Tree Structural Integrity Report

SITE:

15 Akenside Rd,
London
NW3 5BT

PREPARED FOR:

The Francis Crick Institute
1 Midland Road
London
NW1 1AT

PREPARED BY:

Lukasz Schellenberger *DipArb (Lv4) PTI*
Assistant Arboricultural Consultant

BARTLETT PROJECT REFERENCE:

GD.240769.R

SITE VISIT DATE:

22nd October 2024

Consultancy Office
Unit 22-25 Cross Lane Farm
Cross Lanes, Pill
Bristol,
BS20 0JJ

T: +44 (0)1275 371 000 Option 2
E: consultancy@bartlett.com

Submitted on 7th November 2024

Table of Contents

Unit 22-25, Cross Lane Farm, Cross Lanes, Pill, Bristol, BS20 0JJ
Tel: 01275 371000 (Option 2) consultancy@bartlett.com

EXECUTIVE SUMMARY

I was instructed by Ms. Jane Cosgrave, (Accommodation & Tenancy Services Advisor) on behalf of The Francis Crick Institute to complete a visual and advanced tree assessment the Robinia Tree located at 15 Akenside Rd, London NW3 5BT due to the presence of a wood decay fungal pathogen.

I completed my site visit and assessment on 22nd October 2024 and employed the PiCUS® Sonic Impulse Tomography as well as the RESI Powerdrill® PD400 to determine levels of wood density, qualify the extent of wood decay, and estimate residual sound-wood at a number of points on the main stem and co-dominant leaders.

At the conclusion of my survey and assessment, the fungal pathogen has effectively degraded the internal wood structure of the lower main stem, and at a hight of 5.5m on the main stem, resulting in advanced wood decay in these areas.

Following further calculation of the results, it is my professional opinion that the Robinia has been structurally compromised by the fungal pathogen at 5.5 metres, were there was found to be insufficient residual wood present to maintain structural integrity.

The risk assessment based on the results show an over ***moderate*** *risk posed to person sand property.*

In light of this I have recommended that the tree is removed to ground level.

1.0 SCOPE OF REPORT

1.1 Assignment

I was instructed by Ms. Jane Cosgrave, (Accommodation & Tenancy Services Advisor) on behalf of The Francis Crick Institute on 2nd October 2024:

1. To perform a visual tree assessment (VTA) of a Robinia (*Robinia pseudoacacia)* located within the grounds of 15 Akenside Rd, London NW3 5BT following the techniques developed by Mattheck & Breloer (1994).

2. To perform a “Level 3 Advanced Assessment” in accordance with the International Society of Arboriculture’s (ISA’s) Best Management Practices (BMP) *Tree Risk Assessment* using PiCUS® Sonic Tomography & RESI Powerdrill® PD400 to assess the structural integrity of tree stem

3. Preform both ‘measured’ and ‘bespoke’ aerial tree inspections in accordance with Arboricultural Association *Guidance Note 11: Aerial Inspections* to assess the structural integrity of the upper stem.

    a. The bespoke aerial inspection was completed using the IML-RESI Powerdrill® PD400.

4. To undertake a qualified tree risk assessment in accordance with the International Society of Arboriculture’s (ISA’s) Best Management Practices (BMP) *Tree Risk Assessment* (using Level 3 Advanced Assessment techniques) and *Tree Risk Assessment Manual* of the tree part(s) detailed in Assignment Item 2 above.

    After review and discussion with the client, the tree risk assessment will be conducted for the following targets: People (residents, visitors, members of the public), Property (building, bus stop, parked and moving vehicles)

5. To provide a written report on the structural condition of the tree; the level of associated tree risk based on the likelihood of failure and impact to the identified targets detailed above; and to make fully informed management recommendations in accordance with current arboricultural practice and tree health care techniques so that the tree owner (risk manager) can determine their tolerability of risk and take reasonable and proportionate action.

1.2 Background

Mr. Kevin Woodham, Arboricultural Representative, Bartlett Tree Experts – Radlett Office initially visited the property to assess the tree and client’s needs. He identified the presence of fungal fruiting bodies at the base and stem of the Robinia and referred the matter to Bartlett Consulting.

1.0 SCOPE OF REPORT (continued…)

1.3 Report References

Specific tree survey references applied by Bartlett Consulting for this project include:

- Dunstar, J.A, Smiley. T, Matheny. N, Lilly. S. (2017) *Tree Risk Assessment Manual, Second Edition*. International Society of Arboriculture. Champaign, IL.
- Health & Safety Executive (2001) *Reducing Risk, Protecting People: HSE's Decision-Making Process*
- Lonsdale, D. (1999) *The Principles of Tree Hazard Assessment & Management* Department of the Environment. London.
- Mattheck, C., et. al. (2015) *The Body Language of Trees – Encyclopaedia of Visual Tree Assessment* Karlsruhe Institute of Technology Campus North.
- Rinn, F. (2011) *Basic Aspects of Mechanical Stability of Tree Cross Sections*. Arborist News, February.
- Slater, Dr.. D (2016) *Assessment of Tree Forks – Assessment of Junctions for Risk Management* Arboricultural Association, The Malthouse, Gloucestershire.

1.0 SCOPE OF REPORT (continued…)

1.4 Report Limitations & Methodologies

This report is restricted to the tree detailed in the Assignment above.

Our VTA, Level 3 Advanced Assessment and qualified risk assessment of the Robinia located at 15 Akenside Rd, London NW3 5BT is based on a single site visit on 22nd October 2024. All photographs, samples, and readings, if applicable, were taken at the time the assessment was performed.

Following removal of the ivy around the base and on the main stem there were no factors effecting the inspection.

Neither the below ground roots, primary or secondary crown structure were assessed using *Level 3 Advanced Assessment* techniques per the agreement with Ms. Jane Cosgrave.

Targets and *Occupancy Rates* considered in the tree risk assessment were determined based on a conversation and agreement with Ms. Jane Cosgrave as well as observations made during the visit, Targets considered in this tree risk assessment are People (residents, visitors, members of public), Property (building, bus stop, parked and moving vehicles). The *time frame* for the risk assessment is three (3) years.

This information is solely for the use of the tree owner and manager to assist in the decision-making process regarding the management of their tree or trees. Tree risk assessments are simply tools which should be used in conjunction with the owner or tree manager's knowledge, other information and observations related to the specific tree or trees discussed, and sound decision making.

The statements, findings and recommendations made within the report do not take into account any effects of extreme climate and weather incidences, vandalism, changes in the natural and/or built environment around the trees after the date of this report, nor any damage whether physical, chemical or otherwise.

The Level 3 Advanced Assessment was conducted in conjunction with a Visual Tree Assessment (VTA).

Tree risk ratings are derived from a combination of three factors: the likelihood of failure, the likelihood of the failed tree part impacting a target, and the consequences of the target being struck. These factors are then used to categorize tree risk as extreme, high, moderate or low. The factors used to define your risk rating are identified in this report.

Tools used in the assessment included: a nylon hammer to 'sound' the tree and tree parts; a probe to measure the depth of cavities and open wounds, as well as explore soil conditions; and binoculars to observe upper portions of the tree. Tree dimensions were recorded using hand tools such as a laser range finder; diameter tape and measuring tape.

Specifically, I employed the PiCUS® Sonic Tomography and IML-RESI Powerdrill® PD400 to determine levels of wood density; detect internal decay; and measure levels of residual sound-wood associated with the subject tree parts for the Robinia Tree.

1.0 SCOPE OF REPORT (continued…)

1.4 Report Limitations & Methodologies (continued…)

1.4.1 Description and Location of Defect

For the purposes of aiding clarification of the location of an identified defect with the tree crown, a 3D model will be used. Firstly, the tree crown will first be split into four 'blocks' of north, east, south, west. Secondly, the tree crown will then be split into three 'tiers' of upper, middle and lower. Finally, the tree crown will be split into three 'layers' of outer, inner and centre. For example, a feature will be located within the *west/middle/outer* section of the tree.

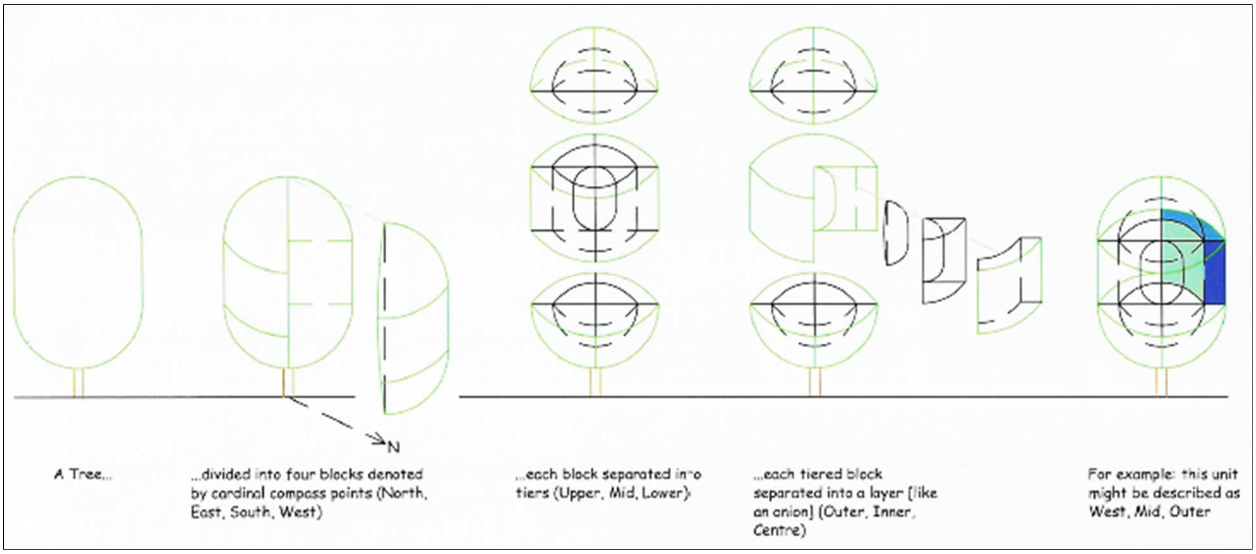


Figure 1: Snipped Image from Arb Association Guidance Note Showing Location of Defect

1.4.2 Types of Aerial Inspection

Presence: An aerial inspection when the aerial operative confirms or denies the presence of a feature in the tree, which may be 'of interest' to the surveyor; or features which the surveyor cannot fully see from ground level to make a judgement about. The information collected will allow the surveyor to make an assessment of the significance of the feature(s) and specify further action.

Measured: An aerial inspection when the aerial operative will collect quantified and photographic evidence of a feature or features, required for interpretation and evaluation by the surveyor to make fully informed recommendations and assessment of risk.

Bespoke or Detailed: An aerial inspection commissioned for a particular feature or features, or for a specific reason such as collection of samples for identification or use of specialist diagnostic equipment.

Species of Interest: Confirming or denying the presence and location of protected species.

Structural Support: An aerial inspection when the aerial operative assesses and records the condition and suitability of invasive and non-invasive structural support systems as well as any other bracing equipment.

1.0 SCOPE OF REPORT (continued…)

1.5 Assessment of Ecological Status of Tree & Potential Constraints

Following the site visit and tree survey and assessment, we believe that there is a LOW potential for wildlife and ecological associations with the tree subject to this report. Ecological associations are considered to be nesting birds.

The Wildlife and Countryside Act 1981, as amended by the Countryside and Rights of Way Act 2000, provides statutory protection to birds, bats, insects and other species that inhabit trees, hedgerows, or other associated vegetation. It is the recommendation of Bartlett Consulting that professional, detailed, advice from an ecologist is sought (if not done-so already) to confirm the consideration of Bartlett Consulting and to check if any such constraints apply to this site and its development proposals.

All trees must be thoroughly assessed for nesting birds prior to any recommended tree works.

2.0 TREE PROTECTION STATUS

The Town & Country Planning Act (Tree Preservation) (England) Regulations 2012 and the Town & Country Planning Act 1990 (as amended) provides legislative protection for trees within England.

I conducted an enquiry on 23rd October 2024 through the London Borough of Camden Council via their interactive mapping website: Camden Maps as well as email correspondence with Rav Curry (planning Assistant).

2.1 Tree Preservation Order (TPO) Status

None

2.2 Conservation Area (CA) Status

Fitzjohns Netherhall Conservation Area.

2.3 Tree Management Implications

Conservation Area (CA) Status affects all trees of a stem diameter greater than 75mm, when measured at 1.5m above ground level. Therefore the Robina will be protected by virtue of its location in the designated CA.

Under the Town and Country Planning Act 1990 (as amended), a Section 211 Notice must be served upon the LPA, providing them with 6 weeks' notice of any intention to implement works to protected trees.

The purpose of this notice is to provide the LPA an opportunity to consider whether a TPO should be made in respect of the trees.

Please note that the removal of dead trees and the pruning of dead wood from living trees are permitted and "excepted" works under the 2012 Regulation listed above. These works can be undertaken only after 5 working days' notice has been given to the local planning authority.

Figure 2: Snipped Image from the London Borough of Camden Council website showing location of 15 Akenside Rd within the Conservation Area

3.0 TREE & SITE DETAILS

Species	Robinia (*Robinia pseudoacacia*)
Stem Diameter at 1.5 metres height	792 millimetres
Age	Mature (85years ±10 years)
Tree Height (metres)	18.0
Crown Spread (metres)	**N** 7.0 **E** 5.2 **S** 6.0 **W** 8.0
Vitality	FAIR dieback in upper crown, major deadwood throughout the crown
Location	Located in raised bed of west boundary of 15 Akenside road
Targets	1. HOUSE: within 1x tree height, CONSTANT OCCUPANCY 2. BUS STOP: within crown spread, OCASIONAL OCCUPANCY 3. CARPARK: 1.5x tree height FREQUENT OCCUPANCY 4. VEHICLE ON THE ROAD: within crown spread, FREQUENT OCCUPANCY 5. PEOPLE: within crown spread, FREQUENT OCCUPANCY
Rooting Environment	1. Rootzone mostly covered by hardstanding (95%) from south east and west 2. Dense understory comprising mostly of shrubs 3. Honey fungus (*Armillaria sp*) located near neighbouring tree (11m south)
Surface Roots / Buttresses	1. Well developed, buttressing formation. 2. Fungi Fruiting body (FFB) (*Ganoderma* sp) attached to western buttress. 3. Hollow tones returned from west to north side when sounded[1]. 4. Burr present on southern buttress.
Main Stem	1. Lateral rib formations creating long seam with FFB (*Ganoderma sp*) present at 800mm. 2. Functional Columns formed to the west and south of FFB. 3. Dysfunctional wood present in seam, probed to 150mm depth. 4. Strong functional units forming around the circumference of the tree. 5. Multiple FFB (*Ganoderma sp.)* present on East side at 5.0m mature and partially desiccated.
Crown	1. Compromised union at 6.0m with detritus build up 2. Bifurcation at 6.5m 3. Codominant leaders sounded[1] during aerial inspection from 6.5m to 8.0m with poor resonance returned from southwestern co-dominant leader 4. Two lateral ribs forming to the south 5. Dieback and major deadwood in the upper and west crown 6. Crown bias to the southwest 7. Sign of selective pruning to the east with approx. 2.5m of regrowth
Assessment	PiCUS® Sonic Tomography ® at 80 Centimetres Height test plane on Main Stem IML-RESI Powerdrill® PD400 at 80 Centimetres Height test plane on Main Stem IML-RESI Powerdrill® PD400 at 5.5 metre Height test plane on Main Stem IML-RESI Powerdrill® PD400 at 8.0 metre Height test plane on south-western co-dominant leader

[1] Trees are sounded as part of the visual assessment, using a nylon hammer, to listen for variations in resonance. Where there is wood degradation and cavities, the sound will resonate with a deeper tone than when the wood is solid. Areas of dead bark will return a loud and sharp 'crack'. Sounding is ordinarily carried out around the full circumference of the tree stem from ground level to at least 2.0 metres height, where access permits.

4.0 FUNGAL, DISEASE OR INSECT PATHOGEN

4.1 Artist's Fungus (*Ganoderma applanatum*)

The presence of desiccated and mature fungal fruiting bodies suspected to be either Artist's Fungus (*Ganoderma applanatum*) were found attached to the west buttress and East side of stem (5.5 metres) of Robinia

A perennial bracket forming successive layers over many years, this fungus can be found close to ground level as well as several metres above on the main stem and occasionally on primary limbs.

The brackets are generally dark matt brown on the top, with a white pore layer underneath, reaching 500 millimetres across and 150 millimetres thick.

The decay strategy is that of a wood softening white rot with preferential lignin decomposition. Decay is localised in early stages, however the hyphae can advance through the ray cells and into the sapwood layers. In advanced stages of decay the fungi can also cause a 'simultaneous rot' where both lignin and cellulose are broken down together.

Partially decayed wood retains tensile strength and trees can produce adaptive growth of surrounding wood. When extensively decayed, wood can fail by either a brittle or ductile fracture.

Green. T & Watson. G. (2011)
Fungi on Trees - An Arborists Field Guide.
Arboricultural Association, Stonehouse

Mattheck. C, Bethge. K, Weber.K (2015)
The Encyclopaedia of Visual Tree Assessment
Karlsruhe Institute of Technology – Campus North

Figure 3: Image of the fungal fruiting body (Ganoderma applanatum) attached to the Base Of Robinia

4.0 FUNGAL, DISEASE OR INSECT PATHOGEN (Continued…)

4.2 Honey Fungus (*Armillaria mellea*)

The presence of fungal fruiting bodies suspected to be Honey Fungus (*Armillaria mellea*) were found attached to the main stem, buttresses and root system of nearby Horse Chestnut tree

The fungal fruiting bodies form annually and appear as honey coloured toadstools, generally located in clusters around the buttresses of trees or on any surface roots. The underside has cream coloured gills, whilst the stem bears a unique collar-like ring below the cap. The fruiting bodies can develop at any time; however they commonly form during autumn.

Unique to the Honey Fungus species, are the presence of clearly identifiable Rhizomorphs which appear to resemble black 'bootlaces'. They can appear within the soil, beneath the bark and sometimes high above the ground.

Honey Fungus is not necessarily a primary pathogen in affected trees and can often co-exist; however colonisation often occurs when the tree is weakened and under physiological stress by either biotic or abiotic causes.

Honey Fungus can colonise healthy wood tissue, with the mode of decay a white rot. This decay strategy degrades both the lignin and cellulose of wood cells. Initial decay is dry and firm due to selective delignification, changing to a wet white rot as the pathogen starts to break-down the cellulose.

Trees retain tensile strength until late stages of decay when trees can either uproot or experience ductile stem fracture.

Green. T & Watson. G. (2011)
Fungi on Trees - An Arborists Field Guide.
Arboricultural Association, Stonehouse

Figure 4: Image of Honey Fungus Fruiting Body on Neighbouring Chestnut

5.0 GROUND LEVEL INSPECTION

5.1 TESTING USING SONIC TOMOGRAPHY (PiCUS®)

PiCUS® testing (Sonic Tomography) enables almost non-injurious testing of decay in trees. Sensor units are attached to adjustable webbing and small nails are driven into the bark to contact the sapwood tissue beneath. Each of the nails is then struck with a test hammer, sending soundwaves through the tree stem, with the soundwave being picked up by the sensor array around the tree stem.

When travelling through solid wood, the soundwaves are uninterrupted and travel quickly; in damaged wood the soundwave will be slowed or forced to travel around features such as an internal cavity. The relative speeds of reception are uploaded onto a data file and processed into a visual image of the interior of the tree stem, using the software provided with the PiCUS® unit. This image displays the different conductivity of the wood in the tree stem, with areas of high velocity and solid wood indicated by brown colours; areas of low velocity and distorted sound waves in violet or blue colours; and areas of unclassified sound waves in green.

This information and representative image are interpreted by Bartlett Consulting based on the visual tree assessment; knowledge of the interaction between the tree species and any potential fungal pathogen(s); any wood decay, degradation, or dysfunction; and the references cited in Section 1.3 above to create an understanding of the internal structure of the tree stem.

Following the VTA, one test was conducted on the main stem of the Robinia

When conducting the assessment, after establishing the 80 centimetre height of the test plane, Sensor 1 was positioned on the northern side of the main stem, with the subsequent 11 sensors then spaced at regular intervals at the same height to create a level test plane.

Figure 5: Image of PiCUS Test Plane conducted on Robinia

5.0 GROUND LEVEL INSPECTION (CONTINUED…)

5.1 TESTING USING SONIC TOMOGRAPHY (PiCUS®) (continued…)

5.1.1 Results of Impulse Tomography (PiCUS ®) Test

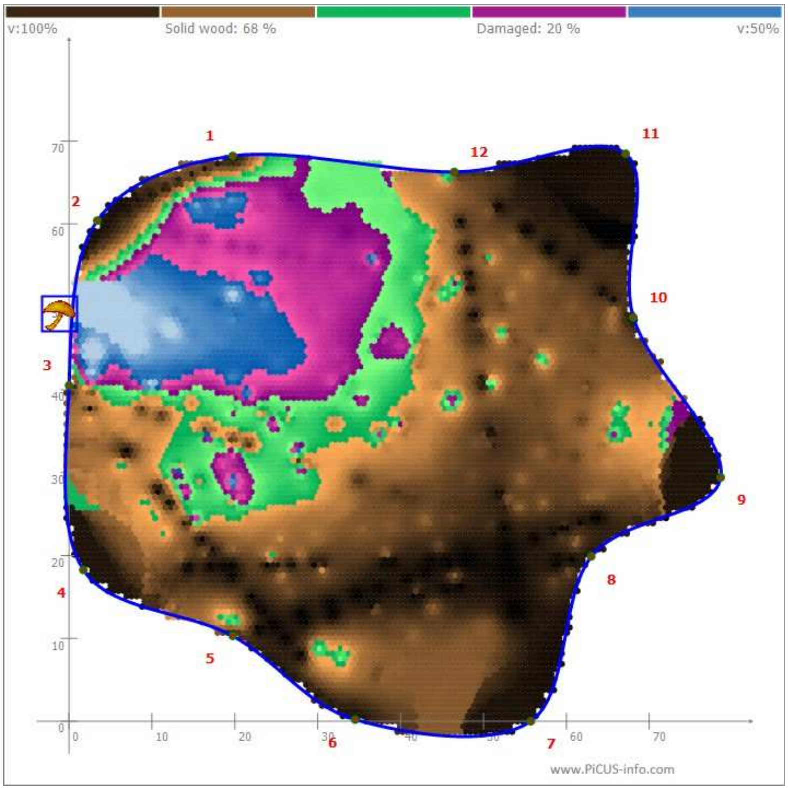


Figure 6: Image of PiCUS® Sonic Tomograph at 80 Centimetres Ht. on Robinia

The Tomogram test depicts that at 80 centimetres above ground level 20% of the wood as indicated by the blue/pink colours returned the slowest rate of soundwave transmittance, whilst 68% as indicated by the brown colour returned the fastest transmittance. The remaining 22% as indicated by the green coloured areas of the image is considered to have moderate rate of soundwave transmittance.

The blue / pink areas with the slowest soundwaves are interpreted as regions where wood is suspected to bedecayed.

5.0 GROUND LEVEL INSPECTION (CONTINUED…)

5.2 TESTING USING AN IML-RESI POWERDRILL®

The IML-RESI is used to establish the internal structural integrity of an individual tree or tree parts. The device drills a micro needle with a bit diameter of 3.0 millimetres at a constant speed, and measures wood density by measuring the drilling resistance and feed speed, to a nominal depth of 40 centimetres within the stem or branch.

The density of the wood being tested creates resistance to the drill needle, with the results provided on a graphic print-out with the "feed curve" and timber density shown in blue, and the "drill curve" and shaft friction shown in green along the y-axis of the graph line. The depth of the drill is shown along the x-axis of the graph line. Both are shown at a scale of 1:1.

The graph translates as information on the internal structure of the wood tested, indicating the levels of decay, unseen voids or cracks, and types of wood decay, as well as providing significant information about the material properties and thickness of the residual wall of sound-wood around the stem or branch.

5.2.1 IML-RESI Powerdrill® Testing Locations

A total of 2 tests were conducted of the Robinia at the 80cm test plane. The test positions were chosen based on the sonic tomography results in order to back up their findings. Test 1 was taken between sensors 1-12 and Test 2 was taken at sensor 5 as shown in figure 7 below.

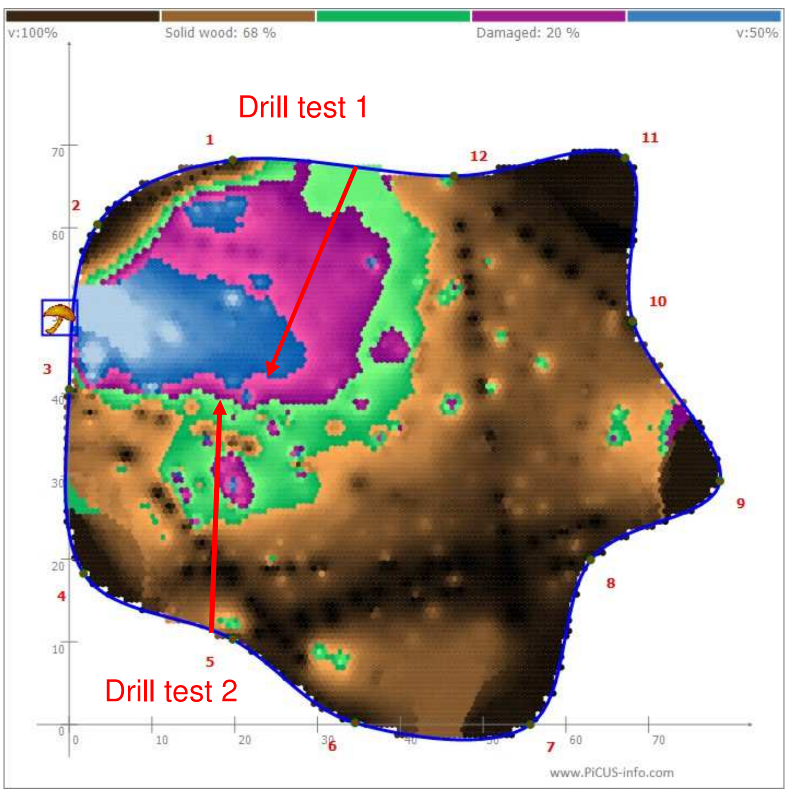


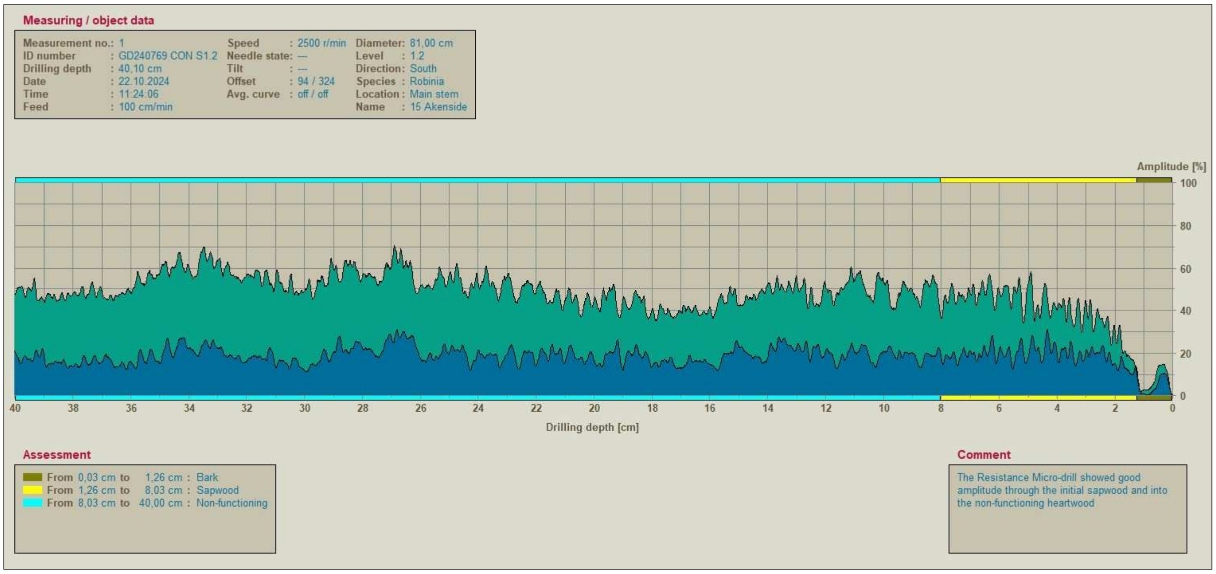
Figure 7: Image of IML-RESI Powerdrill® Test Locations on Robinia

5.0 GROUND LEVEL INSPECTION (CONTINUED…)

5.2 TESTING USING AN IML-RESI POWERDRILL® (continued…)

5.2.2 IML-RESI Powerdrill® Control Test

· Control Test: 120.00 cm Height, Tree Stem, South



NOTE: The above control test shows all the test data and interpretation, including Object Data, Assessment and Comments. The remaining test results will be cropped to show only the micro-drill assessment to reduce the number of pages within the report. Section 5.2.3 below provides a detailed interpretation of the test results.

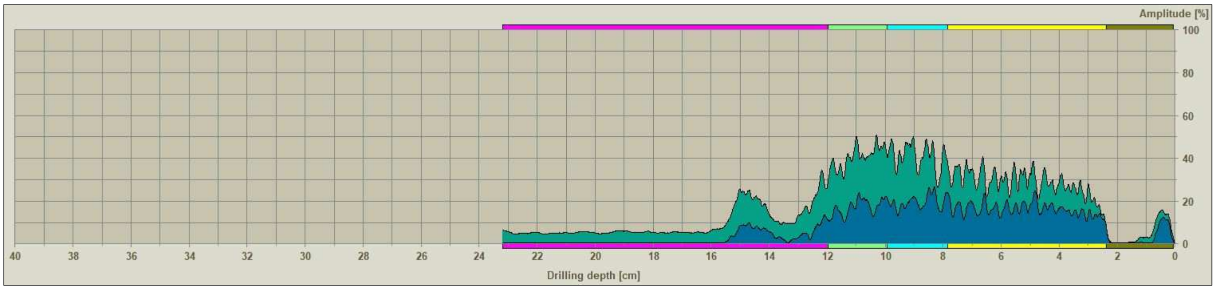
Colour		Description
Brown		Bark
Yellow		Sapwood
Blue		Non-functioning Heartwood / Ripewood
Green		Early-stage Decay
Purple		Advanced Decay
Black		Cavity
Orange		Reaction Zone / Suspect Wood

5.0 GROUND LEVEL INSPECTION (CONTINUED…)

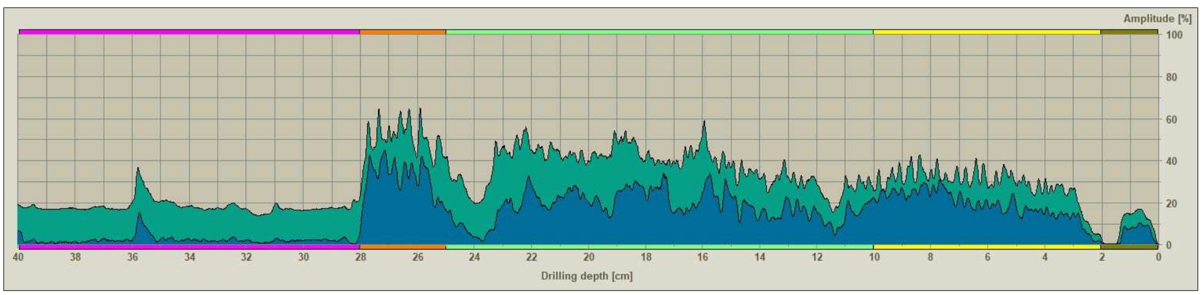
5.2 TESTING USING AN IML-RESI POWERDRILL® (continued…)

5.2.2 IML-RESI Powerdrill® Test Results

Test 01: 80.00 cm height, tree stem, between sensors 1 & 12



· Test 02: 80.00 cm height, tree stem, at sensor 5



5.2.3 IML-RESI Powerdrill® Test Result Interpretation

Whilst comparing the test results, the IML-RESI Powerdrill® (PD400) shows that the general resistance through the zones of vascular tissue and sapwood is initially good and consistent, when compared to the control test, as shown with the blue graph (feed curve). The amplitude is found to be ranging between 20% and 40%, where the differences in wood resistance are better distinguished.

Test 1 reveals that beyond the initial sapwood there is a minimal amount of intact heartwood, with no distinct reaction zone of increased resistance as the drill encountered the area of degraded wood. A slight peak in resistance at 15 cm may indicate a previous reaction zone that has been breached by fungal activity. The absence of a strong defensive response suggests that further decay is likely, potentially leading to the formation of an open cavity from the west.

Test 2 presents a similar pattern to Test 1 but the decay appears to be less advanced. The peaks in amplitude between 25 and 27cm indicates a possible reaction zone; however, the subsequent decrease and irregularity in resistance within the non-functional wood, compared to Control Test, suggest that the reaction zone may be compromised, and decay is progressing.

5.2.4 IML-RESI Powerdrill® Test Results Conclusion

The tests confirm to me that the PiCUS tomography accurately reflects the tree's internal structure. Areas of reduced wood resistance align with the predicted locations, validating the imaging technique's reliability. The decay is off-centre, primarily concentrated in the northwest quadrant correlating with the location of the *Ganoderma* fruiting body.

6.0 AERIAL INSPECTION

6.1 Feature Location and Overview

A total of 3 Features were recorded during aerial inspection:

Feature No. 1 – *Ganoderma* brackets located on the east of the stem between 5.0m and 5.5m

Feature No. 2 – Union between the main stem and lower western lateral scaffold limb at 6.0m

Feature No. 3 –Suspected decay at 7.5m of southwestern co-dominant leader due to poor resonance

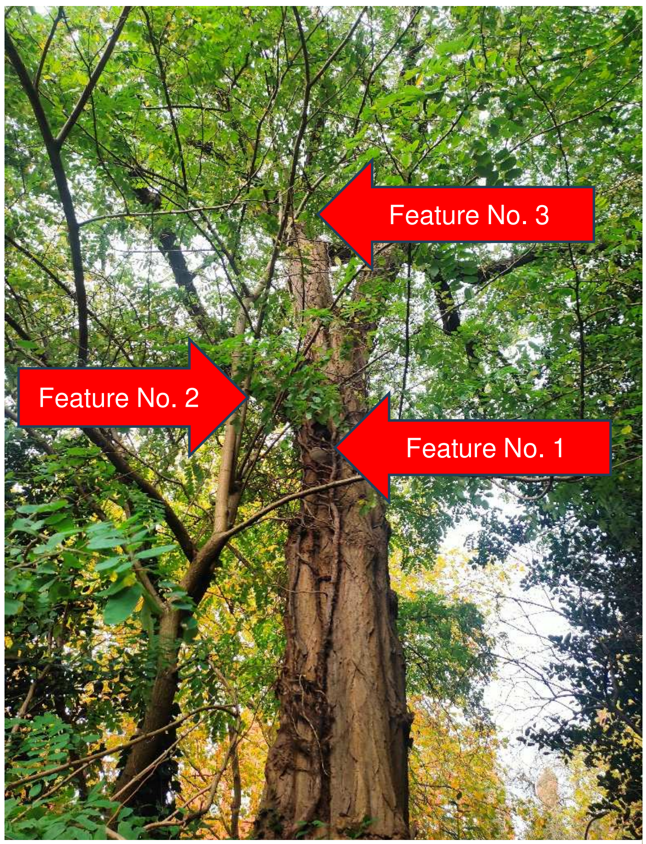


Figure 8 : Picture of The Robinia with marked location of features

6.0 AERIAL INSPECTION (Continued…)

6.2 Feature No.1

Feature No.1		
Location	Main Stem at 5.5m	**Description of Feature & Additional Information on Location**
Cardinal Compass Point	East	Multiple *Ganoderma* fruiting bodies attached to the main stem resulting in the formation of functional units on both sides of colonized area
Crown Tier (Upper, Middle, Lower)	Lower	
Crown Layer (Outer, Inner, Centre)	Center	

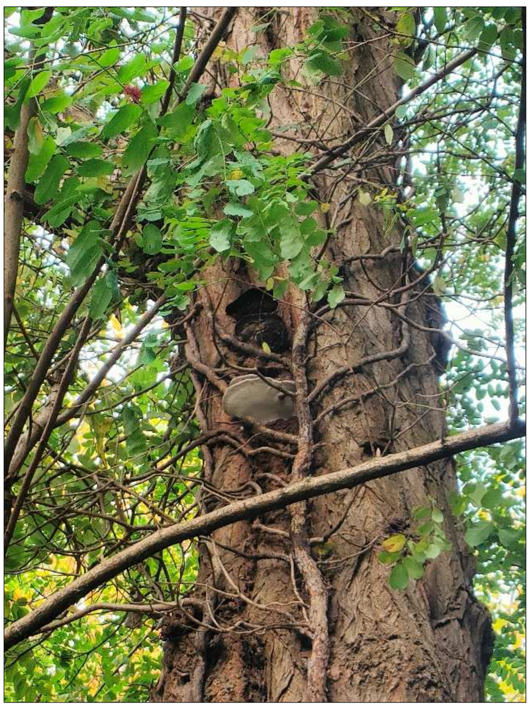


Figure 9: Image of Ganoderma brackets attached to the stem

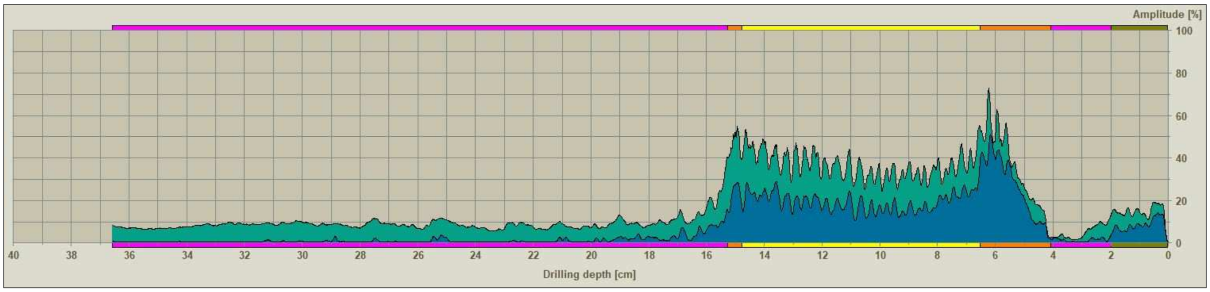
Figure 10: Photo taken during the aerial inspection, showing image of colonised are of stem by Ganoderma fungi

6.0 AERIAL INSPECTION (Continued…)

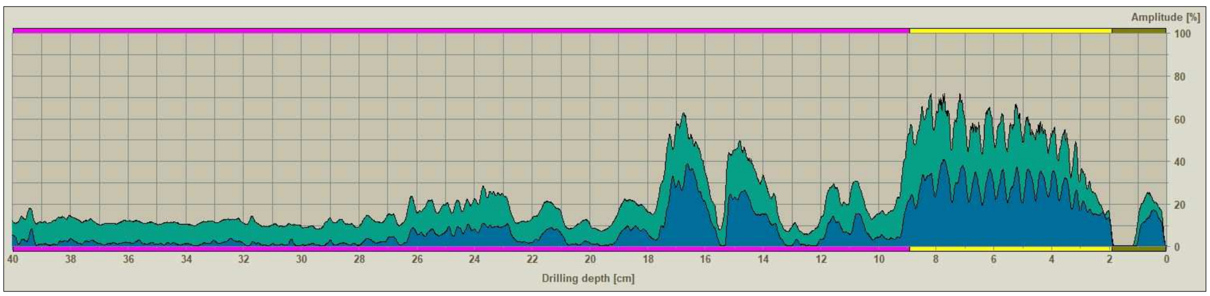
6.2 Feature No. 1 (continued…)

6.2.1 IML-RESI Powerdrill® Test Results

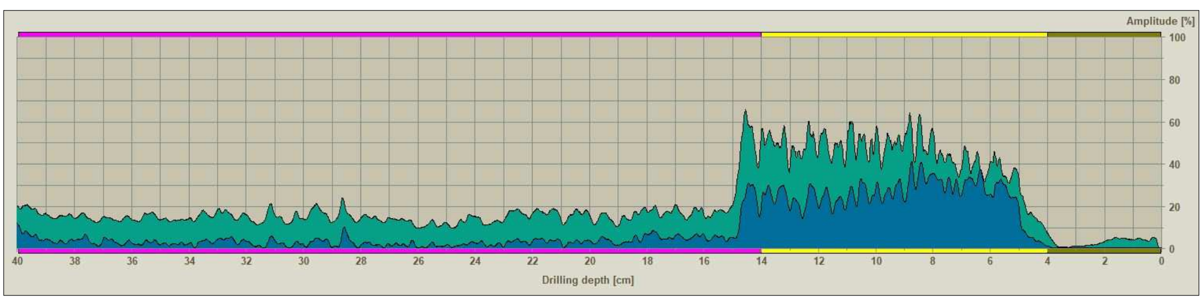
Test 03: 5.5 metre height, tree stem, north



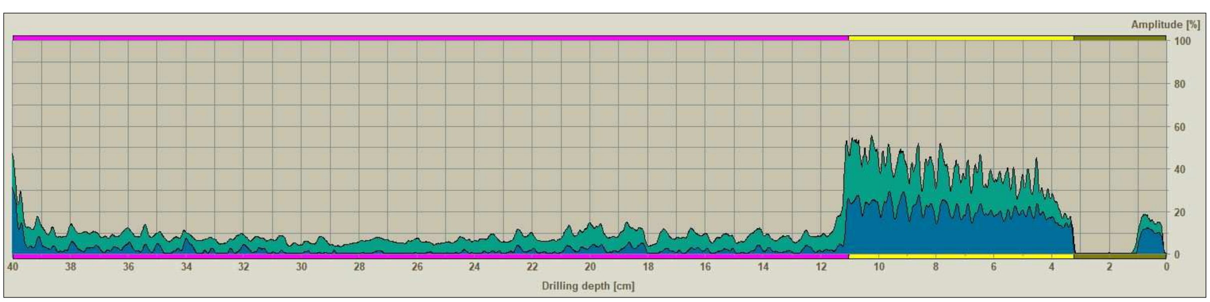
Test 04: 5.5 metre height, tree stem, east



Test 05: 5.5 metre Height, Tree stem, south



Test 06: 5.5 metre height, tree stem, west



6.0 AERIAL INSPECTION (Continued…)

6.2 Feature No. 1 Multiple *Ganoderma* Brackets (continued…)

6.2.2 Interpretation of IML-RESI Powerdrill®

All four of the resistance micro drill test results indicates that at the 5.5m test plane there is a significant amount of internal decay present. The non-functioning heartwood has been significantly degraded with only a portion of the outer sapwood remaining intact.

The clear definition of the rise and fall of each peak within the test profiles indicates prominent growth of the annual rings. This pattern suggests that the tree is prioritising growth of the main stem as it tries to compensate for the loss of structural wood caused by the decay.

Tests 3 showed an initial peak in resistance between 4cm and 6cm however no distinct reaction zone present as the drill encountered advanced decay beyond a depth of 14cm.

Test 4 also showed no distinct reaction zone prior to the drill encountering advanced decay beyond a depth of 9cm. Secondary peaks in amplitude between 14 and 18cm indicates a possible previous reaction zone; however, this has since been compromised, allowing for progression of the decay.

Test 5 & Test 6 both showed good resistance through the initial sapwood however encountered advanced decay beyond 14 cm and 11cm respectively.

Below is an artistic illustration of the findings indicating the extent of decay identified by the drill results. As shown in the image the residual wood at the 5.5 metre test plane measures an approximate average thickness of 77.5 millimetres where the main stem has a radius of 372.5 millimetres. This accounts to an approximate 24% of the solid wood remaining.

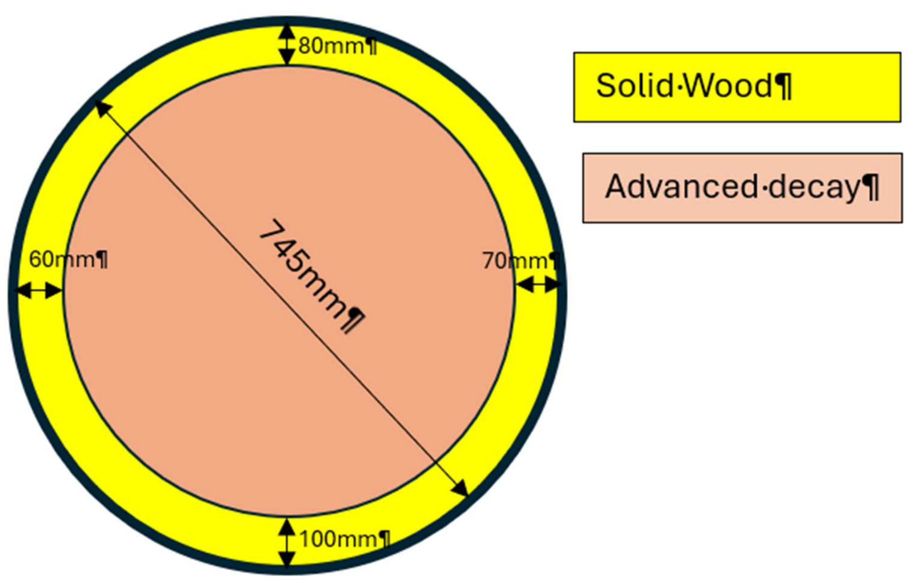


Figure 11 Representation of IML-RESI Powerdrill® test results in 2 dimension graphic

6.0 AERIAL INSPECTION (Continued…)

6.3 Feature No. 2

Feature No.2		
Location	Main stem at 6.0m	**Description of Feature & Additional Information on Location**
Cardinal Compass Point	South	Poorly attached Scaffold limb with buildup detritus.
Crown Tier (Upper, Middle, Lower)	Lower	
Crown Layer (Outer, Inner, Centre)	Center	

Figure 11: Image of probing location of the junction

Figure 12: Image of buildup detritus in the junction

The assessment of Feature 02 indicated that attachment at this junction has been significantly compromised by the presence of damaged and decaying wood. The buildup of detritus around the union limited the ability to fully evaluate the structural integrity of the junction, however probing revealed multiple void spaces between the limb and stem. These voids may indicate separation or degradation within the junction.

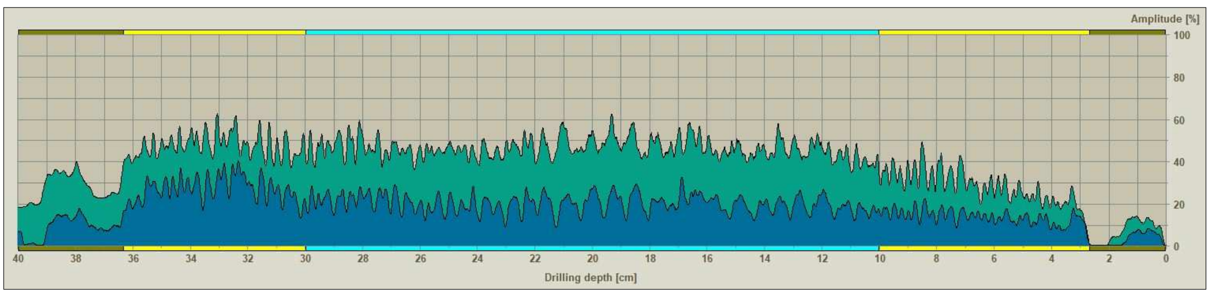
6.0 AERIAL INSPECTION (Continued…)

6.4 Feature No. 3

Feature No.3		
Location	Crown	**Description of Feature & Additional Information on Location**
Cardinal Compass Point	Southwest	Poor resonance was returned when sounding around the circumference of the south-western codominant leader
Crown Tier (Upper, Middle, Lower)	Middle	
Crown Layer (Outer, Inner, Centre)	Inner	

6.5.1 IML-RESI Powerdrill® test of Feature No.3

Test 07: 800.00 cm height, co-dominant stem, north to south



6.5.2 Interpretation of IML-RESI Powerdrill®

Test 07 Indicated good timber strength throughout the test profile.

7.0 PHOTOGRAPHIC OVERVIEW

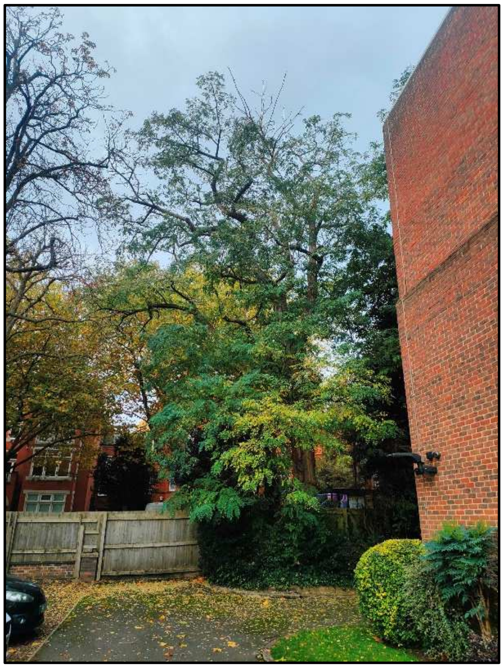


Figure 13: Image showing Robinia in landscape viewed from Carpark

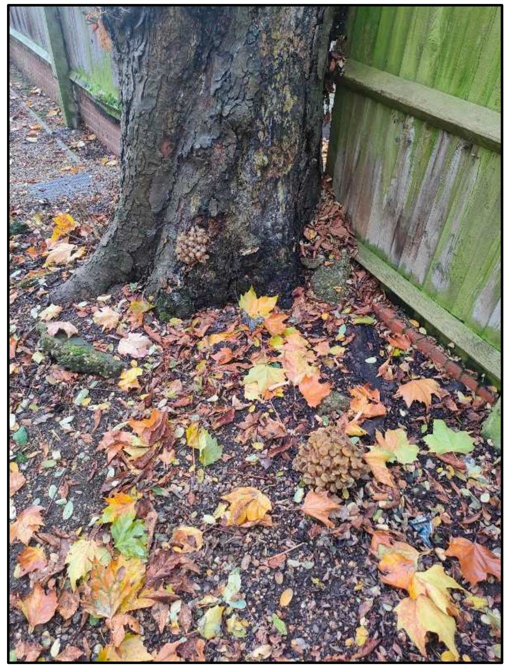


Figure 14: Image showing Honey Fungus on nearby Horse Chestnut

Figure 15: Image showing Ganoderma bracket at the base of the tree

Figure 13: Image showing rib creation next to dysfunction section of the stem

8.0 CONCLUSIONS

My conclusion of the ground based and advanced aerial assessments utilizing impulse sonic tomography and resistance drilling, has highlighted a number of structural concerns with regards to the Robinia tree.

Most notably is the presence of the fungal pathogen *Ganoderma*, which has resulted in advanced decay throughout the stem.

Testing of the lower stem revealed that the presence of the pathogen *Ganoderma* had resulted in a degree of internal decay but had not significantly compromised the structural integrity of the stem at this point. However further testing during the aerial inspection identified that the at a height of 5.5 meters the main stem had been significantly compromised by internal decay with residual sound wood reduced to approximately 24%.

A specification for tree works to reduce the height and lateral spread of the crown would in the short term reduce potential risk of tree failure. However given the tree is already considered within a state of decline the extent to which pruning would be required is likely to exacerbate its already poor physiological condition.

Furthermore given the location of the tree adjacent to the busy public footpath and highway as well as the persistent nature of the fungal pathogen present, the risk of failure is only ever going to increase with the tree unlikely to be retained in any reasonable state beyond a period of 3 years.

There is a young self-set Robinia tree establishing close to the base, which would serve as an ideal successor tree, filling the gap left by the older tree.

8.1 Robinia Tree Risk Assessment

Bartlett Consulting uses the International Society of Arboriculture's (ISA) Tree Risk Assessment methodology, referred to as TRAQ. This is a 'qualitative' system which uses a matrix-based combination of ratings, to reach a conclusion of associated risk. More detail can be found in Appendix 1 and Appendix 2 below.

Target	Tree Part	Likelihood of Failure	Likelihood of Impact	Failure & Impact	Consequences	Risk Rating
People	Lower Stem	Possible	Medium	Unlikely	Severe	Low
	Upper Stem (Feature 1)	Probable	Medium	Somewhat Likely	Severe	**Moderate**
	Lower Scaffold Limb (Feature 2)	Probable	Medium	Somewhat Likely	Severe	**Moderate**
	Co-dominant leader (Feature 3)	Improbable	Medium	Unlikely	Severe	Low
Structure	Lower Stem	Possible	High	Somewhat Likely	Significant	**Moderate**
	Upper Stem (Feature 1)	Probable	High	Somewhat Likely	Minor	**Moderate**
	Lower Scaffold Limb (Feature 2)	Probable	Low	Unlikely	Minor	Low
	Co-dominant leader (Feature 3)	Improbable	High	Unlikely	Minor	Low
Vehicles	Lower Stem	Possible	Medium	Unlikely	Significant	Low
	Upper Stem (Feature 1)	Probable	Medium	Somewhat Likely	Significant	**Moderate**
	Lower Scaffold Limb (Feature 2)	Probable	Medium	Somewhat Likely	Significant	**Moderate**
	Co-dominant leader (Feature 3)	Improbable	Medium	Unlikely	Significant	Low

Using the methods outlined in this report, and the results of the visual and advanced tree assessments of the of the Robinia it is my professional judgment that both feature 1 and feature 2 have a *risk rating* of ***MODERATE***.

9.0 RECOMENDATIONS

9.1 Robinia Tree Recommendations

I recommend the following pro-active tree management operations are carried out to reduce the current risk posed to persons and property.

Actions

- **Remove tree to ground level (within a period no greater than 6 months)**

We have provided a glossary of terms at the end of this report to help with understanding terminology used within this report, as well as with determining your tree care needs and final risk level.

10.0 RISK ASSESSMENT & DUTY OF CARE

10.1 Limitations of Tree Risk Assessments

It is important for the tree owner or tree manager to know, and understand, that all trees pose some degree of risk from failure or other conditions, and as trees are living and dynamic organisms, it is not possible to maintain them free of risk. Some level of risk must be accepted to experience the full range of benefits that trees provide. As such, we reference the National Tree Safety Group (NTSG) publication *Common Sense Risk Management of Trees* (Forestry Commission 2011). This document provides guidance on trees and public safety in the UK for owners', managers, and advisors.

The information and recommendations within this report have been derived from the level of tree risk assessment identified in this report, using the information and practices outlined in the *International Society of Arboriculture's Best Management Practices for Tree Risk Assessment*, as well as the information available at the time of the inspection.

However, the *overall tree risk rating*, the mitigation recommendations, or any other conclusions do not preclude the possibility of failure from undetected conditions, weather events, or other acts and/or influences of human or nature on the tree(s). Trees can unpredictably fail even if no defects or other conditions are present. Tree failure can cause adjacent trees to fail resulting in a "domino effect" that impacts *targets* outside the foreseeable *target zone* of this tree. It is the responsibility of the tree owner or manager to schedule repeat or advanced assessments, determine actions, and implement follow up recommendations, monitoring and/or mitigation.

Bartlett Consulting and Bartlett Tree Experts can make no warranty or guarantee whatsoever regarding the safety of any tree, trees, or parts of trees, regardless of the level of tree risk assessment provided, the risk rating, or the residual risk rating after mitigation. Bartlett Consulting and Bartlett Tree Experts cannot accept any liability in connection with these factors, nor where recommended tree management is not carried out in accordance with modern tree health care techniques, within the timelines proposed and specification provided.

The information in this report should not be considered as making safety; legal; architectural; engineering; landscape architectural; nor land surveying advice, nor any other professional advice.

This information is solely for the use of the tree owner or tree manager to assist in the decision-making process regarding their duty of care, tolerability of risk, and management of their tree or trees. Tree risk assessments are simply tools which should be used in conjunction with the owner or tree manager's knowledge, other information and observations related to the specific tree or trees discussed, and sound decision making.

All recommendations made by Bartlett Tree Experts will be based on the defects that are present and detectable at the time of the inspection or assessment, and the commonly accepted industry practices for reducing or minimising the risks associated with the trees, and are meant to assist the owner/client with the decision-making process regarding the trees. Tree conditions, though, can change, and some features/hazards may not be present or detectable through the inspection process. As such, Bartlett Tree Experts can make no guarantees or warranties of any kind that all features/hazards will be detected; nor can Bartlett Tree Experts accept any liability in any manner whatsoever for any damage caused by any tree on this property, whether the tree was assessed or not, or whether any recommendations to mitigate risk were followed or not.

Therefore, to the fullest extent permitted by law, the owner/client agrees to indemnify and hold harmless Bartlett Tree Experts from any third party law suits or claims based on the past, present, or future conditions of the owner/client's trees, or decisions made by the owner/client regarding the trees, or injuries or damages caused by any future tree or tree part failures, which are under the ownership and control of the owner/client, that Bartlett Tree Experts may suffer as the result of any negligent action, inaction, or decisions made by the owner/client regarding the trees. Such obligations shall not be construed to negate, abridge, or otherwise reduce any other right or obligation of indemnity which would otherwise exist as to any party or person described in this paragraph.

10.0 RISK ASSESSMENT & DUTY OF CARE (continued…)

10.2 Tree Owner's Duty of Care

A tree owner has a duty of care to ensure that all visitors, guests, employees, etc. to their land shall be safe from harm, and that there is no exposure to risks to that visitor's health and safety. This duty of care means that reasonable care must be taken to avoid acts or omissions that could be reasonably foreseen, leading to harm.

This duty must also be reasonable, proportionate, and reasonably practicable when managing tree risk. Therefore, the tree owner can take a balanced approach to manage the risk, retain the many benefits trees provide, and not waste resources on unnecessary tree management.

10.3 Tolerability of Risk

Some level of risk must be accepted to experience the full range of benefits that trees provide, and an evaluation of what is reasonable to balance the benefit of trees and the risk they pose should be undertaken by the tree owner.

Risks which are considered tolerable are risks which the tree owner, visitors, guests, employees, and the wider public are prepared to accept to secure the associated tree benefits. However, tolerable risks come with expectations, such as the trees being properly assessed; control measures being in place; residual risk as low as reasonably practical; and the risk rating is periodically reviewed.

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We trust that the contents and recommendations contained within this report were informative, easy to understand and helpful to you, with regards to managing your tree(s).

Should you have any further questions or concerns, please do not hesitate to contact us again.

REPORT CLASSIFICATION: Tree Structural Integrity Report

REPORT STATUS: Final

REPORT COMPLETED BY: Lukasz Schellenberger *DipArb (Lv4) PTI*
Assistant Arboricultural Consultant

SIGNATURE: **DATE: 25/10/2024**

REPORT REVIEWED BY: Mr G Davies *FdSc Arb MArborA*
Senior Arboricultural Consultant

SIGNATURE: **DATE: 29/10/2020**

APPENDIX 1 – Tree Risk Assessment Glossary

Bartlett Consulting uses the International Society of Arboriculture's (ISA) Tree Risk Assessment methodology, referred to as TRAQ. This is a 'qualitative' system which uses a matrix-based combination of ratings, to reach a conclusion of associated risk. The standard Bartlett Consulting time-line within the TRAQ system is three (03) years, unless otherwise stated within the report.

Risk is the combination of the 'likelihood' of an event: in this case the failure of a tree or part of a tree, and the severity of the potential consequences. A hazard is the likely source of harm. The two tables below define both the likelihood and risk levels as per the TRAQ system.

Tree risk assessment has a unique set of terms with specific meanings. Definitions of all specific terms may be found in the International Society of Arboriculture's *Best Management Practice for Tree Risk Assessment*. Definitions of some of these terms used in this report are as follows:

Classification	**Description of Likelihood of Failure** (As per Dunster, Smiley, Matheny, Lilly 2017)
Improbable	The tree or tree part is not likely to fail during normal weather conditions, and may not failure in extreme weather conditions, within the specified time frame.
Possible	Failure may be expected in extreme weather conditions, but it is unlikely during normal weather conditions, within the specified time frame.
Probable	Failure may be expected under normal weather conditions, within the specified time frame.
Imminent	Failure has started or is most likely to occur in the near future, even if there is no significant wind, weather, or increased load.

Targets are people, property, or activities that could be injured, damaged or disrupted by a tree failure.

Likelihood of Impact may be categorized as high meaning that a failed tree or tree part will most likely impact a target; medium meaning the failed tree or tree part is as likely to impact the target as not; low meaning that the failed tree or tree part is not likely to impact a target; and very low meaning that the likelihood of a failed tree or tree part impacting the specified target is remote.

Consequences of a known target being struck may be categorized as severe meaning that impact could involve serious personal injury or death, damage to high-value property, or disruption to important activities; significant meaning that the impact may involve property damage of moderate to high value, considerable disruption, or personal injury; minor meaning that impact could cause low to moderate property damage, small disruptions to traffic or a communication utility, or very minor injury; and negligible meaning that impact may involve low-value property damage or disruption that can be replaced or repaired, and do not involve personal injury.

Risk Level	**Description of Risk** (As per Dunster, Smiley, Matheny, Lilly 2017)
Extreme Risk	Failure is *imminent*, impact & failure is *very likely*, and the consequences of the failure are *severe*. Mitigation will be a high priority or targets must be temporarily controlled.
High Risk	Impact & Failure is *likely* to *very likely* with *significant* consequences; or consequences are *severe* and the Impact & Failure is *likely*. Mitigation measures should be taken.
Moderate Risk	Impact & Failure is *likely* to *very likely* with *minor* consequences; or consequences are *significant* to *severe* with a *somewhat likely* Impact & Failure. Mitigation will be determined by tolerance of risk.
Low Risk	Consequences are either negligible or minor, with corresponding Impact & Failure ratings of either unlikely or somewhat likely respectively. Mitigation may be desirable but not strictly necessary.

Overall Tree Risk is the highest individual risk identified for the tree.

Residual Risk is the level of risk the tree should pose after the recommended mitigation

APPENDIX 2 – Tree Survey & Assessment Glossary

The scientific study of tree hazard evaluation and assessment is not an exact science, and there is still much to learn with constantly developing technology, research, and calculations. Most limitations of tree hazard evaluation arise from uncertainties with trees and the loads to which the trees are subjected.

The three levels of tree evaluation and assessment employed by Bartlett Consulting are those defined in the International Society of Arboriculture's (ISA) *Best Management Practices for Tree Risk Assessment* and *ANSI A300 Tree Risk Assessment Standard*. All three levels are described below, along with the basic limitations of each.

I. Level 1 Limited Visual Assessment

A *Level 1 Limited Visual Assessment* (also referred to as a Hazard Survey or Negative Tree Survey) is a visual assessment from a specific perspective of an individual tree or a population of trees near specified targets. These assessments are conducted to identify obvious defects or specified tree conditions (such as dead trees) as agreed with the client and tree owner / manager.

A *Level 1 Limited Visual Assessment* is typically performed from a pre-defined and specified perspective (i.e., from the pavement, street, car parking area(s), woodland edge, etc.), and typically of one side of the tree from that specified perspective. The specified tree or trees are visually assessed to identify tree features, defects, or specific conditions constituting a hazard which result in a likelihood of failure of probable or imminent and would impact the specified target(s).

Level 1 Limited Visual Assessments are typically performed to quickly assess large populations of trees to identify trees with the highest likelihood of failure ratings in the population, or trees that are recommended for higher level of assessment.

A *Level 1 Limited Visual Assessment* typically includes:

1. Identifying the location and/or selection criteria of trees to be assessed.
2. Determining and documenting the most efficient route to be taken.
3. Determining and documenting the method of visual assessment (e.g. walk-by, drive-by).
4. Recording the location of, and assessing the condition of, tree(s) of concern from the defined perspective meeting the predefined criteria (e.g. dead trees, broken branches).
5. Evaluating the risk (a risk rating is optional).
6. Identifying trees needing a higher level of assessment (*Level 2 Basic or Level 3 Advanced*) and/or priority corrective action.
7. Submitting risk mitigation recommendations and/or report.

Limitations of *Level 1 Limited Visual Assessments*

As the least thorough means of assessment, tree features and/or conditions may not be visible as the inspection is from a particular viewpoint; not all tree features and observations may be visible or apparent at different times of the year; climbers, undergrowth, basal growth, etc. will not be removed inhibiting the inspection; and the inspection may not be adequate enough to make a risk mitigation recommendation. Residual risk designations for trees are not included.

APPENDIX 2 – Tree Survey & Assessment Glossary (continued…)

II. Level 2 Basic Visual Assessment

A *Level 2 Basic Visual Assessment* is a more detailed visual inspection of a tree and its surrounding site, and a synthesis of the information collected. It requires complete inspection around a tree including the site and ground conditions / growing environment; visible buttress roots; main stem(s); and branches (as defined in the International Society of Arboriculture's (ISA) *Best Management Practices for Tree Risk Assessment* and *ANSI A300 Tree Risk Assessment Standard*).

A *Level 2 Basic Visual Assessment* allows for all aspects of the tree(s) to be surveyed and removal of climbers, undergrowth and basal growth. The crown, branches, stem(s), and buttress roots of the specified tree(s) are all assessed to look for notable features including any defect, decay, dysfunction or other structural weakness, as well as assessing the overall health and vitality of the tree(s). A *Level 2 Basic Visual Assessment* will include the use of hand-tools such as a sounding hammer; depth probe; binoculars; and a measuring tape / laser range finder to record tree dimensions; and possibly a trowel to uncover buttresses. Recommendations for trees that need a higher level of assessment are typically included.

A *Level 2 Basic Visual Assessment* typically includes:

1. Locating and identifying the tree or trees to be assessed.
2. Determining the *targets* and *target zone* for the tree or branches of concern.
3. Reviewing the site history and conditions, and species failure profile.
4. Assessing the potential load on the tree and its parts.
5. Visually assessing general tree health based on observable features at the time.
6. Completing the tree inspection and assessment using tools listed above.
7. Recording all details and observations.
8. Analysing all captured field data to determine the *likelihood of failure* and *consequences of failure* to complete a tree risk assessment.
9. Developing mitigation options, recommending a further Level 3 Advanced Assessment, if deemed necessary, and estimating *residual risk* for each mitigation option.
10. Producing and submitting the report, including when appropriate, advice on re-inspection intervals.

Limitations of Level 2 Basic Visual Assessments

This visual assessment will only include details and information on tree features and conditions that can be detected from a ground-based inspection on the day of the assessment, using the tools listed in the introduction above. The extent of some internal decay, as well as the type of wood decay, and below ground or high canopy features or conditions may be difficult to observe, determine or assess.

APPENDIX 2 – Tree Survey & Assessment Glossary (continued…)

III. Level 3 Advanced Assessment

A *Level 3 Advanced Assessment* is performed to provide detailed information about specific tree parts, conditions or features, targets, or site conditions. A *Level 3 Advanced Assessment* typically incorporates all aspects of a *Level 2 Basic Visual Assessment* and is usually conducted after a *Level 2 Basic Visual Assessment* with client approval.

Specialized equipment, data collection and analysis, and/or expertise are typically required for these advanced assessments to provide detailed and in-depth information about a specific tree parts, conditions or features, and the likelihood of failure, previously identified in a *Level 2 Basic Visual Assessment*.

A *Level 3 Advanced Assessment* typically includes:

1. Locating and identifying the tree or trees to be assessed.
2. Determining the *targets* and *target zone* for the tree part of concern.
3. Reviewing and updating the *Level 2 Basic Visual Assessment* data as necessary.
4. Completing the advanced assessment using methods and/or techniques as determined necessary and appropriate by the Arborist, and as defined in the Scope of Work.
5. Interpreting and analysing the advanced assessment data and information to update and revise the *likelihood of failure* and *consequences of failure* in order to complete a tree risk assessment.
6. Developing mitigation options and estimating *residual risk* for each mitigation option.
7. Producing and submitting the report, including when appropriate, advice on re-inspection intervals.

Limitations of Level 3 Advanced Assessments

Using technology, methodologies and equipment listed below always involves a degree of uncertainty as well as limitations in use. Furthermore, most data is not an accurate measure, but a qualified or quantified estimation.

Arborists employing advanced assessment equipment and technology must have an advanced knowledge of the application and use of the various equipment (e.g., when and where it is appropriate for use and which method); in-depth knowledge of decay fungi and host tree species relationships; training and experience in interpreting data; and likelihood of failure assessment

APPENDIX 2 – Tree Survey & Assessment Glossary (continued…)

III. Level 3 Advanced Assessment (continued…)

Methods of Advanced Assessment

Procedure	Methodology
Aerial Tree Inspection (evaluation of tree structure within crown)	• visual inspection from within the tree crown or from a lift • unmanned aerial vehicle (UAV) photographic inspection • decay testing of branches
Detailed Target Analysis	• property value • use and occupancy statistics • potential disruption of activities
Detailed Site Evaluation	• history evaluation • soil profile inspection to determine root depth • soil mineral and structural testing
Decay Testing	• increment boring • drilling with small-diameter bit • resistance-recording drilling • single path sonic (stress) wave • sonic / impulse tomography • electrical impedance tomography • radiation (radar, X-ray) • advanced analysis for pathogen identification
Tree Health Evaluation	• tree ring analysis (in temperate zone trees) • shoot length measurement • detailed health/vigour analysis • starch assessment
Root Inspection and Evaluation	• root and root collar excavation • root decay evaluation • ground-penetrating radar • sonic / impulse tomography
Storm / Wind Load Analysis	• detailed assessment of tree exposure and protection • computer-based estimations according to engineering models • wind reaction monitoring over a defined interval
Measuring & Assessing the Change in Tree Lean	• visual documentation • plumb line • digital spirit level
Load Testing	• hand pull • measured static pull • measured tree dynamics

Note: All levels of tree inspection, evaluation and assessment consider visible, and detectable, tree observation, conditions, and features in proximity to the known and/or assigned targets of the tree or trees being assessed. Regardless of the level selected, any tree risk assessment will be limited to the tree or trees selected, and the detectable conditions at the time of the defined and assigned assessment. The client should also recognize that not all defects will be detectable, and not all failures can be predictable