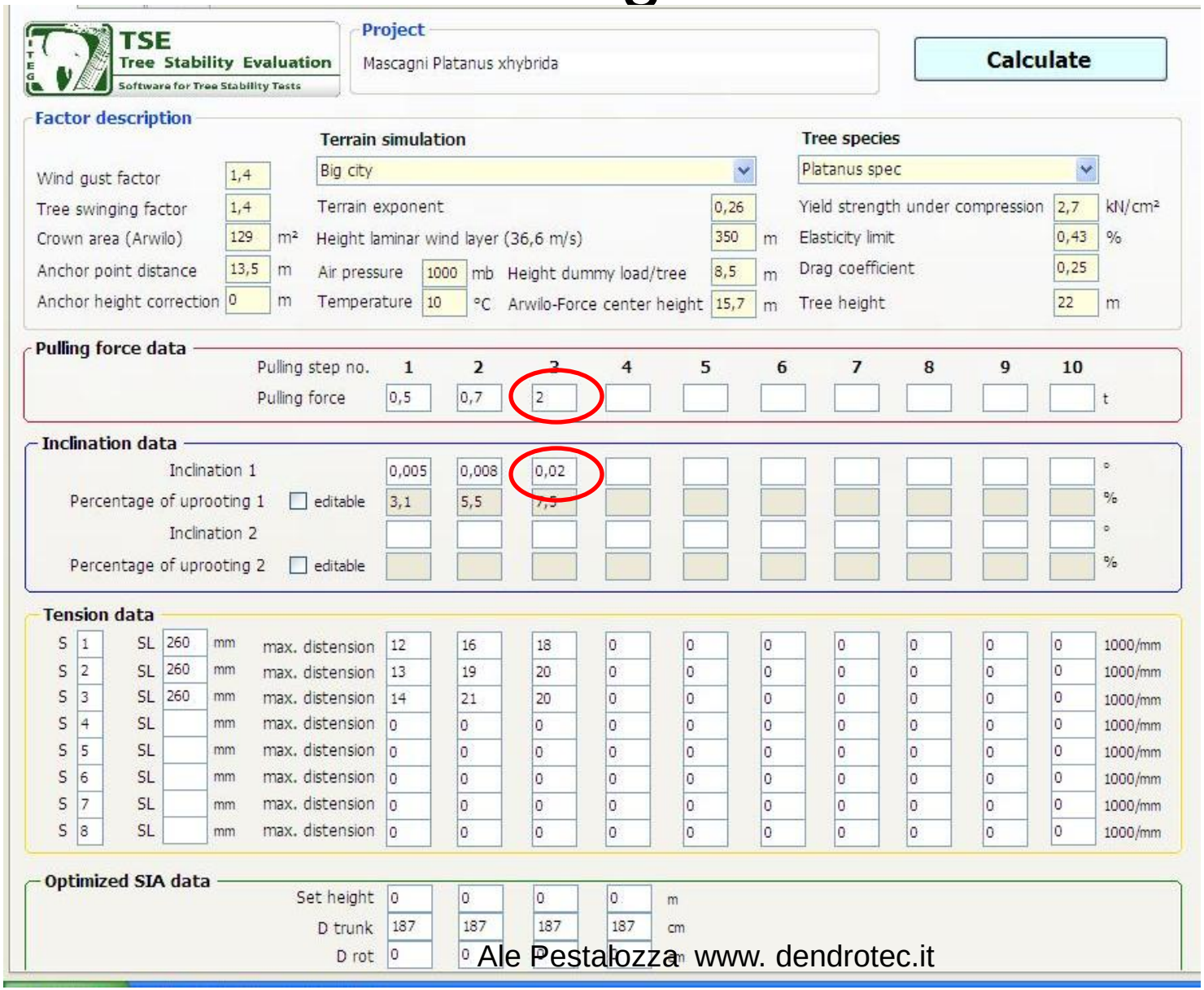
Pulling test data



TSE
Tree Stability Evaluation
Software for Tree Stability Tests

Project
Mascagni Platanus xhybrida

Calculate

Factor description

Wind gust factor	1,4		Terrain simulation: Big city			Tree species: Platanus spec		
Tree swinging factor	1,4		Terrain exponent	0,26		Yield strength under compression	2,7	kN/cm²
Crown area (Arwilo)	129	m²	Height laminar wind layer (36,6 m/s)	350	m	Elasticity limit	0,43	%
Anchor point distance	13,5	m	Air pressure 1000 mb	Height dummy load/tree	8,5	m	Drag coefficient	0,25	
Anchor height correction	0	m	Temperature 10 °C	Arwilo-Force center height	15,7	m	Tree height	22	m

Pulling force data

Pulling step no.	1	2	3	4	5	6	7	8	9	10	
Pulling force	0,5	0,7	2								t

Inclination data

		1	2	3	4	5	6	7	8	9	10	
Inclination 1		0,005	0,008	0,02								°
Percentage of uprooting 1	☐ editable	3,1	5,5	7,5								%
Inclination 2												°
Percentage of uprooting 2	☐ editable											%

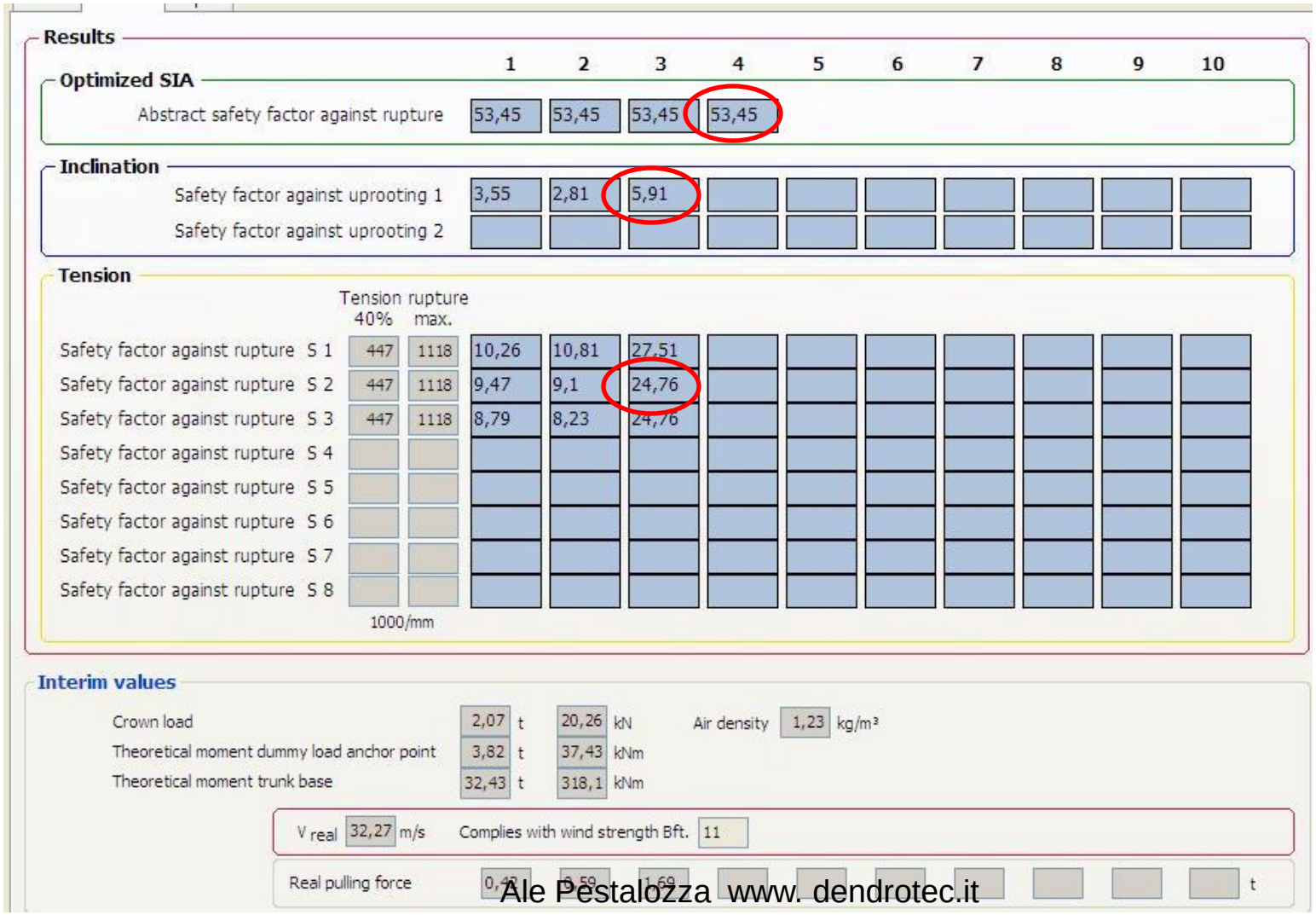
Tension data

S 1	SL 260	mm	max. distension	12	16	18	0	0	0	0	0	0	0	1000/mm
S 2	SL 260	mm	max. distension	13	19	20	0	0	0	0	0	0	0	1000/mm
S 3	SL 260	mm	max. distension	14	21	20	0	0	0	0	0	0	0	1000/mm
S 4	SL	mm	max. distension	0	0	0	0	0	0	0	0	0	0	1000/mm
S 5	SL	mm	max. distension	0	0	0	0	0	0	0	0	0	0	1000/mm
S 6	SL	mm	max. distension	0	0	0	0	0	0	0	0	0	0	1000/mm
S 7	SL	mm	max. distension	0	0	0	0	0	0	0	0	0	0	1000/mm
S 8	SL	mm	max. distension	0	0	0	0	0	0	0	0	0	0	1000/mm

Optimized SIA data

Set height	0	0	0	0	m
D trunk	187	187	187	187	cm
D rot	0	0	0	0	cm

Pulling test results



Results

Optimized SIA

	1	2	3	4	5	6	7	8	9	10
Abstract safety factor against rupture	53,45	53,45	53,45	53,45						

Inclination

Safety factor against uprooting 1	3,55	2,81	5,91							
Safety factor against uprooting 2										

Tension

	Tension rupture 40%	Tension rupture max.									
Safety factor against rupture S 1	447	1118	10,26	10,81	27,51						
Safety factor against rupture S 2	447	1118	9,47	9,1	24,76						
Safety factor against rupture S 3	447	1118	8,79	8,23	24,76						
Safety factor against rupture S 4											
Safety factor against rupture S 5											
Safety factor against rupture S 6											
Safety factor against rupture S 7											
Safety factor against rupture S 8											
		1000/mm									

Interim values

Crown load	2,07	t	20,26	kN	Air density 1,23 kg/m³
Theoretical moment dummy load anchor point	3,82	t	37,43	kNm	
Theoretical moment trunk base	32,43	t	318,1	kNm	

V real 32,27 m/s Complies with wind strength Bft. 11

Real pulling force	0,42	0,59	1,69								t

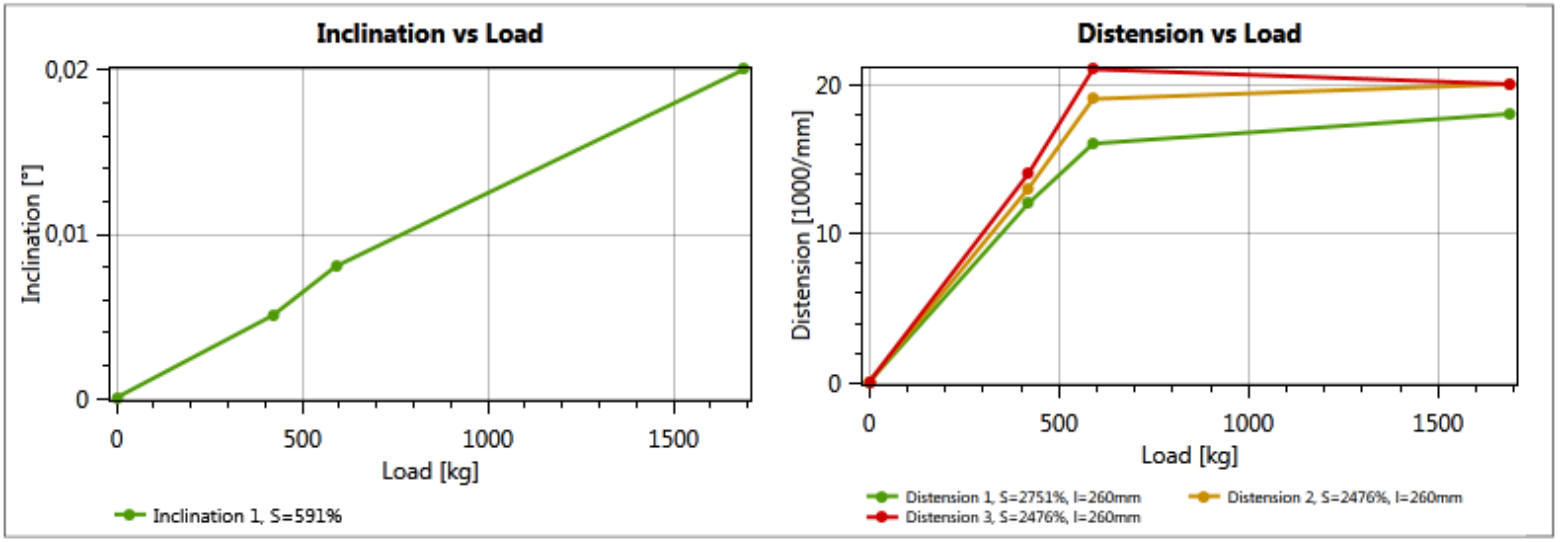
Pulling test results

Project: Mascagni Platanus xhybrida | Tree No. 1 | Report No. 1 | Date: 13/10/2015 | Inspector: A. Pestalozza D. Guzzi

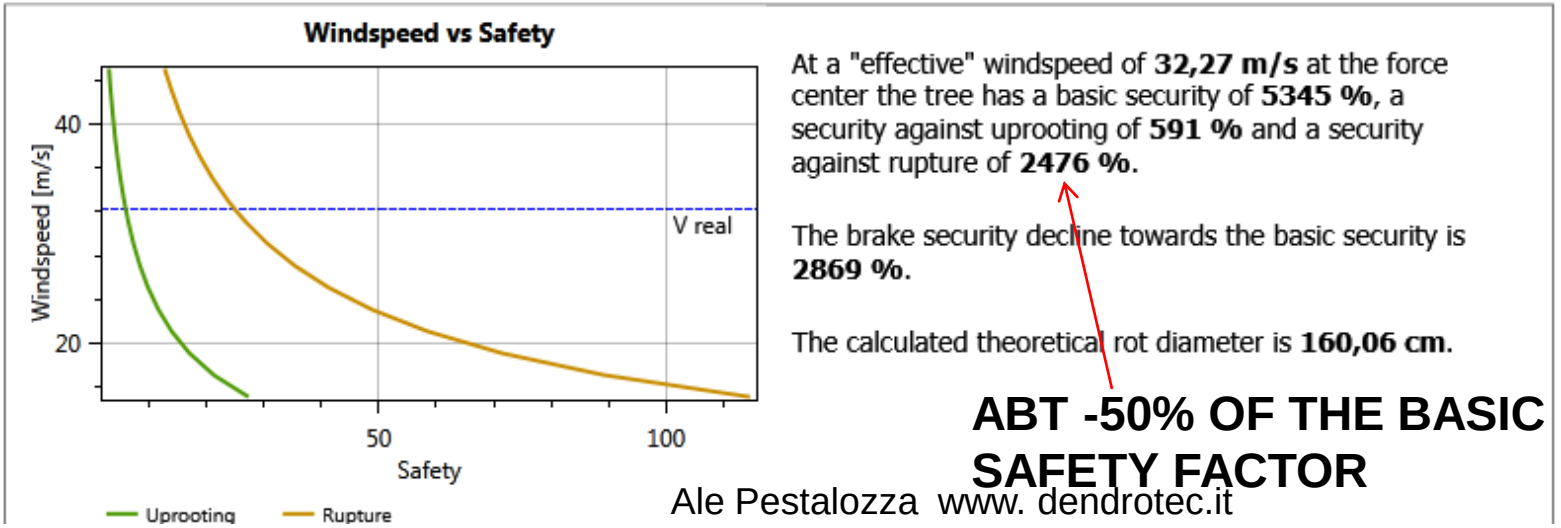
Location:	Big city	Tree height:	22 m
Terrain exponent:	0,26	D trunk:	187/187 cm
Height laminar wind layer:	350 m	Crown area:	129 m²
Species:	Platanus spec	Windspeed force center:	32,27 m/s
Yield strength u. comp.:	2,7 kN/cm²	Wind gust factor:	1,4
Elasticity limit:	0,43 %	Tree swinging factor:	1,4
Drag coefficient:	0,25	Air pressure:	1000 mb
Force center:	15,7 m	Air temperature:	10 °C
Height dummy load:	8,5 m	Air density:	1,23 kg/m³
Anchor point distance:	13,5 m	Bending moment:	318,13 kNm
Anchor height correction:	0 m		

Pulling test results

Measure



Result



At a "effective" windspeed of **32,27 m/s** at the force center the tree has a basic security of **5345 %**, a security against uprooting of **591 %** and a security against rupture of **2476 %**.

The brake security decline towards the basic security is **2869 %**.

The calculated theoretical rot diameter is **160,06 cm**.

ABT -50% OF THE BASIC SAFETY FACTOR

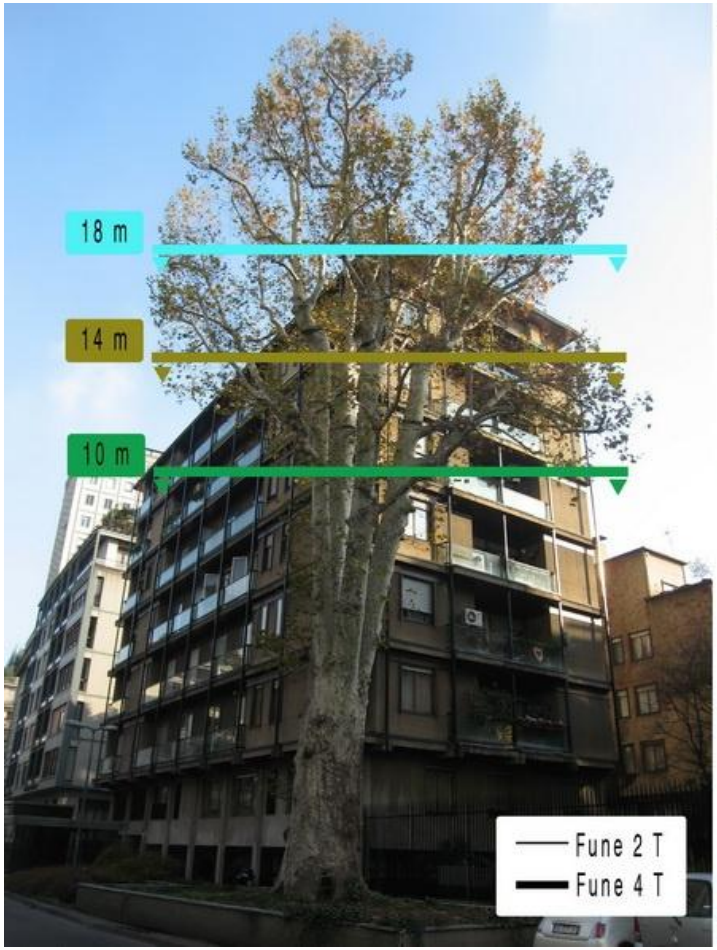
This tree was and is very SAFE !

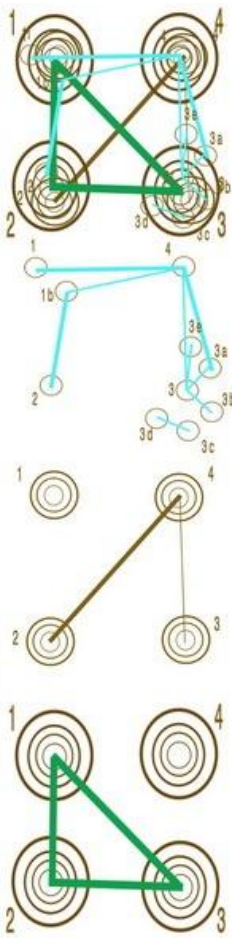
-Basic Safety factor is very higt 53,45

- Uprooting SF = 5,91
-Stem Rupture SF = 24,76

-Calculation based on peripheral fibers deformation and inertial moment are quite similar

Tree Care





NO Felling
NO Pruning
Only cabling and bracing because the very “risky” position in the center of the town