Tree Structural Integrity Report

SITE:

6 Eastfield Road
Redland
Bristol
BS6 6AA

PREPARED FOR:

Julie Condell
M. Coleman Estate Agents
19 Cleeves Wood Road
Downend
Bristol
BS16 2SF

PREPARED BY:

Mr. Chris Watson *ISA TRAQ | LANTRA PTI*
Field Consulting Arborist

Mr. Jason Hasaka *HNDArb TechArborA*
Principal Arboricultural Consultant

BARTLETT PROJECT REFERENCE:

JH.210690.R

SITE VISIT DATE:

16th December 2021

BARTLETT CONSULTING
A DIVISION OF THE F.A. BARTLETT TREE EXPERT COMPANY

Bristol Office
Unit 22 – 25 Cross Lane Farm
Pill, Bristol
Avon
BS20 0JJ
www.bartlett.com

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1.0 SCOPE OF REPORT

1.1 Assignment

Bartlett Consulting were instructed by Mrs. E. Welling (end-client) on 2nd December 2021:

1. To perform a visual tree assessment (VTA) of 1 x Ash tree (*Fraxinus excelsior)* located within the grounds of 6 Eastfield Road, Bristol, BS6 6AA 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 the IML-RESI Powerdrill® PD500 to assess the structural integrity of the tree stem.

3. 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 discussion with the client, our tree risk assessment will be conducted for the following *target(s)*: people and houses

4. To provide a written report on the structural condition of the tree(s); 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

Bartlett Consulting were contacted by Julie Condell from M. Coleman Estate Agents on 17th November 2021, on behalf of the landlord, Mrs. E. Welling, who owns the property and subject Ash tree.

We have been advised by the client(s) that the Ash tree was subject to a crown reduction by approximately 6.0 metres in 2009; however, M. Coleman Estate Agents and/or Mrs. E. Welling have since been unable to gain permission from Bristol City Council to undertake any further pruning until a report on the health and structure of the tree has been assessed.

The original scope of the project was to carry out a visual tree assessment. After removing Ivy from the stem of the tree, it was made clear that an advanced assessment was needed to assess the extent of wood decay associated with the main stem.

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. (2012) *Basics of Micro-resistance Drilling for Timber Inspection*. Holztechnologie, Dresden.
• Rinn, F. (2013) *Shell-wall Thickness and Breaking Safety of Mature Trees.* Western Arborist, Fall 2013.
• Schwarze, F. W. M. R, Engels. J, Mattheck. C. (2000) *Fungal Strategies of Wood Decay in Trees*. Springer-Verlag. Berlin. Heidelberg. New York.
• Shigo, A. (1991) *Modern Arboriculture*. Shigo & Trees Associates. Durham, NH.
• Slater, Dr. D (2016) *Assessment of Tree Forks – Assessment of Junctions for Risk Management* Arboricultural Association, The Malthouse, Gloucestershire.

1.4 Report Limitations & Methodologies

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

Our VTA, Level 3 Advanced Assessment and qualified risk assessment of the Ash located at 6 Eastfield Road, Bristol, BS6 6AA is based on a single site visit on 16th December 2021. All photographs, samples, and readings, if applicable, were taken at the time the assessment was performed.

This assessment was limited by the following factor(s):

· The 'enclosed' nature of the tree in an urban residential garden, surrounded by numerous third-party gardens which we did not have access to, reduced or visual assessment to the northern aspects of the tree. We used binoculars to assess the tree canopy from the adjacent public areas where possible.

· The buttress and root-collar of the Ash were partially surrounded and buried under soil and rubble, which also restricted our visual assessment of this tree part.

Targets and *Occupancy Rates* considered in the tree risk assessment were determined based on a conversation and agreement with Julie Condell whilst on-site. Targets considered in this tree risk assessment are *people* using all of the surrounding gardens, and *houses* constituting 6 Eastfield Road and surrounding buildings.

The *time frame* for the risk assessment is three 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.

1.0 SCOPE OF REPORT (continued…)

1.4 Report Limitations & Methodologies (continued…)

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, Bartlett Consulting employed the IML-RESI Powerdrill® PD500 to determine levels of wood density; detect internal decay; and measure levels of residual sound-wood associated with the subject tree part(s) for the Ash.

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 moderate potential for wildlife and ecological associations with the tree subject to this report. Ecological associations are considered to be limited to nesting birds, however no active nests were visible at the time of our survey.

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 all protected species 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.

An enquiry was conducted by Bartlett Consulting on 2nd December 2021 through the Bristol City Council Pinpoint interactive mapping website: https://maps.bristol.gov.uk/pinpoint/

2.1 Tree Preservation Order (TPO) Status

The Ash is protected by TPO No. 715, recorded as 'confirmed' on 1st November 1999.

2.2 Conservation Area (CA) Status

The Ash is located within the *Cotham & Redland* designated Conservation Area.

2.3 Tree Management Implications

TPO legislation supersedes CA legislation. Therefore, under the Town and Country Planning (Tree Preservation) (England) Regulations 2012, you cannot carry out any works to the protected Ash before obtaining formal written permission as issued by Bristol City Council. This can be sought with the submission of a Tree Preservation Order planning application (1APP) but cannot be acted upon until full planning permission is granted.

This report must be submitted with any 1APP.

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.

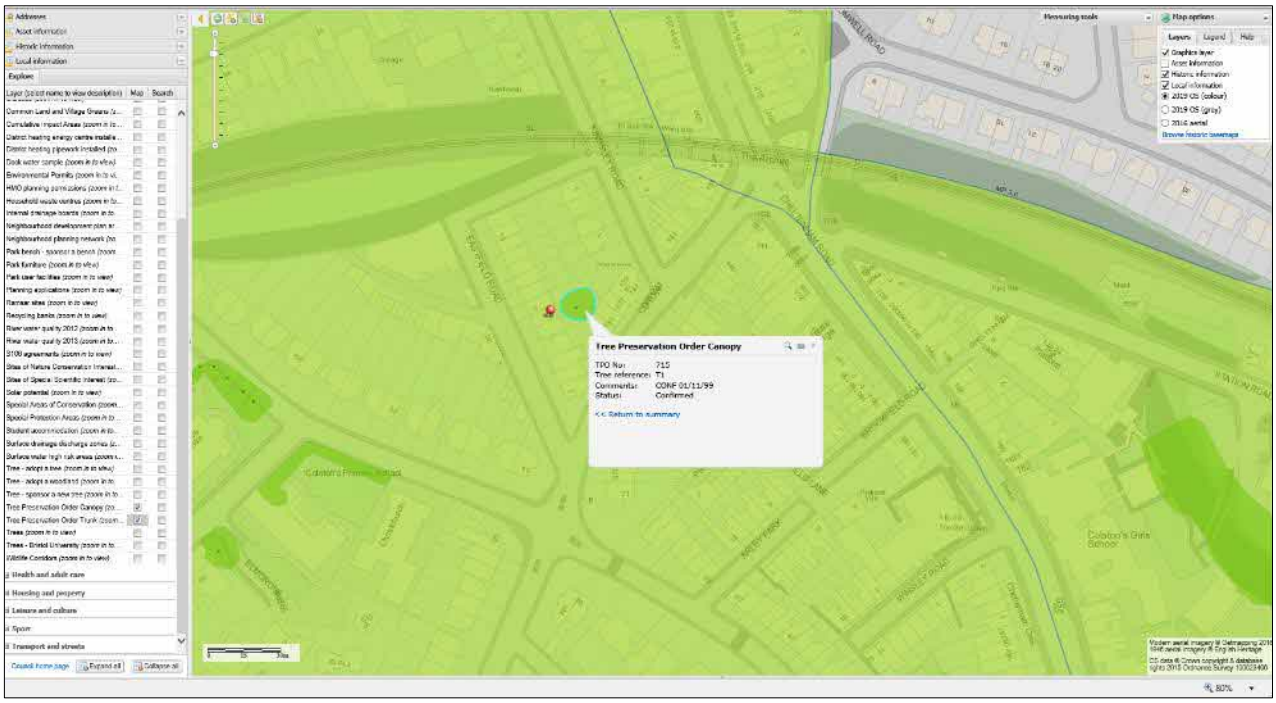


Figure 1: Snipped Image from Bristol City Council Website Showing Location of Ash

3.0 TREE & SITE DETAILS

Species	European Ash (*Fraxinus excelsior*)			
Stem Diameter (mm) (@ 1.5 metres height)	780			
Age	Mature (98 years ±10 years)			
Tree Height (metres)	23.5			
Crown Spread (metres)	**N** 8.0	**E** 4.5	**S** 6.5	**W** 6.0
Vitality	Fair			
Location	Rear Garden, Urban Residential Property			
Targets	1. People: within crown spread, frequent occupancy 2. Houses: within crown spread, constant occupancy			
Rooting Environment	1. Grounds predominantly "scrub" recently cleared with exposed soil 2. Several juvenile / young self-set trees 3. Retaining wall running along the north, east and southern aspects of the tree 4. Retaining wall between 70 – 150 centimetres from stem 5. There is a 1.3 metre drop in level opposite northern retaining wall			
Buttress Roots	1. Buried by soil and bricks / rubble to northeast & southern aspects 2. Depth of material is approx. 60 centimetres depth 3. Buttresses visible elsewhere – no noticeable defects, decay or dysfunction			
Main Stem	1. Old wound on northern side of stem from ground level to approx. 2.0 metres height 2. Wound approx. 30 centimetres in width with exposed, desiccated decayed heartwood 3. Good wound-wood formation 4. Area of loose and sunken bark on southern side of the stem w/exposed and decaying sapwood from ground level to 60 centimetres height above ground level 5. Variations in tone when sounding eastern & western aspects of stem adj. these features 6. Cavity at approx. 3.0 metres height northwest side of stem, probed to depth of 25 centimetres 7. Co-dominant leaders at approx. 4.5 metres height w/partially included bark union			
Crown	1. x2 old pruning wounds eastern side of co-dominant leader approx. 15 cm diameter 2. Wounds partially occluded with loose and flaking bark around them (sapwood dysfunction possible when viewed through binoculars) 3. x4 dead primary limbs on the eastern side of crown approx. 20-25 centimetre diameter 4. Cavity visible on western co-dominant leader approx. 60 x 20 centimetres 5. Fruiting body at approx. 14 metres height western side of primary scaffold limb 6. Small diameter dead branches throughout crown 7. Small dead stubs at old reduction pruning wounds 8. Poorly attached re-growth at old reduction pruning wounds w/little adaptive growth visible 9. No signs / evidence of Ash Dieback			
Assessment	1. IML-RESI Powerdrill® at 1.5 Metres Height, Main Stem			

4.0 FUNGAL, DISEASE OR INSECT PATHOGEN

4.1 Shaggy Polypore (*Inonotus hispidus*)

The presence of old, desiccated fungal fruiting bodies, suspected to be Shaggy Polypore, were seen within the upper canopy of the Ash, on one of the primary co-dominant leaders.

This fungal fruiting body appears annually, usually forming in the summer or early-autumn, as a fleshy bracket with orangey-brown felt-like top. The fresh bracket has a yellow margin, and the underside often has water droplets.

The bracket quickly degrades as it reaches maturity, turning dry, brittle and black in colour. The dead bracket can sometimes remain attached to the tree part for a few months before falling to the ground. When the bracket falls, there is often a black 'footprint' on the tree part where the bracket was attached.

The mode of decay is that of a simultaneous white rot, as the fungus can degrade both lignin and cellulose of wood cells. The fungus can change its mode of decay however, depending on the host species, attacking cellulous preferentially in early-stage decay.

In advanced stages of decay the wood can become embrittled, leading to kinking and snapping fracture of affected branches and stems.

Figure 2: Library Image of Shaggy Polypore Fungal Fruiting Body

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

5.0 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.

As the Resistance Micro-drill is an invasive method of decay detection, Bartlett Consulting injects Potassium Phosphite into the drilling tunnel to aid the tree compartmentalising the wound and combating fungal decay pathogens when practically possible.

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.

5.1 IML-RESI Powerdrill® Testing Locations

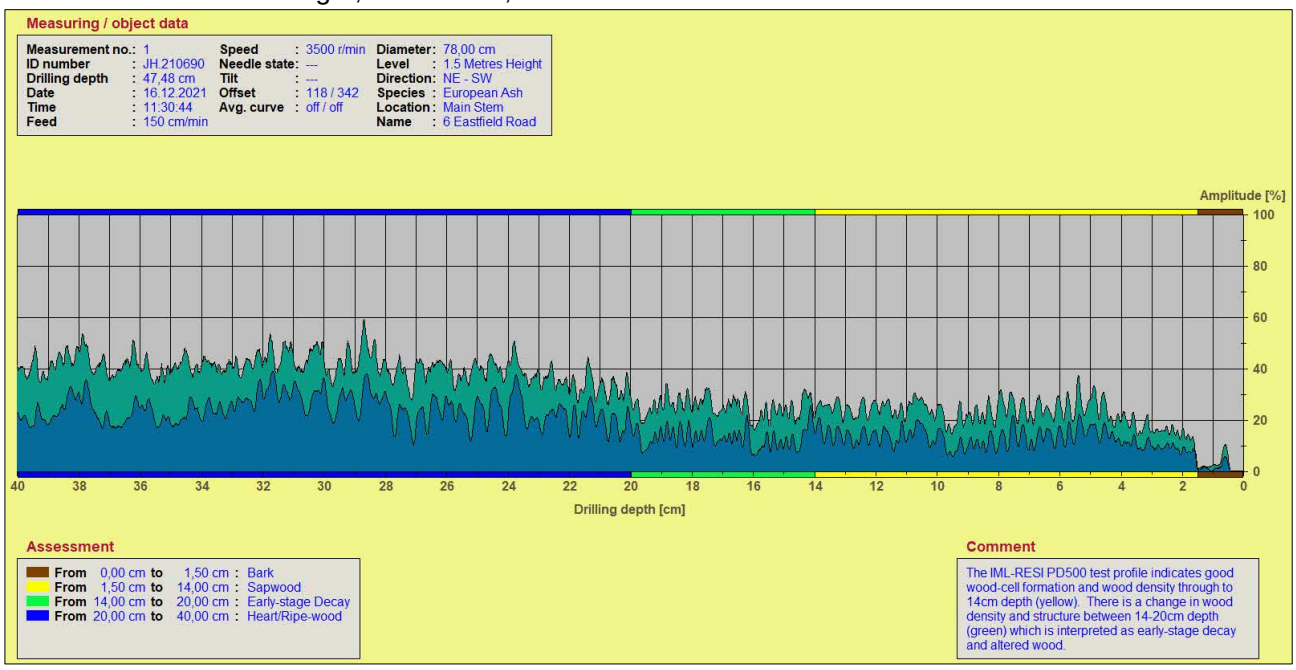
Due to the presence of the wounding and decay column, a total of three (3) tests were conduction at 1.5 metres height on the main stem of the Ash tree. The tests were positioned to the northeast, south and northwest sides of the stem, triangulated around the decay column, to assess the presence of internal decay.

Figure 3: Image of IML-RESI Powerdrill® Test Plane on Ash at 6 Eastfield Road, Bristol

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

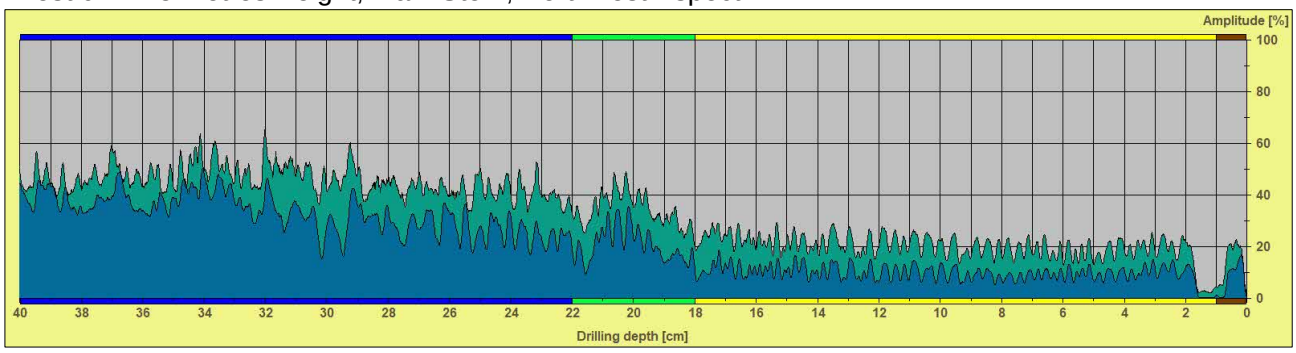
5.2 IML-RESI Powerdrill® Test Results

· Test 01: 1.5 Metres Height, Main Stem, Northeast Orientation

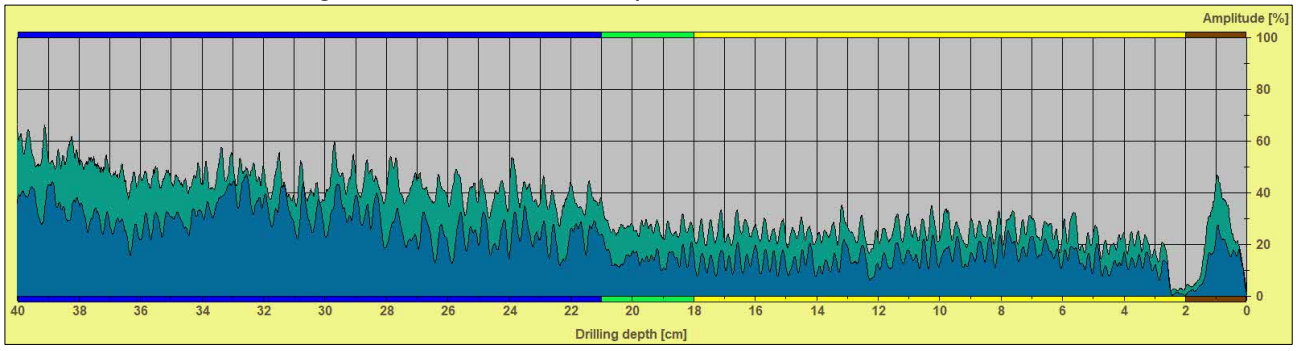


NOTE: The above test profile shows the full device output, including Object Data, Assessment and Comments. The remaining test profiles will be cropped to show only the micro-drill test result reduce the number of pages within the report. Section 5.3 below includes a detailed interpretation of the test results.

· Test 02: 1.5 Metres Height, Main Stem, Northwest Aspect



· Test 03: 1.5 Metres Height, Main Stem, South Aspect



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

5.3 IML-RESI Powerdrill® Test Result Interpretation

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

Whilst comparing the three (3) test profiles, the IML-RESI Powerdrill® (PD500) shows that the general resistance through the zones of vascular tissue and sapwood is initially good and consistent, when compared to each other, and as shown with the blue graph (feed curve).

The amplitude across all three test profiles is found to be ranging between 20% - 40% where the differences in wood formation and density are better distinguished.

Test 1: The test profile is interpreted as indicating good wood density and structure through the sapwood region, spanning approximately 2 – 14 centimetres depth, as coloured yellow on the test profile. There is a distinct variation in wood cell structure and density between 14 – 20 centimetres depth, which is interpreted as altered and decayed wood, and coloured green on the test profile. There are no indications of deep-seated decay or hollowing of the stem beyond the 20 centimetres depth.

Test 2: The test profile is interpreted as indicating good wood density and structure through the sapwood region, spanning approximately 2 – 18 centimetres depth, and coloured yellow on the test profile. There is a distinct change in wood structure and density between 18 – 22 centimetres depth, which is interpreted as altered and decayed wood, and shown as green on the test profile. Again, there are no indications of deep-seated decay or hollowing of the stem beyond the 22 centimetres depth.

Test 3: The test profile is interpreted as indicating good wood density and structure through the sapwood region, again, spanning approximately 2 – 18 centimetres depth, and coloured yellow on the test profile. There is a more subtle, but noticeable, change in wood structure and density between 18 – 21 centimetres depth, which is interpreted as altered and decayed wood, and shown as green on the test profile. Again, there are no indications of deep-seated decay or hollowing of the stem beyond the 21 centimetres depth.

5.4 IML-RESI Powerdrill® Test Result Conclusion(s)

Following the visual tree assessment and advanced assessment using the IML-RESI Powerdrill® PD500, it is our interpretation and conclusion that between 14 – 22 centimetres depth within the stem, there is a zone of decayed wood circumferentially around the stem, which has been compartmentalised by the tree.

This decayed wood, considering the depth within the stem, is most likely associated with, and a result of, the original wounding to the tree which is visible on the northern face of the stem. Wood decay is considered to have spread around the tree following the wounding; however, the tree compartmentalised the wood decay, and continued to 'successfully' grow around the decaying wood, creating annual growth, free from wood decay.

6.0 PHOTOGRAPHIC OVERVIEW

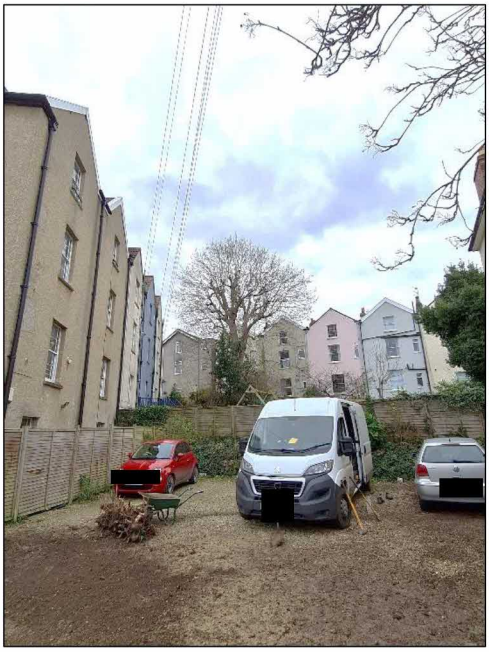


Figure 4: Image Showing Ash in Landscape from North

Figure 5: Image Showing Partially Buried Root Collar

Figure 6: Image Showing Dysfunction & Decay at Old Cutting Points as well as Fungal Fruiting Body (Circled)

Figure 7: Image Identifying Dead Primary Limbs (Red Lines) Throughout Eastern Canopy

7.0 CONCLUSIONS

At the conclusion of the visual tree assessment, the Ash tree has not responded well to past management, with sapwood decay and cavity development at old pruning (topping) points, as well as the presence of fungal fruiting bodies at and below these features / locations. As typical in response to this type of tree pruning, epicormic branches have grown from the pruning points, which is poorly attached to the tree branch with a higher likelihood of failure. Added to these features, the eastern primary branching structure is exhibiting significant dieback and decline, with numerous dead branches.

As the survey was conducted in the winter, we cannot be certain, however, there were no signs or features which indicated that this tree was suffering from Ash Dieback (*Hymenoscyphus fraxineus*) – a fungus which causes leaves to develop black blotches in the summer, leading to wilting; dieback of the shoots and leaves in the summer; lesions developing on branches.

At the conclusion of the advanced assessment using the IML-RESI Powerdrill® to assess the structural integrity of the main stem, there is a circumferential zone of decay within the stem, however this has been compartmentalised by the tree and is not currently deemed to be affecting the structural integrity of the stem.

In summary, the Ash tree requires management to address the features and hazards identified within the tree canopy (primary and secondary branching structure). Due to the specification and potential implications of the necessary management as detailed in Section 7.2 below, the Ash tree may not respond 'positively' and decline in health and vigour. Furthermore, the necessary management will not be a long-term solution, and result in further decay and cavity development within the Ash tree, reducing the 'safe useful life expectancy' of the tree. Therefore, we have provided a second option for the client to consider.

7.1 Ash 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	Epicormic Growth	Probable	Medium	Somewhat Likely	Minor	Low
	Primary Branching	Probable	Medium	Somewhat Likely	Severe	MODERATE
	Main Stem	Improbable	Medium	Unlikely	Severe	Low
Structures	Epicormic Growth	Probable	High	Likely	Minor	MODERATE
	Primary Branching	Probable	Medium	Somewhat Likely	Significant	MODERATE
	Main Stem	Improbable	High	Unlikely	Significant	Low

Using the methods outlined in this report, and the results of the visual and advanced tree assessments of the European Ash tree at 6 Eastfield Road, Redland, Bristol, BS6 6AA, it is our professional judgment that this tree has an *overall tree risk rating* of ***MODERATE***.

Mitigation will be recommended to reduce the risk to a level as low as reasonably practical, which will allow for retention of the tree and the benefits it provides to the landscape and local amenity; or to remove the risk in its entirety.

7.0 CONCLUSIONS (continued…)

7.2 Ash Tree Recommendations

We recommend the following tree management operations to address identified tree features and hazards, as well as to mitigate associated tree risk. We recommend that as the "tree risk manager" current risk and residual risk levels are reviewed, and a determination is made with regards to your acceptable tolerability of risk and appropriate tree management.

Option One:

- Establish Pollard at Approx. 15 Metres Height
  (red annotations opposite)
- Remove Growth Below Pollard Height
- Soil Drench Potassium Phosphite / Fertiliser
  (general purpose fertiliser 7:2:3 mix)
- To Be Completed 6 - Months
- Residual Risk *LOW*

This management option will reduce risk to a level as low as reasonably practical, whilst attempting to retain the tree for the time being. Implications are that a) the pruning may cause a terminal spiral of decline, and if not, then b) the pruning will continue to 'sustain' wood decay and cavity development resulting in continual management (re-pollarding) of the tree until it needs to be removed due to severity of that decay.

The soil drench has been recommended to aid tree health and vitality in response to the wounding (pruning), loss of tree canopy and energy require to reproduce a new canopy, and decay and fungal pathogens associated with this Ash tree.

Option Two:

- Remove Tree to Ground Level
- Establish Replacement Planting
- To Be Completed 6 - Months
- Residual Risk *NONE*

Note: Please note that due to restricted access it is our consideration that arising material will need to be removed from site through the residential dwelling, and that the tree stump cannot be ground-out and removed.

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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.

It is important to understand that tree conditions do change over time, and as such, visual re-assessment is recommended annually and after major storm events.

8.0 RISK ASSESSMENT LIMITATIONS & CLIENT DUTY OF CARE

8.1 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.

8.0 RISK ASSESSMENT LIMITATIONS & CLIENT DUTY OF CARE (continued…)

8.2 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.

8.3 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 accurately 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: Mr. Chris Watson *ISA TRAQ | LANTRA PTI*
Field Consulting Arborist

SIGNATURE: [redacted] **DATE: 14.01.2022**

REPORT REVIEWED BY: Mr. Jason C. Hasaka *HNDArb TechArborA*
Principal Arboricultural Consultant

SIGNATURE: [redacted] **DATE: 18.01.2022**

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 the trees are subjected to.

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 measuring tapes / laser range finders 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* in order 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