



# An Innovative & Sensitive Approach to Analyse Tree Failure Risk



## ► Are Your Trees Really SAFE?

Trees in Hong Kong fail under typhoon, monsoon, heavy rain and even in calm days. Thousands of trees were collapsed in the Typhoon Vicente in July 2012 according to reports. Tree failure may cause properties or even human damage. Innocents had been killed by tree failure in Hong Kong and other part of the world. Precise tree stability measurement equipment is vital in tree risk management.

## ► Unexpected Tree Failure Occurs Every Month

Two major types of tree failure were recorded in the city –

- *uprooting/rootplate movement and*
- *fracture of trunk.*

Tree stability depends on various factor including species, wood strength, modulus of elasticity, wind speed, temperature, size of tree crown, amplitude, relative humidity, size of part, soil texture, soil structure, soil fiction and etc.

## ► Limitation of Visual Tree Assessment (VTA) and Decay Detection Equipments:

- Depends on knowledge and experience of Arborist;
- Depend on the interpretation of decay result;
- **A heavily decayed tree does not mean to be unstable!**

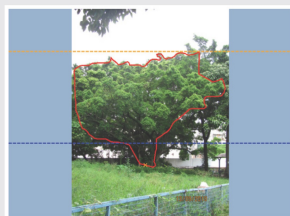
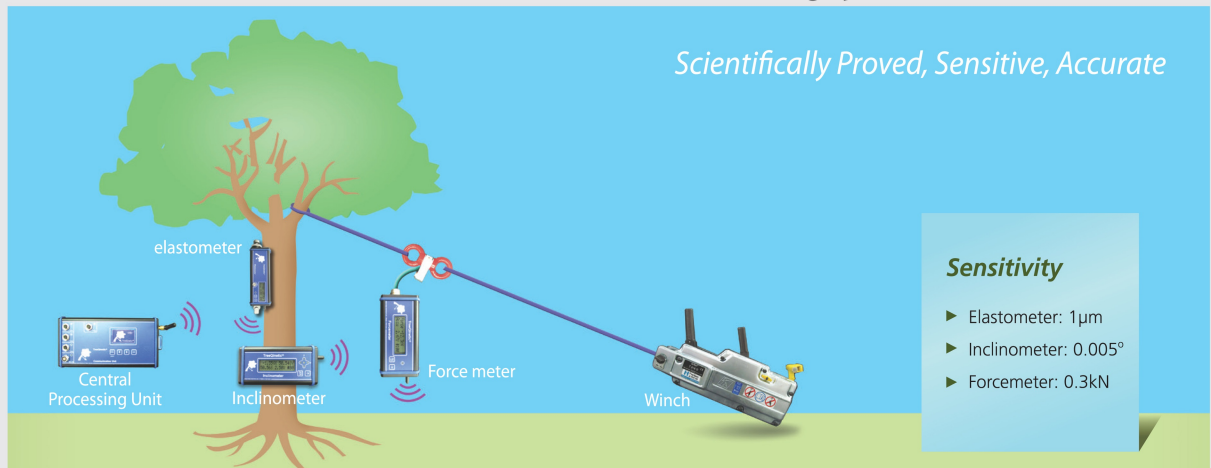
## ► Why Tree Pulling Test?

- Objective & Precise
- Anyone can understand the Safety Factor value.
- Directly relate to failure risk

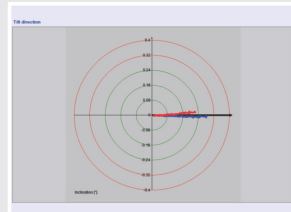
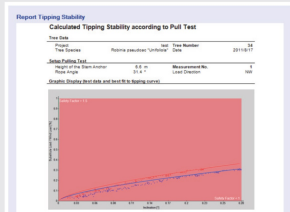
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Tree Pulling Test was developed by Wessolly & Sinn at the University of Stuttgart, the **TreeQinetic Tree Pulling System** is designed to collect data in a non-invasive and precise manner during static Tree Pulling Tests. The data obtained will be analysed using specific software. Environmental and tree parameters including wood strength, modules of elasticity, wind speed and etc will be analysed using the software and the safety factor of the tested tree will be calculated.

## Mechanism of TreeQinetic Tree Pulling System



|                            |                          |                                      |               |
|----------------------------|--------------------------|--------------------------------------|---------------|
| <b>Project</b>             |                          | <b>Site</b>                          |               |
| Project Name               | test                     | Amulfstr. 15                         |               |
| Project Number             | 1                        | 80339 München, D                     |               |
| Test Date                  | 2011/8/17                | Altitude a. sea level                | 0 m           |
| <b>Tree Data</b>           |                          | <b>Applied Material Properties</b>   |               |
| Tree Species               | Quercus robur "Unifolia" | as for                               | Quercus robur |
| Stem circumference         | 93 cm                    | Source                               | Stuttgart     |
| Stem Diameter              | 24 cm                    | Compressive Strength                 | 20 MPa        |
| Stem Diameter in 1m height | 27 cm                    | Modulus of Elasticity                | 7200 MPa      |
| Bark Thickness             | 1.5 cm                   | Limit of Elasticity                  | 0.28 %        |
| Tree Height                | 15 m                     | Green Density                        | 1 g/cm³       |
| <b>Crown Outline</b>       |                          | <b>Load Direction</b>                |               |
|                            |                          | NW                                   |               |
|                            |                          | <b>Surface Area Analysis</b>         |               |
|                            |                          | Crown Base                           | 2.9 m         |
|                            |                          | Effective Height                     | 10.2 m        |
|                            |                          | Total Surface Area                   | 172 m²        |
|                            |                          | Crown Eccentricity                   | 0.59 m        |
|                            |                          | <b>Applied Structural Parameters</b> |               |
|                            |                          | Drag Factor                          | 0.25          |
|                            |                          | Natural Frequency                    | 0.24 Hz       |
|                            |                          | Damping Decrement                    | 51.62         |
|                            |                          | Form Factor for Dead Weight          | 0.8           |
|                            |                          | <b>Applied Site Parameters</b>       |               |
|                            |                          | Windzone                             | D 1           |
|                            |                          | Speed of Applied                     | 100 m/s       |
|                            |                          | Design Wind Speed                    | 1.18 kg/m²    |
|                            |                          | Air Density                          | Sea level     |
|                            |                          | Roughness Category                   | 0.12          |



Snapshots of Analysis Panel

A force is applied to the weakest point of the tree through a winch, the force is measured by the forcemeter. The compress and extension of tree trunk due to the applied force is measured by elastometers installed on the trunk. The angle of tilting due to the applied force is measured by the inclinometer installed on the trunk base. All the data is collected by a central processing unit via blue tooth and transmitted to a software for analysis. Environmental parameters and tree data are input into the software and the Safety Factor of the tree will be calculated. The Safety Factor is a direct unit of measuring tree stability.

## Why Muni?

- ✓ We have the first Tree Pulling System in Hong Kong.
- ✓ We are trained by the device manufacturer from Germany to use the machine.
- ✓ We have conducted researches and obtained wood strength and modules of elasticity data from local species.
- ✓ We have conducted tree risk assessment > 20,000 trees.