Tree Inspection & Assessment of Red Oak, 21 Beech Street, Bowmanville, Ontario

September 22, 2020

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Contents

Introduction

At the request of Jon McNairn I inspected and completed an advanced assessment of a Red Oak immediately east of the sidewalk at 21 Beech Street, Bowmanville.

Limits of the Assignment

- This report is based on visual inspection along with sonic tomography and resistance drillings;
- There was no inspection of roots not clearly visible above soil level;
- This report does not provide any guarantee to stability or survivability of the tree;
- This report is not prepared for use in any legal proceeding.

Subject Tree

Species: Red Oak (*Quercus rubra*)

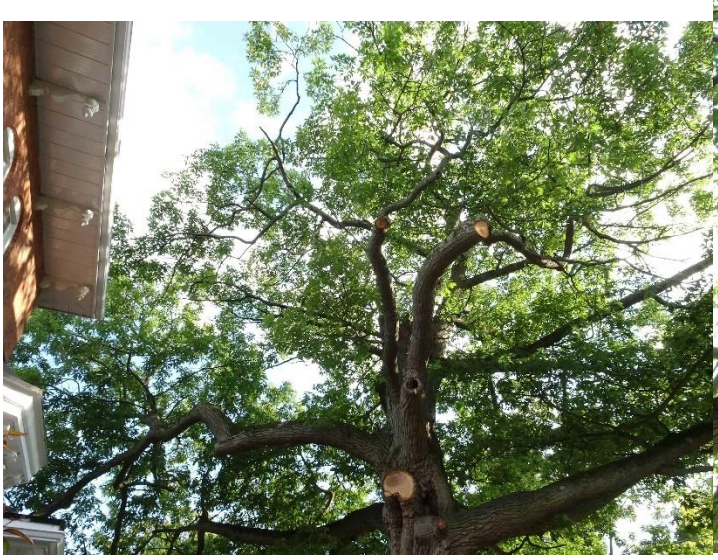
Size – diameter at breast height – 186 cm

Location - in front yard between the sidewalk and the house at 21 Beech St. Lower limbs reach from the tree to the west side of road and from the tree to the house and the driveway to the south. The sidewalk has been adjusted to flow around the tree.

Presenting defects/features – a large limb on the north east corner of the tree has fractured this past summer and landed on the house. The broken branch union reveals a cavity centred in the stem.

Photographs of Subject Tree

Photograph(s) of Noted Defects/Features



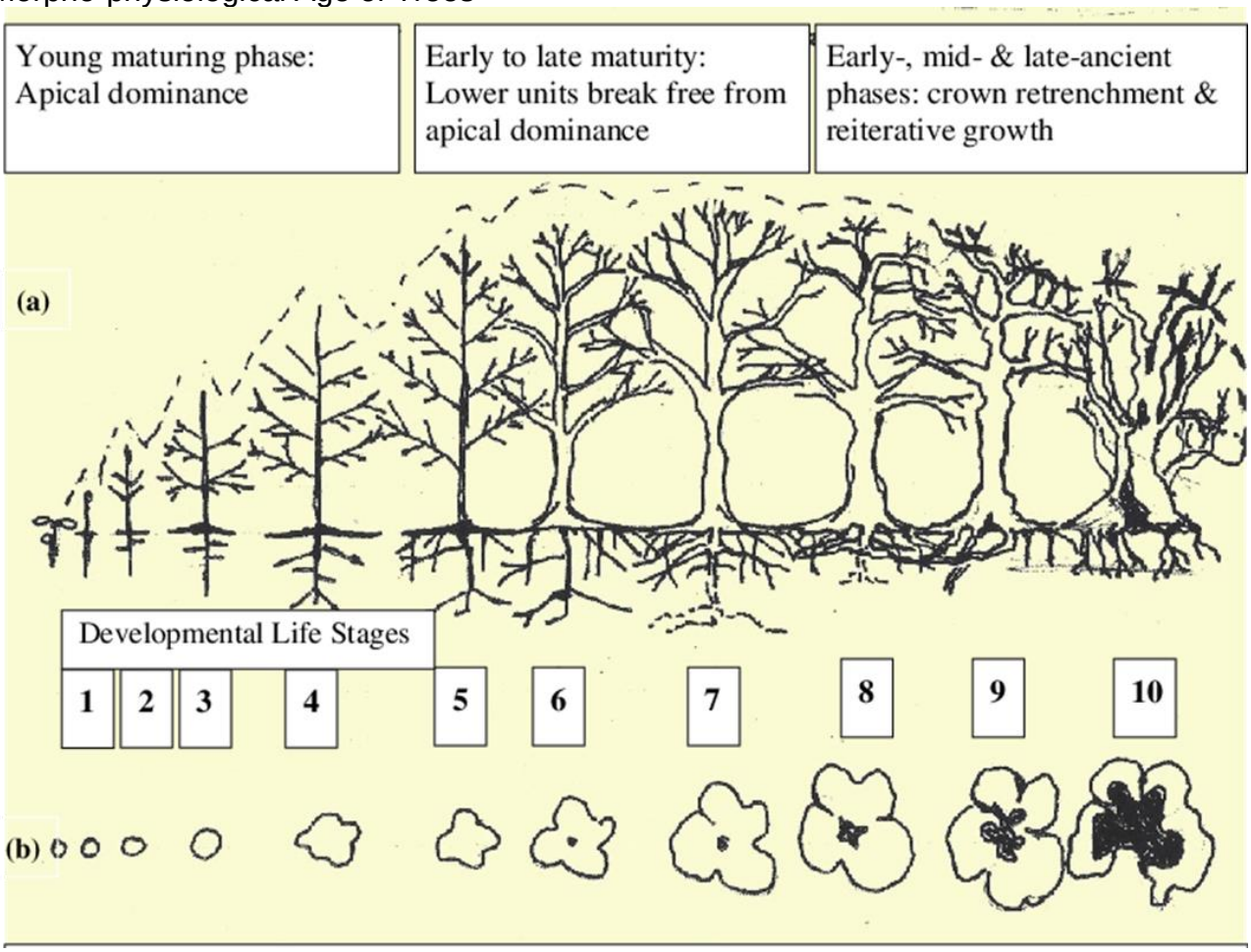
Tree Health

The tree is an over-mature tree within terms of morpho-physiological age. A couple of distinct features of over-maturity are present: declining crown, heartwood decay, and segmentation into distinct functional units.

There are still areas of very good growth as evidenced by strong rib growth and striations.

The lower two limbs are over-extended (extending beyond the natural canopy outline), have had most interior branches and sprouts removed, and bear leaves largely in the outer 3-4 m. Reducing these limbs by more than 1.5 m will likely result in the death of the limbs.

Morpho-physiological Age of Trees



The crown has been heavily pruned in the past as evidenced by the large pruning wounds. The crown is in decline as many dead branches and thin areas exist.

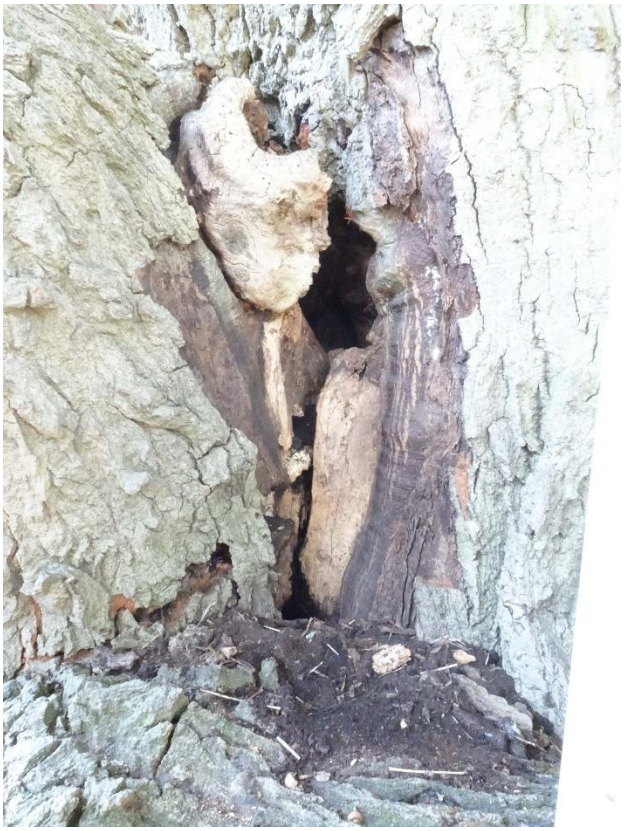
The tree has begun to segment into functional units. This means that a functional unit of a distinct section of the tree consisting of a limb or branch with associated foliage, a portion of the trunk and roots connected through a buttress roots has formed that is acting independently of the rest of the tree. This is particularly evident on the two lower limbs. If a functional unit is over-pruned or the limb completely removed the associated stem and roots will die.

Failure Mode Assessment of the Failed Limb

The failed limb fractured because there was no integration of the branch fibers into the trunk on the upper portion of the of limb combined with the weight applied to the long lever arm. This is a very common failure mode in large oaks. The cavity within the trunk played no role in the failure.

There are very well-formed growth ribs on the underside of the failed limb. The large growth ribs are pushing the limb up but the traditional tension mode of angiosperms was lost many years ago on this limb.

There is no connection between the limb and the trunk on the upper half of the limb. This is identified by included bark, the loss of the branch bark ridge. Near vertical apparent connection interface, and in the photo of the fracture the loss of toothpick like fibres above the fracture line.

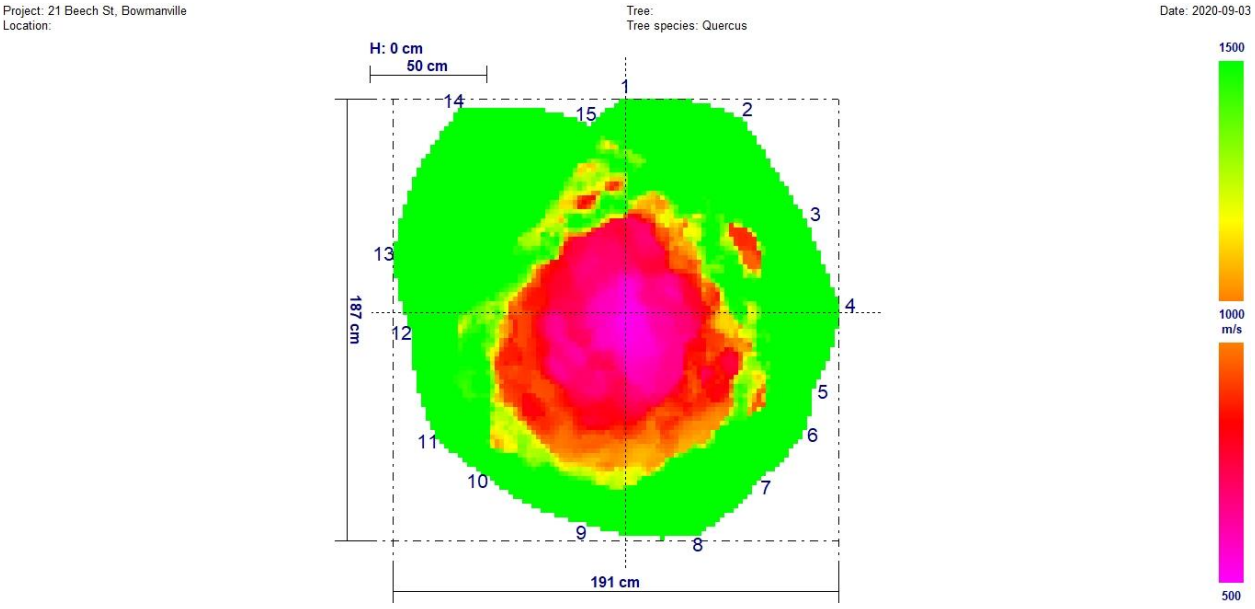


Advanced Inspection of Tree

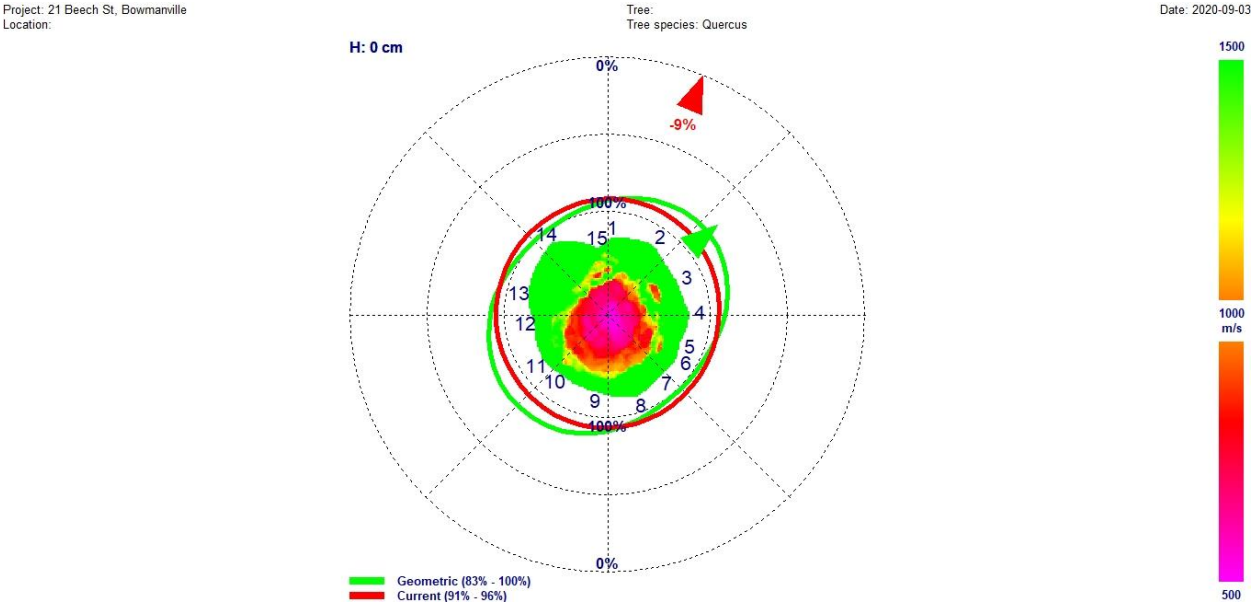
The area of the trunk was inspected using Rinntech Arbotom® Sonic Tomography and Rinntech Resistograph®. The yellow tape and sensors indicate the level of the inspection. Measuring point 1 is to magnetic north.

Photograph(s) of sensors installed on tree and cross-section height

Tomogram of Cross-section Shown in Above Photograph



Tomogram with Mechanical Interpretation of Strength Loss



The tomogram shows loss of solid wood in the cross-section primarily progressing from the center (pith) area towards the edge. Green indicates solid wood while yellow indicates incipient decay and reds and purple complete loss of physical structure.

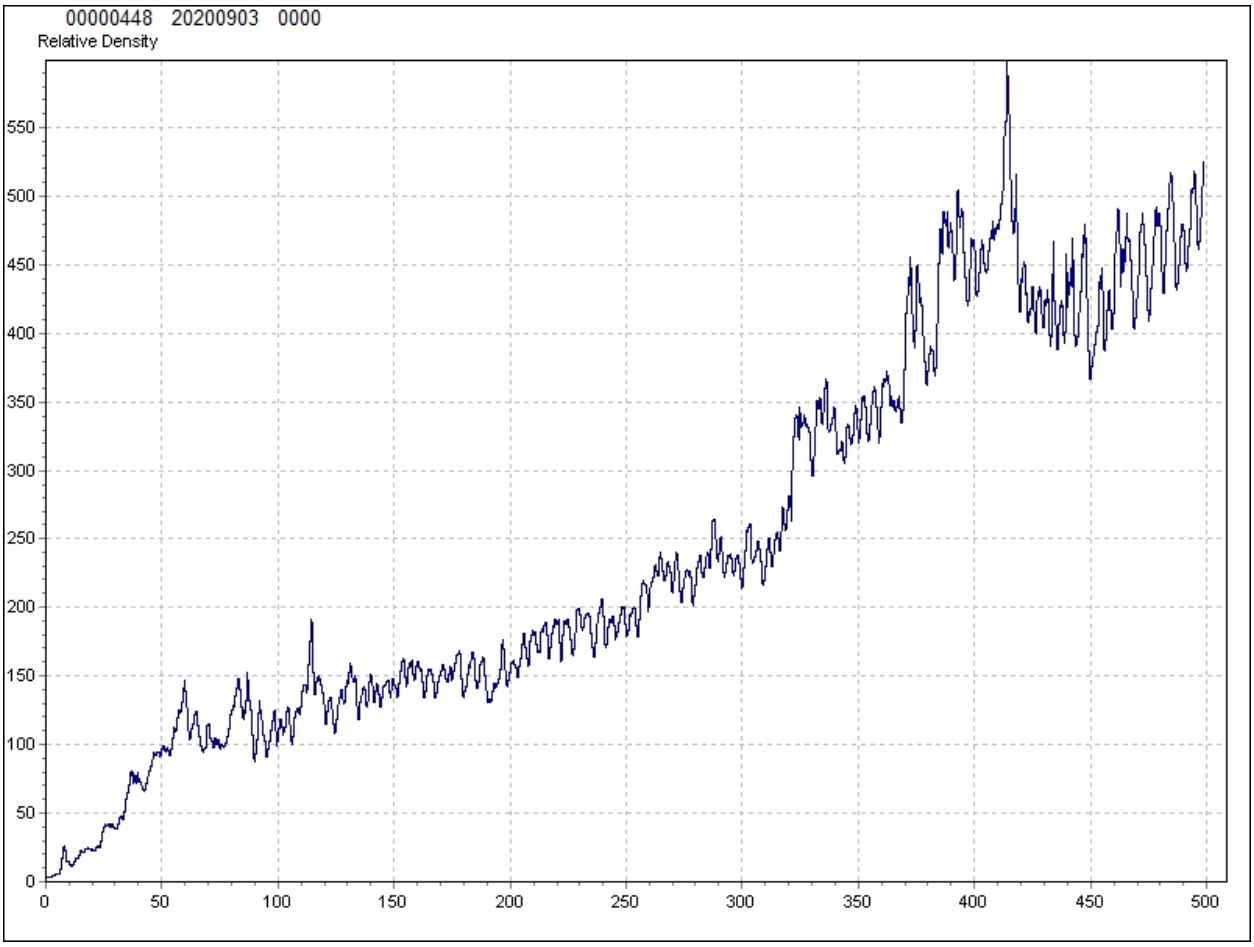
The second tomogram image indicates a maximum loss of 9% of the load carrying capacity of the cross-section as compared to the geometrically same cross-section with no decay.

Central heartwood decay is expected and typical of large old oaks.

Resistograph® Drilling Profiles

Resistance drilling confirms the decay is centrally located and there is a solid intact shell wall.

The tree was drilled on the east face at the top of the red ribbon. The wood was intact to a depth of 50 cm.


00000448 20200903 0000
Relative Density
550
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350
400
450
500

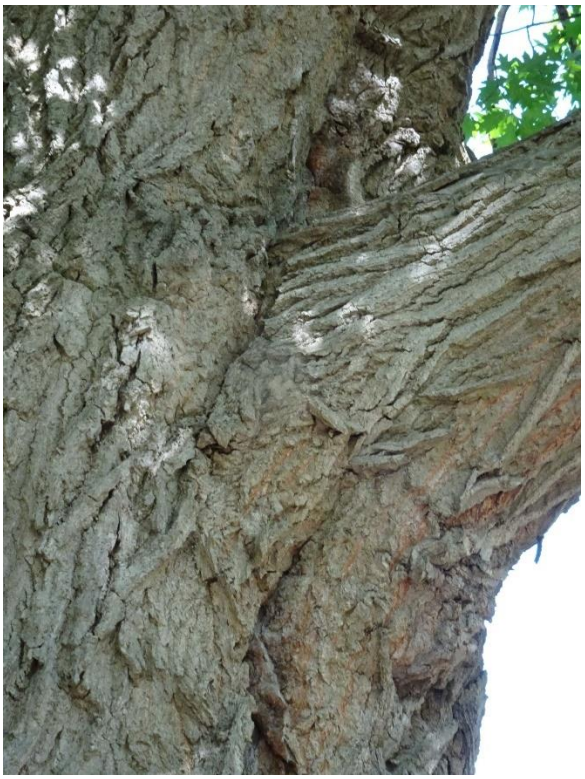
The tree was drilled at the southwest side near measuring point 10. This are was expected to have the thinnest shell-wall. There is approximately 27 cm of intact wood at this location.

Assessment of Defects/Feature

The tree has two very large lower limbs and many large limbs in the canopy.

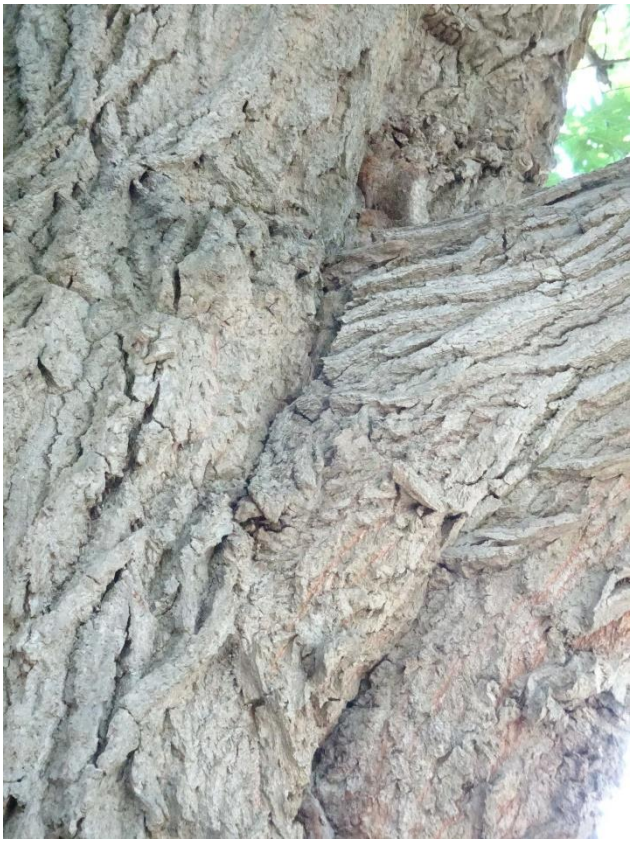
There is a large limb over the road that stretches across the road and intersects another tree. The limb is relatively horizontal with most of the leaves situated at the distal ends. There are very few branches and sprouts along the limb.

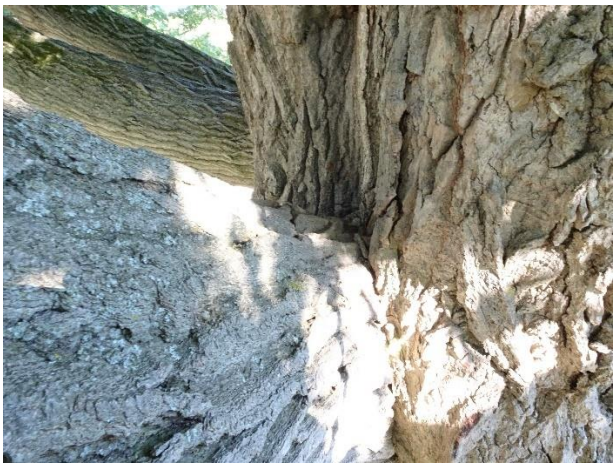
The limb is attached in much the same way as the failed limb. There is strongly included bark and nearly vertical apparent attachment where a brank branch ridge should occur.



The other large lower limb stretches southward across the lawn and reaches the driveway of the house to the south.

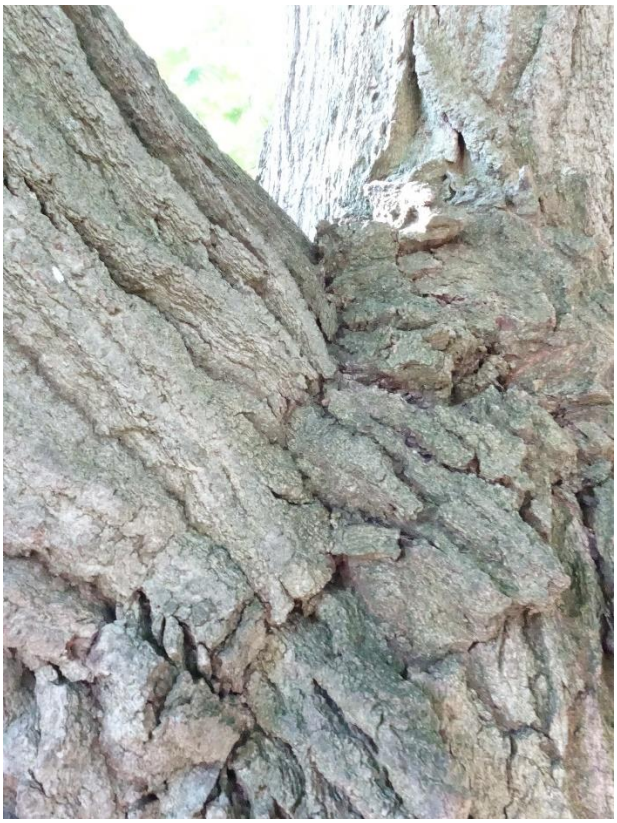
This south limb also has very similar branch attachment characteristics as the limb over the road.





It is my opinion that the two lower limbs will fail in the next five years. These limbs can fail at any time as the length of the lever arm, weight, and poor branch attachments all combine to make it likely the limb will fail do to gravity alone with no added dynamic forces.

There are many other smaller limbs in the canopy with very similar poor branch attachments. Many of these can fail at any time.



Full Tree Risk Assessment

The parts of the tree with the highest likelihood of failure and that may cause significant damage are the two lower limbs. The limbs are relatively weakly attached and are likely to fall due to gravity without the addition of dynamic forces such as wind, rain, wet snow, or freezing rain. The consequences of failure are minimal over the lawn, but either limb may fall onto the sidewalk and have the potential to hit walkers etc., the limb over the road has the potential to strike those on the sidewalk as well as passing and parked vehicles. It is not possible for me to determine the occupancy under the tree as COVID-19 has likely altered street parking. The tree managers are better equipped to determine occupancy and ultimately overall risk associated with the limb falling onto the road and sidewalk.

Should either of these limbs fail and strike a person the likely outcome is severe injuries or death. If a limb falls and hits a parked or passing vehicle the consequences can be expected to be extensive monetary damage and perhaps severe injuries or death to occupants.

Risk has a large component of occupancy. It is clear that the sidewalk is regularly used but by no means is the area under the tree occupied more than perhaps 10% of the year. The area under the tree may have higher occupancy than the sidewalk if cars are parking regularly.

It is my opinion the likelihood of failure of the southern limb in the next five years is probable, the likelihood of impacting someone on the sidewalk is low, but the consequences of failure is severe resulting in the limb having a risk rating of low.

It is my opinion the likelihood of failure of the limb over the road in the next five years is probable, the likelihood of impacting someone on the sidewalk or a vehicle is medium, but the consequences of failure is severe resulting in the limb having a risk rating of moderate.

The overall risk rating of the tree currently is MODERATE.

Management Options

The three primary management options for this tree are:

1. Removal
2. Addition of props and pruning as necessary
3. Do nothing

Option 1. It is clear to me from my time visiting the tree that many locals appreciate and love this tree. I believe the removal may be an inappropriate option.

Option 3. Do nothing will result in the collapse of the lower limbs and gradual failure of the crown, limb by limb. It is my opinion that doing nothing will result in the failure of the two lower limbs within the next five years even in normal weather. The limbs are relatively weakly attached and are likely to fall due to gravity without the addition of dynamic forces such as wind, rain, wet snow, or freezing rain.

It is generally considered that people and property are the primary objects that need protecting by mitigating tree risk. It is also worth remembering that the tree itself is a target and there are many benefits that trees provide. The loss of the subject tree will result in the loss of biological, physical, and physiological that can never be replaced.

Option 2. It is my opinion that to retain the tree the two lower limbs must be mechanically supported and the upper crown supported as necessary. This work will require a complete inspection of tree to determine likely failure points, the loads they represent and the requirement of the support materials. Pruning, including dead-wooding and crown reduction must be specified based upon the need to maintain as much live canopy as possible.

Possible Support Methods

In my opinion the tree must be supported to reduce the likelihood of failure.

Possible support methods are shown. All involve support with built structures (props or may-poles) as more traditional cables will not work in this case.

Reinspection Period

If the limbs and crown are not supported the tree should be inspected:

1) After each storm event to determine if a vertical crack between top side of branches and the stems has opened

2) On a regular basis as determined by the tree managers but I suggest every second month

If the tree has props and a may-pole installed the inspection periods can be lengthened to bi-annual (twice per year) and after major storm events.

Conclusion

The lower limbs are likely to fail over the next five years. The risk associated with the tree is currently moderate but can be reduced with mitigation as described. **It is my recommendation that the tree needs mechanical support if it is to be retained.**

Appendix A – Assumptions and Limiting Conditions

The assessment of the tree(s) presented in this report has been made using accepted arboricultural techniques.

When trees are inspected using Arbotom® Sonic Tomography, Resistograph®, or Arboradix®, results are for that location only and do not necessarily represent the state of the trees in non-probed areas.

Notwithstanding the recommendations and conclusions made in this report, it must be recognized that trees are living organisms, and their health and vigour constantly change over time. They are not immune to changes in site conditions or seasonal variations in weather conditions.

While reasonable efforts have been made to ensure that the subject tree(s) are healthy, no guarantees are offered, or implied, that these tree(s) or any of their parts will remain standing. It is both professionally and practically impossible to predict with absolute certainty the behaviour of any single tree or its component parts under all circumstances. Inevitably, a standing tree will always pose some level of risk. Most trees have the potential for failure under adverse weather conditions, and the risk can only be eliminated if the tree is removed.

This report is not intended as, and does not represent legal advice, and should not be relied upon to take the place of such advice.

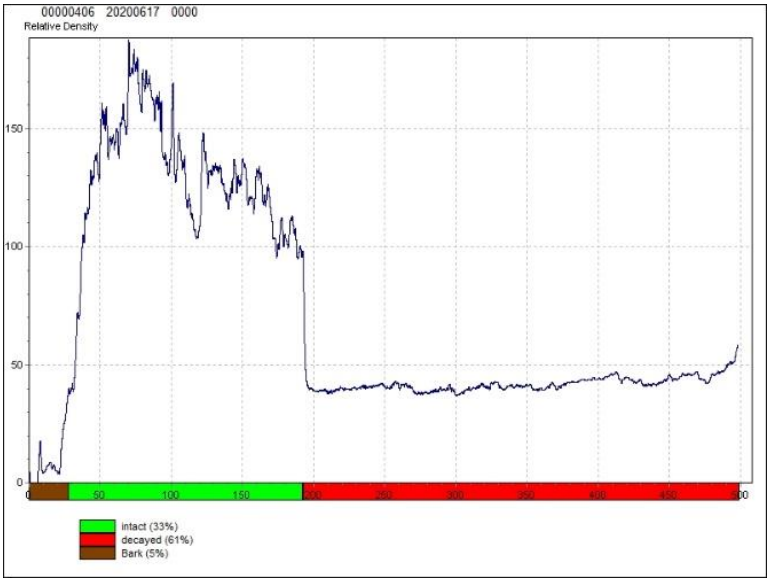
All photographs are reproductions that may vary from the original in size, clarity, tone etc. Original electronic images are stored by the Richardson Tree Care. Any copies of this report must be reproduced in colour or it is not valid.

It is the responsibility of the tree owner to manage the trees. Not withstanding any recommendations made within the report, the consultant is not responsible for their implementation.

Appendix B – Interpretation of Resistance Drilling Profiles

Resistance drilling using the Rinntech R650-ED Resistograph® allows the determination of solid wood vs incipient decay and cracks or hollows. The machine measures the density of the wood and this is used to show a comparative chart of density vs. cross-section depth. Information is captured on an electronic chart and can be used to calculate the loss of LCC compared with an intact cross-section using ArboStApp™.

The horizontal axis represents drilling depth in centimeters and the vertical axis represents relative density of the wood encountered.



Appendix C – Interpretation of Sonic Tomography Images

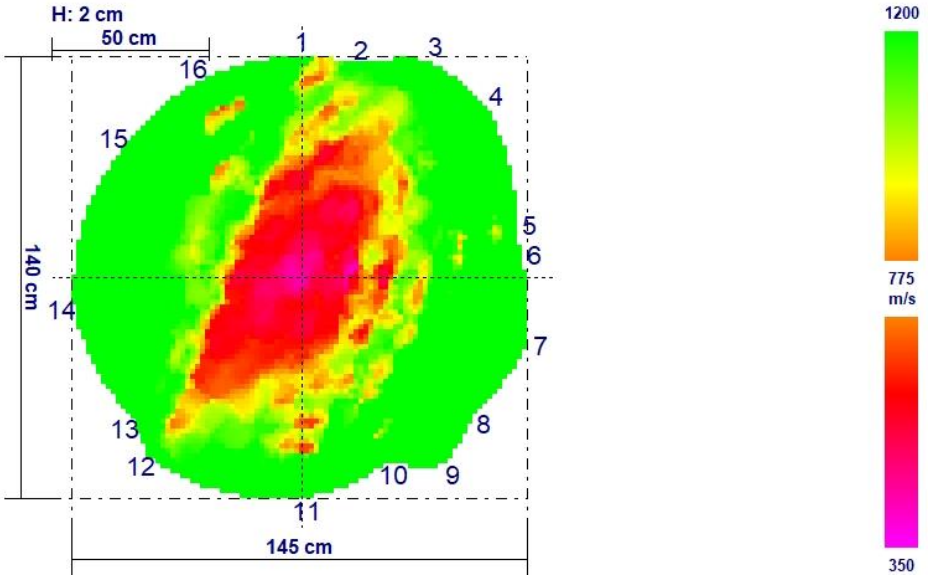
The Arbotom® is used in advanced tree risk assessments. By evaluating the condition of the wood quality in the entire cross section (the extent and configuration of internal decay), strength loss due to decay can be assessed. That data is then used to gain a better sense of what is happening to the tree and how that might affect the likelihood of failure component in a risk assessment.

A series of sensors are placed around the tree trunk or limb, each one connected to the next and then to a computer. Each sensor is tapped, which sends a stress wave across the wood to the other sensors. When wood quality is high (solid wood no defect) the stress waves travel rapidly. When wood quality is low (decay present) the stress waves take longer to move through the wood, and if wood is missing (cavity, or crack) they have to travel around that area, thus taking a lot longer to reach other sensors. The data produced is called a tomogram, which provides a display of the stress wave travel times. Interpreting the tomogram allows the user to get a better sense of where decay might be present, as well as the type and extent of the decay.

Project: Rochester
Location: Above Head 2.5m

Tree:
Tree species: Quercus

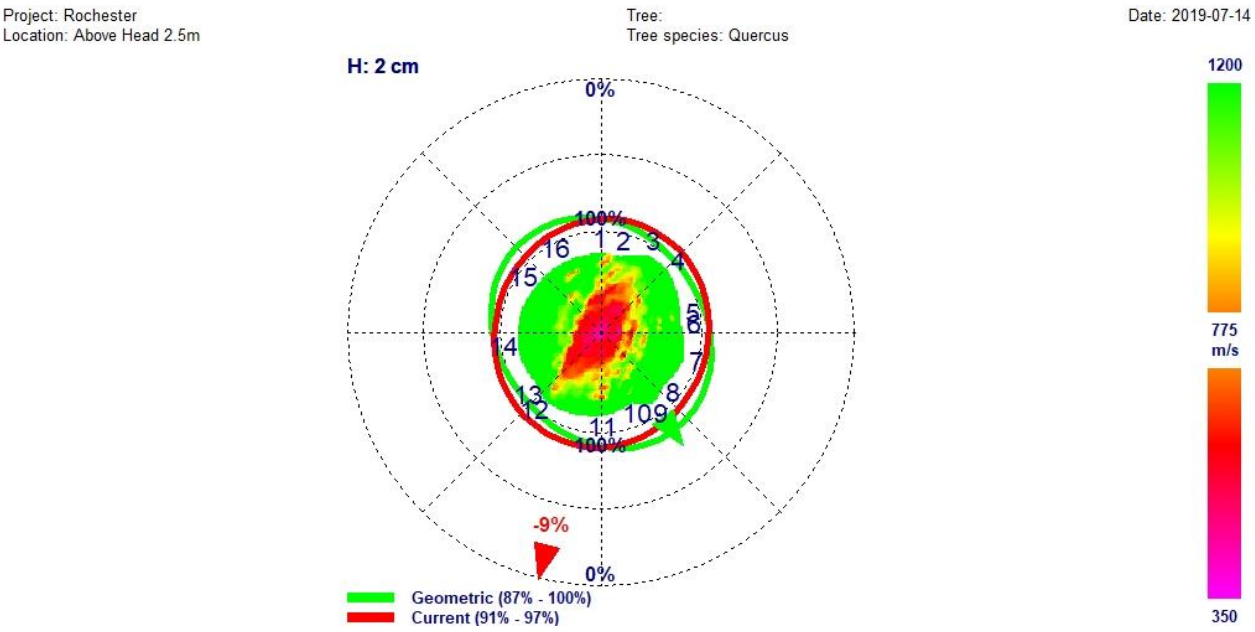
Date: 2019-07-14



Interpreted speed is shown in the left bar with purple indicating hollows, red decayed, yellow incipient decay, and green intact wood.

Appendix D – Interpretation of Mechanical - Sonic Tomography Images

The ‘mechanics-graph’ shows two relative (0 to 100%) scaled curves of the moment of resistance of the cross section to bending by wind from different directions. The green curve is for the intact cross-section, and indicates how the cross-sectional shape of the local mechanical stresses adjusted (e.g. by wind). The red curve shows the relative resistance torque curve in the light of the tomogram graph and any possibly damaged state. The red arrow shows the direction of the “weakest” geometry and the associated number the maximum loss of load carrying capacity as compared with an intact cross-section of the same geometry.

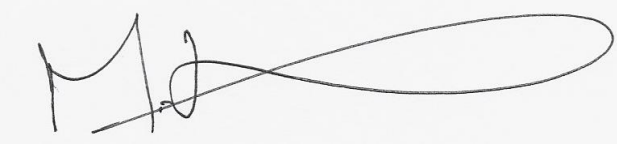


Appendix E – Certificate of Performance

I, Mr. Michael Richardson, do certify:

- That I have personally inspected the plant material referred to in this report and have stated my finding(s) accurately. The extent of the evaluation is stated in the attached report;
- That no one provided significant professional assistance to me, except as indicated in the report. Where observations and data have been collected by others this is stated;
- I have no current interest in the vegetation or the properties that are the subject of this report
- That the analysis, opinions, and conclusions stated herein are my own and are based on current scientific methods and facts;
- That the analysis, opinions, and conclusions were developed and this report has been prepared according to commonly adopted arboricultural standards;
- That my compensation is not contingent upon the reporting of a predetermined conclusion that favours the cause of the client or any other party nor upon results of the assessment, the attainment of stipulated results or the occurrence of any subsequent events;
- I hereby certify that I am an Ontario 444A Arborist having complete the apprenticeship through the Ontario MTCU;
- I have been involved in the field of arboriculture in a full time/part time capacity for a period of more than 25 years;

Signed



Date September 23, 2020

Michael Richardson, B.Sc.F.,
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Ontario MTCU Qualified Arborist
Butternut Health Assessor # 472