Tree Risk Assessment & Mitigation

URBAN FOREST INNOVATIONS INC

Urban Forest Innovations Inc.'s (UFI) extensive tree risk assessment experience enables the company to develop effective risk mitigation strategies for trees in urban settings. Three assessment methodologies allow UFI to accurately determine the level of risk associated with virtually any urban tree:

Proven and Effective Strategies to:

- *Reduce the risks posed by trees to people, property and infrastructure*
- *Reduce the potential liability associated with tree failure*
- *Reduce the costs of long-term tree maintenance and risk mitigation*
- *Maintain older trees as important components of a healthy and diverse urban forest*
- *Provide unbiased and defensible support for tree removal or retention decisions*

Visual Tree Risk Assessment (VTRA) – Using this basic risk assessment methodology, UFI's certified arborists identify factors such as pests, diseases, site conditions and structural weaknesses which may contribute to elevated risk of whole tree failure or failure of component parts, such as branches. This risk assessment methodology has been applied by UFI to thousands of trees in a wide range of settings.

PiCUS® sonic tomography – This advanced risk assessment uses minimally-invasive technology, similar to medical ultrasound scans, to assess wood condition without injuring vital tree tissues. Utilizing sonic waves and precision sensors, this computerized assessment system provides on-site, full-colour images of the internal condition of the subject tree. Sonic tomography empowers clients with the accurate information needed for timely and informed decision making.

Tree Pulling Tests (Elasto-Inclino or Static Integrated Method) – This method uses computer modelling and static load application to predict the behaviour of a subject tree under extreme weather conditions. UFI is the only arboricultural consultancy in North America trained and qualified to apply this risk assessment methodology, and has done so for more than 150 suspected risk trees across the continent.

UFI provides the most accurate, independent and defensible tree risk assessments available today. Every risk assessment includes a complete arborist report, and customized solutions are available to fit any client's individual requirements.

Urban Forest Innovations Inc.
· P: (905) 274-1022 · F: (905) 274-2170 · 1331 Northaven Drive, Mississauga ON L5G 4E8 · info@urbanforestinnovations.com ·

About Urban Forest Innovations Inc.

Urban Forest Innovations Inc. (UFI) is an arboricultural and urban forestry consultancy based in Mississauga, Ontario. Since its founding in 1994 by Philip van Wassenaer, B.Sc, MFC, the company has utilized a research- and science-based approach to provide unbiased, independent and specialized services related to all aspects of urban forest management.

UFI's core services include:

- strategic urban forest management planning,
- consulting arboriculture,
- tree pest and disease identification and management, and,
- comprehensive tree risk assessment.

Our long-standing clients include:

- private homeowners,
- institutions such as school boards and universities,
- golf courses and country clubs, and,
- numerous municipalities across southern Ontario and beyond.

For more information about Urban Forest Innovations Inc.'s tree risk assessments, or other arboricultural and urban forest management and planning services, please contact us at:

Urban Forest Innovations Inc.
1331 Northaven Drive
Mississauga, ON L5G 4E8
P: (905) 274-1022
F: (905) 274-2170
info@urbanforestinnovations.com

Visual Tree Risk Assessment

URBAN FOREST INNOVATIONS INC

Tree risk is typically caused by a complex series of relationships between site factors, tree health and structure, and the potential liability associated with tree failure. In many cases, however, visual tree risk assessment is adequate to determine the nature and extent of risk and to suggest appropriate mitigation strategies.

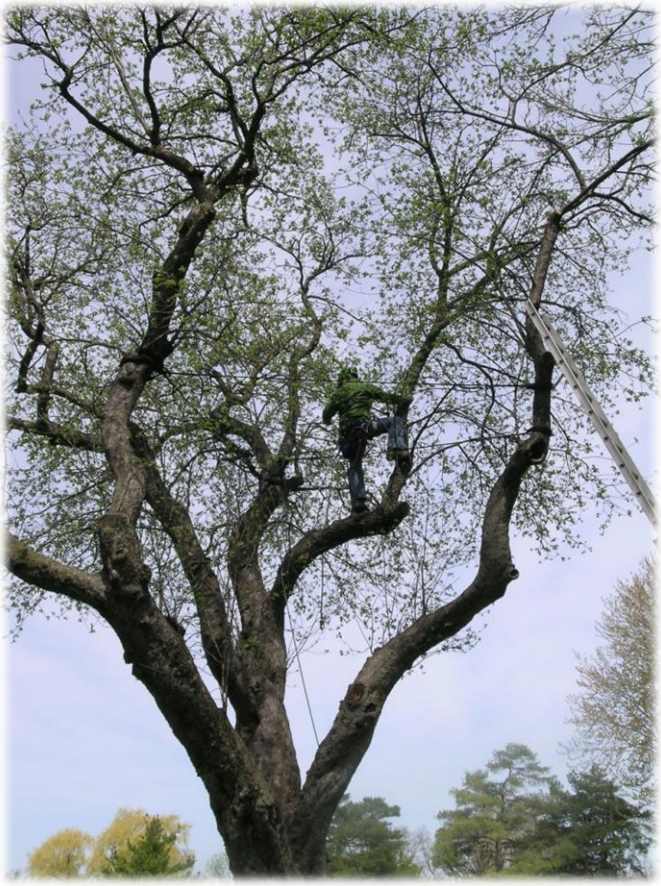
Urban Forest Innovations Inc.'s arborists have visually assessed thousands of urban trees, using the effective combination of a standardized assessment methodology with tree-specific requirements. A typical visual tree risk assessment by UFI's arborists begins from the ground with a thorough examination of the subject tree for the most structurally-compromised component parts, which may be the entire stem, large scaffold branches, or deadwood throughout the crown.

The failure potential of the defect is assessed based on the characteristics of the tree species, the subject tree's overall health and vigour, and the nature of the defect in question. External factors must also be considered in order to provide an accurate visual-based risk assessment. The factors include the tree's growing site conditions and growth history, exposure to wind and other weather conditions, and above all, the potential targets for tree or tree part failure.

The latter point cannot be underemphasized – decisions to remove or retain suspected risk trees must always consider the potential target or lack thereof. Trees with significant defects might pose no risk and be safe to retain in woodlots, while trees with even minor structural weaknesses may require management if they are located in areas of high traffic.

Urban Forest Innovations Inc.
· P: (905) 274-1022 · F: (905) 274-2170 · 1331 Northaven Drive, Mississauga ON L5G 4E8 · info@urbanforestinnovations.com ·

UFI's arborists can also take visual tree risk assessment to the next level – literally. The company has performed hundreds of climbing inspections as part of the visual risk assessment process. This approach is especially useful for examining upper-crown cavities and suspected weak branch connections. Branch attachment is often stronger on the lower side of the branch, and it is often difficult to examine weaker attachment points for decay or other defects without a climbing assessment.



Visual tree risk assessment is best applied to areas where more advanced assessment techniques are impractical due to scale or time constraints, where potential liability related to tree failure is relatively low, or where the risk of failure is evidently low.

UFI's experience and expertise in providing unbiased, independent and systematic visual tree risk assessment has been trusted by a broad range of clients.

UFI's recent visual tree risk assessment projects include:

- *Visual risk assessment and sonic tomography on the Historic Bebb oak at the Dominion Arboretum in Ottawa Ontario*
- *Priority risk assessment for the town trees in Alliston, Beeton and Tottenham for the Town of New Tecumseth, Ontario*
- *Tree inventory and visual risk assessments for the Cities of Hamilton, Cambridge, Mississauga and Bradford West Gwillimbury*
- *Visual risk assessment, sonic tomography, tree-pulling test and risk mitigation for a twin-stemmed Tulip-tree (Liriodendron tulipifera) at Parks Canada's Woodside Historic National Monument, Kitchener, Ontario*
- *Tree inventory and visual tree risk assessments for Beechwood, the National Cemetery of Canada, in Ottawa*

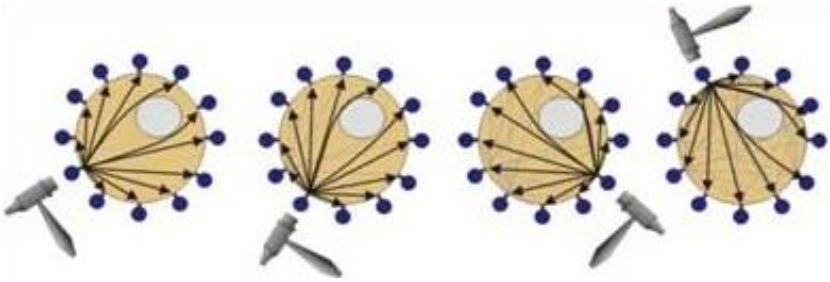
PiCUS® Sonic Tomography

URBAN FOREST INNOVATIONS INC

Sonic tomography is used to non-invasively investigate the internal condition of sound-permeable structures for cracks, decay or other defects. By relaying sound waves through material of varying density, this technology allows assessors to generate a full-colour "density map" of an object by combining the object's measured geometry with the apparent velocity (distance/time) of the sonic waves recorded during the assessment.

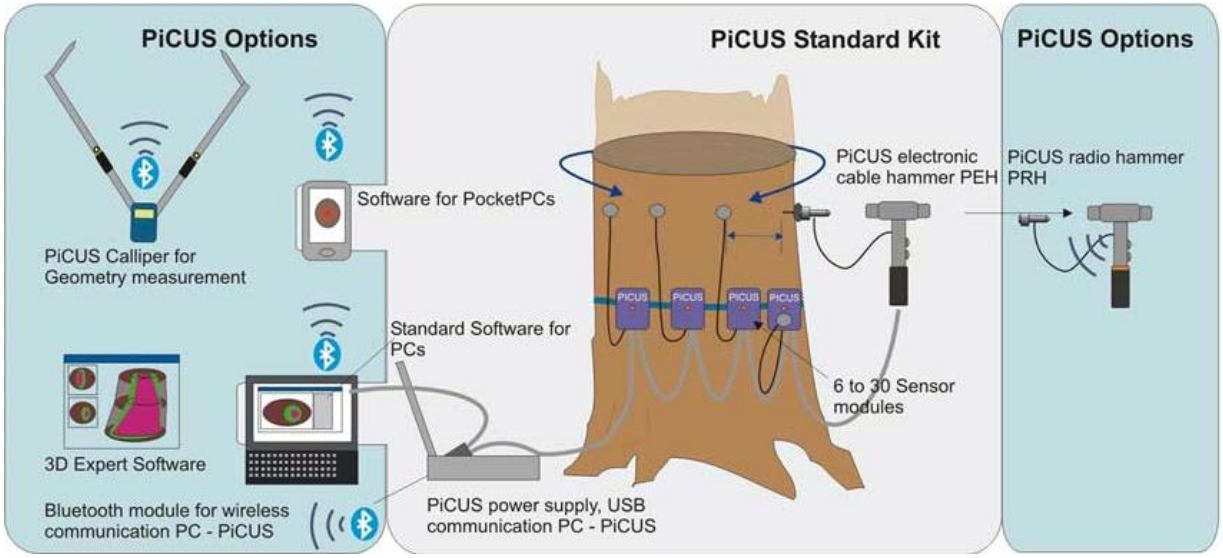
Sonic tomography has been extensively used to test structures such as bridge pilings, utility poles, and even historic masonry buildings. Recently, the computer models associated with sonic tomography have been modified to enable the accurate investigation of trees for their specific kinds of defects, presenting arborists with the same powerful, rigorous and advanced risk assessment methodology used by structural and civil engineers.

Urban Forest Innovations Inc. is one of the few arboricultural consultancies trained and equipped to conduct sonic tomography in North America. Our expertise has been demonstrated on projects as far away as Seattle, North Carolina and the redwoods of California.

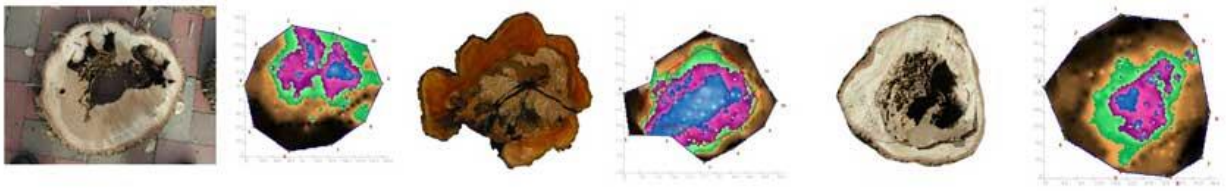


The standard method of propagating sonic waves through a tree and recording the data is to attach one sensor to each measuring point (typically a nail embedded just under the tree's bark layer). The time of flight of sound waves generated by tapping each nail is recorded at each of the sensors, and is then used to determine the tree's internal condition. Tomograph images can be generated from the subject tree as soon as measurements are completed, enabling on-the-spot decision making and comprehensive risk assessment, including measurement of residual walls, cavities, and decay. These measurements can be combined with other factors through a method known as the Statics Integrated Assessment (SIA) to generate an accurate quantification of a tree's resistance to stem failure.

Urban Forest Innovations Inc.
· P: (905) 274-1022 · F: (905) 274-2170 · 1331 Northaven Drive, Mississauga ON L5G 4E8 · info@urbanforestinnovations.com ·



Sonic tomography is an advanced risk assessment technique, and is best suited to assessments of single or small groupings of urban trees with identified potential risk. Accurate tomograph images of a tree's internal condition, generated through UFI's assessments, have on numerous occasions led to the reversal of 'orders to remove', and at other times have supported such decisions for relatively 'healthy-looking' but internally-decayed trees. The repeatable and quantifiable results of sonic tomography risk assessments enable UFI to provide independent and defensible advanced risk assessments for highly-valued urban trees.



The ability of sonic tomography to detect internal decay has been comprehensively proven through dozens of destructive sampling tests. Each new assessment highlights the versatility and capability of this advanced tree risk assessment technique!

UFI's recent PiCUS® sonic tomography tree risk assessment projects have included:

- *Visual risk assessment and sonic tomography on the Historic Bebb oak at the Dominion Arboretum in Ottawa Ontario*
- *Visual risk assessment and sonic tomography on City-owned Riverside white oak tree on Riverside Drive in Toronto Ontario*
- *Sonic tomograph and tree-pulling assessment of White pine (Pinus strobus) for the Town of Oakville, Ontario*
- *Sonic tomograph assessments and tomography seminar at the Biltmore Estate, Ashville, North Carolina.*

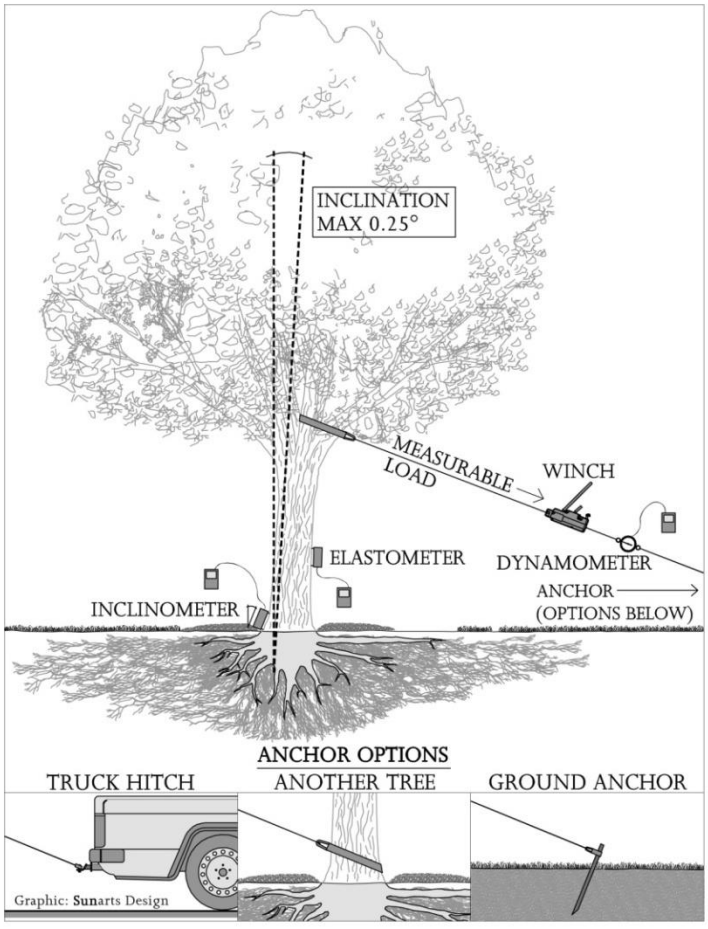
Tree Pulling Tests

(Elasto-Inclino or Static Integrated Method)

URBAN FOREST INNOVATIONS INC

The most comprehensive quantitative tree risk assessment offered by UFI is the Static Integrated Method (SIM), or 'tree pulling test'.

Using this methodology to assess the likelihood of failure (stem breakage or uprooting), the subject tree is pulled to simulate moderate wind loading and the resultant changes in fibre length and root plate inclination are measured. A static load is applied with a strong winch secured to a sling in the tree's upper canopy, and the applied force is measured with an in-line dynamometer. The resultant changes in fibre length are measured with a high-precision elastometer, and are used in the calculation of resistance to stem breakage. An inclinometer measures the changes in the angle of the root plate, and these data are used to calculate the tree's resistance to uprooting. The combined data, entered into a computer algorithm in conjunction with a digitized profile of the tree's crown and factors such as the material properties of the species' green wood, are used to model the tree's stability and resistance to failure in gale-force winds.

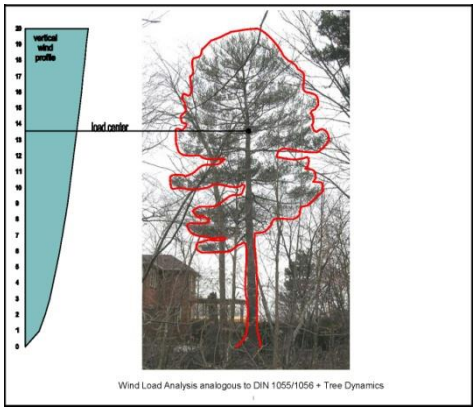


This risk assessment method enables UFI to model risk mitigation prescriptions such as crown height reduction or pruning prior to their implementation, ensuring that the right steps are taken to reduce risk the first time around. This may not only reduce potential liability for the client, but also reduces the costs expended on tree risk mitigation. As with PiCUS® sonic tomography assessments, the SIM risk assessment also lends scientific credibility to tree removal orders or decisions to retain suspected trees, and is an independent, unbiased and accurate tree risk assessment methodology.

Proper application of the SIM requires extensive arboricultural and engineering knowledge and experience, and access to a number of sophisticated assessment tools.

Urban Forest Innovations Inc.
· P: (905) 274-1022 · F: (905) 274-2170 · 1331 Northaven Drive, Mississauga ON L5G 4E8 · info@urbanforestinnovations.com ·

UFI is currently the only arboricultural consultancy in North America with the training and equipment to conduct SIM tree risk assessment, which was developed in Germany at the University of Stuttgart by a group of scientists and professional structural engineers, physicists and arborists. UFI has assessed over 150 trees with this methodology, and many of these trees have shown to be safe to retain with some mitigation measures. Prescriptions for mitigation of risk and improvements to the health of the subject tree are also developed by arborists at UFI.



Wind Load Analysis analogous to DIN 1055/1056 + Tree Dynamics

UFI's recent Static Integrated Methodology tree risk assessment projects have included:

- *Visual risk assessment, sonic tomography, tree-pulling test and risk mitigation for a twin-stemmed Tulip-tree (Liriodendron tulipifera) at Parks Canada's Woodside Historic National Monument, Kitchener, Ontario*
- *Comprehensive tree risk assessments for the City of Mississauga, Ontario*
- *Tree-pulling assessment and sonic tomograph of White pine (Pinus strobus) for the Town of Oakville, Ontario*
- *Tree-pulling test risk assessment of the heritage 'Lyons Oak' tree at Lambton Golf and Country Club*
- *Tree-pulling test risk assessment for the Cities of Calgary, Alberta; Dublin, Ohio and Redwood City, California*