



DPC: 24 / 30472085 DC

BSI Group Headquarters

389 Chiswick High Road London W4 4AL

Tel: +44 (0)20 8996 9000

Fax: +44 (0)20 8996 7400

www.bsigroup.com

Date: 16 August 2024

Origin: National

Latest date for receipt of comments: 16 October 2024

Project No. 2023/00722

Responsible committee: B/213 Trees

Interested committees: B/213/-/3, AW/20

Title: Draft BS 5837 Trees in relation to design, demolition and construction – Code of practice

Comments would be particularly welcome on subclause 6.3 - please see specific question in the draft.

Please notify the secretary if you are aware of any keywords that might assist in classifying or identifying the standard or if the content of this standard

- i) has any issues related to 3rd party IPR, patent or copyright
- ii) affects other national standard(s)
- iii) requires additional national guidance or information

**WARNING: THIS IS A DRAFT AND MUST NOT BE REGARDED OR USED AS A BRITISH STANDARD.
THIS DRAFT IS NOT CURRENT BEYOND 16 October 2024**

This draft is issued to allow comments from interested parties; all comments will be given consideration prior to publication. No acknowledgement will normally be sent. **See overleaf for information on the submission of comments.**

No copying is allowed, in any form, without prior written permission from BSI except as permitted under the Copyright, Designs and Patent Act 1988 or for circulation within a nominating organization for briefing purposes. Electronic circulation is limited to dissemination by e-mail within such an organization by committee members.

Further copies of this draft may be purchased from BSI Shop <http://shop.bsigroup.com> or from BSI Customer Services, Tel: +44(0) 20 8996 9001 or email cservices@bsigroup.com. British, International and foreign standards are also available from BSI Customer Services.

Information on the co-operating organizations represented on the committees referenced above may be obtained from <http://standardsdevelopment.bsigroup.com>

Responsible Editorial Project Manager: Sophie Watson

Direct tel: 01473 684477

E-mail: sophie.watson@bsigroup.com

Introduction

Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international and European standards, comments will be reviewed by the relevant UK national committee before submitting the consensus UK vote and comments. If the draft standard is approved, it is usual for the resulting published standard to be adopted as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

UK Vote

Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

Submission of Comments

Annotated drafts are not acceptable and will be rejected.

All comments should be submitted online at <http://standardsdevelopment.bsigroup.com>. You will need to register in order to comment.

Trees in relation to design, demolition and construction – Code of practice

Persons reviewing the Draft for Public Comment are particularly requested to give feedback on the following point.

Subclause 6.3. Do you agree with an increased root protection area for mature category A trees and veteran trees? If you disagree, what alternative should be recommended and why?

Contents

0	Introduction	6
0.1	Purpose of the standard	6
0.2	Using the standard	6
1	Scope	7
2	Normative references	7
3	Terms and definitions	7
4	General process	9
	<i>Figure 1 – General process for trees in relation to design, demolition and construction</i>	9
5	Establishing a baseline	10
5.1	Process flowchart	10
	<i>Figure 2 – Process flowchart for establishing the baseline</i>	10
5.2	Statutory constraints and planning policies	10
5.3	Topographical survey	10
5.4	Soil assessment	11
5.5	Detailed tree survey	11
5.6	Quality categorization method	14
	<i>Figure 3 – Flowchart for tree quality assessment</i>	15
6	Arboricultural constraints and opportunities	16
6.1	Process flowchart	16
	<i>Figure 4 – Process flowchart for arboricultural constraints and opportunities</i>	16
6.2	Arboricultural constraints and opportunities plan	16
	<i>Table 1 – Identification of quality categories</i>	17
6.3	Root protection area	17
6.4	Canopy cover	18
7	Design	20
7.1	General	20
7.2	Hierarchy of controls to protect trees	21
7.3	Layout design considerations	21
7.4	Modifications to the RPA to accommodate proposed activities	22
8	Assessing arboricultural impacts	23
8.1	Process flowchart	23
	<i>Figure 5 – Process flowchart for assessing arboricultural impacts</i>	23
8.2	General	23
8.3	Principles of assessing impacts	24
8.4	Impacts to individual arboricultural features	24
8.5	Macro impact assessment	25
8.6	Arboricultural impact report	26
8.7	Arboricultural impact plan	27
9	Arboricultural method statement	27
9.1	Process flowchart	27
	<i>Figure 6 – Process flowchart for arboricultural method statement</i>	27
9.2	Arboricultural method statement	27
9.3	Barriers and ground protection	28
9.4	Alternative protection within the RPA	31
9.5	Tree protection plan	31
10	Delivery	32
	Annex A (normative) Measurement of tree stems	33
	<i>Figure A.1 – Measurement of tree stems</i>	33
	Annex B (informative) Trees and the planning system	34
	<i>Table B.1 – Delivery of tree-related information into the planning system</i>	34
	Annex C (informative) Soil assessment	35
	<i>Figure C.1 – Soil texture triangle</i>	36
	<i>Figure C.2 – Determination of soil texture by manual texture test</i>	38

Figure C.3 – Influence of soil pH on nutrient availability 39

Annex D (informative) Canopy cover 40

Figure D.1 – Example of canopy cover projection with detail showing combined cover without double counting area 41

Figure D.2 – Correlation of crown form and branching angle reduction factor 43

Annex E (informative) Tree growth 44

Figure E.1 – Illustrative root spread in relation to root protection area 45

Annex F (normative) Factors for demolition and construction in proximity to trees 46

Annex G (normative) Engineering and construction solutions for foundations and subterranean construction 48

Annex H (normative) Utilities and drainage 50

Annex I (informative) Avoiding damage caused by trees 51

Figure I.1 – An example of bridging shallow roots 52

Annex J (normative) Hard surfacing within the RPA 54

Annex K (normative) Tree works 57

Annex L (informative) Tree protection barrier examples 59

Figure L.1 – Robust specification for protective barrier 59

Figure L.2 – Alternative examples of above-ground stabilizing systems 60

Figure L.3 – Stem protection example with box frame 61

Figure L.4 – Stem protection example with wrapping 62

Annex M (informative) Significance of impacts on arboricultural features 63

Bibliography 64

Foreword

Publishing information

This British Standard is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on **XX Month 202X**. It was prepared by Technical Committee B/213, *Trees and tree work*. A list of organizations represented on this committee can be obtained on request to the committee manager.

Supersession

This British Standard supersedes BS 5837:2012, which is withdrawn.

Information about this document

This is a full revision of the standard, and introduces the following principal changes:

- a new series of process flow charts;
- measuring stem diameter at 1.3 m above ground level;
- different quality categorization assessment method;
- modifications to how root protection areas are calculated, spatially represented and modified;
- introducing an approach to assessing impacts including canopy cover assessments, populations assessment and assessing significance of impacts on arboricultural features; and
- alternative methods of physically protecting trees.

This British Standard provides recommendations and guidance for arboriculturists, architects, build and demolition organizations, developers, ecologists, engineers and landscape architects. It is also expected to be of interest to policy makers, decision makers, land managers, contractors, planners, planning authorities, statutory undertakers, surveyors, and all others interested in harmony between trees and development in its broadest sense.

This publication can be withdrawn, revised, partially superseded or superseded. Information regarding the status of this publication can be found in the Standards Catalogue on the BSI website knowledge.bsigroup.com, or by contacting the Customer Services team.

Where websites and webpages have been cited, they are provided for ease of reference and are correct at the time of publication. The location of a webpage or website, or its contents, cannot be guaranteed.

Use of this document

As a code of practice, this British Standard takes the form of recommendations and guidance. It is not to be quoted as if it were a specification. Users are expected to ensure that claims of compliance are not misleading.

Users may substitute any of the recommendations in this British Standard with practices of equivalent or better outcome. Any user claiming compliance with this British Standard is expected to be able to justify any course of action that deviates from its recommendations.

It has been assumed in the preparation of this British Standard that the execution of its provisions is entrusted to appropriately qualified and experienced people, for whose use it has been produced.

The copyright for Figure E.1, Figure L.1, Figure L.2, Figure L.3 and Figure L.4 of this British Standard is owned by BSI. Purchasers of this British Standard are authorized to use the model content contained within Figure E.1, Figure L.1, Figure L.2, Figure L.3 and Figure L.4, and to make an unlimited number of copies for their own use, without infringement of

copyright. However, following the recommendations given in this British Standard does not necessitate use of the model content.

Presentational conventions

The provisions of this document are presented in roman (i.e. upright) type. Its recommendations are expressed in sentences in which the principal auxiliary verb is “should”.

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Where words have alternative spellings, the preferred spelling of the *Shorter Oxford English Dictionary* is used (e.g. “organization” rather than “organisation”).

Contractual and legal considerations

This publication has been prepared in good faith, however no representation, warranty, assurance or undertaking (express or implied) is or will be made, and no responsibility or liability is or will be accepted by BSI in relation to the adequacy, accuracy, completeness or reasonableness of this publication. All and any such responsibility and liability is expressly disclaimed to the full extent permitted by the law.

This publication is provided as is, and is to be used at the recipient's own risk.

The recipient is advised to consider seeking professional guidance with respect to its use of this publication.

This publication is not intended to constitute a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

0 Introduction

0.1 Purpose of the standard

This standard is intended to guide the multi-disciplinary design and delivery teams along with local planning authorities, when involved, through the process to be undertaken when selecting trees for retention and protection, and integrating existing trees and new tree planting on development sites. In policy terms, increasing the biodiversity contribution of trees is as important as their contribution to amenity.

In a changing world, trees enable society to be more resilient to the effects of climate change. They also form important elements of green infrastructure and are a key feature in supporting biodiversity with mature trees providing greater benefits.

Trees are widely recognized for their many benefits, including:

- environmental – microclimate effects, climate moderation, cooling through evapotranspiration, intercepting precipitation, some airborne particulate matter removal, carbon storage, supporting biodiversity by providing niche habitats;
- social – amenity, softening the built environment and enhancing quality of place, adding maturity, providing shade and safe spaces for play, providing local identity and improving health and well-being; and
- economic – increasing property values and the above tangible and intangible benefits provide economic advantage.

Trees take many decades to achieve their full potential, so design decisions should be based on similar timescales to achieve sustainable outcomes, recognising that planting trees to compensate for felled trees does not provide immediate compensation. Therefore, within the planning balance there should be a general presumption that established trees are retained, with removal focussed on lower quality trees with limited remaining contribution.

0.2 Using the standard

The standard follows a logical sequence of events that is summarized in the flowchart in Clause 4. This flowchart cascades down to a separate flowchart for each of the separate topics covered in Clause 5 to Clause 10. Each of these individual flowcharts aligns with a Royal Institute of British Architects (RIBA) plan of work stage and is immediately followed by a series of recommendations relating to that particular subject.

Annexes explore each subject in greater depth, with figures to add further clarification. Following the establishment of baseline and arboricultural constraints and opportunities, the process can be iterative, especially when designs are modified.

The full sequence of events in the standard might not be applicable in all instances. For example, a permitted development conservatory might not require the level of detail that needs to accompany a planning application for the development of a site with one or more dwellings.

1 Scope

This British Standard gives recommendations and guidance on the relationship between trees and design, demolition and construction processes.

It sets out the principles and procedures to be applied to achieve a sustainable relationship between trees and structures.

The standard is applicable whether or not planning permission is required.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes provisions, or limits the application, of this document¹⁾. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 3998, *Tree work – Recommendations*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 access facilitation pruning

one-off tree pruning operation, the nature and effects of which are without significant adverse impact on tree physiology or amenity value, which is necessary to provide access for operations on site

3.2 arboricultural constraints and opportunities plan (ACOP)

scale drawing showing the spatial constraints of trees within a study area and opportunities for their development and landscaping

3.3 arboricultural feature

trees, groups of trees, woodlands, hedges, hedgerows and shrub masses

NOTE The term “group” denotes trees that form cohesive arboricultural features either aerodynamically (e.g. trees that provide companion shelter) and/or visually (e.g. avenues or screens).

3.4 arboricultural method statement

methodology for the monitoring, implementation, supervision and reporting of any aspect of development that is within the root protection area (RPA) (3.18), or has the potential to result in loss of or damage to a tree to be retained

3.5 arboriculturist

person who has, through relevant education, training and experience, gained expertise in the field of trees in relation to construction

3.6 canopy

two-dimensional representation of the area covered by the branches and foliage of an arboricultural feature

3.7 canopy cover

total area of canopy (3.7) for a given population of trees

3.8 competent person

person who has training and experience relevant to the matter being addressed and an understanding of the requirements of the particular task being approached

NOTE 1 A competent person is expected to be able to advise on the best means by which the recommendations of this British Standard may be implemented.

¹⁾ Documents that are referred to solely in an informative manner are listed in the Bibliography.

NOTE 2 A competent person is expected to act in a manner consistent with the code of conduct applicable to their own professional discipline.

3.9 construction

site-based operations with the potential to affect existing trees

3.10 crown

entire top part of a tree comprising branches and foliage

3.11 crown spread

radial extent of the crown (**3.10**) measured from centre of stem at ground level

3.12 designer

persons with an influence over the form, layout, construction/demolition and sequencing of works that could impact trees

3.13 diameter at breast height (DBH)

standard form of measuring the stem size of a tree with the diameter measured at 1.3 m above ground level

NOTE Annex A shows how DBH is measured on commonly encountered tree stem forms.

3.14 ecosystem services

social, environmental and economic goods and services provided to humans from natural environment

3.15 effect

outcome or result to an arboricultural feature from an impact (**3.16**) arising from development

NOTE For example the effects on a landscape of tree removal.

3.16 impact

activity or action resulting in changes to an arboricultural feature

NOTE 1 For example, excavation removing tree roots.

NOTE 2 The outcome of an impact is referred to as an effect (see 3.15).

3.17 mature tree

tree that has attained and or has passed the maximum expected crown size (height and spread) for the species or cultivar in the context of its growing conditions and past management

NOTE 1 In mature trees the elongation of branches radially from the stem has stopped or has greatly slowed, unless the crown or parts of the crown have been modified by pruning. Due to dieback or retrenchment, branches might be reducing in length.

NOTE 2 Veteran trees are a potential subset of mature tree (not all mature trees become veteran).

NOTE 3 Trees with advanced maturity have in the past been referred to as over-mature or post-mature, terms that might only be used in relation to ancient tree life stages and not used in this document.

3.18 root protection area (RPA)

the minimum area around an arboricultural feature deemed to contain sufficient roots and rooting volume to maintain its viability, and where the protection of the roots, mycorrhiza and soil structure is treated as a priority

NOTE The RPA is a minimum area and should not be assumed to contain all roots of the tree.

3.19 stem

principal above ground structural component(s) of a tree that support(s) its branches

3.20 structure

manufactured object, such as a building, carriageway, path, wall, utility run, and built or excavated earthwork

3.21 tree protection plan

scale drawing, informed by descriptive text where necessary, showing finalized proposals, trees for retention, and tree and landscape protection measures

3.22 utility

any above- or below-ground structure or apparatus required for the provision of services

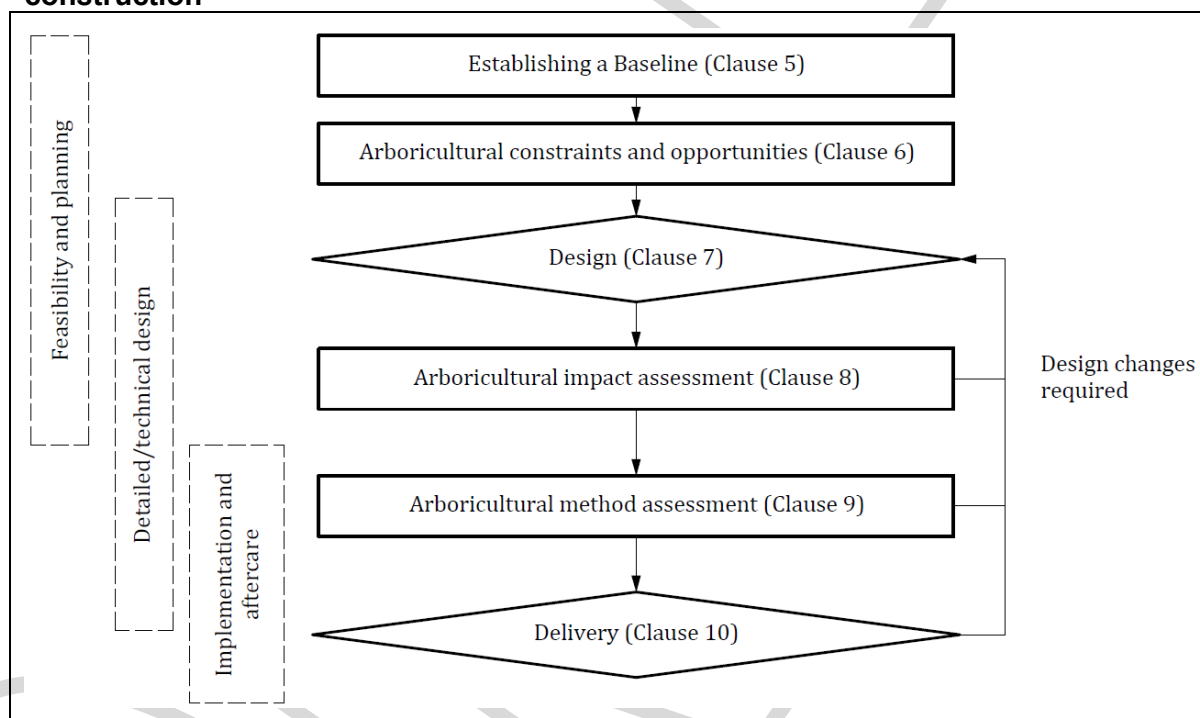
NOTE Examples include drainage, gas supplies, ground source heat pumps, CCTV and satellite communications.

4 General process

4.1 The process shown in Figure 1 should be followed for all projects where trees are involved.

NOTE Prior to undertaking any surveys, it might be prudent to undertake an initial desk study screening of the site to establish the presence of national, regional or local designations in relation to trees. This can enable sufficient information to be gathered for priority arboricultural features during the survey. It is prudent to undertake a site visit to verify desk study findings.

Figure 1 – General process for trees in relation to design, demolition and construction



4.2 Plans should be to scale. They should show a scale bar and a north point.

4.3 When plans are drawn in colour, they should carry the following statement (or similar): "The original of this drawing was produced in colour – a monochrome copy should not be relied upon."

4.4 To enable a coordinated, collaborative and joined-up approach to planning, design and delivery on site, information should be shared in a predefined format for incorporation by different disciplines within their drawings.

4.5 The work involved in preparing and implementing all arboricultural surveys, impact assessments and measures for avoidance, mitigation, compensation and enhancement should be proportionate to the predicted degree of risk to arboricultural features and to the nature and scale of the proposed development.

NOTE This approach is aligned with UK government planning guidance, for example paragraph 44 of the National Planning Policy Framework for England [1].

5 Establishing a baseline

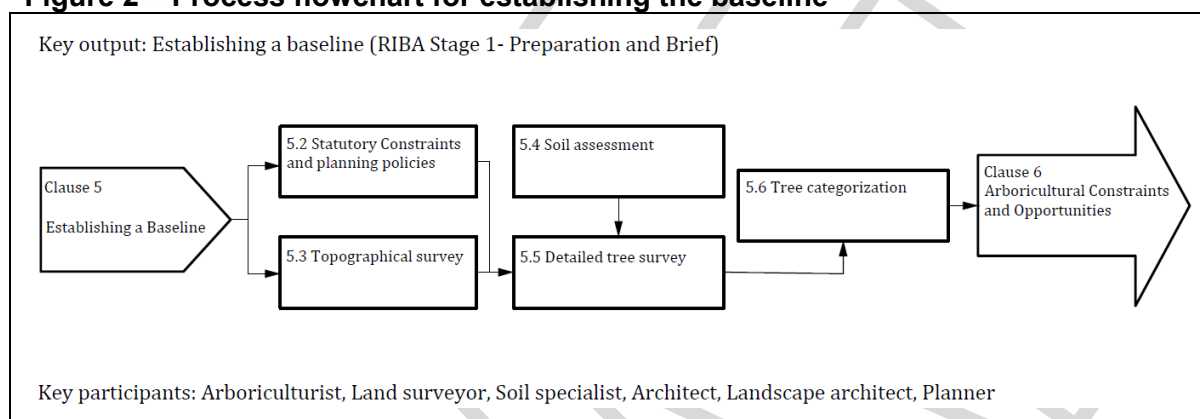
COMMENTARY ON CLAUSE 5

Taking a proportionate approach for some projects might include a feasibility or scoping review of the site using information available in, for example, photographs, maps and statutory constraints (5.2) to highlight at an early stage key constraints and opportunities. Such a study, given its limitations, is not sufficient to inform detailed design or a planning application (guidance regarding trees and the planning system is in Annex B).

5.1 Process flowchart

The baseline should be established in accordance with the order shown in Figure 2 and should meet the recommendations given in 5.2 to 5.6.

Figure 2 – Process flowchart for establishing the baseline



5.2 Statutory constraints and planning policies

Prior to undertaking a detailed tree survey, the arboriculturist should obtain and assess information regarding the following, as it can influence the level of detail recorded:

- a) national, regional and local planning policies relating to arboricultural features;
- b) records of veteran trees or ancient woodland; and
- c) statutory protection, including tree preservation orders, conservation areas, felling licence and hedgerow regulations.

NOTE Clear information regarding statutory protection of trees reduces the likelihood of confusion as to what tree works are permitted at the Delivery stage.

5.3 Topographical survey

5.3.1 An accurately measured topographical survey should be undertaken showing relevant features.

NOTE 1 A method of carrying out topographical surveys is given in the RICS publication Measured surveys of land, buildings and utilities [2].

NOTE 2 Prior to commencing the topographical survey, it might be appropriate to seek the advice of an arboriculturist on its scope, particularly where there are woodlands or substantial tree groups present.

5.3.2 Where clearance of undergrowth is essential to facilitate the topographical survey process, this should be undertaken in consultation with relevant professionals, in order to avoid damage to, for example, arboricultural, archaeological, landscape or ecological features. Where appropriate, this should include attendance of a competent person on site to oversee and advise during the works.

5.3.3 The topographical survey should be made available as scale drawings and in a commonly recognized digital format. It should be used to inform tree survey, design and planning decisions.

5.3.4 The topographical survey should record:

- a) spot levels at the base of trees and throughout the site at an interval appropriate to meet design requirements, recorded as a grid and interpolated as contours, and including any abrupt changes;
- b) the position of all trees within the site with a DBH of 75 mm or more;

NOTE 1 In the case of woodlands or substantial tree groups, only individual trees with DBH greater than 150 mm usually need be plotted.

- c) the position of all trees within the site with a DBH of 75 mm or more;
- d) the position of trees with an estimated DBH of 75 mm or more that overhang the site or are located nearby beyond the site boundaries;
- e) for woodlands or substantial tree groups, the overall extent of the canopy and significant stems;

NOTE 2 The overall extent of the canopy can be taken from a recent georectified aerial photograph.

- f) the extent, basal ground levels and height of shrub masses, hedges, hedgerows and stumps; and
- g) other relevant landscape features and artefacts, such as:
 - 1) streams and ditch inverts;
 - 2) embankments and retaining features;
 - 3) buildings and other structures;
 - 4) boundary features and means of enclosure; and
 - 5) overhead and underground utility apparatus.

5.4 Soil assessment

COMMENTARY ON 5.4

Soil type has an influence on the spread, depth, and distribution of the root system, as does the level of the water table. Simple field-based soil assessment and the digging of small trial holes can provide useful information about soil structure, composition, and drainage.

A soil assessment should be undertaken by a competent person to inform decisions relating to the root protection area (RPA), potential work within the RPA, tree protection measures and foundation design. The type of soil assessment should be proportionate to the level of detail required to inform design.

NOTE Annex C and BS 5930 give guidance for testing soils and site investigations.

5.5 Detailed tree survey

COMMENTARY ON 5.5

The risk of project delay due to material constraints being identified at a late stage can be avoided by early procurement of a tree survey.

Where proposed development is subject to planning control, a tree survey would usually be regarded as an important part of the evidence base to inform planning decisions.

Arboricultural features are dynamic living organisms typically increasing in size each year until they reach maturity and whose condition can change rapidly (due to biotic and abiotic factors). Where a project takes years in design and planning, it might be necessary to assess the validity of the tree survey.

NOTE 1 Trees can be assessed by ecologists for habitat potential to inform biodiversity assessments.

NOTE 2 To establish conservation value, the arboriculturist could be informed by the outcomes of surveys by ecologists, e.g. bat surveys (see BS 8596) or detailed hedgerow surveys.

NOTE 3 Assessing the visual amenity and importance in the landscape is typically undertaken in a landscape and visual impact assessment where a landscape architect is appointed.

5.5.1 General

5.5.1.1 A tree survey should be undertaken by an arboriculturist to record information about the arboricultural features on or adjacent to a site. The tree survey should be completed and made available to designers prior to and/or independently of any specific proposals for development.

5.5.1.2 The results of the tree survey, including material constraints arising from existing arboricultural features, should be used (along with other relevant baseline data) to inform feasibility, design, impact assessments and arboricultural method statements.

5.5.1.3 During any detailed tree survey, the arboriculturist should assess the site to determine the conditions that could affect arboricultural features, including but not limited to:

- a) exposure;
- b) topography;
- c) ground levels;
- d) drainage;
- e) site use;
- f) past site management;
- g) changes to the site; and
- h) ground conditions that could affect tree root distribution.

NOTE It is advisable to undertake this assessment with the aid of a topographical survey, to determine how the ground conditions could affect the distribution of tree roots. This could include, particularly in an urban setting, what physical barriers might limit root development.

5.5.1.4 During the detailed tree survey, if trees are found that require urgent intervention (hazardous trees or trees with notifiable plant health conditions), they should be referred immediately to a relevant person or organization (including statutory authorities where applicable).

5.5.2 Method

5.5.2.1 The tree survey should include arboricultural features included in the topographical survey (see 5.3), and any additional arboricultural features that might have been missed, e.g. those that overhang the site or where the RPA (see 6.3) would be within the site.

5.5.2.2 Arboricultural features growing as groups or woodland should be identified and assessed as such, where the arboriculturist determines that this is appropriate. However, an assessment of individuals within a group should be undertaken if there is a need to differentiate between them, e.g. in order to highlight significant variation in attributes (including physiological or structural condition) or to provide more detail to inform design and impact assessments.

5.5.2.3 Where trees are present within a hedgerow that are significantly different in character from the hedgerow, e.g. where they are distinct trees, these should be identified and recorded separately.

5.5.2.4 As part of the tree survey, a schedule should be created which lists all the arboricultural features and records sufficient information to make suitable assessments of impact and assist decision makers. At least the following information should be recorded (see 5.5.2.5 for measurement conventions):

- a) sequential reference number;
- b) number of trees if not recorded individually (estimated for larger arboricultural features);
- c) species listed by common name, with a key provided to scientific names;
- d) height:
 - 1) of each individual tree; or
 - 2) for other arboricultural features an average or a maximum and minimum;
- e) DBH:
 - 1) of each individual tree, measured in accordance with Annex A; or
 - 2) for other arboricultural features an average or a maximum and minimum;

NOTE 1 Within conservation areas it might be necessary to record stem diameter at 1.5 m above ground level to establish whether they are protected by the Town and Country Planning Act 1990, s211 [3].

- f) crown spread:
 - 1) for individual trees, taken as a minimum at the four cardinal points with additional measurements to capture irregular shapes; or
 - 2) for other arboricultural features, recorded as the lateral spread to derive an accurate representation of the crown;

NOTE 2 It is not always practical or necessary to record crown spread for every tree within a group or woodland.

NOTE 3 In some cases, layout design might be aided by the arboriculturist providing data on future tree height and crown spread. Further guidance on canopy cover is given in Annex D.

- g) existing height above ground level of the:
 - 1) first significant branch junction with stem and direction of growth (e.g. 2.5-N) for individual trees; and
 - 2) crown;
- h) life stage (e.g. young, semi-mature, early mature, mature, veteran);

NOTE 4 When assessing potential veteran trees in the context of planning, national planning policy definitions for veteran trees are to be taken into account.

NOTE 5 Characteristics of a veteran tree typically include a large girth, signs of crown retrenchment and hollowing of the stem.

NOTE 6 The term “ancient tree” is not referenced in the standard because every ancient tree is a veteran tree.

NOTE 7 Whilst veteran trees typically provide a range of niche habitats, they are especially valuable if ancient, due to their scarcity and high habitat values for associated species of fungi, lichens and saproxylic invertebrates, including some that are rare or endangered and occur only where such trees have been continuously present for centuries.

- i) structural condition;
- j) physiological condition;
- k) general observations relating to notable ecological features, amenity, safety or condition and/or preliminary management recommendations;
- l) estimated remaining contribution, in years (<10, 10+, 30+);
- m) quality category (see 5.6); and
- n) ground conditions and surface material.

NOTE 8 A reduced tree schedule could be appropriate for either preliminary surveys or for particularly large projects where the site boundaries are not fixed. In such circumstances a proportionate approach needs to be taken.

5.5.2.5 The measurement conventions should be as follows.

- a) Height and crown clearance should be recorded to the nearest half metre for dimensions up to 10 m and the nearest whole metre for dimensions over 10 m.
- b) Crown spread should be recorded to the nearest 0.5 m.
- c) DBH should be recorded in millimetres, rounded to the nearest 10 mm.
- d) Estimated dimensions (e.g. for off-site or otherwise inaccessible trees where accurate data cannot be recorded) should be clearly identified as such (e.g. suffixed with a "#").

5.5.2.6 On shrinkable soils (whether known or suspected), if it is evident that trees have been removed, this should be recorded, along with any apparent signs of past management, such as laying hedgerows or significant height reduction; such information can be relevant to foundation design.

5.6 Quality categorization method

COMMENTARY ON 5.6

The purpose of the quality categorization method is to identify the quality and value (in a non-fiscal sense) of the existing tree stock, allowing informed decisions to be made concerning which trees are to be prioritized for retention in the event of development occurring.

Quality categorization is a design tool to guide tree retention. It does not set out which trees are to be retained.

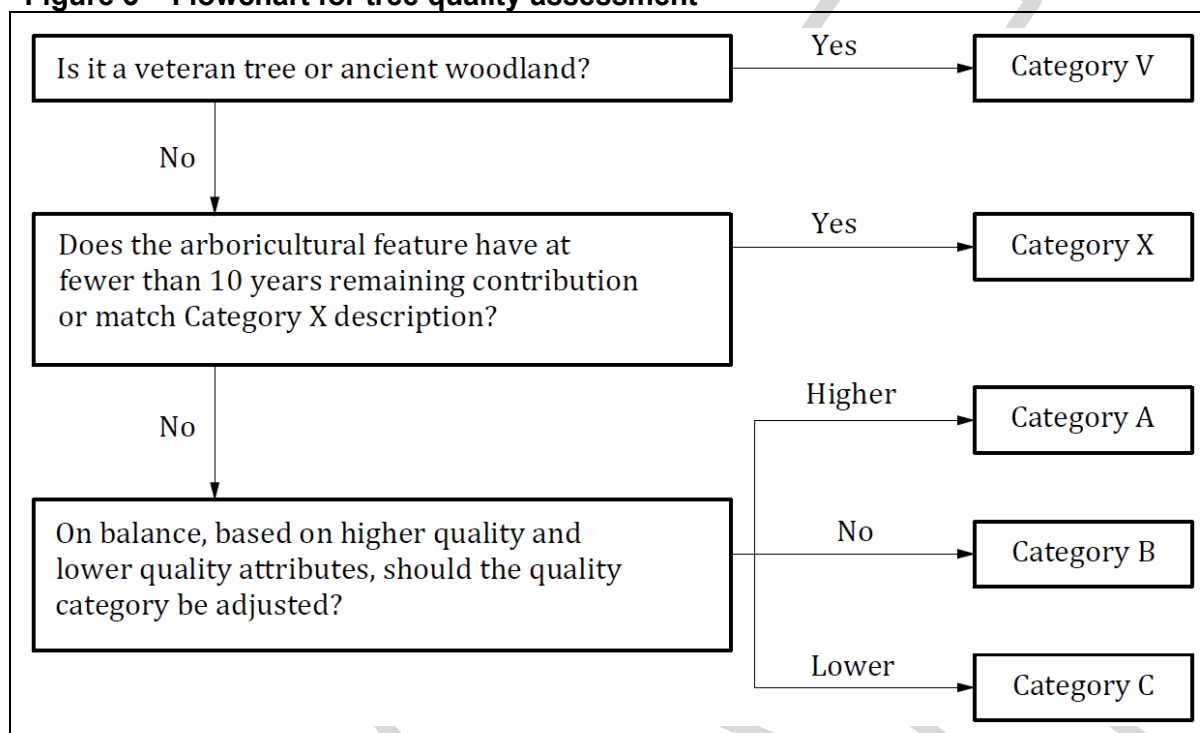
Particular care is needed when evaluating young trees, especially where they occur as individual trees. Where these are less than 150 mm DBH, it might be acceptable and relatively straightforward to compensate for their loss with similar new tree planting. Alternatively, it might be practicable to relocate such trees within the site (e.g. using a tree spade).

NOTE 1 Retention of established trees might be preferable to removal and new tree planting, as there is a risk of trees not establishing and the opportunity cost of removing trees that have high potential for growth.

NOTE 2 It is sometimes possible to relocate mature trees. However, as this is a costly and complex operation with a variable chance of success, it is a viable option only in exceptional cases.

5.6.1 Arboricultural features should be categorized in accordance with Figure 3.

Figure 3 – Flowchart for tree quality assessment



5.6.2 Arboricultural features should be recorded as Category V if they are either veteran trees (see 3.23) or ancient woodland.

5.6.3 Arboricultural features should be recorded as Category X trees if they are in such a condition that they cannot realistically be retained as living trees in the context of the current land use for longer than 10 years. Sufficient information should be recorded in the tree survey schedule (see 5.5.2.4) to show the rationale for assessing as Category X.

NOTE Examples of Category X arboricultural features are:

- trees that have a serious, irremediable, structural weakness, such that their early loss is expected due to collapse, including those that will become unviable after removal of other category X trees (e.g. where, for whatever reason, the loss of companion shelter cannot be mitigated by pruning);
- trees that are dead or are showing signs of significant, immediate, and irreversible overall decline; and
- trees infected with pathogens of significance to the health and/or safety of other trees nearby, or very low-quality trees suppressing adjacent trees of better quality.

5.6.4 For arboricultural features that are neither Category V nor Category X, the default position should be that all arboricultural features are Category B (moderate quality), unless they are elevated to Category A (high quality) or reduced to Category C (low quality) based on the following higher and lower quality attributes:

a) higher quality attributes/indicators:

- 1) minimum 30 years estimated remaining contribution (required for Category A);
- 2) arboricultural features that are particularly good examples of their species, especially if rare or unusual;
- 3) essential components of formal or semi-formal arboricultural features (e.g. key members of an avenue);
- 4) visually important as arboricultural and/or landscape feature;
- 5) significant conservation value;

- 6) historical or commemorative or other cultural value, including locally notable trees; and
- 7) sub-mature trees and capable of achieving full potential in current setting; and
- b) lower quality attributes/indicators:
 - 1) poor structural or physiological condition (minor imperfections do not justify downgrading);
 - 2) young, small or insignificant and either easily replaced or transplanted;
 - 3) no developed significant ecological features;
 - 4) high maintenance costs that cannot be justified or retention would require severely disfiguring tree work; and
 - 5) removal would benefit other better quality trees.

NOTE Arboricultural features have many attributes which can increase or reduce their quality and value. The approach to categorization is subjective due to the complexity of multiple factors to be taken into account by the arboriculturist.

5.6.5 The tree survey schedule should record sufficient information to support the A or C categorizations.

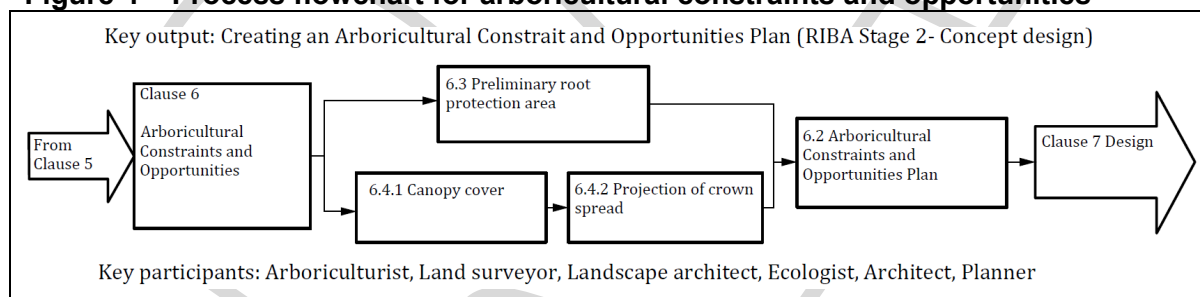
6 Arboricultural constraints and opportunities

6.1 Process flowchart

Arboricultural constraints and opportunities should follow the order shown in Figure 4 and should meet the recommendations given in **6.2** to **6.4**.

NOTE An accurate baseline is important to inform decision makers and it is important to understand that the baseline is not static; trees grow, and site conditions can change.

Figure 4 – Process flowchart for arboricultural constraints and opportunities



6.2 Arboricultural constraints and opportunities plan

6.2.1 To inform the design team, arboriculturists should prepare an arboricultural constraints and opportunities plan (ACOP), setting out, in plan format, the spatial constraints and opportunities arboricultural features present and allow for future growth.

6.2.2 Above-ground constraints consist of tree stems and crowns; tree stems and crowns should be delineated on the ACOP. Below-ground constraints relate to the tree rooting environment and should be shown on the ACOP as root protection areas (RPAs)

6.2.3 The RPA (see **6.3**) and any other relevant constraints should be plotted around all arboricultural features on relevant drawings, including proposed site layout plans.

NOTE 1 An indication of potential direct obstruction and/or filtering of sunlight can be illustrated by plotting a segment, with a radius from the centre of the stem equal to the height of the tree, drawn from due north-west to due east, indicating the shadow pattern through the main part of the day.

NOTE 2 Proprietary software is available that can assist with calculation and plotting of tree shadow extent (see also BRE CP75/75 [4] and BR 209 [5]).

6.2.4 The quality categories should be clearly identified on the ACOP, using the colours shown in Table 1.

Table 1 – Identification of quality categories

Category	Colour	RGB code
V	Light blue	000-255-255
A	Light green	128-255-255
B	Mid blue	000-000-255
C	Grey	091-091-091
X	Dark red	255-000-000

6.3 Root protection area

Persons reviewing the Draft for Public Comment are particularly requested to give feedback on the following point. Do you agree with an increased root protection area for mature category A trees and veteran trees? If you disagree, what alternative should be recommended and why?

COMMENTARY ON 6.3

The root protection area (RPA) is based on the size of the tree at the time of detailed tree survey. The RPA is sufficient for the tree at its current size but if the tree has yet to attain a mature size, additional space immediately adjoining the RPA can be important for development of the arboricultural features.

A root opportunity area (ROA) can be shown on the ACOP immediately adjacent to the RPA, which illustrates areas where roots are likely to be present beyond the RPA and can be an area to support sustainable development of the arboricultural feature; as noted in Annex E, tree roots can extend from the tree to a much greater extent than the RPA. The ROA can be used to inform potential areas of mitigation where parts of the RPA are impacted.

6.3.1 Shape of RPA

6.3.1.1 The RPA for each arboricultural feature should initially be plotted as a circle centred on the base of the stem.

6.3.1.2 Where pre-existing site conditions or other factors indicate that rooting has occurred asymmetrically, a polygon of equivalent area to the RPA should be produced. Modifications to the size and shape of the RPA should reflect a soundly based arboricultural assessment of likely root distribution. A modified RPA should take account of the following factors:

- a) sensitivity and tolerance of the arboricultural feature to disturbance or damage, based on factors including:
 - 1) species;
 - 2) maturity;
 - 3) physiological condition; and
 - 4) past management;
- b) site features, such as roads, structures and underground apparatus that could influence the morphology of the roots;
- c) historic groundwork that could have damaged or removed roots;
- d) topography, particularly variation of ground levels;
- e) drainage (whether natural or artificial); and
- f) soil type and structure, including depth and potential contaminants.

6.3.1.3 Whether the shape of an RPA is modified from the initial circle or not, the project arboriculturist should be able to justify the rationale for the shapes used. Where there is a

low level of confidence in the RPA shape or size, the designer(s) and decision maker(s) should be made aware, as there is potential for the design subsequently to be incompatible with successful tree retention.

NOTE 1 If there is a need to establish the actual distribution of tree roots, ground-penetrating radar can be used to establish locations of tree roots; however, users need to have full knowledge of the limitations in its accuracy and ability to locate relatively large roots. Excavation can provide more certainty with regard to the location of tree roots, and either manual excavation or pneumatic excavation (air lance and/or vacuum), if carefully undertaken, can avoid damage to roots.

NOTE 2 Annex E gives guidance on the extent of root systems and Annex F gives guidance on excavation. It is unlikely that small roots and mycorrhizae would be observed and retained in trial excavations or appear in ground-penetrating radar surveys.

6.3.2 Size of RPA

6.3.2.1 The calculated RPA radius should be rounded up to the nearest 0.1 m and should be not less than 2 m.

6.3.2.2 The DBH should be measured in accordance with Annex A. For trees with more than one stem, one of the two calculation methods below should be used.

a) For trees with two to five stems, the combined DBH should be calculated as follows:

$$\sqrt{d_1^2 + d_2^2 \dots + d_s^2}$$

where d_n is the DBH of each stem;

b) For trees with more than five stems (not illustrated in Annex A), the equivalent DBH should be the greatest of either:

1) DBH of the largest stem; or

2) $\sqrt{d_m^2 \times n}$

where d_m is the mean stem DBH and n is the number of stems.

6.3.2.3 The RPA size should be calculated in the following order:

a) for Category V arboricultural features:

1) for ancient woodland, 15 m from the woodland boundary; and

2) for veteran trees, based on a circle with a radius 15 times DBH (with no cap), or 5 m beyond the crown spread, whichever is greater;

b) for mature Category A arboricultural features, based on a circle with a radius 15 times DBH up to a cap of 22.5 m (area capped at 1 590 m²);

c) for all other live arboricultural features, based on a circle with a radius 12 times DBH up to a cap of 15 m (area capped at 707 m²); and

d) for dead arboricultural features, the RPA should be sufficient to enclose the former mechanically active root plate.

NOTE Retention of dead trees might require safety assessment by an arboriculturist, followed by implementation of appropriate risk control measures.

6.4 Canopy cover

COMMENTARY ON 6.4

Trees provide a range of ecosystem services such as cooling the urban heat island effect, shade provision, particulate entrapment, storm water drainage attenuation, carbon sequestration and wildlife habitats. Higher levels of tree cover tend to provide greater amounts of ecosystem services and larger trees tend to provide greater benefits; further information on tree growth is given in Annex E. Tree canopy cover can be used as a proxy for measuring ecosystem services and benefits of trees.

6.4.1 Canopy cover general

6.4.1.1 The crown spread should be plotted on the ACOP as an irregular oviform shape to represent the crown of each individually recorded tree and the crown extents for other arboricultural features. The following principles should be adopted for representing the crown:

- a) individual trees: plot crown based on cardinal point measurements from the tree survey; and
- b) other arboricultural features: measure and plot the edges of the tree canopy using the general dripline.

6.4.1.2 An assessment of canopy cover (see **8.5.2**) should include the arboricultural features potentially affected by development. The ACOP should therefore include all arboricultural features on the site and crowns overhanging from adjoining land.

6.4.1.3 When calculating a total for the site, only the plan view area covered by crowns should be measured (overlapping crowns should not be double counted).

6.4.1.4 The canopy cover area should be reported in square metres and expressed as a percentage of the site area. The area should be based on scaled drawings or calculated with the use of drawing design software.

6.4.2 Future projection of crown spread

6.4.2.1 Future crown spread should be plotted on the ACOP.

NOTE 1 Annex D gives guidance on canopy cover.

NOTE 2 The projected crown spread is primarily designed to provide broad guidance that informs and assists designers and decision makers.

6.4.2.2 The crown spread of arboricultural features tends to grow until it attains a mature size, subject to site-specific limiting factors; the projected crown spread should not exceed the expected ultimate size of the arboricultural feature. Above-ground features which limit crown spread, such as buildings and other trees, should be included when assessing ultimate size for trees.

6.4.2.3 Assessing future growth potential is a complex analysis that should be undertaken by an arboriculturist on a case-by-case basis, accounting for site-specific factors, including but not limited to:

- a) species and cultivar;
- b) maturity;
- c) physiological condition;
- d) past and future management;
- e) local microclimate;
- f) competition with other vegetation and trees for nutrients, light and moisture;
- g) pre-existing above-ground features affecting crown spread, such as buildings, trees or overhead power cables;
- h) ground conditions, including local soil, available rooting volumes, drainage, and sealed surfaces; and
- i) for new trees, their provenance, size at planting, plant quality, likely future maintenance and soil suitability.

6.4.2.4 The canopy cover projection should provide a total canopy cover comprising that of both newly planted trees and retained trees.