Mr Andrea Barbieri
Artemide
106 Great Russell Street
London
WC1B 3NB

Ref: BA3234rev1

Date: 02/03/2012

Dear Mr Andrea Barbieri,

RE-ASSESSMENT OF PLANE TREE IN REAR GARDEN.

Please find my reassessment of the mature plane tree following your concerns regarding its safety and suitability to its location, which was initiated due to the significantly tapered form of the main stem which typically indicates the presence of internal decay as the tree attempts to adapt to the decay.

INTRODUCTION

Qualifications and experience: I have based this report on my site observations; I have come to conclusions in light of my experience. I have experience and qualifications in arboriculture and list the details in Appendix 1.

The Terms of Reference: This assessment is based upon a ground based visual assessment of the tree and a detailed assessment of the main stem using Thermal Imaging, Picus Sonic Tomography and Picus Electronic Impendence Tomography. The assessment follows an earlier assessment in spring 2011 to enable a comparison of the results.

Documents and information provided: Written instructions to report.

Scope of this report: This reassessment is principally concerned with the decay within the main stem and a climbing assessment of the main canopy unions. The general stability, health and safety of the tree are also assessed.

Assessment of the potential influence of trees, upon buildings or other structures resulting from the effects of trees upon shrinkable load bearing soils is excluded from this assessment, though issues related to direct damage are briefly covered.

This assessment is based upon visual assessment of the tree and the use of Picus Sonic Tomography (SOT), Picus Electrical Impedance Tomography (EIT) and Thermal imaging (TI) to assess the internal condition of the tree and to identify the presence, position and extent of possibly decayed wood within the stem. To enable comments upon the condition of the internal stem and allow a comparison of the sound versus the colonised wood, enabling an assessment of the trees stability.

The Terms of Reference: This report is based on Visual Tree Assessment (VTA) methodology, as devised by Mattheck (1993) in addition to Hazard Evaluation devised by Matheny & Clark (1993). Guidance is also taken from Lonsdale (1999) Principles of Tree Hazard Assessment and Management and Sterken (2005) A Guide for Tree-Stability Analysis.

Duration of validity: The statements made in this report do not take account of the effects of extremes of climate, vandalism or accident, whether physical, chemical or fire. Barnes & Associates cannot therefore accept any liability in connection with these factors, nor where prescribed work is not carried out in a correct and professional manner in accordance with current good practice. The authority of this Report ceases at any stated time limit within it, or if none stated after one year from the date of the survey or when any site conditions change, or pruning or other works unspecified in the Report are carried out to, or affecting, the Subject Tree(s), whichever is the sooner.

Trees unlike built structures are a dynamic structure and offer several specific management issues that need to be considered. Reasonable risk management generally aims to provide trees that can be regarded stable in a normal / foreseeable, storm event. I have included further general information upon risk management of trees in Appendix 2.

SITE VISIT AND OBSERVATIONS

Date of Assessment: 21st January 2012

Weather Conditions: The weather was Bright & visibility was good.

Assessment Methods: The assessment of the stem was undertaken from the ground, specific heights are provided in the individual assessment below. The height and spread of the canopy were estimated due to the restricted access to the neighbouring site and the limited depth of the garden.

Internal assessments are undertaken using various methods that can test different properties of wood and provide an insight into wood quality. The methods of assessment used on site are detailed below:-

Sonic Tomography: This is a non-invasive tool for assessing decay in trees. It works on the principle that sound waves passing through decay move more slowly than sound waves traversing solid wood. The Picus sends sound waves from a number of points around a tree trunk to the same number of receiving points, the relative speed of the sound can be calculated, and a two-dimensional image of the cross-section of the tree, 'a tomogram', can be generated. Using the differences in the transit times between each pair of sensors, the Picus analysis software constructs a two-dimensional picture (acoustic tomogram), which show zones of differing sound transmission properties within the stem. These zones are colour-coded, so that intact wood is shown as brown, slight degradation as green, moderate degradation as violet and advanced degradation / hollow as blue. The (Picus) Sonic Tomography gives valuable density information about the trees. The density strongly correlates with the soundness of the wood. This is very useful to access the stability of the tree. In some situations the sonic investigation is interfered with by the internal structure of the wood. In particular circular cracks and star shaped cracks which can interfere with the sonic measurement.

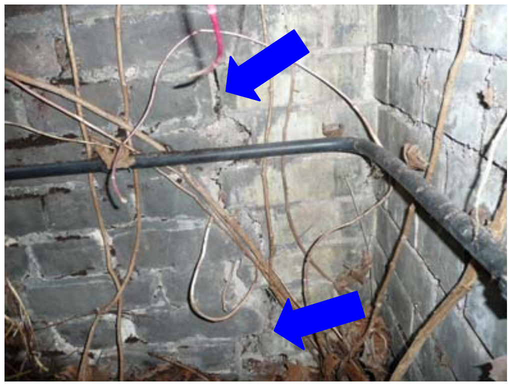
Electronic impendence Tomography: This system gathers chemical information about the wood such as water and/or ion concentration. The electrical resistivity or its reciprocal, the electrical conductivity, is a physical property that provides information about the internal condition of the stem. This determines the spatial resistivity distribution in a non-destructive way. Low resistivity can identify increased moisture content, whereas hollowed structures cause increases in observed resistivities. The measurement uses point-like electrodes (nails) that are attached to the tree just below the bark and a current is generated. The resulting electric field depends on the resistivity distribution and is measured using the other electrodes to obtain a potential difference (voltage). After collecting all the measurements the reconstruction of the resistivity distribution is carried out. The model can be displayed in the form of a coloured distribution plan for analysis.

Resistograph: The IML Resistograph system is based on the principle of measuring the drilling resistance. A drilling needle is inserted in the wood under constant drive. While drilling, the needed energy is measured depending on the drilling depth of the needle. That way, anywhere and with little effort it is possible to get information about inner defects or residual walls of trees and timber structures. Depending on the instrument series, the obtained data being recorded on a paper trace.

INDIVIDUAL TREE ASSESSMENT

Species: London Plane
Mean Height: 22m
Height to underside of Canopy: 9m
Circumference at Breast Height: 3250mm
Canopy radius:
N: 4m **S:** 12m **E:** 11m **W:** 11m
Age Range: Late Mature / Over Mature

Comments: The tree is located in a narrow bed in the northwest corner of the garden close to the rear and side boundary walls. The area between the stem and the wall is filled with leaves which have accumulated over the recent seasons as shown in the photograph. Cracking can be seen in the nearby walls.



The northern and western tree buttress touches the wall at a low level, when measured at 600mm above the ground the face of the stem has a gap of approximately 200mm between the brick work and the tree.

Closer assessment of the western wall shows a large step crack which extends vertically from a point close to the stem as indicated by the blue arrow in the photograph opposite. Elsewhere the western boundary has a series of smaller step cracks which I assume is a result of direct damage.

The tree has caused localised disruption of the paving and a gentle rippled pattern can be seen within the paving surface indicating lifting by the significant root system in addition to direct damage by a kerb edge on the nearby shrub bed.

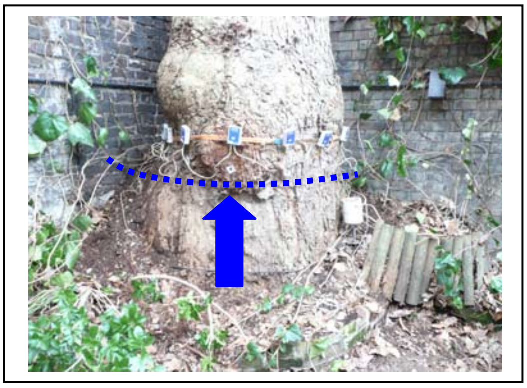
The tree has a large potential for growth. Such a tree has the potential to result in direct damage to built structures nearby; it is significantly closer than recommended within section 10 of the British Standard BS5837:2005 Trees in relation to construction, table 3. This recommends that at least 2 metres should separate a tree with a stem diameter of greater than 600mm diameter and a masonry boundary wall; and 2.5 meters should separate a tree and an in situ concrete path; as shown in table 3, which is copied below.

Extract of Table 3 - BS 5837:2005

Minimum distance (m) between young trees or new planting and structure to avoid direct damage to a structure from future tree growth			
Type of structure	Diameter of stem at 1.5 m above ground level at maturity		
	<30 cm	(30-60) cm	>60 cm
Buildings and heavily loaded structures	-	0.5	1.2
Lightly loaded structures such as garages, porches etc.	-	0.7	1.5
Masonry boundary walls	-	1.0	2.0
In situ concrete paths and drives	0.5	1.0	2.5
Paths and drives with flexible surfaces or paving slabs	0.7	1.5	3.0

Closer assessment of the stem shows a distinct flaring of bottle butt normally an indicator of internal decay, which prompted the internal assessment. Unfortunately, due to the presence of the wall I was unable to accurately measure the stem dimension as would normally be undertaken using the Picus equipment, to get around this the north–south axis of 1250mm and the east-west axis of 1300mm were used to create an ellipse and the sensor points were set at equal intervals.

The assessment height is approximately 800mm above ground level, at a point where the stem circumference is 3800mm indicated by the blue dotted line on the photograph above. This is the same location as the assessment in 2011 to enable a comparison of the results. The blue arrow shows the position of Sensor 7.



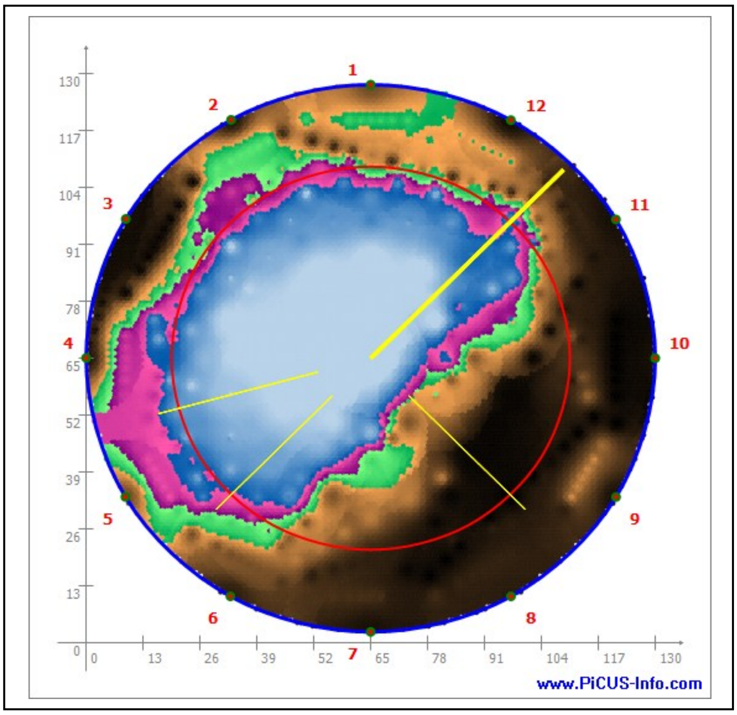
The results of the Sonic Tomography are shown below.

The buttress of the tree appears to be normally formed with typical adaptive growth suggesting that the tree is forming a new root system above the original roots.

Sonic Tomography - SOT

The Tomograph shows that the internal section of the stem has been affected by a section of stem decay indicated by the blue and magenta areas, which in a significant area goes beyond normal safe limits shown by the red line which shows the position of the 30% stem radius.

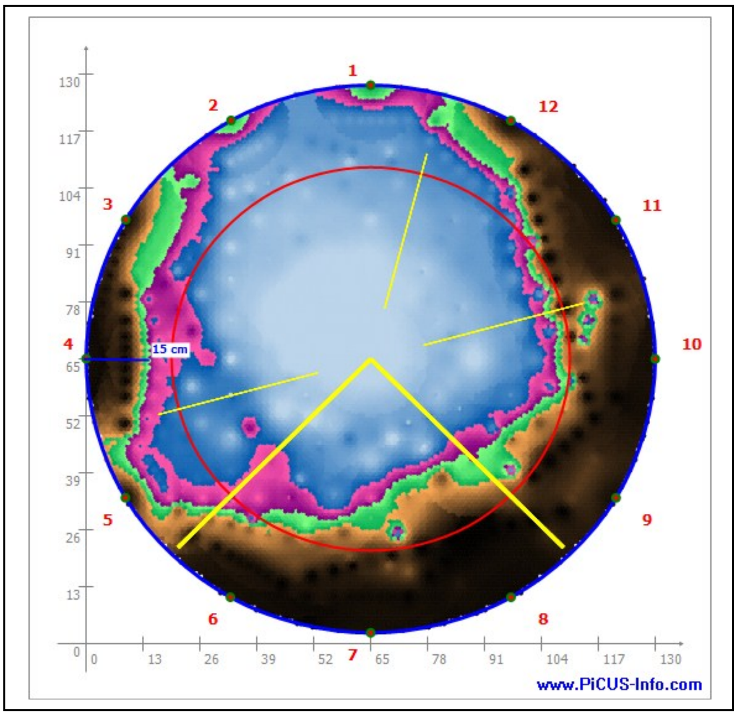
2011 Results



The yellow line on the tomography indicates the likely presence of internal cracks, which may have accelerated the spread of the decay fungi and may have adversely affected the tomography by increasing the time of flight for the sound signal.

A significant area of decay is present in the north western section of the stem indicated by the Blue section.

2012 Results



The yellow line on the tomography indicates the likely presence of internal cracks which are more defined then previously.

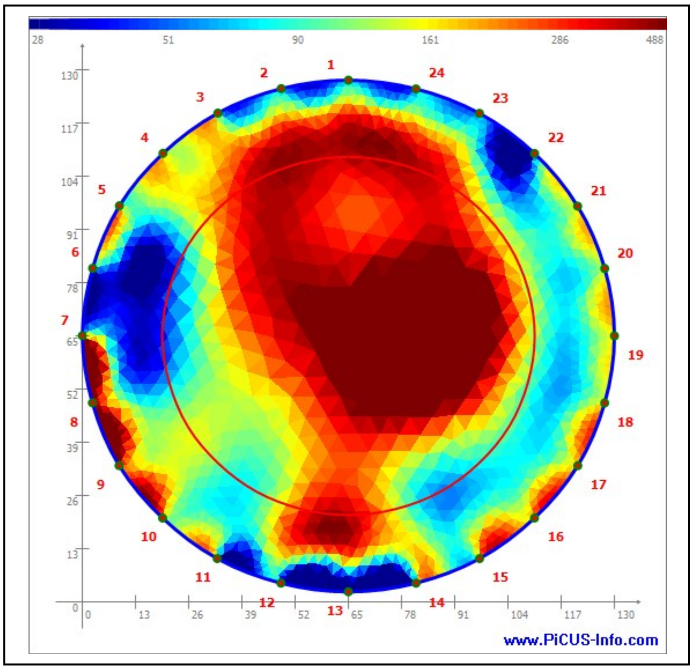
The extent of internal decay is significantly increased in volume and breached the Red minimum safety line in several places.

To get a better understanding of the stem characteristics a second assessment using the Picus Treetronic was undertaken at the same location as the original sonic assessment, this is shown in the adjoining tomogram.

Electronic impendence Tomography - EIT

The results show the tree to have an area of elevated resistance or drying of the wood in the central section indicated red.

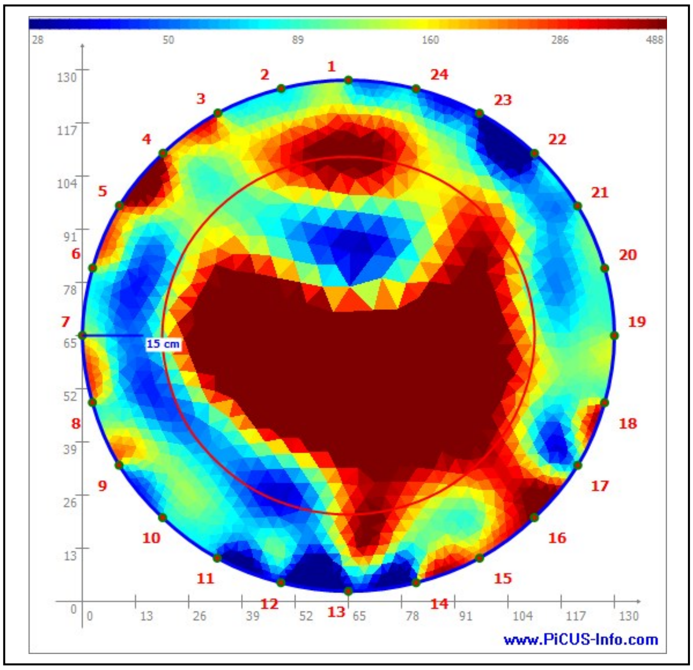
2011 Results



The additional red areas on the outside of the stem around sensor 7 to 10 and particularly sensors 15 to 18 indicate restrictions in sap flow likely a response to the competitive environment.

The central section of the stem has a significant elevation in drying, indicating the area is affected by advanced decay.

2012 Results



The outer stem has a higher moisture content which is assumed to be related to moisture storage during the dormant period.

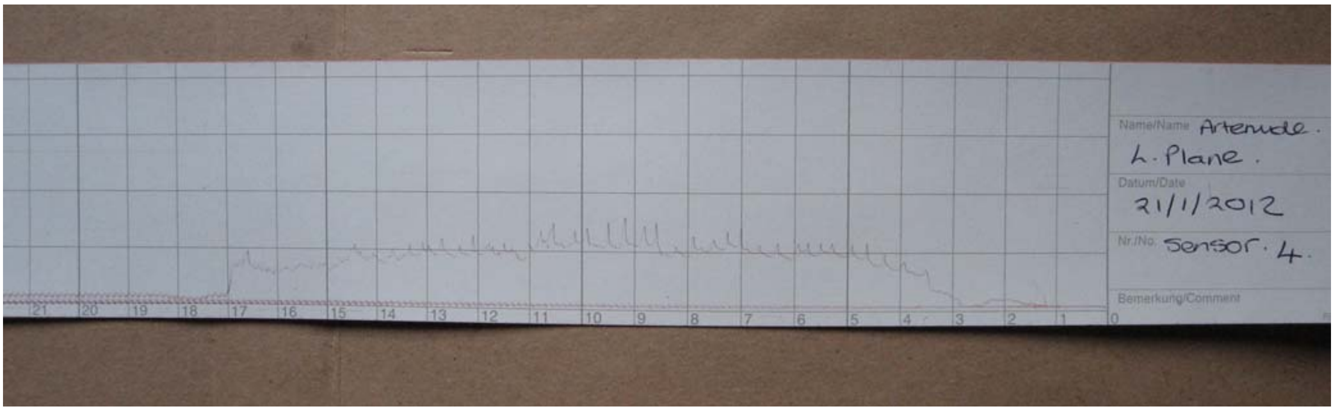
The additional blue area in the northern stem is expected to be a response of elevated moisture content in the decayed element.

The area of elevated resistance (red) closely follows the pattern of decay shown in the sonic result of this year. Showing the central section of the stem has a significant elevation in drying, indicating the area affected by advanced decay.

Resistograph

To gain a better understanding of the trees condition several resistographs were taken in the tree on the eastern and southern face – in light of the strength of the adaptive tissue these results had such a high resistance in the first 20mm to 40mm that the results were off the chart and resulted in the breakage of 2 probes. This is relatively common as the tree produces high quality wood in response to internal defects.

A third successful assessment was made on the western stem at sensor point 4 which was chosen as the most likely to have soft sections of the stem based upon the tomogram results and sounding with a mallet (this area of stem produced a distinct hollow sound when struck). Resistograph results are shown below:-



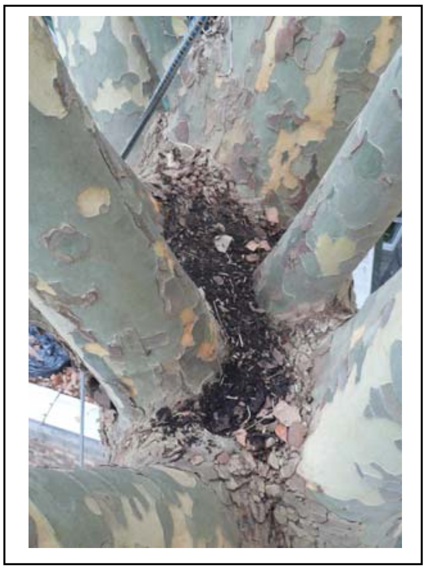
The results show the tree to have typical increasing wood quality through the bark and the vascular tissue from 3 cm on the trace, with relatively low quality wood extending to 17cm into the stem before hitting a cavity. This gives the tree a sound wall thickness of only 14cm and aligns well with the results on the tomographs above on which I have drawn a 15cm line on the represent the location of the Resistograpth.

Climbing Assessment

Following the assessment of the lower stem I assessed the main union at the base of the canopy by aerial inspection.

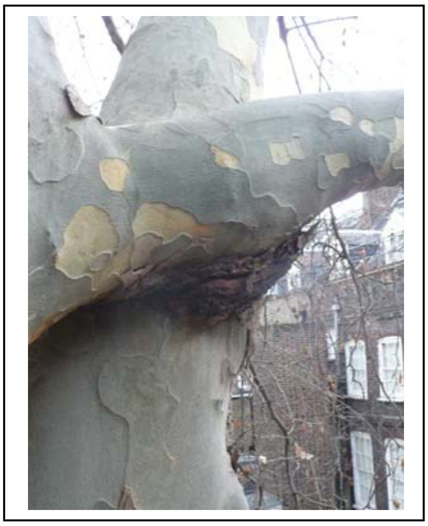
This shows a hole on the north western face of the stem, leading to a cavity that extends both below the main collection of branch attachments and down the stem to some 1200mm.

I have attempted to show the extent of the cavity on the photograph below indicated by the blue shading.



The main canopy attachments are typical of such a previously lopped tree with a slight depression which is filled with organic matter. The feature is typically congested and included unions can be expected to develop as the stems increase in diameter, leading to the formation of a series of tightly formed unions liable to collapse.

Elsewhere in the canopy a series of rubbing main leaders and crossing and rubbing main branches can be seen as shown in the photograph below. These can be expected to develop into abrasion wounds and become a site for pathogen entry, ultimately leading to branch failure.



Whilst in the tree a quick visual assessment of the neighbouring land shows signs of direct root damage to the wall with the boundary wall being deflected out of position as shown opposite.

In addition to this the neighbouring footpath has suffered direct damage from tree roots as shown in the photograph opposite which could form a trip hazard.

Additional information.

The tree has caused localised disruption of the paving both on site and on neighbouring land; in addition to this both damage and deflection of the side and rear boundary walls can clearly be seen. To understand this more fully an assessment by a Structural Engineer was undertaken on the 13th February – I have included a copy of this as Appendix 3.

The tree has potential for further growth and as such it can be expected to result in further direct damage to built structures nearby; it is significantly closer than recommended within section 10 of the British Standard BS5837:2005 Trees in relation to construction, table 3. This recommends that at least 2 metres should separate a tree with a stem diameter of greater than 600mm diameter and a masonry boundary wall; and 2.5 meters should separate a tree and an in situ concrete path; as shown in table 3, which is copied below.

Extract of Table 3 - BS 5837:2005

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Lightly loaded structures such as garages, porches etc.	**-**	**0.7**	**1.5**
Masonry boundary walls	**-**	**1.0**	**2.0**
In situ concrete paths and drives	**0.5**	**1.0**	**2.5**
Paths and drives with flexible surfaces or paving slabs	**0.7**	**1.5**	**3.0**

The assessment by the engineer finds the damage offers a significant risk to nearby built structures and concludes that removal of the tree is the only reasonable management option to elevate the problem.

Appraisal: The results of the internal stem assessment and the climbing inspection show both the lower stem and the stem below the main canopy union are affected by decay which breaches the normal safe limits.

The decay in the lower stem has caused the stem to thin to 14cm at sensor 4 which leaves the tree predisposed to Euler buckling, which is a situation which is neither predictable or manageable.

The canopy is dominated by a series of elongated leaders which extend upto 12 metres and can be expected to transfer a significant loading into the main canopy union and is expected to result in failure. Additionally, to the loading the presence of the tight unions indicate that the trees branches are predisposed to failure, this situation could be managed though regular ongoing pruning; however this would have a detrimental effect upon the trees amenity.

The tree is poorly located in relation to built structures and continued direct damage is expected, a situation that cannot be managed and which offers a foreseeable nuisance to the built structures, which may offer a potential liability to the trees owner. This situation may be exacerbated by the relative differences in ground level, between the rear boundary wall and the neighbouring land which is approximately 1.2 metres lower.

Conclusion: The results of the assessment by Tomography shows the tree has been affected by advancing decay which is confirmed by the Resistograph trace at sensor 4.

The canopy has a series of elongated limbs with high mechanical loading which are affected by localised decay and tight unions, which can be expected to suffer failure.

In addition to this the tree offers a significant current and foreseeable nuisance to the nearby walls and paving which has been confirmed by a Structural Engineer details in Appendix 3.

Recommendations: On this basis of the above findings I find the tree retention is unsustainable as it offers an unreasonably high risk to both site users and neighbours .This risk is offered through the potential failure of the main stem at or close to the buttress, the potential for main stem to fail at or below the main canopy attachment and its potential for failure of the main branch’s from within the canopy.

In addition the tree constitutes a statutory nuisance to the local built environment, a situation that cannot be managed.

On the basis of the high risk to site users and the ongoing damage to the nearby wall and paving I find this tree to be unsustainable and recommend that the tree should be removed and replaced. Ideally, any replacement planting should consider fully the site restrictions to avoid ongoing management issues.

OTHER CONSIDERATIONS

If required, I can prepare a detailed breakdown of the works. Works schedules can also be supplied including an appropriate technical specification for the various arboricultural and horticultural operations. Additionally, I can offer contract management, site meetings and follow up inspections if required.

You should ensure that any contractor employed for the above works is suitably qualified and experienced, familiar with current best practice and covered by current public, products and employee liability insurance, to an adequate level. Contractors must also abide by all relevant legislation for health and safety including highway requirements.

All tree works must be carried out in accordance with BS3998:2010 – Tree Work - Recommendations, and or the European Tree Pruning Guide - European Arboricultural Council (English Version) though in strict accordance with current arboricultural best practice ensuring that any pruning works accord with current target pruning methodology.

Contractors must be fully conversant with current arboricultural best practice and adhere to all relevant legislation including the New Road & Street Works Act 1991 for works in proximity of highways, and The Working at Heights Regulation 2004.

Works should be planned to avoid times when birds are nesting, and be aware that a bat survey may be needed on significant tree hollows. There are thought to be 17 species of bat breeding in the UK and a number of additional species considered to be migrants, found in Britain, these are fully protected under Schedule 8 of the Wildlife and Countryside act (as amended) 1981 and the Conservation (Natural Habitats) Regulations 1994. The applicant should inspect the tree for the presence of bat activity. If bats are discovered during inspection or subsequent work, English Nature must be informed immediately.

Trees subject to statutory controls: The above outline options for work are necessary to maintain a reasonable level of safety and therefore should be acceptable to interested parties.

Should you require any further information please contact me at the office above.

Yours Sincerely

Ian Barnes
Registered Consultant Arboricultural Association
TrustMark Tree Care Approved Consultant
Chartered Environmentalist
QTRA Licensed User
F.Arbor.A, HND Arb, ND Ht/Arb, Tech.Cert (Arbor.A), MI Hort, CEnv, ISA Certified Arborist

APPENDIX 1 - BRIEF QUALIFICATIONS AND EXPERIENCE OF IAN BARNES

Qualifications:

Higher Diploma in Arboriculture (H.N.D Arb)
National Diploma in Horticulture & Arboriculture (N.D.Ht/Arb)
Arboricultural Association Technicians Certificate (Tech.Cert. (Arbor.A))
ISA Certified Arborist

Membership grades by peer review:

Chartered Environmentalist (CEnv)
Corporate Member Institute of Horticulture (MI Hort)
Fellow of the Arboricultural Association (F.Arbor.A)
Professional member Consulting Arborist Society UK.

Registration Schemes:

Arboricultural association Registered Consultant (49)
Trustmark Approved Tree Consultant

Practical experience:

I have worked in the Arboricultural Industry since 1987. Firstly as a climbing Arborist in both the public and private, sector, undertaking a wide range of practical operations on a variety of sites, before becoming a gang foreman. I set up and ran my own Arboricultural contracting business for 15 years, though this is now under new ownership. I have developed an arboricultural consultancy practice over the last 15 years, working throughout England for clients in both the public and private sector.

Continuing professional development:

As part of my ongoing education, I am a member of a range of related Arboricultural bodies. Including the Arboricultural Association (AA), International Society of Arboriculture (ISA), Royal Forestry Society (RFS), Forestry Contracting Association (FCA), and Arboricultural Mortgage & Insurance Users Group (AMUIG), which has been incorporated into the Consulting Arborist Society (CAS) of which I am a professional member. I am a corporate member of the Institute of Horticulture (MI Hort) and a Fellow of the Arboricultural Association (F.Arbor.A). An inclusive member of the British Mycology Society (BMS) in addition to being a Chartered Environmentalist (CEnv).

I am a registered consultant of the Arboricultural Association.

I regularly attend seminars and training events on issues relevant to Arboriculture these include events focusing on General Tree Management, Veteran Tree Management, Tree Health, Tree Pest management, Tree Diseases management, Trees Biology & Morphology, Tree Stability, Wind Loading of Trees, Tree Risk Assessment, in addition to keeping an upto date level of CPD.

I am a licensed user of the Quantified Tree Risk Assessment (QTRA) System and regularly attend updates.

I am a trained user of Picus 'Acoustic' Tomography and have attended training to extend my knowledge in this area.

I am trained and licensed in the use of thermal imaging as an aid to detecting defects in trees.

Relevant experience:

My career to date has involved me in a variety of tree care, dealing with trees in many different environments, and with differing management aims, these included: Tree planting schemes, including Woodland Design & Management, Detailed Health and Safety Appraisals, Tree inventories / population surveys, Management & selection on both proposed and active development sites, Advice upon trees in relation to structures, Additional areas of work such as Contract Specification & Management, Planning applications, Expert Witness.

This has provided me with a range of experience, enabling me to comment upon trees and their management, in line with current best practice. Full CPD and training record can be forwarded upon request.

APPENDIX 2 – RISK MANAGEMENT

Reasonable risk management generally aims to provide trees that can be regarded stable in a normal / foreseeable, regularly experienced storm event. In this region, this is likely to be a 'Near Gale' of force 7 using the Beaufort Scale (32 - 38 miles per hour) of wind speeds on land. Although it should be remembered that all trees do pose a risk. Recent work in Germany has show even sound trees that would be regarded as safe can fail during high wind events through various factors relating to wood physiology, dynamics and relationship between the root system and the supporting soils. It should be remembered that for any given tree regardless of its stability, there will always be a wind load that has the potential to break or uproot a tree regardless of its condition.

Typically, trees have evolved to fail in part, i.e. twigs and branches are sacrificed / fail from a parent tree rather than the tree being lost entirely. Observations at various sites in this country have found that twigs and branches, can break from trees at wind speeds of as little as 31 miles per hour, the upper limit of a 'strong breeze' as detailed in Beaufort Scale 6 (25 - 31 miles per hour). This has led to recommendation for restriction to access on some areas of the site when wind speeds approach Beaufort Scale 5 (25 - 31 miles per hour). With certain sites with grounds open to the public, being closed when the wind speeds approach 'Near Gale' or Force 7, as detailed by the Beaufort Scale (32-38 miles per hour).

Branch and tree failures are difficult to predict with any great level of detail and so a general position is best adopted. Typically the level of risk offered by trees will be significantly greater as the force of the wind increases, the threat from aerial parts i.e. deadwood, tight unions and elongated branches may remain even following remedial works. Typically branch failures are likely to be limited to small diameter branches and to periods of extreme weather, though as often seen in any natural model, exceptions to the rule can be expected. Therefore in managing trees we are aiming to limit or reduce the risk to nearby features, unfortunately it is not possible to remove the risk offered by a tree entirely.

As an arborist, I am a tree specialist and use my knowledge, education, training and experience to examine trees, to recommend measures to enhance their beauty and health, and attempt to reduce the risk of living near trees. As a client, you may choose to accept or disregard these recommendations, or seek additional advice. As an arborist, I cannot detect every condition that could possibly lead to a tree or limb failure. Trees are living organisms that may fail in many ways, some of which we do not fully understand.

Conditions are often hidden within the tree and below the ground. As arborists, we cannot guarantee that a tree will be healthy or safe under all circumstances, or for a specified period, of time. Sometimes trees may appear "healthy," but may be structurally unsound. Likewise remedial treatment, like any medicine, cannot be guaranteed.

Treatment, pruning and removal of trees may involve considerations beyond the arboricultural perspective, such as property boundaries and ownership, disputes between neighbours, planning issues, sight lines, landlord-tenant matters etc. Arborists cannot take such issues into account unless complete and accurate information is given to them. Likewise, as an arborist, I cannot accept any responsibility for the authorization or non-authorization of any recommended treatment or remedial measure. Furthermore, certain trees are borderline cases as to whether they should remain or be removed. Also, conditions change, and a tree may need further monitoring in the future to determine its health and structure.

Trees can be managed, but they cannot be controlled, and to live near a tree is to accept some degree of risk.

APPENDIX 3 – ASSESSMENT BY STRUCTURAL ENGINEER

Copied from email - Assessment by Structural Engineer

A structural survey of the area immediately surrounding the tree was carried out on 13th February 2012. The purpose of the survey was to establish the extent of existing structural damage to the buildings, external structures and hard standings. It was also required to assess the likelihood of continued structural damage and potential failure.

The setting of the tree, its species, height and canopy have all been described and summarised in detail within the arboricultural report.

Due to the position and size of the tree, along with the lean of the stem and root growth, a significant stepped crack has occurred within the boundary wall. This is clearly a reversal crack and has occurred due to upward movement of the base of the wall. In addition, the boundary wall has suffered lateral movement due to ongoing and increasing contact with the base of the tree. There is also significant visual evidence of direct root damage to the external areas of this and the neighbouring property in the immediate vicinity of existing surface water below ground drainage.

Due to the size and position of the tree, along with the lean of the trunk, we consider that continued structural damage will occur to the boundary wall and external hard standings / infrastructure drainage. This damage will undoubtedly lead to further instability of the root system and compromise further the integrity of the tree.

With reference to the results of the SOT and EIT surveys within this report, it has been established that the lower stem and volume of the stem below the main canopy are affected by decay with a likelihood of failure. The consequences of such a failure of the stem of the tree, or indeed significant limb failure, cannot be justified in structural terms and would present an unpredictable and significant risk of catastrophic damage to surrounding structures.

We would conclude that, in structural terms, there is absolutely no doubt that this tree should be removed in order to obviate any risk of further damage due to direct contact, loss of limbs or total instability / collapse.

paul@paul-nicholls.co.uk
Tel : +44(0)1924 271177
Fax : +44(0)1924 230812

paulnicholls & co consulting civil and structural engineers

P Nicholls & Co, 11 Church Street, Horbury, Wakefield, WF4 6LT