CAVAT

(Capital Asset Value for Amenity Trees)

Quick Method: User's Guide

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Introduction

CAVAT (Capital Asset Value for Amenity Trees) provides a basis for managing trees in the UK 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 particularly for councils and other Public Authorities and primarily for publicly owned trees. However, it may be used by other public bodies, including the Courts, private institutions and individuals. It 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 relevant skills and experience.

It is established in UK law, in the Town and Country Planning Act 1990 Section 198, that trees have value as a public amenity and therefore local planning authorities are given a 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, and 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, and in a way that is directly related to the quantum of public benefits that each particular tree provides. Applied to the tree stock as a whole it enables it to be managed as if it were a financial asset of the community. Applied to single trees it gives a value that is meaningful in itself but 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, and then adjusting this to reflect the degree of benefit that the tree provides to the local community. 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*).

The Two Methods

There are two versions of the CAVAT method. The Full Method, described in detail separately, is recommended for use in decisions concerning individual trees or groups, when precision is required and sufficient time is available for a full assessment. The Quick Method, described here, 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. 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 manage, 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 data required is limited to the minimum necessary to express the value of the tree stock as a whole, and to provide information to assist with management decisions. Data will generally be collected in conjunction with regular surveys of the tree stock. The database software will need to be adapted to include the necessary fields, and to produce useful analysis of the information collected.

The main differences form the Full Method are that the influence of the accessibility of location and that individual factors are not considered, on the grounds that these even out over the stock as a whole and that the extra simplicity is important for presentation and understanding of results. Size, in terms of DBH is required, but is converted into inclusion in one of a series of 16 value bands. They are designed to respond quickly to changes in girth in the early stages of establishment. The values are updated each year to take account of the effects of inflation. The tree's relative functional health and integrity is considered, but in 25% gradations rather than 10%. Finally the effect of life expectancy on the value of the population will be estimated by an arithmetical adjustment to the total stock value, and not individually.

Taken together this has the vital effect of reducing any added survey time effectively to zero, overcoming a potentially significant objection to inclusion, as intended, in the tree stock survey.

The suggested approach to using the CAVAT Quick Method as a strategic tool is summarised in Note 2.

The Quick Method

The Variables

The Quick Method potentially involves three steps, and key variables:

1. Basic value/size;
2. CTI value/CTI factor;
3. Functional value/functional status.

Data collection will generally be carried out as part of the annual survey of the tree stock, although a sample approach could be used, and results calculated from this sample, providing a representative selection is made. (*See Note 3*).

Life expectancy may be assessed as part of the survey. Alternatively may be statistical adjustment is made when calculating the value of the stock for reporting purposes. The SLE adjustment bands are shown in Table B and the method of statistical adjustment described in Note 4.

Step 1: Basic Value.

On survey each tree is placed in one of 16 bands according to its DBH (*see table A*), which gives its basic value. The table of up to date values is available separately. For the purposes of CAVAT the exact size is not needed; if it is being measured precisely in any case as part of the survey it may be possible for the database program to calculate automatically the CAVAT banding. The derivation of the unit value factor is given in Note 5.

Step 2: Community Time Index (CTI) Value.

The basic value of the tree population will be adjusted according to the population density of the urban areas of the Local Authority, using Community Tree Index (CTI) factor (*see Note 6 & Table C*). This gives the CTI value.

Once selected the CTI factor is generally not varied, although some large metropolitan authorities where population densities vary significantly across their area may find that more accurate results will be obtained through having different CTI values for different wards, etc. The CTI factor will in the majority of authorities be 100% (i.e. no change) but may be up to 250% for the most densely populated boroughs. CTI factors for England may be found in the separate National Community Tree Index table.

Step 3: Functional Value.

The Functional Value can be retained at 100%, but may be reduced by a factor of 25%, 50%, 75% or 100%, according to the inspector's assessment of the tree's functional status. **Only one combined adjustment of the basic value is required**, comprising crown size and functionality, giving the overall functional value. There are similar provisos in respect of any condition, e.g. structural weakness, which does not affect the current functional status of the tree, or a need for any immediate works. (See note 7).

Notes

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

The premise of CAVAT is that the basis for a calculation of value suitably robust, practicable and useful as an asset management tool for the public value is the widely accepted approach of depreciated replacement cost.

CAVAT allows the value of a tree to be assessed 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 have been designed to give the value of trees as public assets in the UK whereas the stated aim of the CTLA method is to express the private value of the tree to its owner.

Essentially the basic value once calculated is then modified by a consideration of the impact of those factors that modify the quantum of benefits that the public may expect to receive from the particular tree. The factors which are essentially related to "wear and tear" to the tree, including a shortened life expectancy, are dealt with in terms of depreciation. On the other hand factors based on a variation from an arithmetic mean, (for example the particular benefits that flow from the characteristics of the species in question), allow for a either a potential increase or decrease in value.

Its results are broadly comparable with what research, both in the U.S.A. and the U.K., suggests 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.

The CAVAT Quick Method follows the general approach of the Full Method, but is simplified for management of the population as a whole, by exclusion of the less critical factors and those which balance out over the population as a whole, by taking a broader view of functionality, and by treating Safe Life Expectancy statistically.

Note 2: Strategic Management, using CAVAT.

The CAVAT Quick Method allows the value of the public tree stock to be expressed as an index. The index will rise, or fall, with changes in the extent and character of the stock over time. It is suggested that the basic unit of the index should be the equivalent of £10,000 for an Outer London Borough, which is approximately the value of an average street tree. The aim of the asset value management approach is therefore not simply to produce a figure for the stock value, but to manage the stock 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.

As the value of the stock of urban trees changes with time, the index will allow those changes to be expressed in a simple numerical form, and for the results to be subject to a variety of analyses. In turn this will allow the tree manager to analyse existing practices and procedures, test and adjust strategies, and to form appropriate local management policies, as part of an overall strategy. It will be possible to begin to view the value of the system against the cost of management and annual investment levels, for example in new planting. Using simple, standard management analysis techniques, such as a strengths and weaknesses analysis (SWOT) it will then be possible to generate medium term action plans, say for a six-year period, as well as longer term strategic plans. It will also allow him to communicate the basis of policy making and the results of his management to interested parties, and not least the public, in a clear and consistent way. In turn this will allow budgets to be set in accordance with the Borough's agreed strategy.

Note 3: Data collection for the Quick Method.

To implement Asset Value Management data handling will need to be integrated with existing database software. Three data fields are needed in respect of each tree:

1) The value band, derived from trunk diameter;
2) the functional status; and
3) the asset value.

The value band may be available through existing DBH data, or may be calculated as part of the annual survey. Functionality is a concept specifically developed as part of CAVAT, and needs to be assessed by inspection; it is unlikely to be realistically judged from existing records (although this has not been tested). The assessment will generally therefore be done as part of the general survey or resurvey of the stock and so would add minimal cost.

For purpose of analysis the software needs to be able to calculate at least:

- Numbers of trees in each value band, total and as divided by percentage function.
- functional value of trees in each category, in total and as divided by % functions;
- the adjustment for SLE;
- all either for stock as a whole, or for specified areas (e.g. parish/ward/street, etc.,).

Note 4: Safe Life Expectancy Adjustment.

Trees with a safe life expectancy greater than 80 years retain 100% value; those with less than 5 years have zero 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. The principles followed are those of SULE, but the final step, relating to usefulness is omitted to avoid potential double counting in respect of the allowance for Amenity/Appropriateness. The SLE bands are shown in Table B.

As an alternative to individual assessment an adjustment may be made statistically, for the stock as a whole, based on the average life expectancy for different species. In this case, the stock is divided into 3 bands.

1. Long-lived species with a life expectancy greater than 160 years in urban conditions, (.e.g oak, plane, lime, etc.,);
2. those with a moderate life expectancy, 160 – 80 years, (e.g. beech, robinia etc.,) and;
3. those with a short life expectancy, less than 80 years, (e.g. birch, cherry, plum etc.,).

If the age distribution were assumed to be even across each species, (e.g. there were as many 5 as 100 year old oaks etc.,) then to calculate the final value the following adjustments would have to be made:

- For every long-lived tree the functional value would be reduced by 10%.
- For every moderate life expectancy tree the functional value would be reduced by 20%.
- For every short life expectancy tree the functional value would be reduced by 40%.

If the assumption were made that there was also an even distribution between short, medium and long-lived species that average depreciation for life expectancy would be 23.3%. The overall stock value would be reduced accordingly. If the age distribution were known or estimated to be significantly distorted an appropriate adjustment would need to be made.

Note 5: The Unit Value Factor. (UVF)

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.

The current UVF represents 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 prices nurseries including immediate planting costs. The best estimate of the planting cost factor has been found to be 150%, based on consultation with tree officers and within the wider landscape industry.

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. The up to date figure is used in the current CAVAT calculations, available separately.

Note 6: Community Tree Index (CTI).

The CTI index factor is a means to reflect in the tree stock's asset value the relative population density in the local area and thus the relative number of those potentially able to benefit from the local authority's trees. There are 7 CTI bands; their values are shown in Table C. They vary from 100%, for the majority of the country, up to a maximum of 250% in the most densely populated inner city areas, according to the published population density. The population data has been sourced from Office of National Statistics (ONS) information. The results as applied nationally to England can be found in the separate National Community Tree Index Table.

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

Note 7: 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. For the Full Method the estimate is made to the nearest 10%, in the Quick Method to the nearest 25%.

The two considerations are:

1) Crown Size.
The value is reduced proportionately if:
   - The crown is being 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 reduced proportionately in advance where, e.g. you find there to be an immediate need (i.e. as soon as practicably possible, and in no more than 1 year), for arboricultural reasons, e.g. structural weakness, to reduce the crown. 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%, and thus has a value of £0. Alternatively where crown reduction is proposed immediately, with the effect for example of allowing the tree to be retained rather than felled, the value may be recorded as if the tree had been pruned.

Tables

Table A: Value Bands

Band No.	Trunk Diam. (cm)	Value (£) 100%
1	<5.9	231
2	6-8.9	577
3	9-11.9	1,130
4	12-14.9	1,868
5	15-19.9	3,139

6	20-24.9	5,189
7	25-29.9	7,751
8	30-39.9	12,556
9	40-49.9	20,755
10	50-59.9	31,005
11	60-69.9	43,304
12	70-84.9	57,653
13	85-99.9	83,021
14	100-114.9	113,000
15	115-129.9	147,592
16	<130	186,796

Table B: Safe Life Expectancy Adjustment:

Life Expectancy (Years)	% Loss of Value
40 – 80	5
20 – 40	25
10 - 20	60
5 – 10	85
<5	100

Table C: 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

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