LEVEL 3 - ADVANCED TREE ASSESSMENT METHODS

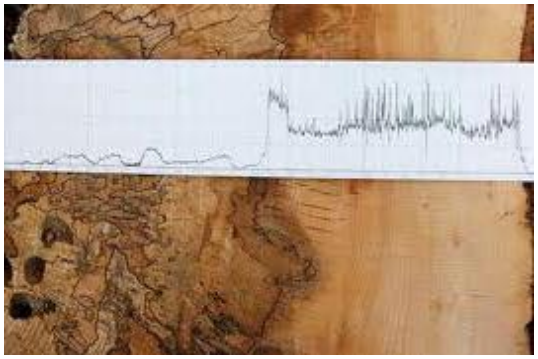
We hope this information will help you choose the most appropriate assessment to meet your needs. Please find below a brief outline of methods that provide additional information in relation to tree safety.

If you have any requirements in relation to your site then please feel free to discuss them with us, as we should be able to tailor information to suit your particular needs.

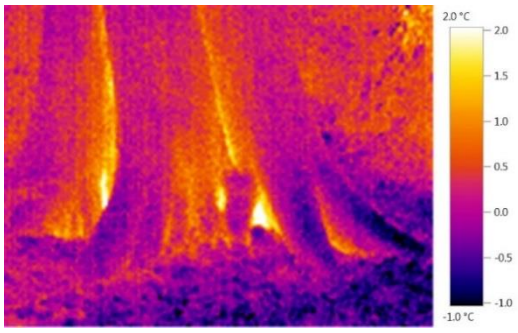
INCREMENT BORE - After screwing the tube into the tree, an extractor is used to remove the wood core. The thickness of sound wood can be measured accurately. Increment borers provide good information but create a significant hole (up to 1cm or so) that can breach a trees internal defence mechanism, we typically only use this where there is a significant safety concern or as a last resort.

RESISTOGRAPH - This measures the drilling resistance of a needle drill. Data can be displayed as a paper trace (shown opposite) or as a digital output for a more detailed assessment of the internal condition of the tree.

Again this method can breach a trees internal defence mechanism and as a result we only use this method where there is strong suspicion of decay or to confirm other test results.



THERMAL IMAGING CAMERA (TI) - Produce images upon the amount of infrared energy emitted, transmitted, and reflected by an object. A thermal imaging camera will show subtle temperature changes when the tissues of the wood or bark are altered or destroyed by physical actions or pathogens in addition to identifying areas of restricted vascular activity or destroyed tissues below the surface.



CHLOROPHYLL FLUORESCENCE – By measuring the capacity of a plant to carry out photochemistry this can provide a measure of health and identify impacts from a range of issues including stresses caused by environmental conditions.

It is used as a means of detecting physiological damage caused by biotic or abiotic stress factors. The very nature of the technique ensures early detection of stress that could lead to decline well before visible symptoms manifest.

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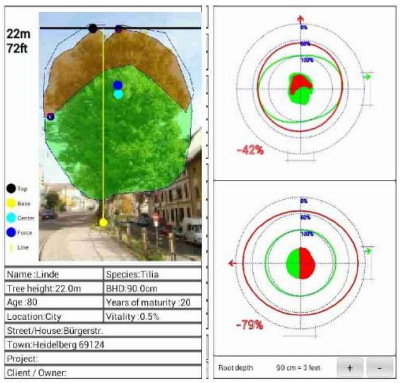
STRESS WAVE TIMER - Stress wave techniques are the equivalent of a single shot Tomograph. The time taken for a sound wave to travel across a known distance give an insight into the deterioration in wood structure. Deterioration in tree stems increases the time taken for the signal as the sound wave needs to travel around faults of decay or holes between the two sensors. The reference velocity depends on tree species.

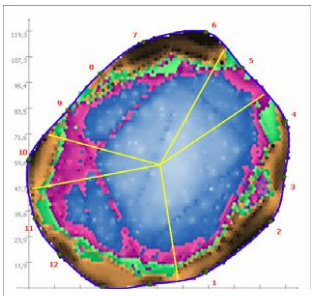
STABILITY MODELLING – Key dimensional information is used to compute various factors in relation to tree stability, enabling determination and comparative evaluation of:

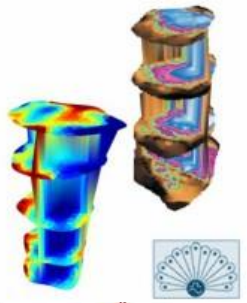
- Tree wind load and centre of gravity.
- Safety improvement following crown reduction.
- Stability reduction by decay.
- Tipping-stability reduction by root decay and/or trenching.
- Enable safety-balancing between the retained stem cross-section and wind-load experienced by the tree.



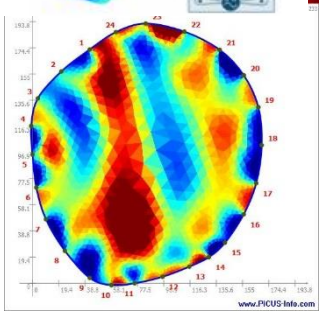
This allows the determination of strength loss due to structural defects in the cross sections of stems and branches and anchorage plate losses in relation to canopy size and expected wind-loads. In addition, the method enables evaluation of load reduction by crown reduction pruning to further achieve higher safety in damaged trees. The inputs are based on observations rather than diagnostic instruments but enable accurate (if not as precise) estimations of safety which are sufficient for many tree assessment purposes. However, the precision of the evaluation can be increased by putting in results from proper sonic tomography or resistance drilling with density-calibrated devices.

SONIC TOMOGRAPHY (SOT) - A non-invasive tool for assessing decay in trees – shown to the right. It works on the principle that sound waves passing through decay move more slowly than sound waves traversing solid wood. The Picus sonic tomogram sends sound waves from a number of points around a tree trunk to the same number of receiving points, the relative speed of the sound can be calculated, and a two-dimensional image of the cross-section of the tree, 'a tomogram', can be generated. Using the differences in the transit times between each pair of sensors, the Picus analysis software constructs a two-dimensional picture (acoustic tomogram), which show zones of differing sound transmission properties within the stem. These results can be combined with other scans in a 3D representation to provide a better understanding of the internal condition of the stem.

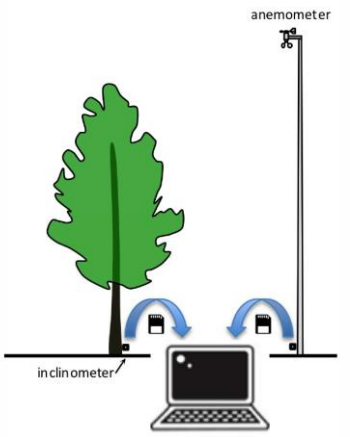




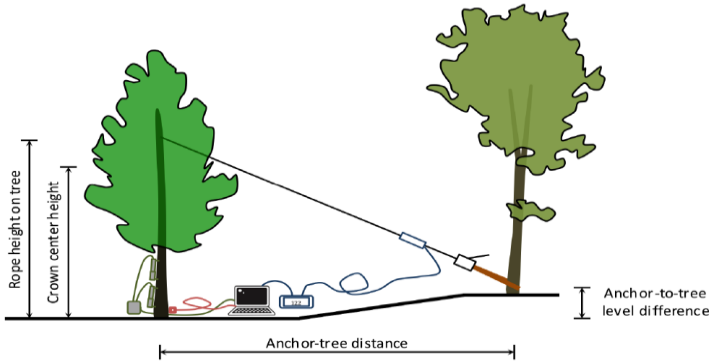
ELECTRICAL RESISTANCE TOMOGRAPHY (ERT) – This method gathers chemical information about the wood such as water and/or ion concentration and physical properties that provides information about the internal condition of the stem. Low resistivity can identify increased moisture content, whereas hollowed structures cause increases in resistance. After collecting all the measurements, the information is displayed in the form of a coloured distribution plan for analysis as shown opposite. Again, these results can be combined with other scans in a 3D representation to provide a better understanding of the internal condition of the stem.



NATURAL SWAY MONITORING - Sensors attached to the base of the tree enable us to test the root anchorage & stem stability. When wind blows trees start to sway and this load is transmitted into the ground via the stem and rootplate - transferred to the root plate. We use sensors to record sway motion of trees in natural winds. The motion of the tree shows the real response of a tree to the natural conditions and enable identification of excessive movement and helps identify weak trees.



PULLING TEST - The tree-pulling test provides information about the breaking stability of the trunk and the stability of the roots. It is used to assess a tree's resistance to stem fracture and uprooting precisely and non-invasively. In a pulling test, a load (substituting for the wind) is exerted on a tree. The reaction of the stressed tree under this defined load is measured with high resolution devices (elastometer's and inclinometer), and the data obtained are compared with those of sound trees. The major components to be considered in such calculations are the wind-load (the surface of the load-bearing structure, tree height, etc.) and the material properties of green wood.



Please see the table below, which provides a comparison of the methods used in advanced tree assessment and their suitability to assessing particular features and an indication of relative cost. If you have any particular requirements in relation to your site or require a combination of assessment of your trees please feel free to discuss them with us, as we should be able to tailor information to suit your particular needs and would be happy to provide a fixed price quote.

	Tipping Safety	Fracture Safety	Tree Vitality	Damage to Tree	Cost per test
Increment Bore	🔴	🔴	🟡	🔴	Low
Resistograph	🔴	🟡	🟡	🟡	
Thermal Imaging Camera	🔴	🔴	🔵	🔵	
Chlorophyll Fluorescence	🔴	🔴	🔵	🔵	
Stress Wave Timer	🔴	🔵	🔴	🔵	
Stability Modelling	🟡	🟡	🔴	🔵	
Sonic Tomography	🔴	🔵	🔴	🔵	
Electrical Resistance Tomography	🔴	🔵	🔴	🔵	
Sway Monitoring	🟡	🟡	🔴	🔵	
Static Pulling Test	🔵	🔵	🔴	🔵	High

Comparison of methods in advanced tree assessment Blue 🔵 Good Yellow 🟡 Fair Red 🔴 Unfavourable

Adapted from Roloff (2016)