



# **A Risk Limitation Strategy for Tree Root Claims**

*3rd Edition - Revised May 2008*

**The London Tree Officers Association**

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**The LTOA is Hosted by the London Borough of Camden**



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### **The LTOA Risk Limitation Strategy Working Party**

In common with the previous two editions of the Strategy the Working party was made up of professionals working in the arboricultural industry.

#### **Working Party Members:**

Tim Gould	Arboricultural consultant
Becky Hesch	Executive Officer, LTOA
Dave Lofthouse	Arboricultural Manager, London Borough of Merton Vice Chairman, LTOA
Mike Sankus	Arboricultural Manager, Medway Borough Council
Jim Smith	London Trees and Woodlands Framework Manager
Andy Tipping	Principal Arboricultural Officer, London Borough of Barnet Chairman, LTOA

#### **Contributor**

Chris Neilan	Landscape Officer & Arboriculturist, Epping Forest District Council
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This edition also benefits from a distinguished peer review group who have contributed to the production of the final document with comment, constructive criticism and advice.

#### **Peer Review Group**

Peter Annett	Arboriculturist, Communities & Local Government.
Dr Giles Biddle	Arboricultural Consultant
Brian Clancy	Chartered Structural and Civil Engineer
Richard Driscoll	Consultant
Dr Neil Hipps	East Malling Research
Peter Osbourne	Independent Subsidence Consultant
Julie Richardson	Head of Trees Team, Department of Communities & Local Government

The LTOA is indebted to these above individuals for putting their valuable time and effort into commenting on the draft of the document.



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## **Foreword**

We live in times when we know that one of the greatest threats to the existence of the human race is climate change; but we also know that trees are one of the major factors that works to counteract this effect.

The balance between trees and property in urban environments has been a matter of serious debate among interested parties for at least the last 30 years.

It is accepted that the presence of trees adds value to properties in urban areas – some authorities say by as much as 20%! Trees also help to reduce pollution from vehicles and industrial processes, they benefit our health, they cool our cities and they are very attractive! But at the same time trees are perceived by others to be a potential threat to the ground beneath property in clay subsoil areas, resulting in possible subsidence damage-some parts of London being particularly prone to this effect.

Overall the debate now favours retaining trees wherever possible - but not without regard to adjacent property. Developing policies to get the best out of the balance between trees and property in urban areas is essential and that is what this excellent risk limitation document by the London Tree Officers' Association attempts to do. It sets up-to-date standards and gives good guidance for all who are interested in this very important topic – on which not only the value of our property, but our very lives may depend in the future.

## **Brian Clancy**

**Past President of the Institution of Structural Engineers and  
Chairman of the Institution's Subsidence Task Group**



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## **1. Executive Summary**

This 3<sup>rd</sup> Edition of the LTOA's Risk Limitation Strategy has extended the scope and range of the advice it offers local authority tree managers. Despite the many changes and additions you will see in this edition of the document, the core recommendations of the LTOA remain the same. The LTOA recommends that local authorities continue a policy of adopting cyclical tree pruning with selective removal and replacement as best practice. The LTOA further recommends that local authorities take a more proactive role in allocating sufficient resources to manage a very valuable asset so that unwarranted and poorly investigated claims are challenged and repudiated.

Local authorities which have already adopted the recommendations of this Strategy have seen substantial financial savings in dealing with alleged subsidence claims and have been able to retain trees that would otherwise have been removed.

The strategy also encourages the principle that local authorities undertake preventative action rather than wait for claims to arise. This is most usually in the form of following a programme of cyclical pruning in those areas affected by subsidence and where appropriate, undertaking a selective removal and replacement programme.

These recommendations if followed together with the other guidance in this document will allow local authorities to save considerable sums of public money that would otherwise have been paid out in the management and settlement of claims. These savings will be achieved by reducing the numbers of claims made and also by dealing with each claim on its own merits so that any unwarranted claims are repudiated at an early stage based on sound and reasonable argument.

Local authorities should undertake a cost benefit analysis and dedicate a proportion of the costs of current claims to funding officer time in considering and where appropriate repudiating claims, undertaking focused cyclical pruning and selective removal and replacement. Local authorities can expect to recoup these costs quickly and thereafter reduce the number of claims they have to deal with annually.



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### **The LTOA Risk Limitation Strategy recommends that:**

#### **Publicly Owned Trees:**

- Local authorities instigate a regime of cyclical pruning of council tree stock in areas predisposed to building movement where this is appropriate.
- Local authorities provide dedicated resources for dealing with subsidence generated claims directed at council owned trees.
- Local authorities instigate a regime of selective removal and replacement of street tree stock in areas predisposed to building movement where this is appropriate.

#### **Privately owned Trees:**

- Local authorities provide dedicated resources for dealing with subsidence generated Conservation Area notifications and Tree Preservation Order applications.
- Local authorities review all existing unsettled claims providing dedicated resources to challenge those unwarranted claims based on poorly investigated and inaccurate evidence or where in the case of preserved trees the Town & Country Planning (Trees) Regulations 1999 can provide relief from the claim.

#### **All Trees:**

- Local authorities challenge unwarranted claims based on poorly investigated or inaccurate evidence.



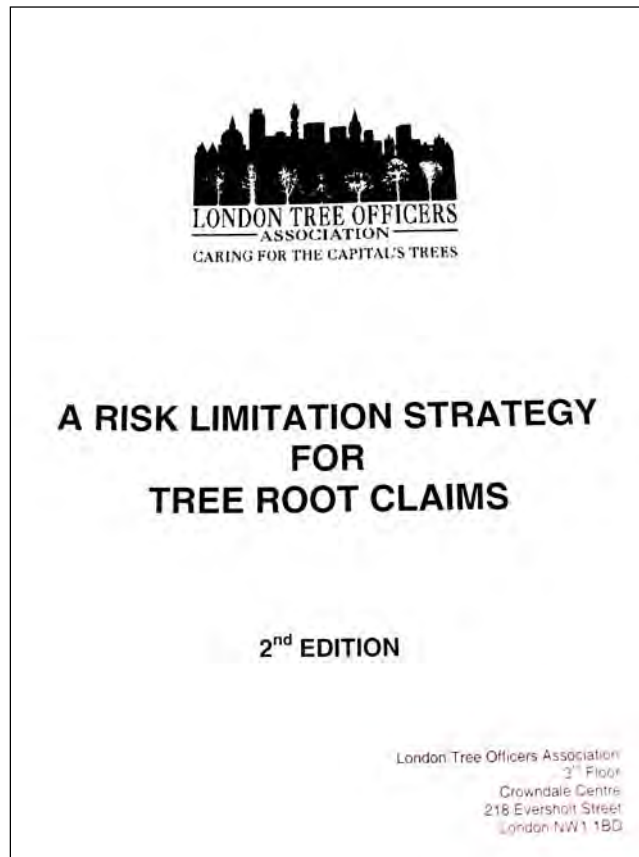
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### **2. Introduction**

The London Tree Officers Association produced its first Risk Limitation Strategy for Tree Root Claims in 1992. The first edition was a collaborative effort between a broad partnership of the affected sectors. The tree officers from various London boroughs involved in its drafting received advice and guidance from the insurance and loss adjusting sectors. It was produced in response to the demand from tree officers and insurers alike to have some frame of reference to deal with what, at that time, was an increasingly contentious issue.

A second, revised and updated, edition was produced in 1995 and since then it has been an essential tool in assisting tree officers who deal with tree root claims on a daily basis. Since the 2<sup>nd</sup> Edition was published there have been considerable changes within all the main partner sectors that deal with tree root claims including local authorities, insurers and loss adjusters.





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There has also been a considerable amount of new work planned and published on the importance of trees and the issue of subsidence since the last edition.

Examples are:

- **Institution of Structural Engineers "Subsidence of Low Rise Buildings" 2000 ISBN 1 874266 54 9**

This report was produced in 2000 following nearly two years of work by a large group of professionals from all the major industries linked to the management of tree related insurance claims- engineers, loss adjusters, insurers, mortgage lenders, arboriculturists and local authority tree officers. It includes a whole chapter on trees and tree management. It remains the most authoritative national guidance on the investigation and management of subsidence claims where trees are considered to be involved.

- **Foundation for the Built Environment. Subsidence Damage to Domestic Buildings-Report 1; lessons learned and questions remaining Sept 2000.**

This report gives an overview on the investigation of subsidence claims and particularly highlights the inconsistency of insurers spending hundreds of millions of pounds on building repairs and yet under funding initial investigations to determine the actual cause of damage.

- **Building Research Establishment**

The BRE have a list of research publications specifically detailing the investigation of foundation movement and soil's properties and dynamics.

These include:

BRE Digest 240 Part 1 Low rise buildings on shrinkable clay soils.  
BRE Digest 241 Part 2 Low rise buildings on shrinkable clay soils.  
BRE Digest 251 Assessment of damage in low rise buildings  
BRE Digest 298 Low rise building foundations: Influence of trees in clay soils.  
BRE Digest 352 Underpinning.  
BRE Digest 361 Why do buildings crack?  
BRE 383 Site investigation for low rise buildings: soil description.  
BRE 386 Monitoring, building and ground movement by precise levelling.  
BRE 412 Desiccation in clay soils.  
BRE Good Repair Guide 2 Damage in buildings caused by trees.  
BRE Good Repair Guide 1 Cracks caused by foundation movement.  
BRE Good Building Guide 53 Foundations for low rise buildings.  
BRE Information Paper 4193 A method for determining the state of desiccation in clay soils.  
BRE Information Paper 7/06: pruning trees to reduce water use. Summaries of Research, conclusions and recommendations.



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- **Roberts, J., Jackson, N. & Smith, M. 2006. *Tree Roots in the Built Environment*. Department for Communities and Local Government. Research for Amenity Trees No 8. TSO, London. ISBN13 978 0 11 753620 3 / ISBN10 0117536202**

A comprehensive review of current research and knowledge detailing how tree roots interact with buildings and structures. It provides a basic overview of soil science and the biology of root growth. It highlights the susceptibility of tree roots to damage from localised adverse environmental changes. It also looks at methods of protecting tree roots from damage and assesses the effects they may have on man made structures and vice versa. An essential manual for all arboriculturists whether dealing with tree root claims or not.

- **Horticulture LINK Project 212 2006 – Controlling Water use of Trees to Alleviate Subsidence Risk.**

This 5 year research project was jointly sponsored by a consortium of industry and the Office of the Deputy Prime Minister. Its purpose was to establish a greater understanding of how tree pruning affects the water content of surrounding soil and if lessons could be learned about appropriate methods of management in response to an increasing number of tree related insurance claims (see appendix C for further details).

- **The Joint Mitigation Protocol.**

The Joint Mitigation Protocol has been produced by a group of partners (The Subsidence Forum, the LTOA, Forestry Commission and Greater London Authority etc.) who have been working with local authority risk managers, tree officers and representatives of the insurance and loss adjusting industries to produce a protocol for consistent management of subsidence claims suspected of involving trees. The aim has been to standardise investigative reports, response times, processes and overall timescales so that each new insurance claim has a defined and limited shelf life. This protocol was published on the 16<sup>th</sup> of May 2008 and will benefit local authority managers, insurance companies, loss adjusters and home owners when it is adopted.

- **P.G Biddle, *Tree Root Damage to Buildings Volumes 1 & 2*. 1998. ISBN 0 9533086 0X**

Dr Biddle published his two volumes on the identification, investigation, and remedy of tree related subsidence in 1998 and they have contributed greatly to the long term goal of providing more and better information on the subject.



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- **Chris Britt and Mark Johnston, *Trees in Towns II 2008*. ISBN 978 185 112 8891. Department for Communities and Local Government. Research for Amenity Trees No 9. TSO, London.**

The long awaited follow up to the first Trees in Towns document, it provides an important and authoritative insight into the planning, management and future of trees in urban areas in the UK.

- **Charles Mynors, *The Law of Trees, Forests and Hedgerows*. 2002. ISBN 0421590408**

A comprehensive and detailed guide to the general law relating to trees, forests and hedgerows. It covers ownership, disputes, highway trees, trees covered by Conservation Areas and Preservation Orders. It details numerous legal cases and examples of trees implicated in building damage and disputes between tree owners, local authorities and insurers.

- **The National Urban Forestry Unit, *Trees Matter! 2005*.**

A synopsis of all the benefits that trees and woodlands bring to people living in urban areas and how trees ameliorate in a tangible way the harsh side to urban living. It references core research material to demonstrate the importance of trees to the environment, health, wealth and wellbeing of city dwellers.

(Additional information is detailed in the references in Appendix C)

Despite these recent works and a number of high profile court cases there is still a lack of commonality on how the principal interested parties (local authorities, private tree owners and building insurers) interact and reach an agreed resolution on the progression of these claims.

The LTOA therefore believes the time has come for a 3<sup>rd</sup> Edition of its Risk Limitation Strategy that reflects the latest information available on this subject and also covers the issues that have arisen as a result of the changes within the sectors briefly mentioned above. This edition is informed by the experience of local authorities already following the principles detailed in this Strategy.

The assertion of this document is that the issue of building movement due to the shrinkage of clay soils caused by lack of rainfall is one that continues to



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incorrectly implicate trees as being the material cause in a great many of these claims. The process by which many claims have been dealt with in the past, claims sometimes presented with only cursory and questionable evidence, has resulted in trees being blamed for movement that should have more properly been attributed to other factors.

The LTOA further asserts that the issue is also one of dedicating sufficient resources to maintain and manage London's trees so that they may continue to be an essential part of Londoner's lives in the future.

The principal aim of this strategy is to reduce the number and cost of tree root claims to local authorities within London. The benefits of these cost reductions will be enjoyed by both local authorities and insurers alike, but crucially not at the expense of losing from London's skyline one of its most recognisable assets, its trees.

There will of course be other broad ranging and cross-cutting benefits that flow from adoption of this Strategy. The LTOA believes that local authorities will, by adopting the recommendations listed here, be contributing in an important way to achieving their objectives in the government's Cleaner, Safer, Greener Communities initiative for the country's urban areas and assisting in meeting many of the environmental requirements of Local Area Agreements. By securing the position of the tree in the urban environment despite the pressures from insurers to remove them, local authorities can demonstrate achievement of performance indicators in a measurable and sustained manner.

In placing considered and objective tree retention or replacement at the heart of its policies a local authority can effectively achieve a number of the department of Communities and Local Government's performance indicators and at the same time be acting in a truly sustainable way.

The previous two editions of the Risk Limitation Strategy were intended to apply only to the management of local authority street trees. However, in the interests of consistency and because the LTOA believe the same principles of evidence should apply to all trees whether they are on a street, in a school, in a park, woodland or private garden this 3<sup>rd</sup> Edition applies to all trees wherever they are located. Privately owned trees covered by Conservation Areas or by Tree Preservation Orders are subject to a different legislative framework than those owned by local authorities (See appendix A) and this is acknowledged in the advice offered below. The LTOA believes



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nonetheless that the core scientific and evidential requirements of proof are the same regardless of the tree's ownership status and the advice given in this document reflects this view.

The document provides two major approaches for dealing with alleged subsidence and trees.

- **Initially it outlines an approach to tree management to minimize the risk of a tree causing building subsidence in the first place.**
- **Subsequently, it gives guidance to the local authority on how to proceed once a claim has been received.**

In this way the local authority can take steps to ensure it is minimizing its risk to exposure from future claims that might otherwise have arisen. When new claims are made the local authority is in a better position to investigate and challenge these on the basis of having taken prudent, timely action or when the supporting evidence is incomplete, inconclusive or inaccurate.

The Risk Limitation's Strategy's previous effectiveness in assisting local authorities in dealing with claims has been proven by its wide dissemination and acceptance as authoritative advice. It is hoped that this 3<sup>rd</sup> Edition will in the future continue to be a key reference document for local authorities in how they manage their tree stock.

This should especially be the case if the document is specifically referenced in borough's Local Development Frameworks, Tree Strategies, Supplementary Planning Documents and Tree Preservation Order appeal statements. Referencing the Risk Limitation Strategy in this way will add weight to the local authority's arguments in any subsequent defence of claims.

## 3. The Wider Context

Building movement due to the shrinkage of clay soils is not a new phenomenon. London in particular has always had a problem with the movement of its building stock. It has been a continuing problem since the construction of the first brick buildings that characterised the wholesale expansion of London as a capital city during the Victorian and Edwardian eras.



Prior to the early 1970's subsidence was not even an insured risk on many policies and the presence of minor cracking in a property in the London area did not usually affect the value of the property or the ability of the owner to sell it. When minor movement did occur it was usually dealt with by the owner as a cosmetic problem that required re-plastering and redecoration. As there was no public expectation of the need for a claim e.g. to protect



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their financial investment, very few claims for these minor works were made, those situations that did require more extensive works were dealt with but they represented only a very few cases as a proportion of the entire building stock in the London area.

The main driver to changing this “level playing field” situation was mortgage lenders requiring that subsidence become an insured risk on the policies of a burgeoning class of new home owners in the early 1970’s. Subsequently, during the drought of 1976 a large number of claims were made and insurers found themselves dealing with increased numbers of claims that were essentially without precedent and related to mainly minor cosmetic defects that did not affect the structural integrity of the building.

Many of these claims were made on properties that were recently built using modern but brittle building materials that did not have the same level of flexibility associated with older buildings constructed using lime mortar. This has led to a dramatic increase in the numbers of insurance claims made that in more considered times would not have generated a claim and would not have disadvantaged the property owner.

These above changes in procedure and perception, together with a property boom in the South East has created an unrealistic, although perhaps understandable expectation on the part of the public that their property or a property that they might be interested in purchasing should be free from even minor defects. This expectation was produced not by them but by the approach of the mortgage lenders and insurers in terms of what level of damage triggered a claim or might prevent a mortgage being issued. It then became a fact promulgated by the insurance industry and their agents that the issue of building movement, tree related or otherwise became a serious inhibitor to completing purchases on many properties.

The principal factors which underlie the problems are as follows:

- a) High density housing built on what are now considered to be shallow foundations.
- b) Successive dry summers and winters (with below average rainfall).



- c) Trees growing in close proximity to buildings.
- d) Geometry of contemporary buildings with large openings and cross wall construction.
- e) Lack of a mortar plasticizer such as lime or a modern substitute in many 1930's and post war buildings.



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- f) The huge increase in the value of property in the London area following the property boom of the 1980's and in recent years.
- g) Inaccurate and alarmist media articles and industry papers on trees and subsidence.
- h) The public's unrealistic perception that all property in the London area should necessarily be in a pristine state, regardless of its age, the materials used in its construction or its maintenance history.
- i) Covering over of front gardens with impermeable surfaces.
- j) Incorrect diagnosis of building movement being attributed to trees when in fact it is caused by other factors.
- k) Legislation and decisions handed down by the Courts which are regularly subject to changes, re-interpretations and appeals. These judgements continue to alter the way subsidence claims are considered.

### **3.1 The Cost of Claims**

All the above factors have contributed in combination to increase the numbers of claims that insurers have had to deal with. The numbers of these claims being closely related to the level and extent of annual rainfall and summer temperatures. In the London area during the period 1986-1988 a total of 719 tree root claims were received, during 1990-1992 this figure increased to 2841 (Zurich Municipal)

More recent figures show the dramatic increase nationally in the problem.

- 1994- 27,660 claims at an overall cost of £125 million.
- 1997- 53,000 claims at an overall cost of £472 million.
- 2003- 54,100 claims at an overall cost of £390 million.

The above figures have been provided by the Association of British Insurers and demonstrate the cost to the insurance industry of claims in an event year



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### **3.2 Cost Benefit Analysis - Claims versus Remedial Action**

The majority of London boroughs have already instigated proactive cyclical pruning programmes. Those that have can demonstrate on average significant reductions in the numbers of claims received annually (18.5%) as well being able to retain more of their tree stock that had been identified as being connected with a claim.

A survey conducted by the LTOA in 2007 demonstrated that boroughs carrying out proactive cyclical pruning retain a significantly higher percentage of their trees that were requested for removal by insurance companies and their agents than those boroughs that did not undertake cyclical pruning.

The survey showed that the 27 London boroughs that have instigated proactive cyclical pruning received 7364 claims in the past 5 years (an average of 272 claims per borough) and have been able to argue against tree removal in a majority of these claims as a consequence of undertaking this pruning. The two remaining boroughs which manage their trees responsively received 666 claims (333 each) over the same period (four boroughs returned no figures for this survey).

Those boroughs which undertook cyclical pruning felled 840 trees involved in subsidence claims (average of 31 per borough). The two boroughs without a cyclical pruning programme felled 140 trees between them as a result of subsidence claims.

These figures demonstrate that those boroughs which did not undertake some form of cyclical pruning on their tree stock removed (as a result of subsidence claims) more than double the amount of trees per borough on average than those boroughs which did undertake cyclical pruning.

The survey also demonstrated that on average boroughs which undertake cyclical pruning can expect to reduce their annual cost on subsidence claims by almost 18.5%

By undertaking a cost benefit analysis based on those areas that require cyclical pruning as identified by the process in this Strategy, boroughs can expect to reduce the levels of annual claim costs they receive each year at the same time as retaining more of their tree stock.



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Trees in Towns II states that the average budget for local authority tree maintenance is £271,000 per annum. Setting this figure against an accumulating number of annual subsidence claims, claims which on average cost between £5k to £7k and sometimes considerably more it is clear that a borough which receives 54 claims per year could incur an accumulating liability of £378,000 each and every year.

A similar situation exists with the processing of tree preservation order applications that may ultimately result in a large compensation claim following the issuing of a refusal notice.

The LTOA therefore advocates boroughs undertake a cost benefit analysis to determine if spending a smaller proportion of their annually accumulating liability on cyclical pruning and resourcing the challenging of unwarranted claims reduces the overall cost of claims, on both council owned and private trees by reducing the numbers and costs of claims received overall.

### **3.3 Alternative Causal Factors**

Tree Officers frequently receive requests that action be taken against a particular tree, or trees, either because they may possibly at some future date cause problems with a building, or because they are already suspected of having caused a problem with the foundations of a nearby property. Unfortunately due to inaccurate and frequently misleading press reports linking trees with damage to buildings it has, in the public's mind, become axiomatic that trees are always the cause of building movement even before adequate site investigations have been conducted.

This approach runs contrary to the currently accepted national guidance on the subject provided in the Institution of Structural Engineer's (ISE) document "Subsidence of Low Rise Buildings" 2000 which stipulates other factors should be eliminated before assuming the tree is the cause of the movement<sup>1</sup>. This Risk Limitation Strategy concurs with this approach as laid out in the ISE's report and would recommend that anyone responsible for assessing claims retain a copy as a valuable reference document. Particular reference should be made to the flow chart for processing investigative evidence on page 10 of the document.

Tree Officers accept that trees are on many occasions a contributory factor in subsidence and related structural damage. However, it is also true that on



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many occasions they are not the causative agent in the movement, although frequently cited as the prime cause. This may be despite the presence of substantive evidence that points to other more immediate factors causing movement. Proper investigation and cross correlation of appropriate investigative results frequently identify other factors as being the primary cause of the movement.

These other factors could for example be:

- Natural seasonal soil moisture changes, irrespective of the presence of trees.
- Localised geological variations, in particular buildings founded on made ground or soils with a high sand or silt content that would interfere with the accuracy of any test results.
- Vibration caused by the passage of nearby road vehicles and over/underground trains.
- Insufficient foundation design for structures that are ancillary to the main super structure of the property, resulting in differential movement between the two e.g. garages, conservatories, late addition extensions, porch, steps and bay structures.
- Lack of flank wall restraint.
- Overloading of internal walls.
- Internal alterations reducing the load bearing capacity of the original building.
- Installation of replacement windows without proper support.
- Loft conversions.
- Settlement and land slip.
- Drainage defects in presence of soil types predisposed to the washing out of fines and the lowering of the load bearing capacity of the soil.
- Lack of proper building maintenance e.g. above ground soil stacks and rainwater goods etc.
- Construction of impermeable hard standing in gardens preventing soil re-hydration during the winter.

### **3.4 Climate Change**

It is interesting to note that when the LTOA first published its Risk Limitation Strategy, Climate Change or Global Warming as it was then more usually referred to, was considered to be an unproven hypothesis that was on the fringes of mainstream scientific thought.



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Much has been done in the last decade to persuade Governments all over the world that climate change is a fact and that its impact is going to be severe even if fossil fuel emissions are reduced in the next 50 years<sup>2</sup>. With respect to the situation in London and how the proposed impact of climate change will affect London's trees it is clear that the perception of the impact of climate change is already having an increasing effect on London's traditional landscape.



The increase in the numbers of insurance claims, followed as they inevitably are with requests from building insurers to remove all the trees in the vicinity of the damaged building, can only put increased pressure on a natural resource that already suffers greatly from all the other infrastructure issues that come with having trees in urban areas.

The LTOA's strongly held position is that in urban areas in a number of ways (see below) trees greatly ameliorate the effects of climate change and that



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we must resist precipitate removal of trees just because this seems the least expensive and quickest option at the time for the insurer to settle or deal with a claim.

The issue is far more complex than this and requires the consideration of appropriate evidence, properly collected and presented. Not to follow correct and well thought out procedures that treat each case on its own merits invites an ever increasing cascade of tree removals as climate change begins to bite. Taking a logical position on the basis of current assessments by the insurance industry itself, a significant number of London's trees could eventually be removed to satisfy an unrealistic attempt to prevent all soil drying as a result of climate change.

The LTOA's position is that climate change is already happening, buildings will continue to move irrespective of the presence of trees and that a London without its tree cover would not be a city worth either living or working in.

The LTOA reaffirms its belief that trees contribute hugely to making London a world class city and they greatly ameliorate the effects of increased temperatures in urban areas through a number of mechanisms innate to tree cover generally.

## 4. The Value of Urban Trees

Trees in cities provide a range of tangible and also more esoteric benefits that can sometimes be difficult to quantify but are nonetheless real. They have considerable beneficial impacts on the lives of those who live in cities but do not have immediate access to other more traditional types of open space.



### 4.1 Environmental Benefits

- Absorbing Carbon dioxide (the main green house gas).<sup>3</sup>
- Filtering, absorbing and reducing pollutants (Ozone, sulphur dioxide, carbon monoxide, nitrogen dioxide, dust, particulates and noise).<sup>4, 5 & 6.</sup>
- Producing Oxygen.

- Reducing localised extremes in temperatures, cooling in the summer and warming in the winter (Countering urban heat islands effects).<sup>7</sup>
- Reducing the effects of flash floods.<sup>8</sup>
- Acting as carbon sinks (although in terms of trees in towns this role is limited and is more symbolic than actual).<sup>9</sup>

## 4.2 Social Benefits

- Providing amenity, aesthetic value and historical continuity.<sup>10</sup>
- Providing habitats for a broad range of wildlife.<sup>11, 12, 13, 14, 15, 16 & 17.</sup>
- Marking the changing seasons with leaf changes and floral displays
- Symbolizing community focal points.



## 4.3 Economic Benefits

- Increasing property values (the presence of trees can increase the value of residential and commercial property by 5%<sup>18, 19</sup>-15%.<sup>20 & 21</sup>).
- The value of undeveloped land which can provide mature trees can be increased by 27%.
- Providing a sustainable source of graded timber, mulch and charcoal.
- Providing a sustainable source of woodchip biofuel.
- Providing a sustainable source of compost (leaf litter).
- Providing employment through all aspects of the industry.
- Trees in Towns II states that in excess of £100 million pounds will be spent annually on tree maintenance on Council owned trees in the UK (this amounts to £1bn spent over a ten year period).
- When planted strategically they can reduce fossil fuel emissions by reducing fuel costs for heating and cooling buildings.



## 4.4 Health and Well Being

- Reducing skin cancers by providing shade from harmful ultra-violet radiation.
- Reducing stress and illness by providing psychological refreshment and a sense of well being through softening the built environment, creating character and a sense of place and permanence.<sup>22, 23, 24, 25, 26, 27, & 28</sup>
- Releasing scents and aromas that elicit a positive emotional response contributing to health and well being.<sup>29.</sup>



In recent years it has become increasingly accepted that the presence of trees as individuals and in groups contribute directly to the health and well being of the people who live and work around them. Trees and woodlands have been identified as key elements of schemes that stimulate urban regeneration and improvements in public health. Defra's England's Trees,



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Woods and Forests Strategy, The Forestry Commission's Naturally Active campaign and The London Trees and Woodlands Framework promote trees and woodlands in terms of access, recreation and urban regeneration. Trees provide the frame on which disadvantaged urban fringe communities can be rebuilt into vibrant, healthy and active societies. The Royal Horticultural Society's campaign for reducing skin cancers by planting appropriate species and encouraging people to avoid long exposure to the sun's harmful rays highlights the need for shade plants and trees in people's everyday lives.

Other schemes have particular resonance for London- Green Arc, Greening the Gateway, Lea Valley Regional Park Development Plan and more recently the creation of the largest new park in Europe for the 2012 Games site in East London. In all of these schemes trees will make an important contribution to dealing with and mitigating the problems of social exclusion and climate change by creating communities in which young urban children and youth can rediscover a sense of themselves and their place in the world.

Many nationally and regionally produced reports highlight the importance of trees:

- Trees in Towns, DoE 1993.
- Action for London's Trees, Task Force Trees, Countryside Commission 1993.
- Trees Matter! NUFU 2005.
- The London Tree Survey 1993: Cobham Research Consultants, published by Countryside Commission.
- Does Money Grow on Trees? 2005, Cabespace.
- The London Trees and Woodlands Framework 2005, Forestry Commission & Greater London Authority.
- Trees in Towns II 2008, Department of Communities and Local Government. Research for Amenity Trees No 9.TSO, London.

All these reports emphasise that trees are an extremely important part of the urban landscape, indeed in many places on the streets and roads of London they are the only ameliorating element possible in an otherwise harsh urban landscape.

The National Urban Forestry Unit's report Trees Matter! 2005, particularly reinforces the importance of trees in urban and urban fringe areas.



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All these guidance documents and reports exemplify and reiterate the essential principle that to undertake their roles effectively, local authority tree officers require a highly developed sense of social responsibility. This responsibility comes with being the custodians of a finite natural resource which is regrettably under continuous detrimental pressure from a variety of different areas.

Pressure to remove trees that are identified by insurers and their agents to be implicated in building movement is only one of these pressures. It is clear that insurance companies have to date been less inclined to demonstrate collective social responsibility in acknowledging this finite resource, and have instead adopted a strict and inflexible financial position that relies on following the cheapest possible course of action regardless of the environmental consequences.

In today's world this approach has been shown to be unsustainable, socially irresponsible and ultimately results in the impoverishment of the urban environment for all concerned.

The LTOA believes that the benefits associated with having trees in London far outweigh any problems that may be caused by their presence. Trees are an extremely important environmental, social and economic asset both collectively as London's urban forest and also as a resource to individual boroughs. The many benefits detailed above could be lost to the people of London if the gradual, relentless and in many cases unnecessary removal of trees continues.

### **4.5 Placing a Value on London's Trees**

At present trees only show on the Boroughs' balance sheets, if at all, as a drain on their financial resources. There is no way either to account for their contribution to the public good, or to measure how the value of the tree stock may change as a result of management. To remedy this a system has been adopted by the LTOA to place an asset value on the public tree stock. It is called Capital Asset Value for Amenity Trees (CAVAT).

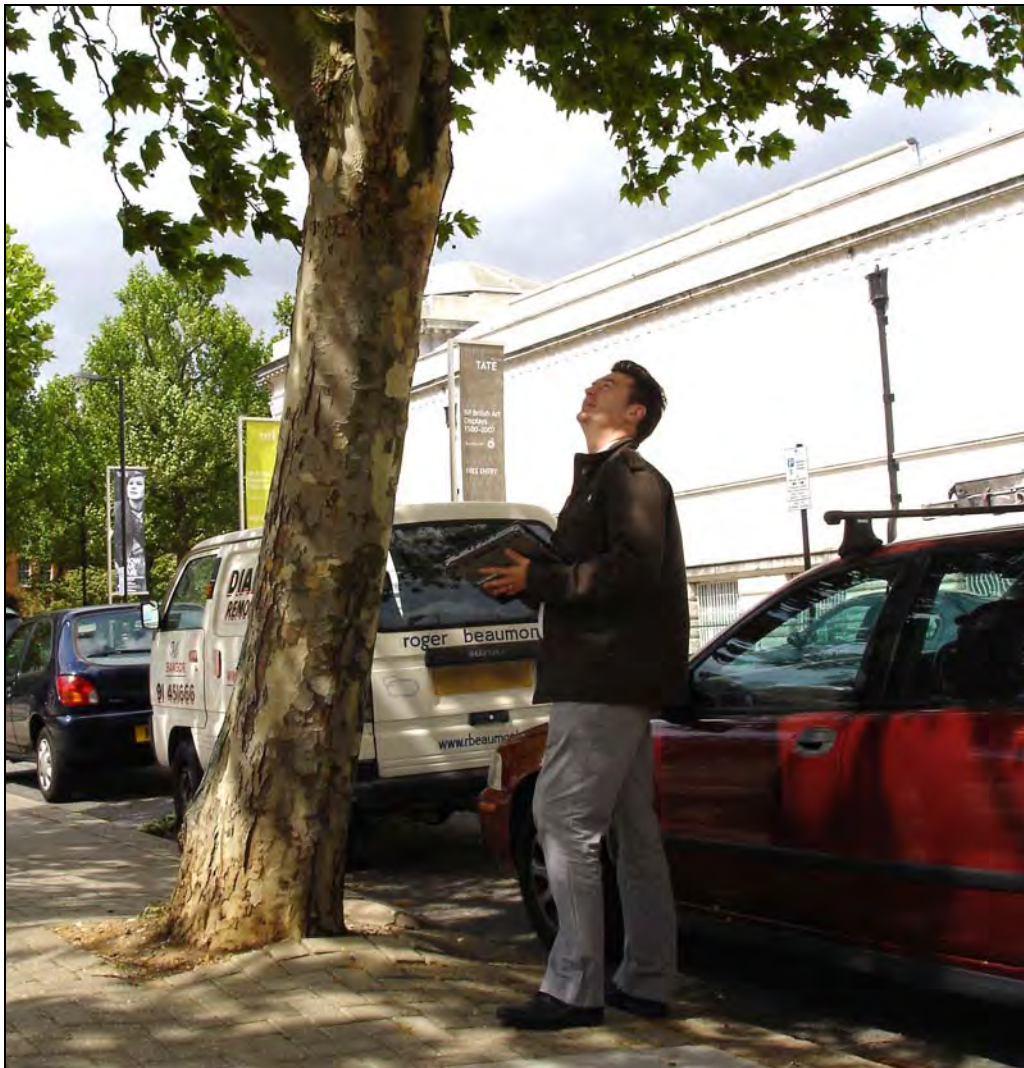
There are two variants of the method, one designed to allow the stock as a whole to be managed in relation to its value, and the second intended for cases relating to individual trees, or groups, where a more detailed consideration is necessary.



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The basis of both methods is the American 'trunk formula' method. The value calculated is in effect a notional replacement value. In CAVAT this has been revised to reflect the public value of the tree. A basic value calculated from the trunk diameter is modified by its functionality, in broad terms defined as how complete the crown is relative to what would be expected for a tree with the same trunk diameter, and in what functional condition it is found to be. A range of other factors, reflecting the Helliwell system and recent research are also taken into account in the case of individual trees.



The system was proposed by Chris Neilan of Epping Forest District Council, an LTOA member. It has been developed and tested by a user group formed from LTOA members working with him and found to be robust and reliable. As a result of the testing the methods have evolved in particular to include



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consideration of life expectancy. London has also been divided into three zones reflecting the different relative cost of planting trees, which carries through to their calculated value. It is considered that this is also a reflection of different land values. The LTOA considers the social value of trees very important and has therefore included in the CAVAT system a factor relating to population density called the Community Tree index (CTI).

The Community Tree Index has been included in the CAVAT calculations on the basis that the more people who see and experience a tree the more valuable it is to the community in which it stands. Recently the concept of valuation of ecosystem services and tree valuation in particular has been gaining ground among tree management professionals. The CTI is a pragmatic method of introducing the social importance of trees into the calculations.

The CAVAT variant used for individual cases, including those relating to subsidence, is the 'Full' method. This has four stages. In the first a basic value for the tree is calculated from its trunk diameter. This is then converted to a functional value by consideration of the crown area. Special factors which may increase or decrease the value of the tree are then taken into account to produce an adjusted functional value. The final value is then calculated by adding consideration of life expectancy, using the Safe Life Expectancy (SLE) method.

The method has a particular use in relation to root related subsidence claims because it allows a robust ranking of tree value to be established and hence lower value trees can be objectively separated from medium or high value trees. While the method does rely on judgement and as a result there is a capacity for disagreement, the method is designed specifically to minimise the effect of such potential disagreements by ensuring that the judgements that have to be made are ones on which a majority of arboriculturists with suitable training are likely to agree.

There is a need for familiarisation training in order to use the method. However, this is not unduly onerous and it is anticipated that it will be made readily available through the LTOA or other tree officer groups. Once tree officers are confident in the use of CAVAT it will allow the borough to specify the levels of evidence required dependent on the value of the implicated tree (Joint Mitigation Protocol 2008. See Appendix B for full description of CAVAT.



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### **5. The Strategy**

The LTOA recommend that local authorities adopt the following Strategy and incorporate this into their own Borough Tree Strategies. These action points becoming an integral part of a section within their own strategies dedicated specifically to the issue of trees and building movement.

#### **The LTOA Risk Limitation Strategy recommends that:**

##### **Publicly Owned Trees;**

- **Local authorities instigate a regime of cyclical pruning of council tree stock in areas predisposed to building movement where this is appropriate.**
- **Local authorities provide dedicated resources for dealing with subsidence generated claims directed at council owned trees.**
- **Local authorities instigate a regime of selective removal and replacement of street tree stock in areas predisposed to building movement where this is appropriate.**

##### **Privately owned Trees;**

- **Local authorities provide dedicated resources for dealing with subsidence generated Conservation Area notifications and Tree Preservation Order applications.**
- **Local authorities review all existing unsettled claims providing dedicated resources to challenge those unwarranted claims based on poorly investigated and inaccurate evidence or where in the case of preserved trees The Town & Country Planning (Trees) Regulations 1999 can provide relief from the claim.**

##### **All Trees;**

- **Local authorities challenge unwarranted claims based on poorly investigated or inaccurate evidence.**



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*"Crown reduction to normal BSI only had a small effect on reducing soil drying by tree roots which did not persist beyond one growing season. Severe pruning (>50% crown volume) significantly reduced soil drying and persisted longer. Thus, crown reductions should be repeated on a regular managed cycle with an interval based on monitoring tree growth."*

**Dr Neil A Hipps  
East Malling Research 2007**

*"The LTOA is absolutely right to demand better test evidence to protect London's trees. I also believe the notion of placing a financial value on trees is the way forward and I would urge the arboricultural profession to develop an accepted 'pricing mechanism' for urban trees."*

**Richard Driscoll 2007**

### **5.1 The Strategy for Reducing New Claims**

Local Authority Owned Trees - Recommended Actions:

**Local authorities instigate a regime of cyclical pruning of council tree stock in areas predisposed to building movement where this is appropriate.**





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Reduce new claims by:

- Identification of those areas predisposed to movement due to the presence of shrinkable clay soils.
- Identifying areas that have anomalous geological features, composite soils, low shrinkability soils, soils with a high sand and gravel content and made up ground overlaying clay soils.
- Identifying high risk trees in the areas of high risk clay soils and if required incorporate them into an appropriate tree pruning programme.
- Taking a considered approach when planting new trees, take account of species, site location, soil type and proximity to nearby buildings. Adopt a "Right Place Right Tree" approach (London Trees & Woodlands Framework 2005) subject to likely management techniques and pruning programmes.
- Introducing regular management programmes that demonstrate an active approach on the part of the borough in those areas considered to be "high risk".
- Taking prompt action when notified of a potential claim.
- Adopting a recognised formal method (CAVAT) for placing a value on their tree stock.
- Adopting the Joint Mitigation Protocol as the process by which claims are handled and endeavour to deal with the claims within the appropriate time period.
- In dealing with alleged tree related subsidence claims, if the evidence presented is inconclusive or lacking particular relevant tests or reports ask for (immediately request upon receipt of the claim) further specific test results that would assist in determining the actual cause of movement (see Levels of Evidence below).
- In dealing with these claims, assessing whether or not the insurer has followed the Joint Mitigation Protocol, if not, adopting a robust approach when repudiating unwarranted claims by basing the arguments on the evidence (or lack of it) presented.
- Scrutinising evidence presented with all claims for adequate and appropriate levels of evidence.

This LTOA Risk Limitation Strategy offers a 'best practice' tree management solution for reducing the likely instance of new claims. In those local authorities where the conditions are identified as there being a risk of building movement, the LTOA advocate that local authorities formally adopt



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an overall Tree Strategy or framework which includes within it a section dealing specifically with subsidence claims, it being essential that this section also includes in it the requirement for appropriate and timely investigative data.

Recent research (Horticulture Link Project 212 see appendix C) has indicated the potential value of severe pruning as a sustainable approach to dealing with the issue of subsidence. It also showed that this work must be done on a frequent basis. However, the interactions between trees, soils and buildings are so variable that meaningful predictions cannot be made about the actual risk of future damage in individual cases (ISE Subsidence of Low Rise Buildings, Chapter 8<sup>1</sup>).

The combination of following a risk limitation strategy and an informed, collaborative and reasonable approach by all parties concerned is vital to managing London's tree population in a future of predicted climate change and likelihood of increased litigation.

The LTOA recommend that on street trees in areas that have been identified as high risk the local authority instigate a regime of cyclical pruning. The frequency and method of this pruning being dependant on the size, species and location of the tree. Implicated trees and those that are likely to become involved in subsidence claims are systematically pruned to both reduce and stabilize their water uptake.

### **These Actions:**

- Should mitigate the overall cost of existing claims.
- Should assist in reducing the number of new claims. In addition as groups/areas of trees are pruned there may be scope for financial reductions (i.e. not undertaking 'one-off' pruning of trees under a fire brigade management regime).
- Allows Loss Adjusters to contest claims based on the premise of reasonable care. This may reduce the cost of potential claims.

The additional perceived problems which may be associated with these trees, e.g. blocking of light, dropping leaves, obstructing telephone wires, etc. would be addressed under this pruning regime. It follows that the number of public complaints concerning these trees could be reduced as the public fear and prejudice against trees in respect to subsidence damage would be effectively addressed.



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However, this type of cyclical pruning may lead to complaints over level of works and place increased demand on existing budgets. This option also highlights the need for a detailed survey (and re-survey) and a long-term commitment of resources.

Privately Owned Trees covered by Conservation Areas or the subject of Tree Preservation Orders -Recommended Action:

**Local authorities provide dedicated resources for dealing with subsidence generated Conservation Area notifications and Tree Preservation Order applications.**

Reduce new claims by:

- Identification of those areas predisposed to movement due to the presence of shrinkable clay soils.
- Identifying areas that have anomalous geological features, composite soils, low shrinkability soils, soils with a high sand and gravel content and made up ground overlaying clay soils.
- Identifying high risk trees in the areas of high risk clay soils
- Seeking to advise the owners of such trees that they should undertake an appropriate and regular pruning programme on the trees under their control.
- In considering notifications and applications for work on protected trees always consider permitting appropriate works.
- In dealing with subsidence related Conservation Area notifications, document any lack of evidence and notify the owner/agent of the shortfall.
- In making a new Tree Preservation Order generated from subsidence related CA notifications ask to see the investigative reports that show the tree is the cause of the damage.
- In dealing with subsidence related TPO applications, if the evidence presented is inconclusive or lacking particular relevant tests or reports ask for (immediately upon receipt of the application) further specific test results that would assist in determining the actual cause of movement (see Levels of Evidence below).
- For all pre 2nd August 1999 application orders, if the applicant fails to provide the relevant requested tests consider informing the applicant that the local authority is unable to determine the application.



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- For all post 2nd August 1999 application orders, if the applicant fails to provide the relevant requested tests consider issuing a Refusal Notice and notify the applicant that the lack of these tests form one of the reasons for this refusal.
- Taking a considered approach when recommending replacement trees to private owners trees, take account of species, site location, soil type and proximity to nearby buildings. Adopt a "Right Place Right Tree" (LTWF- 2005) approach subject to likely management techniques and pruning programmes.
- In a co-ordinated and coherent way review and remake all current pre 2nd August 1999 Tree Preservation Orders so that the borough benefits from the new regulations pertaining to compensation entitlement (See appendix A).
- Processing all tree applications in such away as to minimize the local authorities' exposure to tree related compensation claims.
- Scrutinising evidence presented with applications for adequate and appropriate levels of evidence.
- In granting planning permissions for buildings on clay soils always requiring via planning condition, foundations that are adequate to accommodate existing trees and the scale of trees that are conditioned as part of any landscaping scheme.

The legislative framework for dealing with claims that arise from trees covered by Tree Preservation Orders is different from that which arises from other civil actions. There can be no new claims against the local authority until the correct procedure has been followed by the applicant in cases of trees covered by TPO.

Local authorities are automatically deemed to be liable for any additional foreseeable costs that arise from the issuing of a Refusal notice when dealing with Tree Preservation Order applications (T&C Planning Act 1990). NB. The entitlement to compensation was altered when new regulations were introduced on 2<sup>nd</sup> August 1999 and local authorities can under certain circumstances benefit from these new regulations when protecting themselves from unwarranted claims (See appendix A).

If local authorities are to continue to protect important trees in London this brings with it the very real associated risk of having large compensation claims made against them when exercising their duty to protect and preserve important trees.



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It has become apparent that the Tree Preservation Order legislation compensation regulations have been seen as a legitimate mechanism for recouping the costs of building repairs where trees are identified as being involved with the building movement.

The Tree Preservation Order legislation compensation regulations are extremely onerous on Local Authorities if they are required to determine applications for protected tree removal when the insurance and loss adjusting industries fail to provide adequate evidence of the tree's involvement in building movement.

It is therefore crucial local authorities follow a set procedure at each stage prior to and during the making a new Tree Preservation Order, dealing with any new tree applications in a structured way so as to limit the Council's exposure to poorly investigated and unwarranted claims.

### **Summary for reducing all new claims**

By following the above guidance the local authority will be placing itself in the best possible position to reduce the numbers of new claims it receives.

The principal mechanisms for this reduction will be:

- Providing regular more consistent management for its own trees.
- Making information available to private owners to maintain their trees effectively and avoid the type of neglect that can frequently trigger claims on trees covered by Tree Preservation Orders.
- In a co-ordinated way review and remake all current pre 2nd August 1999 Tree Preservation Orders so that the borough benefits from the new regulations pertaining to compensation entitlement (see appendix A).
- Reducing the numbers of unwarranted claims made by adopting a robust approach to evidential requirements and where appropriate challenging these claims.
- Ensuring that any replacement tree planting is appropriate and less likely to create an issue in the future.
- Ensuring, via planning conditions, new buildings and their foundations constructed on new development sites where protected trees exist or are newly planted do not constitute a latent liability in the future.

## 5.2 The Strategy for Reducing Existing Claims

Local Authority Owned Trees – Recommended Actions:

**Local authorities challenge unwarranted claims based on poorly investigated or inaccurate evidence.**

**Local authorities instigate a regime of selective removal and replacement of street tree stock in areas predisposed to building movement where this is appropriate.**



Reduce existing claims by:

- Allocating sufficient resources to review the evidence presented in existing claims.
- Where inadequacies or discrepancies occur in the reports these should be brought to the attention of the insurers and the claim challenged.



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- Adopting specific levels of evidence required for particular trees of value and applying these to existing claims where applicable.
- Where the evidence clearly indicates another cause for movement the claim should be repudiated and the insurer informed of the local authority's position.

Once a claim has been received the local authority must decide whether or not to accept the claim or to challenge it. This Risk Limitation Strategy recommends following a structured approach to the assessment of claims. This should result in the local authority being able to separate real claims where the tree is the proven cause of the problem from unwarranted claims where in essence the tree is conveniently blamed for a problem that has been created by a combination of more complex factors.

The normally recognised legal test in civil actions and level of proof for accepting a claim is that the tree is deemed to be "on the balance of probabilities" the causal factor in creating the movement. In seeking to reduce the numbers of existing claims it follows that the local authority should apply resources, including using their own structural engineers and district surveyors and their records for establishing exactly the mechanism at work and whether or not there are other factors that might be causing the movement.

It is the LTOA's position that the balance of probabilities argument has for far too long been used to identify trees as being the culprits largely because it has become established in most professionals' and members of the public's minds that trees are almost always the cause of the problem.

Recent publications and guidance notes have sought to clarify the mechanisms by which water is retained or transported through different soil types and highlight the difficulties in establishing levels of moisture content in urban soils at which a volumetric change in the soil occurs.<sup>30, 31, 32 & 33.</sup>

The culture of complacency that has characterised the investigation of tree root claims should be challenged and replaced with one of accurate and qualitative assessment of the relevant facts.

In reviewing its existing claims portfolio in a consistent and structured manner local authorities should achieve substantial reductions in their current levels of liability. In essence they would be identifying inadequacies in the investigations to challenge existing claims, thereby changing what



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were considered previously to be poor cases into ones that could be defended robustly in court if necessary.

Equally they will be more able to identify genuine claims quickly and be able to deal with them effectively prior to costly litigation.

In dealing with existing claims in this manner local authorities would not only reduce their existing claims but would also make it much less likely for new claims to be brought that had not been properly investigated and presented.

In addition to systematic pruning, those trees which for reasons of their size or species are inappropriate for their location may be selectively removed. These trees might be replaced by alternative species or replaced in an alternative position. Consideration should be given to the retention of trees with significant amenity and/or conservation value.

This system permits the planting of smaller ornamental species and also the larger forest type trees with their inherent high 'streetscape' value.

Ornamental species are valued for being aesthetically pleasing and for colour, flowers and form. There is a lower perceived risk of subsidence, a lower actual risk of tree root damage and they require less intensive management. A wide range of species are available from a global provenance suitable for the predicted impacts of climate change in London.

In the context of forest types, traditional "Victorian London" plantings consisting of Planes and Limes, are not only of prominent amenity value but also tolerate repeated and various heavy pruning and the increasingly harsh climatic conditions in the urban heat island. These qualities combine to make these trees eminently suitable for retention and planting in urban areas provided in risk areas they are regularly managed as laid out in this document.

The criteria for selective removal and replacement are:

- If the evidence presented demonstrates the tree is, on the balance of probability, the actual cause of the damage and regular pruning does not mitigate the trees effect
- That the tree should be in such poor condition that cyclical pruning would either kill it or lead to its having a NIL value (See CAVAT appendix B).



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- That the tree is one which requires an uneconomically high level of attention with regard to claims, complaints, structural faults, etc,
- That the BRE Category of damage is 3 or above *and* that the sum of the investigative evidence suggests that pruning will not control the situation even if repeated annually.
- Investigation of the specifics of the particular case shows that there would be benefit in starting again with a new specimen.

In the long-term, costs would be reduced as the replacements would not constitute a high subsidence risk to property.

### **These actions:**

- May result in public and political resistance to the removal of trees.
- May result in problems in establishing tree replacements, for example, loss through vandalism and drought. Ultimately, previously well stocked areas may be depleted of trees and a balance must be struck between managing a difficult to replace resource and the cost implications of retention.

### **Privately Owned Trees Covered by Tree Preservation Orders - Recommended Action:**

**Review all existing unsettled claims providing dedicated resources to challenge those claims based on poorly investigated and inaccurate evidence or where in the case of preserved trees The Town & Country Planning (Trees) Regulations 1999 can provide relief from the claim.**

For purposes of this document all trees covered by a Tree Preservation Order are necessarily deemed to be within the "High" category listed below in Section 6, Levels of Evidence.

### **Reduce existing claims by:**

- Allocating sufficient resources to review the evidence presented in existing claims.
- Where inadequacies or discrepancies occur in the reports these should be brought to the attention of the insurers and the claim challenged.



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- Adopting specific levels of evidence required for particular trees of amenity value and applying these to existing claims where applicable.
- In post 2<sup>nd</sup> August 1999 TPO claims ensuring the local authority makes the best use of and benefits from the new regulations in respect of compensation entitlement (see appendix A).
- Where the evidence clearly indicates another cause for movement the claim should be repudiated and the insurer informed of the local authority's position.

### **These actions:**

- **May result in new evidence being presented which proves the case for removing a preserved tree.**
- **May result in public and political resistance to the removal of preserved trees.**
- **May result in a reduction in the cost of any potential claim for compensation.**
- **May result in legal challenges.**

For an existing compensation claim to have been registered against the local authority it must have already issued a Refusal Notice or be the subject of a "deemed refusal" following an appeal on a Tree Preservation Order application.

The same principles apply to reducing the numbers of existing claims in this area as for local authority owned trees. That is to systematically critique the evidence presented thereby accurately indicating the mechanism responsible for movement in the building. This permits the construction of a robust defence that may exonerate the tree where appropriate.

It is essential that in assessing the evidence presented the local authority make co-operative use of all the expertise and knowledge base available to it within its own building control, structural engineering and tree sections. By bringing all this expertise to bear on assessing the evidence presented unwarranted claims are more easily dismissed and claims that do have merit may be mitigated proportionately.

There will be a different approach depending on when the TPO was made and what compensation entitlements apply. These differences in approach between pre and post 2nd August 1999 Tree Preservation Orders should be considered carefully before taking action. (See appendix A).



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### **Summary for reducing existing claims**

By following the above guidance the local authority will be placing itself in the best possible position to reduce the numbers and cost of existing claims.

The principal mechanisms for this reduction will be:

- Providing regular and more consistent management of its own trees
- Indicating to the tree owner the benefits of regular planned management of trees in high risk urban areas in accordance with the principles of this Strategy.
- Identifying appropriate levels of evidence that can be applied in each case.
- Setting in place the necessary resources for scrutinising the evidence presented for each claim.
- Adopting a strategy of selective removal and replacement where appropriate.
- Identifying positive interpretations of the Tree Preservation Order compensation regulations to reinforce the council's legal position.
- Co-operative advice sought from local authority building control, structural engineering and tree sections.



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### **6. Levels of Evidence**

One of the most contentious issues in the submission and processing of tree related subsidence cases is the level of evidence that is required for a conclusion to be reached on whether or not a tree is the causal factor in an incident of building movement.

It is important to note that legally the onus is always on the complainant to prove the tree is the cause of the damage to a building. Local authorities should not be tempted to commission their own set of tests when challenging a claim as this would result in an increase in the direct cost of the claim to the local authority and result in a clash of experts without reaching clarity. It is enough that they draw on published national guidance standards in considering whether or not reliable and appropriate tests have been carried out and whether such tests can be relied upon to give a reasonable and accurate picture of what is occurring beneath the building's foundations.

The LTOA's position is that the quality and veracity of the investigative evidence is the primary question that must be addressed by any investigation that claims to make a link between the presence of a tree and the movement of a building on a shrinkable soil.

At present no one test can either prove or disprove that a tree is linked to the movement of a nearby building. The complex interactions that occur and the wide ranging variability of the soils on which buildings are constructed make it presently impossible to rely on a single test for an all-encompassing and accurate diagnosis to be made.

It has become generally accepted that a number of tests are required, the results of which can be assessed and cross-correlated, together with knowledge of the ground conditions and other influencing factors so that an opinion may be formed as to the mechanisms at work that have created the building movement.

It is frequently the case that tree officers receive considerable documentation in respect of tree related subsidence cases and that this documentation includes some test results that claim to show the tree is the cause of the problem, while excluding other available test results that would allow a more balanced picture to be considered. In many instances these



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other test results could exonerate a tree from being the material cause of the movement.

Increasingly, due to the Freedom of Information Act, tree officers are required to justify their decisions for tree removals in much more detail and to a greater level of accountability.

This essentially means that tree officers require appropriate evidence that corroborates the view that the tree is the material cause of the problem and that other factors have been eliminated as potential influences. In this they are following the guidance given in the ISE document Subsidence of Low Rise Buildings 2000 and the BRE Good Repair Guide 2 which recommend that other recognised causes of movement are eliminated before any assumptions are made about a tree's involvement and what course of action to take.

In terms of applications to fell trees covered by Tree Preservation Orders the department for Communities and Local Government (the Government Department responsible for tree preservation policy) has made clear that a local authority is entitled to request information needed to balance any loss of amenity caused by the proposed tree works against the need or justification for them. It is good practice for the authority to specify what additional information should be submitted, and any such request should be reasonable in the circumstances. In the event that an applicant does not supply the requested information but chooses instead to appeal for non-determination, it is open to the local authority to ask the Secretary of State to determine the validity of the original application before going on to consider the merits of the appeal.

### **6.1 The Relevant Tests**

There are a wide variety of geotechnical tests available that can be used for the assessment of soil composition and desiccation. The majority of the tests are listed in the standard work on the subject British Standard 1377 Methods for Test for Soils for Civil Engineering Purposes Part 2. For some time now questions have been raised about the adequacy and reliability of the information and test results that are usually presented with tree related insurance claims.<sup>32, 33.</sup>

Many of the tests currently undertaken and the results presented could not be said to be truly accurate (bearing in mind the extremely variable nature



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of the soils on which they are undertaken) and could be replaced with more reliable tests as detailed in BS 1377.

In dealing with sometimes extremely expensive compensation claims on local authority owned or privately owned preserved trees, the organisation or person being pursued for damages does have the right to expect that only accurate, attributable and accredited tests are used in seeking to apportion blame.

Similarly, a home owner who is advised that the removal of their tree is required has the right to expect that the tests undertaken, and which have a bearing on the value of their home and their ability to sell it, are accurate, attributable and reliable.

The following list of investigations contain those tests that are most often presented by the insurance industry and may be used in conjunction with each other in a variety of circumstances and soil types to indicate if a soil has become affected by the drying action of tree roots, or if some other cause has resulted in the movement of a building.

It should be borne in mind that the type and combination of tests required to indicate a tree's involvement in a subsidence event will depend on the property itself, detached, semi-detached or terraced. It will also depend on the nature and location of the damage within variable designs of property. Damage to a bay in an Edwardian terrace may not require as extensive investigation as damage to the corner of a Victorian villa.

The range of possible investigations includes the following:

- Trial pit showing the soil profile beneath the foundations with an augered bore hole depth 3m-5m.

This test gives a detailed profile of all the soil type horizons on which the building is founded. It is essential in being able to eliminate or highlight potential reasons for the movement. It should detail if the soil is clay, a composite soil, sand, silt or made up ground. This differentiation assists in being able to request further tests such as a drainage survey or shear strength tests or even eliminate the requirement for other tests such as soil suctions.

- Tree root identification of roots taken from beneath the foundations.



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The purpose of tree root identification is ostensibly to identify which tree is causing the movement by establishing which trees in the vicinity have roots beneath the existing foundations. Caution should be used in applying this test if there are multiple trees of the same species but in different properties near the seat of damage. DNA testing may be a limited solution to this problem in the future. A starch test is often used to see if the roots are alive. In some conditions starch may persist in roots for considerable lengths of time despite being unconnected to any living plant. The identification of a tree root is not proof that the tree has caused a problem, it is usually taken as evidence of trespass and therefore establishes a connection. An assessment of quantity of roots found can be helpful

- Passing Soil Sample through a 0.425mm sieve.

This test is often used to demonstrate that a large percentage of a soil sample is made up of very small particulates i.e. clay particles and so is used to reinforce the view that the soil is predominantly clay. However medium, fine and very fine sand and silt will also pass through a 0.425mm sieve (Craul 1999)<sup>31</sup>. In composite soils and made up ground this element can frequently alter the nature and properties of the soil from being predominantly clay to one that is predisposed to result in foundation movement under certain conditions. Care should be taken when relying on this test and if necessary a more accurate test should be undertaken. A soil's percentage content of different soil particle sizes and its constituents must be established to eliminate invalid assumptions about its properties under different conditions. (See T.R.I.B.E. & Craul)<sup>30,31</sup>.

Tables 1.0 and 2.0 below illustrate the variable interpretations available on classification of soil particle sizes.

Size Class.	UK System	US System	International System
Stones /Gravel	>2.0mm	>2.0mm	>2.0mm
Coarse sand	2.0-0.2mm	2.0-0.2mm	2.0-0.2mm
Fine sand	0.2-0.06mm	0.2-0.05mm	0.2-0.02mm
Silt	60-2µm	50-2µm	20-2µm
Clay	<2µm	<2µm	<2µm



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**Table 1.0.**

**Range of Soil Particle Size Classes (Source: Essential Soil Science M.R Ashman & G.Puri)**

Size Class.	Diameter Range.
Gravel	3 inches –2mm.
Very Coarse sand	2.0mm-1.0mm.
Coarse sand	1.0mm-0.5mm
Medium sand	0.5mm-0.25mm.
Fine sand	0.25mm-0.10mm.
Very fine sand	0.10mm-0.05mm.
Silt	0.05mm-0.002mm.
Clay	<0.002mm.

**Table 2.0.**

**Soil Particle Size Classes (Source: US Dept. of Agriculture in Craul<sup>31</sup> )**

- Liquid limit test

The liquid limit test as detailed in BS 1377 Soils Classification is used to establish the point at which a soil sample alters its state. Care should be taken when using this test as BS 1377 states that the four point cone penetrometer method (test 4.1) is more reliable than the one point cone penetrometer (test 4.4). It is very often the case that the less reliable method is used in soil investigations, where this occurs the results should be considered carefully in conjunction with other test results. (See 0.425mm sieve test above and those tests below)

- Plastic limit test

The Plastic Limit test is used to make an assessment of the point at which a soil sample ceases to be mouldable and becomes friable. This test is described by BS 1377 as being subjective. Care should be taken in using the results of this test when making an assessment as a number of external factors can affect the



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results- temperature, humidity, and operator expertise. (See 0.425mm sieve test above and those tests below).

- Soil plasticity test.

The soil plasticity test is used to make an estimation of the likely behaviour of a soil upon drying out. It gives a rough indication of the extent to which a soil will be subject to a volumetric change during desiccation. It is calculated using the results of the liquid limit and plastic limit test calculations. Care should be taken in using the results of less reliable and subjective tests to determine the plasticity index of a soil. (See 0.425mm sieve test above and those tests below).

- Modified plasticity index

The modified plasticity index is used to modify the results of the usual Plasticity Index test calculations on soils that have a large coarse grain fraction (sand, gravel etc). It does this by removing coarse grained particles from the sample prior to undertaking the plastic limit and liquid limit tests on the sample remaining. Care should be exercised in making use of the result of this test in the assessment of soil plasticity (See 0.425mm sieve test above and those tests below).

- Soil moisture contents test throughout the soil profile.

Soil moisture contents tests can be a valuable method of assessing the condition of the soil at varying depths. This information is then used with the results of other tests to make a more informed decision on whether or not the soil is desiccated.

Great caution should be exercised in interpreting soil moisture content results due to the inherent variability of moisture in soils and availability to plants. This variability is compounded by the huge diversity inherent in composite soils and urban Made Ground. (See T.R.I.B.E & Craul.).<sup>30,31.</sup>

- Assessment of Soil Water Potential throughout the soil profile (Soil suction tests).

Soil suction tests are often used to make an estimation of the extent of desiccation within a soil sample. Essentially they assess the potential pressure gradient within a soil sample; the more negative the soil water potential the more likely it is the soil is desiccated.

This test is useful in an appropriate soil sample and should only be used in soil that is designated a heavily consolidated clay. It is sometimes used in composite soils where the results are questionable. Attempting to identify desiccation using this test in composite free draining soils sampled during periods of high temperatures can give misleading results<sup>34</sup>.



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- Assessment of desiccation (Driscoll method, 0.4 x liquid limit).

The Driscoll method has traditionally been used to estimate whether or not a particular soil is desiccated. This method is tentative and BRE Digest 412 considered it to be unsatisfactory. It should be used only as an indicator in conjunction with other tests rather than as proof that the soil is dryer than the norm.

In this test, **as a rule of thumb only**, the onset of desiccation is indicated by an actual water content of less than 0.5 x LL and significant desiccation, an actual water content of less than 0.4 x LL. The interpretation of this test is often stated to be a clear indication of desiccation. **Such conclusion can only be corroborated by cross correlation with other test methods listed here.**

**The time of year (particularly winter) is relevant for assessing soil moisture and the Driscoll method in that if the soil sample was taken in Feb. or March it is probable that no significant desiccation will be shown. This does not mean that if the sample had been taken in the autumn that significant desiccation would have then been shown**

- Shear strength tests throughout the soil profile.

A shear strength test makes an assessment of the load bearing capacity of the soil. It can be very useful in conjunction with other tests for either eliminating or corroborating the possibility of tree induced subsidence. It can, in the presence of high moisture content, do the former by demonstrating classic failure of soil structure which is responsible for the building movement.

- Drainage survey by visual inspection, CCTV and pressure testing.

A full drainage survey covers the structural integrity and performance of the complete drainage system in the vicinity of the affected building. It should cover all aspects of the system from the sewer in the street upstream to the gulleys and also to the soil and rainwater goods on the side of the building.

It can be very useful used in conjunction with other tests in determining alternative factors for building movement other than the presence of trees and is essential in any case where drains are present in the vicinity of damage. (See ISE, Subsidence of Low Rise Buildings, page 10)<sup>1</sup>

- Crack monitoring.

Crack monitoring can help to establish the direction, scale and rate of movement (measured in mm) that is occurring within a building that has already suffered movement. It usually takes place over a number of months and is most useful when undertaken over a seasonal period (i.e. summer to winter) so that it can demonstrate seasonal movement and recovery at particular times of the year.



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Care should be taken as on very plastic soils seasonal movement may be occurring in the building regardless of the presence of trees. It is helpful at identifying persistent soil moisture deficits by demonstrating a yearly incremental increase in crack width.

Crack monitoring does not give a true three dimensional image of the movement and therefore is limited especially if the amplitude of movement and the period of monitoring is small. It is also important that monitoring commences at the earliest opportunity.

- **Level survey.**

Level surveys are undertaken to establish the vertical distortion a building is going through and are effective at illustrating a correlation between movement and the physical location of a tree or trees.

Care should be taken on older buildings as it cannot always be assumed that the building has been statically level since being constructed and distortion may be historical and unconnected to the current event.

- **Level monitoring with deep control datum.**

Level monitoring is possibly the best method of determining the mechanism that is creating a building's movement as it covers two dimensional distortions with the additional factor of time. So actual real time movements can be linked to the most active phases of a nearby tree's growth and water uptake.

This test in conjunction with other tests listed above can usually give a high degree of certainty that a tree is or is not causing building movement.

- **Determination of Particle Size Distribution. Test 9.0. BS 1377 Part 2**

Determination of particle size distribution is an accurate test for assessing the different percentages of soil particle size in a soil sample. Currently assessments are made by passing samples through a 0.425mm sieve (see above). A particle size distribution test is far more accurate and uses centrifugal force to separate out different particle sizes; it can quantify percentages of clay, sand, and silt in a soil sample. It enables a more informed decision on the likely behaviour of a soil in the presence of other factors, particularly leaking drains. Similarly to Test 6.1, this test is almost never used in the assessment of tree root claims despite



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As mentioned above it is acknowledged in BS 1377 Part 2 that some of the above tests do not have the level of accuracy to provide definitive and authoritative results on which to solely rely when forming the basis of an opinion as to the causal factor for building movement.

### **For Example:**

The usual basis of the soil investigations are the tests made under British Standard 1377 Part 2, Soils –Classification Tests. This standard work on soils testing states that the one point cone penetrometer method (the one used in the majority of investigations, Test No.4.4 BS 1377 Part 2) for assessing liquid limit is “likely to give results that are less reliable than those obtained from the four point method and is therefore only suitable where a possibly less accurate result is acceptable”.

In view of the fact that the figure obtained to ascertain liquid limit is used in conjunction with the calculation for plastic limit, a calculation that BS 1377 Part 2 refers to as being “subjective” to obtain a determination of the plasticity index of the soil, the LTOA believes that the onus is on the investigating company to comply with the requirements of the British Standard in obtaining as accurate a result as possible. In many instances use of test 4.1, the four point cone penetrometer method would be more appropriate and give a more accurate result.

Anything less than obtaining the most accurate result practicable is unacceptable to the LTOA in attempting to determine the fate of either a fine street tree or a protected private tree, particularly as these calculations are also used in the Driscoll test for identifying desiccation (i.e.  $0.4 \times$  the liquid limit). This test is known within the engineering and soil analysis industry to be tentative and potentially questionable (BRE Digest 412). Those factors that are subjective and the products of such tests tend to skew other results against the subject tree or trees.

In terms of determining soil desiccation BRE Digest 412 actually describes these tests saying that “none are satisfactory” and it suggests using an array of tests on which to form an opinion as to the mechanisms at work.

Soil suctions test similarly should only be used on heavily consolidated clay soils yet they are frequently presented as evidence of desiccation when having been undertaken on soils with sand and silt components.



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Assessments of soils fractions passing through a 0.425 mm sieve are also misleading and give the impression that only clay particles pass through, thereby reinforcing the view that the soil is predominantly clay. In fact medium and fine particles of sand and silt also pass through the 0.425mm sieve and consequently have an influence on the constituents of the soil type and therefore its characteristics and behaviour.

More accurate tests are available within the BS 1377 Part 2 for testing for shrinkability and percentages of clay to sand or silt in a soil (see above). However, these tests are invariably more expensive and the insurance industry naturally would rather use the less expensive tests in order to demonstrate their point of view.

The addition of a shear strength test can also be very informative as to the load bearing capacity of the soil in the presence of leaking drains or a raised soil moisture content and may corroborate or disprove the presence of desiccation.

In seeking to challenge unwarranted claims it would be helpful for the local authority to highlight shortcomings in some of these individual test results. Especially where other tests results do not corroborate and concur with the conclusion that the tree is the cause or indeed where no other test results are actually presented.

### **6.2 Technical Information Required by the Local Authority**

The baseline technical information required by the local authority to be able to properly address a claim will include copies of results from the above tests in different sets of combination dependent on the circumstances. This information should also include a number of reports from other professionals detailing the site itself and an accurate position of the trees, the nature of the damage, the type of building, its method of construction and foundation design.

The site reports required are:

- Engineers report on assessment of damage to building. (Seat, nature and BRE category).



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- Plan and profile of foundations.
- Plan of site showing location of building in relation to the trees both on the site and on neighbouring properties as well.
- Arboricultural report (not required for a low value tree that may be removed and replaced).
- Clear evidence that the ground is desiccated and that this has stemmed substantially from the presence of a tree.

As detailed above the contentious issue for tree officers, risk managers and insurers and their agents has been which individual tests results should be presented at what stage of the claim. It is the view of the LTOA that in the assessment of any individual tree related subsidence claim there are a minimum number and combination of reports and test results that are essential in the assessment of the cause of any damage. The next section will indicate which of the above reports and tests are, in the view of the LTOA, required in a case, when considered on its merits and should be presented to the local authority at the very earliest stages of a claim.

The driver for the requirement to submit this information is nothing-less than the nature of democratic and accountable local government. Residents and community groups as well as local historical societies and the public themselves all now have the legally enshrined right to see the technical evidence on which decisions to either remove or severely prune trees are taken.

It is therefore essential that tree officers are scrupulous in ensuring these decisions are based on adequate and appropriate levels of evidence.

### **6.3 Linking Levels of Evidence to Value of Tree**

Recently, representatives of the local authority and insurance sectors have been looking for ways to grade the amount of information and test results that are required and relating this requirement to the quality and value of the tree implicated in the damage. This work has now been published as the Joint Mitigation Protocol- see further reading appendix C. This would enable the insurance sector to know the cost of the reports they would need to commission prior to proceeding with accepting a member of the public's subsidence claim on their policy. It would also give risk managers and tree officers the ability to ask for much more detailed and better quality investigations when allegations are made regarding a tree of high value.



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In terms of trees covered by Tree Preservation Order this approach has already been accepted as being valid. The Office of the Deputy Prime Minister (now Department for Communities and Local Government, the Government Department responsible for Tree Preservation policy) informed LTOA members that in seeking to balance the loss of a preserved amenity tree against any alleged damage to an adjacent building the local authority is entitled to ask the insurance company to provide investigative reports related to proving the tree was the cause of the damage. The level of evidence and detail in these reports should be commensurate with the amenity value of the preserved tree or trees.

The LTOA concur with this approach and recommend that the Joint Mitigation Protocol and the CAVAT System (see above and appendix C ) for valuing trees is adopted by local authorities as a method for deciding which reports and test results should be asked for under which circumstances. This process should be applicable to all trees, local authority owned or otherwise. This is of course subject to consideration by the courts in due course.

### **6.4 Establishing Value Categories for Trees**

Prior to the formal adoption of the Joint Mitigation Protocol and CAVAT by individual local authorities and insurers, the following categories are suggested by the LTOA as being the most appropriate in establishing how much detail and what level of investigation and testing is required in the assessment of a tree related subsidence claim for a tree of a given value.

It cannot be overstated that each case should be treated on its own merits when deciding on what level of investigative evidence is appropriate, circumstances will change from situation to situation.

N.B. The suggested categories and the tests listed below are considered by the LTOA to be the tests required in the absence of a definitive and accurate method for measuring on the balance of probabilities a tree's connection to a subsidence event. It is of course possible to replace some of the more questionable tests with more accurate tests in an attempt to limit investigative costs. Any decision to do this should be taken on the basis of a lack of correlation between some of the less reliable tests.

The categories listed below while not identical to those in BS 5837 are informed by such and more information on their qualities and value maybe referenced in this document.

These are:



**6.4.1 No Value: A tree with no intrinsic value that is dead or with serious structural defects and pathogenic infections that should be removed and replaced.**

Information Required:

Trees in this category will be removed solely for sound arboricultural reasons unconnected with the progression of any claim.



## 6.4.2 Low Value: A low value tree that could be removed and replaced.

Information Required:

Site Information

1. Report on damage to building. (For example see attached Engineering Appraisal Report.)
2. Plan and profile of foundations.

3. Plan of site showing location of building in relation to all trees and significant vegetation in the vicinity of the site.

### Test Results

4. Trial pit cross section to underside of foundation depth plus borehole through base of trial pit to a minimum depth of 3m (explanation to be provided if borehole unable to reach 3m depth). Borehole log to be provided.
5. Root ID from beneath underside of foundation.



**6.4.3 Medium Value: A medium value tree that makes an important contribution to the area.**

### Site Information

1. Report on damage to building. (For example see attached Engineering Appraisal Report.)



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2. Plan and profile of foundations.
3. Plan of site showing location of building in relation to all trees and significant vegetation in the vicinity of the site.

### Test Results

4. Trial pit cross section to underside of foundation depth plus borehole through base of trial pit to a minimum depth of 3m (explanation to be provided if borehole unable to reach 3m depth). Borehole log to be provided.
5. Root ID from beneath underside of foundation.
6. Soil moisture content readings at 0.5m centres, starting at the underside of the foundation, down to 3m depth of B/H.
7. Liquid limit test results at underside of foundation and approx 2m depth.
8. Plastic limit test results at underside of foundation and approx 2m depth.
9. Soil plasticity calculated from LL – PL.
10. Control borehole to 3m depth with log, with same tests as above, if it is possible to locate such a borehole on the site and remote from the influence of any vegetation. If impossible then explanation needed.
11. Oedometer or suction test results at underside of foundation & 1.0m centres down depth of 3m borehole **ONLY** when there is **NO** control borehole. If there is a control borehole then other tests listed are sufficient.
12. Shear vane test results at 0.5m centres, starting at the underside of the foundation, down to 3m depth of borehole(s).
13. CCTV & hydraulic testing to drains (excluding Water Board owned) located within 3m distance of area of subsidence damage. If unable to water test due to no access/blind entries/etc then give reason.
14. Crack monitoring is required on a 6 weekly frequency and is to be set up ideally at time of first visit by building insurer representative or within 7 days of 1<sup>st</sup> visit. Send all available readings with Submission of Evidence.



#### **6.4.4 High Value: A high value tree that makes an extremely important contribution to the area.**

##### Site Information

1. Report on damage to building. (For example see attached Engineering Appraisal Report.)
2. Plan and profile of foundations.
3. Plan of site showing location of building in relation to all trees and significant vegetation in vicinity of site.



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### Test Results

4. Trial pit cross section to underside of foundation depth plus borehole through base of trial pit to a minimum depth of 3m (explanation to be provided if borehole unable to reach 3m depth). Borehole log to be provided.
5. Root ID from beneath underside of foundation.
6. Soil moisture content readings at 0.5m centres, starting at the underside of the foundation, down to 3m depth of B/H.
7. Liquid limit test results at underside of foundation and approx 2m depth.
8. Plastic limit test results at underside of foundation and approx 2m depth.
9. Soil plasticity calculated from LL – PL.
10. Control borehole to 3m depth with log, with same tests as above, if it is possible to locate such a borehole on the site and remote from the influence of any vegetation. If impossible then explanation needed.
11. Oedometer or suction test results at underside of foundation & 1.0m centres down depth of 3m borehole **ONLY** when there is **NO** control borehole. If there is a control borehole then other tests listed are sufficient.
12. Shear vane test results at 0.5m centres, starting at the underside of the foundation, down to 3m depth of borehole(s).
13. CCTV & hydraulic testing to drains (excluding Water Board owned) located within 3m distance of area of subsidence damage. If unable to water test due to no access/blind entries/etc then give reason.
14. Control borehole (if possible) & point of subsidence borehole, each to 5m depth (not 3m as for medium value).
15. Level monitoring commencing at outset of claim for a relevant period (max. 12 months) using a deep datum (if possible) to 8m depth, otherwise use deep manhole.
16. Particle Size Distribution Analysis to BS 1377 Part 2 test 9.0 on a single soil sample taken from a 1m zone below the underside of foundation (Only if drains are present within 3m of the site of damage).

Some of the tests detailed above have been described by national guidance documents as being less reliable and unsatisfactory as other tests detailed in the BS 1377 Soils Classification tests. Consequently the LTOA believe that in exceptional circumstances when trees of exceptional value have been implicated in causing damage and a number of the above tests give



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inconclusive results the more accurate and reliable tests listed above (14,15 & 16) should be relied on to make the assessment.



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### **7. Conclusion**

In conclusion this Risk Limitation Strategy of cyclical pruning, selective removal and replacement, challenging inaccurate information together with a framework of process and investigation offers a corporate business solution to reducing the problems and unknown/unpredictable costs of tree related subsidence insurance claims. There has been considerable research and new guidance produced since the 2<sup>nd</sup> Edition of this document was published and it is hoped that by drawing this information together in this 3<sup>rd</sup> Edition local authorities are better placed to cope with an increasingly costly subject.

The potential savings to local authorities and insurance companies by adopting the approach detailed in this strategy are considerable. Local authorities that pay out large sums to settle claims should see their costs reduced substantially as they repudiate unsubstantiated claims. Equally by presenting much more accurate and reliable investigative results at the onset of a claim, insurance companies should see their claims being dealt with much quicker, thereby reducing their costs and the potential for long drawn out and time consuming negotiations.

The LTOA remains of the view that trees are an essential prerequisite for people to live healthily and happily in urban areas. They do cause problems and difficulties from time to time, but the benefits they bring far outweigh these difficulties and they will become increasingly important in ameliorating the many negative effects of climate change in London in the future.

It is hoped that by following the advice given in this the LTOA's 3<sup>rd</sup> Edition of its Risk Limitation Strategy, London's trees will be able to co-exist with London's buildings well into the next century and beyond.



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### Appendices

#### **Appendix A**

##### **Trees covered by Conservation Areas and Tree Preservation Orders.**

Once correspondence is received concerning a notification of works to a tree in a Conservation Area the only way a local authority can prevent these works if it disagrees with them is to make a new Tree Preservation Order within six weeks of the date of the notification. The applicant then has to reapply under the terms of the new Order.

The significance of this is that uniquely in Planning Legislation the actual wording of the Act (Town and Country Planning Act 1990) covering all Tree Preservation Orders allows for an applicant to claim compensation from a local planning authority if a decision to refuse consent for works to a preserved tree results in an additional foreseeable loss or damage to the applicant.

The Wording in Article 9 of the Tree Preservation Order Regulations is as follows:

(1) Subject to paragraphs (2), (4), and (6), a person shall be entitled to recover from the authority compensation in respect of loss or damage caused or incurred in consequence of:

- (a) the refusal of any consent required under this Order; or
- (b) The grant of any such consent subject to conditions.

On Tree Preservation Orders made before the Town & Country Planning (Trees) Regulations 1999 there was within the legislation an option for the Local Authority to issue an Article 5 Certificate when dealing with a preserved tree. This is issued when the local authority claim that the tree is so exceptional that it should not be permitted to be sued for compensation as a result of its decision not to permit works.

If issued an applicant has the right of appeal against such a certificate and the majority of appeals succeed. Article 5 Certificates are not considered to



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be an effective way of avoiding or minimising an expensive claim as very few trees are so exceptional either for historical or amenity reasons as to warrant one.

### Origin of Liability

The point at which the local authority becomes liable to pay compensation is the date when the local planning authority issues the refusal notice whether this is for felling, pruning or some other type of work, for which, the applicant can prove prevention results in a loss or damage to their interests or property.

The loss or damage cannot be for the loss in value or development potential of land but for an actual physical/financial loss if the tree subsequent to the refusal leads to additional foreseeable costs being incurred. Examples are:

1. Direct root damage (pushing brickwork).
2. Indirect root damage (foundation subsidence).
3. Branches hitting and damaging roof tiles, brickwork, windows etc.
4. Falling limbs/tree subsequent to the refusal if the owner applied saying the tree was dangerous and the local authority refused consent to fell or prune.
5. Requiring expensive repair works that would not have been required had the tree been felled.

For all Tree Preservation Orders made after the 2nd of August 1999 there is an extremely important change in the Regulations (Town & Country Planning (Trees) Regulations 1999) that permit the local authority a raised level of defence in dealing with these claims than for trees protected prior to the 2nd of August 1999.

This change resulted from concern that local authorities could be targeted for unfair property damage compensation claims that were in essence due to the neglect or in action on the part of the tree owners themselves or their agents.

Consequently new Tree Preservation Order regulations were issued that stated:

**“No compensation is payable to a person for loss or damage which was (i) reasonably foreseeable by that person, and (ii) attributable**



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**to that person's failure to take reasonable steps to avert the loss or damage or mitigate its extent".**

However, these regulations were not back dated and do not apply to any Tree Preservation Orders that were made prior to 2nd August 1999. This means that with respect to the situation as of the present day the vast majority of trees covered by Tree Preservation Orders are not covered by the new regulations. If a compensation claim is mounted against a local authority, even if the owner or owner's agent has wilfully neglected the tree and done absolutely nothing to mitigate the loss or damage, when the local authority issues a refusal to fell the tree it automatically becomes legally liable for the damage and therefore the repair costs. Even though this damage may have arisen through no fault of the local authority but due to the presence of the tree and the neglect or inaction of the tree owner or their agents, prior and subsequent to the application/claim.

This problem is further compounded by the fact that in dealing with complex insurance cases where a preserved tree is alleged to be causing subsidence the local planning authority only have eight weeks within which to make a determination (decision on the application). This eight week period starts from the date the application is received irrespective of the level of evidence or accuracy of the information provided by the applicant to support the view that the tree or trees are the cause of the problem.

If after eight weeks the applicant has not received a determination of the application, in common with other full Planning applications they are permitted to appeal on the grounds of a "deemed refusal". In essence this means that the local authority on many occasions is being forced to make Hobson's choice. If it issues a Refusal based on the initially presented inadequate evidence it will be faced under the terms of the Tree Preservation Order legislation with a compensation claim for damages that may include legal fees and costs. It will therefore be placed into the position of having to defend a compensation claim for additional foreseeable costs against the public purse from a weakened position without the evidence it requires and which is deemed necessary to be able to defend itself from such a claim.

If it permits the removal of a tree or trees based on the inadequate evidence presented it will have failed in its duty to protect them from unnecessary felling and will to a large extent have failed the owners of the trees and the wider public who look to the local authority to use the powers available to it to prevent this type of felling.



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If it requests further evidence and the applicant decides (as has occurred in many existing cases) to appeal for non-determination after eight weeks it is judged to have issued a deemed refusal and the compensation clause of the Tree Preservation Order legislation still applies.

By invoking their rights of appeal for non-determination and creating a deemed refusal while at the same time failing to provide appropriate and accurate information the applicants may not be acting within the spirit of the legislation. These actions prevent the local authority from properly balancing public amenity, public interest (the effects of large compensation claims on the public purse) with private interests.

This process is complex and it has become apparent that the Tree Preservation Order legislation compensation regulations may have been seen as a legitimate mechanism for recouping the costs of building repairs where trees are identified as being involved with the building movement.

In fact proper examination of the evidence frequently indicates other factors are the material cause of the movement rather than the presence of the tree. One of these factors is frequently the neglect of the tree owner or their agents in not managing the tree over a considerable period prior to the application being made.

Many Tree Preservation Orders are pre 2<sup>nd</sup> August 1999. In these cases planning authorities are heavily exposed to the compensation claim approach when dealing with insurers and their agents. They are also unable to mount a defence that could include the action or inaction of the building insurer, agent or insured before and during the processing of the application. This defence might include such things as failing to provide sufficient evidence in support of the application, failing to undertake pruning to mitigate the effect of the tree or in some cases be as simple as failing to appeal to the Secretary of State and thereby attempting to mitigate the loss.

It is for these above reasons that local authorities should begin to revoke (or vary, depending on the circumstances) and re-serve all their pre-2<sup>nd</sup> August 1999 Tree Preservation Orders so that they are covered by the 1999 regulations. This needs to be done in any event as Government advises all local authorities to keep their Tree Preservation Orders continually under review as many of the details and wording of subsequent Orders as well as addresses and property register titles on which the old Orders were made



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may have changed with the passage of time. This is particularly so following development. This means many of these Orders are technically questionable and open to challenge. This work must be done in a structured way so that those Orders with the greatest potential to be compensation claims are dealt with first and in an expedient fashion.

The LTOA advocates the re-making of all pre 2<sup>nd</sup> of August 1999 Tree Preservation Orders as one element of a Risk Limitation Strategy for placing local authorities in the best possible position to defend themselves from unwarranted claims for compensation.

## Appendix B

### CAVAT (Capital Asset Value for Amenity Trees)

Full Method: User's Guide



Group of Lime and London Plane, Epping, values from £150k to £250k

Christopher Neilan



# A Risk Limitation Strategy for Tree Root Claims

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## Introduction

For the first time in the UK CAVAT (Capital Asset Value for Amenity Trees) provides a method for managing trees as public assets rather than liabilities. It is designed not only to be a strategic tool and aid to decision-making in relation to the tree stock as a whole, but also to be applicable to individual cases, where the value of a single tree needs to be expressed in monetary terms.

It is intended for local authorities in particular together with other public authorities which manage publicly owned trees. It may also be used by other public bodies, including the courts, private institutions and individuals. CAVAT complements other tools of arboricultural analysis, such as single tree hazard assessment systems. So far as possible it draws upon objective evidence and published data, but it also relies on expert arboricultural knowledge and in some cases assessments that are specific to CAVAT. It can therefore only be used by arboriculturists who have received relevant training, and who have the appropriate skills and experience.

Within UK law the Town and Country Planning Act 1990 (section 198) establishes, that trees have value as a public amenity and gives local planning authorities the duty to protect trees in the public interest. The legislation itself does not specify how amenity is to be assessed, leaving it open for the value of trees to be expressed in the most appropriate way for the intended purpose, not necessarily in monetary terms. Because CAVAT is specifically designed as an asset management tool for trees that are publicly owned, or of public importance, it does express value in monetary terms in a way that is directly related to the public benefits that trees provide. When applied to the tree stock as a whole it enables them to be managed as if the tree stock were a financial asset of the community. Applied to single trees, it both gives a value that is meaningful in itself and allows a comparison to be made with the value of other public trees.

CAVAT works by calculating a unit value for each square centimetre of tree stem, by extrapolation from the average cost of a range of newly planted trees. In the Full method this basic value is adjusted to reflect the degree of benefit that the tree provides to the local population. The adjustment is designed to allow the final value to reflect realistically the contribution of the tree to public welfare through tangible and intangible benefits (*see note 1*).

Acknowledgement should be made here that the method of calculating the CTI (Community Tree Index) at stage 2 relies greatly on the work of members of the LTOA (The London Tree Officers Association) and in particular Andy Tipping, and that at the final stage life expectancy is assessed using the approach of SULE (Safe Useful Life Expectancy), created by Jeremy Barrell.



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### **The Two Methods**

There are two versions of the CAVAT method. The Full method, described in this Guide, is recommended for use in cases concerning individual trees or groups, when precision is required and sufficient time is available for a full assessment. The second, referred to as the Quick method, is intended specifically as a strategic tool for management of the stock as a whole as if it were a financial asset of the community. The data required is limited to the minimum necessary to express the value of the tree stock as a whole, to analyse it, and to provide information to assist with management decisions. Data may be collected in conjunction with regular surveys of the tree stock.

In effect, it is designed to enable the value of the public tree stock to be expressed as an index. The index would rise or fall with changes in the quality and character of the stock over time. The tree manager would act as an asset manager, showing evidence to increase the overall value year by year, bearing in mind the particular nature and disposition of the stock, and the opportunities and resources available. The Guide to the Quick method is published separately.

### **General Instructions for the Full method**

Although the method is designed to be robust, prospective users need to be aware of certain key principles and the need for training to ensure consistency and accuracy of results.

Steps 1 and 2 in both methods rely on measurement, government data, and the conversion formula, updated annually to take account of inflation, but also the assessment of accessibility which is specific to CAVAT. Step 3, Functionality, relies on expert assessment, also specific to CAVAT. For example, when the health of the tree is assessed the key judgement is not whether it has flaws to the arboricultural expert, but to what extent those flaws detract from its current performance as a public amenity. Where there is no loss of performance no penalty is imposed. Any potential shortening of life expectancy, say as a result of structural weakness, would be considered separately at step 5.

Steps 4 and 5 apply only to the Full Method. At step 4 the adjustments for amenity rely on observation, but also plant knowledge; at step 5 the assessor requires a good understanding of tree health, and the ability to estimate reliably the safe life expectancy of the tree.

Assessors must also be aware that CAVAT does not discount the value of trees generally to account for indirect problems that they may cause, such as the potential to cause structural damage, nor additional costs of management to resolve any such problems. This is because it is designed to give a cost / benefit



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analysis, and to allow for these costs within the method would lead to a form of double accounting. However, the Full method does discount value as part of step 4, Adjusted Value, when it is found that there is an intrinsic problem, that is to say direct harm is being caused by the tree without it being resolved by management.

### The Full Method

The Full method is used in situations when a more detailed and precise assessment of the value of trees as individuals is required. For example, it would be used when reviewing the management options available for an individual tree or a group or avenue.

In relation to cases involving subsidence, according to the JMP (Joint Mitigation Protocol) the levels of evidence to be submitted in cases involving public trees will be set by reference to a full CAVAT valuation, to be undertaken by the Local Authority.

The full method involves a site inspection, and may in occasional cases involve further investigation, including internal decay detection or a climbing inspection. A full record of the inspection must be retained with appropriate evidence, including photographs.

#### The Variables

The Full Method involves five steps, and sets of key variables

1. Basic value/ unit value x size;
2. CTI value/ location, in terms of population and use, and accessibility;
3. Functional value/ functional status;
4. Adjusted value/ amenity factors, both positive and negative; and
5. Full value/ safe life expectancy.

#### Step 1: Basic Value

The basic value is calculated using trunk area as the key measure of size. The trunk area is calculated in the standard way, by using the measured trunk diameter or circumference, and converted to give the radius. The current national unit value factor is selected to allow the basic value to be calculated, using the equation:

$$V = \pi \times \text{radius}^2 \times \text{unit value factor. (See notes 2 and 3).}$$

A spreadsheet has been produced to make the necessary calculations for the full method. When using it the basic value is automatically calculated, using the diameter and the UVF.



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### Step 2: CTI Value

There are two operations in step 2. Firstly, the basic value is adjusted to take account of the population density using the Community Tree Index (CTI) factor (*see Note 4*). Then the modified basic value is discounted by up to 60%, according to how accessible the tree is in the particular location.

The CTI index factor is a measure of the relative population density potentially able to benefit from the trees, derived from Office of National Statistics (ONS) information. The values of the 7 CTI bands are shown in Table A. They vary from 100%, for the majority of the country, up to a maximum of 250% according to the published population density. The results as applied nationally to England can be found in Table B.

(Note: the CTI factor supersedes the previous value band approach, based on differential planting costs, which no longer applies.)

#### Operation 1.

The CTI index gives the basic adjustment for the local authority. The effective CTI value factor is that given in the final column of the table. In some instances, however, the area may not be typical of the local authority's overall area. In that case the ward figure, also available from the ONS website, may be used, with the CTI index factor values as shown in Table A.

#### Operation 2.

The second operation is to consider the relative accessibility to the public of the tree in its general locality. The tree may retain 100% of its value, or be discounted by up to 60%.

Taken together, these 2 operations give the CTI value.

### Step 3: Functional Value

The CTI value is then reduced according to the surveyor's expert assessment of the tree's functionality, i.e. how well it is performing biologically, as against what would be expected of a well-grown and healthy tree of the same species and girth in that location.

The surveyor must consider crown size and crown condition (*see Note 5*). **Only one combined adjustment of the basic value is required**, giving the overall functional value. Precision is required in the assessment, either maintaining the value at 100% or reducing it proportionately in increments of 10%.



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### Step 4: Adjusted Value

The functional value is then adjusted to take into account the surveyor's assessment of any special amenity factors and also the tree's appropriateness to the location. **One combined adjustment is made;** up to +/- 40 % is possible. (See Note 6)

### Step 5: Full Value

Finally, the value is adjusted for safe life expectancy (SLE), assessed on the principles of SULE. (See Note 7). Trees with a safe life expectancy greater than 80 years retain 100% of their adjusted value; those with a life expectancy of less than 5 years lose 90%. The SLE adjustment bands are shown in Table E.

No reduction is made for a condition, e.g. structural weakness, where life expectancy is not shortened and the tree is judged to be safe. However, if management, e.g. crown reduction is required, the functional status is adjusted accordingly under step 3, Functional Value. A tree that cannot be safely retained has a SLE score of 0, and thus a value of £0.

## Notes

### Note 1: CAVAT, Lifetime Benefit and the Trunk Formula Method

CAVAT has been designed primarily as an asset management tool. However, the full version is expressly designed for cases where the value of an individual tree needs to be expressed. The premise of CAVAT is that the widely accepted approach of depreciated replacement cost is used as the basis for a calculation of value since it is suitably robust, practicable and useful for these purposes. .

The basis of the method is to calculate the value of a tree by extrapolation from the cost of a newly planted standard tree, using the ratio between their respective trunk areas as the critical measurement. This approach is also used in the Council of Tree and Landscape Appraisers (CTLA) "trunk formula method", an appraisal method widely used in the U.S.A. However, the CAVAT methods are designed to give the value of trees as public assets in the UK in comparison to the CTLA method whose stated aim is to express the private value of the tree to its owner.

CAVAT allows for the contribution of the factors of location, relative contribution to amenity, social value and appropriateness, and an assessment of functionality and life expectancy. Essentially, the planting cost basis is then modified by a consideration of the impact of those factors that contribute to the quantum of benefits that the public may expect to receive from it. The factors which are essentially related to "wear and tear" on the tree, including a shortened life



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expectancy, are dealt with in terms of depreciation. On the other hand, factors which allow for a variation from an arithmetic mean (for example the particular benefits that flow from the species in question or the various influences of the tree's location) allow for a potential increase or decrease in value.

Its results are broadly comparable with what research suggests, both in the U.S.A. and the U.K., is a realistic estimate of the tangible lifetime benefits of trees to the community. The tangible benefits approach is reflected both in use of official population statistics to generate the CTI index rating in CAVAT and the nature of the adjustment for functionality, and also in the scale of the adjustments for accessibility and amenity factors.

### Note 2: Basic Value

The relevant measurement to calculate the value for an individual tree in the Full method is the area of the trunk at breast height, using the standard CTLA Trunk Formula methodology, from which the basic value is calculated, using equation  $A = n r^2$ . The procedure, therefore, is first to measure the trunk radius in centimetres, (generally by converting the circumference to a radius by a "rounded-down" tape, or using the formula  $r = c \div 2\pi$ ). The radius is then squared, and multiplied by  $n$  (pi, approx. 3.142). This is subsequently converted into the basic value by multiplying by the current UVF (unit value factor). When using the spreadsheet the basic value is calculated automatically, using the diameter and the UVF.

### Note 3: The Unit Value Factor

The UVF represents the full cost of a newly planted tree in a given area, divided by its trunk area. It has two components; the nursery gate price, expressed in terms of the cost of each square centimetre of stem, (or unit area cost) and the planting cost (transport, planting, materials, immediate care and management costs, but *not* after-care). The calculation of the unit area cost is from the average cost of a basket of species rather than for each individual species, in order to eliminate differences based only on production factors or variations in demand. The initial specification used in this calculation was 12-14 cm. standard containerised trees, however prior research has subsequently demonstrated that size, as opposed to species or production methods, is not generally a critical factor in unit cost variation.

For 2007/08 the UVF has been calculated at £5.02, representing the average cost per square centimetre of stem area of the ten most commonly planted species, containerised, at trade prices, and from equivalent and competitively priced nurseries. The best estimate of the planting cost factor has been found to be 150%, based both on consultation with tree officers and within the wider landscape industry. This is equivalent to a 2007/08 national unit area value of £12.55.



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By applying the Community Tree Index factor, the national unit area value may then be modified to take account of the effects of location to the benefits received by the local population, , (see note 4).

The unit area cost is upgraded each year in line with inflation, (using RPI/X) from an original survey in 2004/5. Again, this is to minimise fluctuations in the UVF unrelated to the tree stock's contribution to public amenity.

### Note 4: Community Tree Index

To generate the CTI index factor in the Full method the adjustment is made in two stages; first according to the population density of the wider location, and secondly according to the tree's relative accessibility in that location. Any special characteristics of the immediate location are accounted for in step 4, Adjusted Value.

#### Operation 1

The CTI index factor is a measure of the relative population density of the local authority, and thus the relative number of those potentially able to benefit from the local authority's trees. The CTI values for each Local Authority in England are shown in table B.

It may give more accurate results to calculate the stock value on a ward by ward basis, rather than by using the overall local authority value. This will depend upon an assessment of whether the local authority is relatively homogenous in character overall, or whether there are significant variations from ward to ward. Ward statistics are available from the Office for National Statistics, via the ONS website, <<https://www.ons.co.uk/Default.asp>>.

#### Operation 2

Having applied the factor for the general character of the area, the assessor then judges the relative accessibility of the tree within that area, and whether it is fully available to contribute to the public good. The potential CTI value after operation 1 may either be retained, by a score of 100%, or further reduced to a factor of 80%, 60%, or 40% of its original value.

The key considerations under operation 2 are:

1. whether the tree is fully accessible to the public i.e. within a public highway, public park, or woodland. For these locations the accessibility score remains 100 %.
2. wholly or partially accessible from public areas i.e. in a local authority owned location such as a school, local authority building or housing estate.



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For these locations the accessibility score is reduced to 80% of its original value.

3. a less accessible publicly owned area i.e. a courtyard of a building, sheltered housing unit or individual back gardens of local authority owned properties. For these locations the accessibility score maybe reduced to 40% or 60% of its original value.

A tree that is fully accessible and visible, in a prominent and well-used setting within the general area will score 100%; a tree not publicly accessible or visible will score 40% of its original value. A degree of judgement will be necessary to assess these scores.

### Note 5: Functionality

The basis of CAVAT is trunk area, but the crown area may often be reduced from what would be predicted for an average tree of the size by species characteristics, possibly exaggerated by grafting, as in many flowering cherries, or by pruning, or by natural events such as disease or branch failure. Alternatively, the crown may be fully present, but functioning poorly; in either case the assessor carefully estimates the adjustment to be made, so that the functional value represents as realistically as possible the actual capacity of the tree to provide public amenity. Only 1 adjustment is made for both crown size and condition.

The two considerations are:

#### 1) Crown Size.

The value is reduced proportionately if:

- the crown is reduced by regular pruning;
- the crown area has been reduced by natural causes, e.g. storm damage or disease, and the tree has not recovered; or
- the crown has failed to develop, e.g. because of top grafting onto a stronger stock, and is smaller than would be expected from the stem size.

#### 2) Condition.

If the tree is in functionally poor condition, including disfigurement by disease obvious to the public, the value is reduced proportionately. Such conditions would include:

- leaf or shoot disease;
- root disease, clearly affecting vitality,
- canker, or severe trunk lesions,
- fire damage.

No reduction is made at this stage for a condition, e.g. structural weakness, which does not affect the current functional status of the tree, providing that no immediate action (other than monitoring) is proposed. The value should be



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reduced proportionately in advance where there is an immediate need for arboricultural reasons e.g. structural weakness and hence the need to reduce the crown. This should be as soon as practicably possible, and no later than 1 year. Pests such as Horse Chestnut Scale, diseases such as bacterial wetwood, or physical conditions such as uneven form or wounding are not taken into account, unless they are sufficiently severe to adversely affect biological functionality, to grossly affect appearance or to trigger crown reduction, etc.

A dead or effectively dead tree, or one requiring urgent removal, scores 0% value retained, and thus has a value of £0.

### Note 6: Amenity and Appropriateness

#### 1) Amenity Factors.

The value may be increased to take account of features of the tree that are of special benefit to the community. Special factor adjustments should be used sparingly; most trees will not have any special factor adjustment. There may be up to a maximum of 4 special factors and a total adjustment of up to 40%; (10% for each amenity factor, other than Veteran/ Ancient Trees: 30%), for example:

#### Townscape and visual importance:

- integral part of a designed landscape, including avenues or designed park or garden;
- contribution to the setting of an important place or building;
- in a school, or by its entrance;
- in a particularly prominent location, e.g. a town centre, or at the entrance of a major public building, etc; or
- part of a wider grouping giving character to the area, e.g. long-maintained street pollards.

#### National or Local designations or connections:

- in a Conservation Area, where the presence of trees has contributed to the designation;
- a locally designated tree, e.g. Landmark or Favourite Trees;
- a commemorative or memorial tree; or
- a tree known to be planted by a notable person.

#### Species characteristics:

- rare or unusual species; or
- attractive visual characteristics, e.g. notably attractive form, showy flowers, variegated foliage, attractive bark, etc. (N.B. count as 10% each, up to 20%); or

#### Nature Conservation:

- particular wildlife importance, e.g. a bat roost, heronry, etc.;
- designated species in local BAP (Biodiversity Action Plan); or



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- a Veteran/ Ancient Tree. (N.B. counts as 30% by itself).

### 2) Appropriateness to the Location.

Conversely, the value may be reduced as for amenity factors by 10% each and by up to 40% if the species is seriously inappropriate for its location causing a problem or foreseeable direct hazard not effectively controlled by management, for example:

Inappropriate species characteristics for the location causing obstruction or inconvenience:

- a weeping or low spreading habit in a narrow footpath;
- obstruction, e.g. vigorous spiny suckers across a footway;
- major surface roots damaging the footpath;
- large, squashy fruit in hard surfaced area;
- honeydew drip e.g. in a dedicated car park or playground ;

Problems relating to the particular specimen:

- a pronounced lean, causing a potential obstruction;
- tree planting out of context, for example, a visually intrusive species in an otherwise consistent avenue.

### Note 7: Safe Life Expectancy Adjustment.

Safe Life Expectancy (SLE) is accounted for by a potential depreciation of up to 90% of the adjusted value. The principles followed to generate the adjustment are those of SULE, but the final step relating to usefulness is omitted in order to avoid double accounting. As generally in CAVAT, the banding approach is used, for robustness and to reflect some of the practical difficulties of estimating age. The surveyor may be expected to more accurately estimate the SLE in a tree's later years, when changes in the tree condition will have a much bigger impact on the SLE.

Trees with a safe life expectancy greater than 80 years retain 100% value; those with less than 5 years have 10% of their potential value. The weighting given to the intervening bands is derived from an exponential curve, on the basis that at less than 80 years life expectancy value is initially lost only slowly, but that towards the end of a tree's life the decline in value becomes increasingly swift. (*See Table F*). Eighty years is chosen as representing in round figures the current length of human life expectancy in the UK.



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### Tables.

Table A: CTI Factors

Population Density /Ha	CTI Factor %	CTI Band
<20	100	1
20 -39	125	2
40 -59	150	3
60 -79	175	4
80 -99	200	5
100-119	225	6
>119	250	7

Table B. National Community Tree Index

Local Authority	Pop per ha	CTI factor	CTI Band
Adur	14.3	100%	1
Allerdale	0.8	100%	1
Alnwick	0.3	100%	1
Amber valley	4.4	100%	1
Arun	6.4	100%	1
Ashfield	10.2	100%	1
Ashford	1.8	100%	1
Aylesbury Vale	1.8	100%	1
Babergh	1.4	100%	1
Barking & Dagenham	45.4	150%	3
Barnet	36.3	125%	2
Barnsley	6.6	100%	1
Barrow-in-Furness	9.2	100%	1



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Basildon	15.1	100%	1
Basingstoke and Deane	2.4	100%	1
Bassetlaw	1.7	100%	1
Bath and North East Somerset UA	4.9	100%	1
Bedford	3.1	100%	1
Berwick-upon-Tweed	0.3	100%	1
Bexley	36	125%	2
Birmingham	36.5	125%	2
Blaby	6.9	100%	1
Blackburn with Darwen UA	10	100%	1
Blackpool UA	40.7	150%	3
Blyth Valley	11.5	100%	1
Bolsover	4.5	100%	1
Bolton	18.7	100%	1
Boston	1.5	100%	1
Bournemouth UA	35.4	125%	2
Bracknell Forest UA	10	100%	1
Bradford	12.8	100%	1
Braintree	2.2	100%	1
Breckland	0.9	100%	1
Brent	60.9	175%	4
Brentwood	4.5	100%	1
Bridgnorth	0.8	100%	1
Brighton and Hove UA	30	125%	2
Bristol; City of UA	34.7	125%	2
Broadland	2.1	100%	1
Bromley	19.7	100%	1
Bromsgrove	4	100%	1
Broxbourne	16.9	100%	1
Broxtowe	13.4	100%	1



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Burnley	8.1	100%	1
Bury	18.2	100%	1
Calderdale	5.3	100%	1
Cambridge	26.7	125%	2
Camden	90.8	200%	5
Cannock Chase	11.7	100%	1
Canterbury	4.4	100%	1
Caradon	1.2	100%	1
Carlisle	1	100%	1
Carrick	1.9	100%	1
Castle Morpeth	0.8	100%	1
Castle Point	19.2	100%	1
Charnwood	5.5	100%	1
Chelmsford	4.6	100%	1
Cheltenham	23.6	125%	2
Cherwell	2.2	100%	1
Chester	2.6	100%	1
Chesterfield	15	100%	1
Chester-le-Street	7.9	100%	1
Chichester	1.4	100%	1
Chiltern	4.5	100%	1
Chorley	5	100%	1
Christchurch	8.9	100%	1
City of London	24.8	125%	2
Colchester	4.7	100%	1
Congleton	4.3	100%	1
Copeland	0.9	100%	1
Corby	6.6	100%	1
Cotswold	0.7	100%	1
County of Herefordshire; UA	0.8	100%	1



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County of Herefordshire; UA	0.8	100%	1
Coventry	30.5	125%	2
Craven	0.5	100%	1
Crawley	22.2	125%	2
Crewe and Nantwich	2.6	100%	1
Croydon	38.2	125%	2
Dacorum	6.5	100%	1
Darlington UA	5	100%	1
Dartford	11.8	100%	1
Daventry	1.1	100%	1
Derby UA	28.4	125%	2
Derbyshire Dales	0.9	100%	1
Derwentside	3.1	100%	1
Doncaster	5.1	100%	1
Dover	3.3	100%	1
Dudley	31.2	125%	2
Durham	4.7	100%	1
Ealing	54.2	150%	3
Easington	6.5	100%	1
East Cambridgeshire	1.1	100%	1
East Devon	1.5	100%	1
East Dorset	2.4	100%	1
East Hampshire	2.1	100%	1
East Hertfordshire	2.7	100%	1
East Lindsey	0.7	100%	1
East Northamptonshire	1.5	100%	1
East Riding of Yorkshire UA	1.3	100%	1
East Staffordshire	2.7	100%	1
East Sussex County	2.9	100%	1
Eastbourne	20.3	125%	2



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Eastleigh	14.6	100%	1
Eden	0.2	100%	1
Ellesmere Port and Neston	9.2	100%	1
Elmbridge	12.8	100%	1
Enfield	33.8	125%	2
Epping Forest	3.6	100%	1
Epsom and Ewell	19.7	100%	1
Erewash	10	100%	1
Exeter	23.6	125%	2
Fareham	14.5	100%	1
Fenland	1.5	100%	1
Forest Heath	1.5	100%	1
Forest of Dean	1.5	100%	1
Fylde	4.4	100%	1
Gateshead	13.4	100%	1
Gedling	9.3	100%	1
Gloucester	27.1	125%	2
Gosport	30.2	125%	2
Gravesham	9.7	100%	1
Great Yarmouth	5.2	100%	1
Greenwich	45.3	150%	3
Guildford	4.8	100%	1
Hackney	106.4	225%	6
Halton UA	14.9	100%	1
Hambleton	0.6	100%	1
Hammersmith and Fulham	100.8	225%	6
Harborough	1.3	100%	1
Haringey	73.2	175%	4
Harlow	25.8	125%	2
Harrogate	1.2	100%	1



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Harrow	41	150%	3
Hart	3.9	100%	1
Hartlepool UA	9.4	100%	1
Hastings	28.6	125%	2
Havant	21.1	125%	2
Havering	20	125%	2
Hertsmere	9.3	100%	1
High Peak	1.7	100%	1
Hillingdon	21	125%	2
Hinckley and Bosworth	3.4	100%	1
Horsham	2.3	100%	1
Hounslow	37.9	125%	2
Huntingdonshire	1.7	100%	1
Hyndburn	11.2	100%	1
Ipswich	29.7	125%	2
Isle of Wight UA	3.5	100%	1
Isles of Scilly	1.3	100%	1
Islington	118.3	225%	6
Kennet	0.8	100%	1
Kensington and Chelsea	131	250%	7
Kerrier	2	100%	1
Kettering	3.5	100%	1
King's Lynn and West Norfolk	0.9	100%	1
Kingston upon Hull; City of UA	34.1	125%	2
Kingston upon Thames	39.5	125%	2
Kirklees	9.5	100%	1
Knowsley	17.4	100%	1
Lambeth	99.2	200%	5
Lancaster	2.3	100%	1
Leeds	13	100%	1



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Leicester UA	38.2	125%	2
Lewes	3.2	100%	1
Lewisham	70.8	175%	4
Lichfield	2.8	100%	1
Lincoln	24	125%	2
Liverpool	39.3	125%	2
Luton UA	42.5	150%	3
Macclesfield	2.9	100%	1
Maidstone	3.5	100%	1
Maldon	1.7	100%	1
Malvern Hills	1.3	100%	1
Manchester	34	125%	2
Mansfield	12.8	100%	1
Medway UA	13	100%	1
Melton	1	100%	1
Mendip	1.4	100%	1
Merton	50	150%	3
Mid Bedfordshire	2.4	100%	1
Mid Devon	0.8	100%	1
Mid Suffolk	1	100%	1
Mid Sussex	3.8	100%	1
Middlesbrough UA	25	125%	2
Milton Keynes UA	6.7	100%	1
Mole Valley	3.1	100%	1
New Forest	2.2	100%	1
Newark and Sherwood	1.6	100%	1
Newcastle upon Tyne	22.9	125%	2
Newcastle-under-Lyme	5.8	100%	1
Newham	67.3	175%	4
North Cornwall	0.7	100%	1



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North Devon	0.8	100%	1
North Dorset	1	100%	1
North East Derbyshire	3.5	100%	1
North East Lincolnshire UA	8.2	100%	1
North Hertfordshire	3.1	100%	1
North Kesteven	1	100%	1
North Lincolnshire UA	1.8	100%	1
North Norfolk	1	100%	1
North Shropshire	0.8	100%	1
North Somerset UA	5	100%	1
North Tyneside	23.3	125%	2
North Warwickshire	2.2	100%	1
North West Leicestershire	3.1	100%	1
North Wiltshire	1.6	100%	1
North Yorkshire County	0.7	100%	1
Northampton	24.1	125%	2
Norwich	31.2	125%	2
Nottingham UA	35.8	125%	2
Nuneaton and Bedworth	15.1	100%	1
Oadby and Wigston	23.7	125%	2
Oldham	15.3	100%	1
Oswestry	1.5	100%	1
Oxford	29.4	125%	2
Pendle	5.3	100%	1
Penwith	2.1	100%	1
Peterborough UA	4.5	100%	1
Plymouth UA	30.2	125%	2
Poole UA	21.4	125%	2
Portsmouth UA	46.4	150%	3
Preston	9.1	100%	1



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Purbeck	1.1	100%	1
Reading UA	35.4	125%	2
Redbridge	42.3	150%	3
Redcar and Cleveland UA	5.7	100%	1
Redditch	14.5	100%	1
Reigate and Banstead	9.8	100%	1
Restormel	2.1	100%	1
Ribble Valley	0.9	100%	1
Richmond upon Thames	30	125%	2
Richmondshire	0.4	100%	1
Rochdale	13	100%	1
Rochford	4.6	100%	1
Rossendale	4.8	100%	1
Rother	1.7	100%	1
Rotherham	8.7	100%	1
Rugby	2.5	100%	1
Runnymede	10	100%	1
Rushcliffe	2.6	100%	1
Rutland UA	0.9	100%	1
Ryedale	0.3	100%	1
Salford	22.2	125%	2
Salisbury	1.1	100%	1
Sandwell	33.1	125%	2
Scarborough	1.3	100%	1
Sedgefield	4	100%	1
Sedgemoor	1.9	100%	1
Sefton	18.5	100%	1
Selby	1.3	100%	1
Sevenoaks	3	100%	1
Sheffield	13.9	100%	1



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Shepway	2.7	100%	1
Shrewsbury and Atcham	1.6	100%	1
Slough UA	36.6	125%	2
Solihull	11.2	100%	1
South Bedfordshire	5.3	100%	1
South Bucks	4.4	100%	1
South Cambridgeshire	1.4	100%	1
South Derbyshire	2.4	100%	1
South Gloucestershire UA	4.9	100%	1
South Hams	0.9	100%	1
South Holland	1	100%	1
South Kesteven	1.3	100%	1
South Lakeland	0.7	100%	1
South Norfolk	1.2	100%	1
South Northamptonshire	1.3	100%	1
South Oxfordshire	1.9	100%	1
South Ribble	9.2	100%	1
South Shropshire	0.4	100%	1
South Somerset	1.6	100%	1
South Staffordshire	2.6	100%	1
South Tyneside	23.7	125%	2
South Yorkshire (Met County)	8.2	100%	1
Southampton UA	43.6	150%	3
Southend-on-Sea UA	38.4	125%	2
Southwark	84.9	200%	5
Spelthorne	20.1	125%	2
St. Albans	8	100%	1
St. Edmundsbury	1.5	100%	1
St. Helens	13	100%	1
Stafford	2	100%	1



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Staffordshire County	3.1	100%	1
Staffordshire Moorlands	1.6	100%	1
Stevenage	30.7	125%	2
Stockport	22.6	125%	2
Stockton-on-Tees UA	8.7	100%	1
Stoke-on-Trent UA	25.8	125%	2
Stratford-on-Avon	1.1	100%	1
Stroud	2.3	100%	1
Suffolk	1.8	100%	1
Suffolk Coastal	1.3	100%	1
Sunderland	20.4	125%	2
Surrey	6.4	100%	1
Surrey Heath	8.4	100%	1
Sutton	41	150%	3
Swale	3.3	100%	1
Swindon UA	7.8	100%	1
Tameside	20.6	125%	2
Tamworth	24.2	125%	2
Tandridge	3.2	100%	1
Taunton Deane	2.2	100%	1
Teesdale	0.3	100%	1
Teignbridge	1.8	100%	1
Telford and Wrekin UA	5.5	100%	1
Tendring	4.1	100%	1
Test Valley	1.7	100%	1
Tewkesbury	1.8	100%	1
Thanet	12.3	100%	1
Three Rivers	9.3	100%	1
Thurrock UA	8.8	100%	1
Tonbridge and Malling	4.5	100%	1



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Torbay UA	20.6	125%	2
Torrige	0.6	100%	1
Tower Hamlets	99.2	200%	5
Trafford	19.8	100%	1
Tunbridge Wells	3.1	100%	1
Tynedale	0.3	100%	1
Uttlesford	1.1	100%	1
Vale of White Horse	2	100%	1
Vale Royal	3.2	100%	1
Wakefield	9.3	100%	1
Walsall	24.4	125%	2
Waltham Forest	56.2	150%	3
Wandsworth	76	175%	4
Wansbeck	9.2	100%	1
Warrington UA	10.6	100%	1
Warwick	4.5	100%	1
Watford	37.2	125%	2
Waveney	3	100%	1
Waverley	3.4	100%	1
Wealden	1.7	100%	1
Wear Valley	1.2	100%	1
Wellingborough	4.4	100%	1
Welwyn Hatfield	7.5	100%	1
West Devon	0.4	100%	1
West Dorset	0.9	100%	1
West Lancashire	3.1	100%	1
West Lindsey	0.7	100%	1
West Lindsey	0.7	100%	1
West Oxfordshire	1.3	100%	1
West Somerset	0.5	100%	1



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West Sussex	3.8	100%	1
West Wiltshire	2.3	100%	1
West Yorkshire (Met County)	10.2	100%	1
Westminster	84.4	200%	5
Weymouth and Portland	15.2	100%	1
Wigan	16	100%	1
Winchester	1.6	100%	1
Windsor and Maidenhead UA	6.8	100%	1
Wirral	19.9	100%	1
Woking	14.1	100%	1
Wokingham UA	8.4	100%	1
Wolverhampton	34.1	125%	2
Worcester	28.1	125%	2
Worthing	30	125%	2
Wychavon	1.7	100%	1
Wycombe	5	100%	1
Wyre	3.7	100%	1
Wyre Forest	5	100%	1
York UA	6.7	100%	1



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Table C: Safe Life Expectancy Adjustment.

Life Expectancy (Years)	% Value Retained
80+	100
40 - 80	95
20 - 40	80
10 - 20	55
5 - 10	30
<5	10



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## References

- Council of Tree and Landscape Appraisers (2000) *Guide for Plant Appraisal 9<sup>th</sup> Ed.*, ISA Barrel, J. (1993) *Pre-Planning Tree Surveys: Safe Useful Life Expectancy (SULE) is the Natural Progression*, Arboricultural Journal Vol. 17 No. 1.
- Helliwell, R.D. (2000) *Amenity Valuation of Trees and Woodlands*, Arboricultural Association.
- Arnold, H.F. (1993) *Trees in Urban Design 2<sup>nd</sup> Edition*, Van Nostrand Reinhold.
- NUFU (2003) *Measuring the economic value of urban greenspace. Case Study No 35*, National Urban Forestry Unit.

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### Appendix C

#### References

1. **Institution of Structural Engineers**, Subsidence of Low Rise Buildings 2000, 2<sup>nd</sup> Edition, A Guide for Professionals and Property Owners.
2. **London Climate Change Partnership**, Adapting to Climate Change Lessons for London. 2006.
3. [www.natenergy.org.uk/comment.htm](http://www.natenergy.org.uk/comment.htm)
4. **Stewart H, Owen S, Donovan R, Mackenzie R, Hewitt N, Skiba U and Fowler D (2003)**. Trees and Sustainable Urban Air Quality: Using Trees to improve Air Quality in Cities, Lancaster University, Lancaster.
5. **Broadmeadow MSJ and Freer-Smith PH (1996)** Urban Woodland and the Benefits for Local Air Quality, Research for Amenity Trees No.5 HMSO, London.
6. **Nowak DJ (1992)** Urban Forest Structure and the functions of Hydrocarbon Emissions and Carbon Storage, in Rodbell P D (ed) Proceedings of the Fifth National Urban Forest Conference, Los Angeles, 48-51 American forests, Washington DC.
7. **Huang YJ, Akbari H, Taha H and Rosenfeld AH (1987)** The Potential of Vegetation in Reducing Summer Cooling Loads in residential Buildings, Journal of Climate and Applied Meteorology 26 (9): 1103-1116.
8. **Soltis D (1997)** Loss of Trees Increase Stormwater Runoff in Atlanta, Water Engineering and Management 144: 6.
9. **Broadmeadow, M and Matthews, R. (2003)** Forests, Carbon and Climate Change: the UK Contribution, Forestry Commission Information Note 48, Forestry Commission, Edinburgh.
10. Town and Country Planning Act 1990.
11. **Kennedy CJ and Southwood TRE (1984)**. The Number of Species of Insect Associated with British Trees: A Re-analysis, Journal of Animal Ecology 53: 453-478.
12. **Fuller RJ (1995)** Bird Life of Woodland and Forest, Cambridge University Press, Cambridge.
13. **Kirby KJ and Duke CM (1993)** Dead Wood Matters: the Ecology and Conservation of Saproxylic Invertebrates in Britain, English Nature Science No.7 English Nature, Peterborough.
14. **Speight MCD (1989)** Saproxylic Invertebrates and their Conservation, Nature and Environment Series No.42, Council of Europe, Strasbourg.
15. **Corbet GB and Harris S (eds) (1991)** handbook of British Mammals, 3<sup>rd</sup> Edition, Blackwell Scientific Publications Oxford.



## **A Risk Limitation Strategy for Tree Root Claims**

*3rd Edition - Revised May 2008*

16. **Stearns F (1972)** The City as Habitat for Wildlife and Man, in Detwyler R and Marcus MG (eds) Urbanisation and Environment, Duxbury Press Belmont California.
17. **De Graaf RM and Wentworth JM (1986)** Avian Guild Structure and Habitat Associations in Suburban Bird Communities, Urban Ecology 9: 399-412.
18. **Anderson LM and Cordel HK (1988)** Influence of Trees on Residential Property Values in Athens, Georgia: A Survey Based on Actual Sales Prices, Landscape and Urban Planning 15: 153-164.
19. **Morales DJ (1980)** The Contribution of Trees to Residential Property Value: Journal of Arboriculture 6 (11):305-308.
20. **Morales DJ, Micha Fr and Weber RC (1983)** Two Methods of Evaluating Trees on Residential Sites, Journal of Arboriculture 9 (1): 21-24.
21. **CABE Space (2005)** Does money Grow on Trees? Commission for Architecture and the Built Environment, London.
22. **National Urban Forestry Unit (1999)** Trees and Healthy Living, National Conference, Wolverhampton, UK, National Urban Forestry Unit, Wolverhampton.
23. **Ulrich RS, Simmons RF, Losito BD, Fiority E, Miles MA and Zeison M (1991)** Stress Recovery During Exposure to Natural and Urban Environments, Journal of Environmental Psychology 11: 201-230.
24. **Mudrak LY (1982)** In the Environmental Benefits of Vegetation at a Global Local and Personal Level: A Review of the Literature, Green Releaf, Horticultural Trades Association and Royal Botanical Gardens, Kew.
25. **Botkin DB and Beveridge CE (1997)** Cities as Environments, Urban Ecosystems 1: 3-19.
26. **Ulrich RS (1984)** View Through a Window May Influence Recovery from Surgery, Science Journal 224 :420-421.
27. **Moore EO (1981-82)** A Prison Environment's Effect on Health Care Demands, Journal of Environmental Systems 11(1): 17-34.
28. **West MJ (1985)** Landscape Views and Stress Response in the Prison Environment, Department of Landscape Architecture, University of Washington, Seattle, unpublished masters thesis.
29. **The Open University et al**, Control and Communication, the Special Senses 2.1.1: 52-55. The Open University 2004. ISBN 0 7492 6642 2.
30. **Roberts, J., Jackson, N. & Smith, M. 2006**-Tree Roots in the Built Environment 2006 – Research for Amenity Trees No 8. Published by Department for Communities and Local Government. London. 488pp. ISBN13 978 0 11 753620 3 / ISBN10 0 11 753620 2



## **A Risk Limitation Strategy for Tree Root Claims**

**3rd Edition - Revised May 2008**

31. **Phillip. J Craul.(1992)** Urban Soil in Landscape Design.ISBN 0-471-80598X
32. **Crilly, M., Desiccation in Clay Soils, (1996)** Building Research Establishment, Digest 412.
33. **British Standards Institute** British Standard 1377, Soils Classification Parts 1-9.
34. **Russell (1973) in Environmental Physiology of Plants** A.H Fitter & R.K.M. Hay 1981 p. 131.

### **Further Reading**

1. Trees in Towns Research for Amenity No.1. Land Use Consultants, Published by the Department of the Environment 1993.
2. Action for London's Trees, Investing in a leaf capital, Task Force Trees a special programme of the Countryside Commission, 1994.
3. The London Tree Survey 1993. Matthews, R . Mottram, N. Ward, K. (Cobham Resource Consultants), Wright, H. (The Oxford Forestry Institute), Halsall, L Hodge, S. Houston , T. Knott, K. Mobbs, D. Forestry Authority Research Division, (1994), Published by the Countryside Commission.
4. Trees in New Ground 2005 The Tree Council,
5. Trees Matter! National Urban Forestry Unit 2005
6. The London Trees and Woodlands Framework, 2005. Forestry Commission and Greater London Authority under the steerage of The London Woodland Advisory Group, Published by the Greater London Authority.
7. Joint Mitigation Protocol. ( Publication to be advised).
8. England Forestry Strategy, Forestry Commission 2006.
9. Trees; Their use, Management, Cultivation and Biology, a Comprehensive Guide. By Bob Watson

### **Useful Research Papers**

**Hipps, N.A., Atkinson, C.J. & Griffiths, H. 2006.** Pruning Trees to Reduce Water Use. Information Paper 7/06 Building Research Establishment. Watford UK. 8pp.

**East Malling Research and University of Cambridge, 2004.** Controlling Water Use of Trees to Allieviate Subsidence Risk Project 212 Final Report. Building Research Establishment and Horticulture LINK Consortium. 114pp.



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