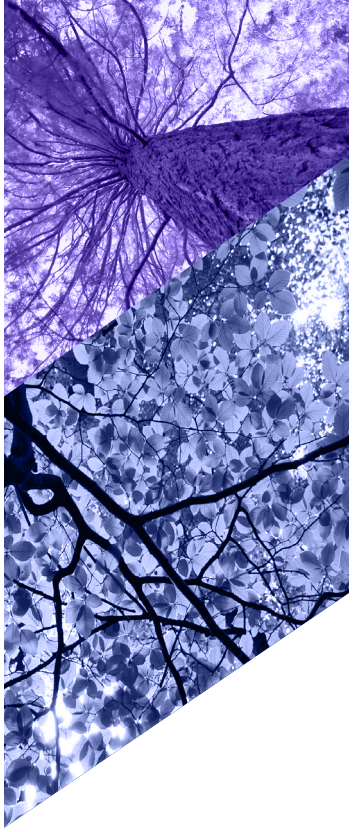

barrell
TREE CONSULTANCY

Pre-development tree assessment:

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Pre-development tree assessments

In Britain there is intense competition for space; people want it to live in, industrialists want it to build factories in, farmers want it to farm in and trees want it to grow in. On a small island with an increasing population there is quite simply not enough space to go round so there is a need to plan who has what and what goes where. In response to these pressures, Britain has evolved a sophisticated array of planning laws and regulations. In almost every aspect of our daily life the British have to deal with some form of control over the whole range of our activities - from how and where we construct our buildings to how many cows we can have running around in our fields!

With an ever increasing awareness of the environment, our urban trees are also subject to a high level of control. This is primarily achieved through The Town & Country Planning Act which allows for the protection of trees and woodlands on grounds of amenity by law. It also places a statutory duty on local authorities to actively consider existing trees and future landscaping when determining applications for permission to carry out new development. If they are not satisfied that trees have been adequately considered in a construction site application then they can refuse permission. Refusals of planning permission cost developers money and stop them making more money. This is the engine that has driven the evolution of tree management methodologies on development sites to such an advanced level in Britain.

In order to meet the requirements of the legislation, advisory guide-lines have also evolved to a high level. One of the most frequently used and highly respected British publications dealing with the management of trees on construction sites is British Standard (BS) 5837 *Guide for Trees in relation to construction* - 1991 [2]. Despite its high status, the British Standard is more of a guidance reference than an absolute set of rules; it represents the starting point from which individual prescriptions can be evaluated by the tree expert (arboriculturist). As with all tree matters there are no simple recipes and the arboriculturist is by far the most important component of the tree management equation. The British Standard offers a framework for managing trees throughout the development process covering pre-development tree assessments, protection during construction, appropriate tree/building separations, changes around existing trees, landscaping and final project hand over. Whilst BS 5837 is not based on any specific research, it is relevant that more recent work, most notably by Mattheck [3], supports the BS guidance further enhancing its credibility.

PRE-DEVELOPMENT TREE ASSESSMENTS

Pre-development tree assessments are a means of establishing the relative usefulness of existing trees on potential construction sites. They involve allocating trees to categories of importance to help identify the most sensitive areas of the site. They can range from a simple assessment based on how visually important each tree is to more complicated evaluations based on life expectancy and usefulness. With this information, reasoned judgements can be made on which layout design will optimise the retention of the best trees. This is a vital pre-requisite to establishing what precautions are necessary to ensure their successful retention.

In the British planning system a high importance has been placed on the value of trees within new developments. This evolution to date has been difficult because the planners designing these new developments are not tree experts and the arboriculturists presenting tree information are not planning experts. The challenge has been to evolve a methodology that allows the transfer of information from the arboriculturists to the layout designers without too much distortion. Trees can only be effectively considered in the overall scheme of a new construction site when the layout designers are presented with easy to interpret information. In practise, the most effective presentations have proved to be simple with a strong visual content.

The planning process begins when the decision to develop is taken and finishes when the completed development is occupied. If trees are to be properly incorporated into the development there should be at least six separate stages of arboricultural input between the beginning and the end. Pre-development tree assessments are only one small part in this overall process (Figure 1) but are the most important because they provide the basis on which all the subsequent decisions are made.

Pre-development tree assessments

The simplest categorisation of trees are based on objective criteria such as size, species or position within the landscape; these assessments can be carried out with a reasonable degree of consistency by anyone with an average level of tree knowledge. However, the more sophisticated methods involve subjective criteria such as life expectancy, hazard potential and usefulness; their proper use demands extensive practical experience with trees and a detailed technical knowledge of tree biology. These more sophisticated methods should only be carried out by professionals experienced and qualified in arboriculture who have been trained in their use.
As pre-development tree assessment methodologies have evolved, a number of problems have materialised:

- **Amenity:** The amenity value of trees is probably their most obvious asset but also one of the most difficult to incorporate into an effective pre-development assessment. The problem arises from the fact that the largest trees with the highest amenity value usually tend to be the oldest with the shortest life expectancy. In most situations it is inappropriate that the long term layout design should be significantly influenced by trees which will only be present for perhaps a few more years at the most.
- **Small trees:** With present day abilities to easily move small trees or replace them with virtually identical semi-matures, it is inappropriate that they should dictate the long term layout of a new construction site. Small or young trees must be specifically dealt with if a pre-development tree assessment methodology is to be effective.
- **Subjectivity:** A major drawback of methodologies based on subjective criteria is the difficulty in consistently arriving at the same answer with different assessors. This problem can never be fully addressed but if a methodology is to survive, it must go some way to ensuring that more or less the same answer can be consistently achieved.

The BS 5837 methodology suffers from all of these problems and in its published form it no longer represents a satisfactory approach to managing trees on development sites.

PRESENTATION OF INFORMATION

The way information is presented is very important; effective presentation will facilitate understanding and interpretation; poor presentation will foster confusion and misinterpretation. Pre-development tree assessments are about the simplification and transfer of complex tree information; the objective is to carry out these processes in a way that minimises any change of content of that information. Tree experts simplify the information and transfer it to non-tree experts who use it. It is the responsibility of the arboriculturist to make sure the information is easily understood by the end users. There are two important elements of information presentation; the tree schedule and the site plan.

All pre-development survey information must be presented as a tabular tree schedule. Tables allow an over view at a glance and enable specific items of data to be extracted almost instantaneously without wading through pages of text. Figure 2 is a sample tree schedule illustrating the range of data that must be incorporated in a full pre-development survey. The key features are:

- Height, spread and trunk diameter all help indicate tree size in a complete way
- Trunk diameter, vigour and maturity are all needed to reference BS 5837 to establish the positioning of protective fencing
- Assessment categories establish the relative importance of each tree
- The 'Comments' column provides the space to elaborate; perhaps the further clarification of the reasoning behind the assessment category allocation or any special characteristics related to amenity
- Explanatory notes after the schedule table should always be included to provide further information on botanical names, abbreviations and background to the assessment methodology

The site plan does not provide any new tree data in addition to what is already included in the tree schedule. Pictures allow the overview to be presented instantaneously; colour makes the data more interesting and increases the amount of information that can be presented on one plan. Figure 3 is a typical site plan illustrating the following important points in presentation:-

- Assessment categories in colour for easy and rapid reference
- Crown spreads drawn as they are on the ground and not the usual perfect circles
- Include trees outside the site but close to the boundaries, especially where their crowns and roots extend into the site
- Height and diameter details next to each tree is useful to provide a quick guide to their size

- Existing features and levels information are vital to enable complete incorporation of the tree data into the layout design

Please note the plan in Figure 2 is shown at a scale of 1:500 to provide an over view. In practice, scales of 1:200 are generally more appropriate.

Presentation is the key to the effective transfer of information; if it is misinterpreted then it is the arboriculturist's failure. Arboriculturists should keep the following points in mind to help improve the effectiveness of this transfer:

- They are trying to convert complex tree information into a simple form and transfer that information to non-tree experts with clarity. There should be no jargon, it should be easy to interpret and it should be interestingly presented.
- Layout designers need full information to make the best use of the site. The common reality is that they will be preparing the layout without having visited the site. The quality of tree data directly affects the quality of the development. Arboriculturists have an important role to play.
- There will be other end users of this information; construction sites are often the subject of detailed arguments and it is likely that a non-tree expert may have to make decisions relating to trees. Information should be easily digestible by non-tree experts. The quality of their decisions will be directly influenced by the quality of the tree information that is placed before them.

SULE IS THE STATE OF THE ART

SULE is an acronym for Safe Useful Life Expectancy. Provisional details were first published two years ago [1] and its evolved form now represents the current state of the art pre-development tree assessment methodology for construction sites in Britain. Its central theme is that in a planning context the length of time a tree can be expected to be usefully retained is by far the most important long term consideration. **SULE** provides a structured methodology for systematically assessing the key aspects of retaining trees near people.

SULE prioritises individual trees within a defined area and enables value judgements to be made on which are the most suitable for retention when there is a shortage of space. The methodology describes the detail of transferring tree information from the arboriculturist collecting it on the ground to the layout designer using it in the office. **SULE** is the vehicle for this information transfer and its strength is that it minimises the opportunity for misunderstandings between the collector and the user. The **SULE** methodology provides two levels of guidance; detailed explanations for the arboriculturist and a general over view for the end users to enhance their background understanding. The end result is an easy to understand categorisation of the trees that enables the layout designer to make the best use of the site.

Each tree on the development site is inspected by the arboricultural surveyor and individually assessed for its **SULE**. This is recorded on a tabular tree schedule along with other appropriate information and visually as a coloured site plan. It is then presented to the layout designer who can identify the most and least important trees on the site and design the layout around them. This allows the full impact in terms of tree loss to be systematically evaluated for different layouts in a reasoned way. It leads to the selection of a preferred layout optimising the use of the existing trees.

SULE is about tree life expectancy, and how long they can be expected to be retained safely and usefully. It is based on a number of obvious management assumptions, and the fundamental principles of safety and usefulness:

- **Management Assumptions:** To make effective management decisions it is necessary to have a core group of basic objectives. It is assumed that the following basic principles apply to most urban tree situations:

  - Management is preferable to no management; good management is preferable to bad
  - Safety is the absolute priority
  - Reasonable management costs is an important secondary objective
  - Sustaining amenity is an equally important secondary objective

  Good management implies that only accepted tree care practises will be used, and that any operation which is known to adversely affect long term tree health would generally not be appropriate. For example, significant reductions of mature trees would not be generally considered as good practise or acceptable. It is also not good practise to artificially keep trees in a position that they are clearly unsuitable for. For example, in most

cases it is artificial and contrary to good management to keep large trees in small spaces because of the need for continual pruning. Good management will strive to achieve the right tree for the site and seek to avoid practises that adversely affect tree health.

- **Safety:** In all situations close to people or property, safety has to be the priority consideration above economics or amenity. The measure for action is hazard potential. Hazard potential is related to tree size, tree structure and the number of targets that could hit [4]. As trees grow bigger their potential to cause damage increases; as tree structure becomes more suspect so the chance of failure increases; as the number and value of targets that could be hit increases so the potential cost of damage or injury increases. The priority when managing trees with a high hazard potential should be to reduce the risk to an acceptable level. This can be achieved through removing the tree, removing the targets or treating the tree.

- **Usefulness:** Trees are useful in an urban environment if they are cheap to keep and they contribute to amenity. They become less useful as maintenance costs become excessive and they begin to have a negative effect on amenity by interfering with better trees or inhibiting the establishment of new trees.
  - ***Economics of management:*** Urban tree management will always have financial constraints with limits on how much expenditure is acceptable. It is not reasonable or useful to manage trees in a way that costs more than other suitable options. Retaining trees at an excessive management cost is not normally acceptable unless there are very special reasons such as rarity or some commemorative value.
  - ***Sustaining amenity:*** In most urban situations the whole point in having trees is because they make a significant contribution to the amenity of the local environment. A major part of this amenity is through their size and impact on the landscape; the larger they are the greater tends to be their importance. It follows that good management should seek to maximise this contribution and minimise the impact of necessary maintenance. It is a common feature of localised plantings or groups that all the trees are of a similar size or age. The implications of this are that many trees will reach maturity and need removing at about the same time, resulting in rapid changes to the local landscape. It is inevitable that as trees mature they will need removing and replacing; good management should seek to spread these operations over the whole rotation, thus reducing the number and impact of removals at any one time. Sustained amenity is achieved by establishing a range of age classes within a local population; from new planting right through to mature trees. In most situations this can be achieved by removing and replacing trees that are not performing because they are not suited to the site or they are interfering with better trees. Trees are useful until their retention compromises this principle of sustaining amenity.

It is not possible for just anyone to go out and undertake subjective tree assessments competently. Extensive experience in day to day practical tree management and a thorough grasp of theoretical arboriculture are basic requirements. In addition to this it is then necessary to undertake further training in order to become competent with a particular method. **SULE** is not easy to understand or undertake; and it is certainly not possible to just go out and do it. There are numerous grey areas and apparent ambiguities that need to be encountered and understood before **SULE** assessments can be carried out with confidence and consistency. When familiar with the method, assessors should be able to quickly go through a structured sequence of considerations mentally to arrive at a **SULE** figure for each tree. For those who are unfamiliar with the method it is necessary to systematically learn how to do this. Structured training under the supervision of an experienced **SULE** instructor is the quickest and easiest way to become competent in its use.

In order to understand the whole, it is necessary to identify the individual component stages in the methodology. Each stage should be considered in a systematic way before a final **SULE** figure can be arrived at for each tree. **SULE** is based on tree life expectancy, safety and usefulness. For every assessment these need to be considered separately in the order listed below:

1. Estimate the age of the tree
2. Establish the average life span of the species
3. Establish if that average life span needs to be modified because of local environmental circumstances

4. Estimate life expectancy (life expectancy = average modified life span of species - age of tree)
5. Consider how health will affect safety
6. Consider how tree structure and size will affect safety
7. Consider how location will affect safety
8. Establish safe life expectancy (safe life expectancy = life expectancy modified by health, structure and location)
9. Consider economics of management - costs must be reasonable
10. Consider adverse effects on better trees
11. Consider sustaining amenity - making space for new trees
12. Establish **SULE** (**SULE** = safe life expectancy modified by economics, effects on better trees and sustaining amenity)

At first sight this may seem long winded and complicated, especially to those who are familiar with carrying out tree assessments. However, for novice **SULE** users this is a vital checklist to make sure that no steps are missed out. As you become familiar with the method and how it all fits together, dealing with the individual steps becomes almost second nature and an assessment can be carried out very rapidly indeed.

Once the **SULE** in years has been assessed it is a simple matter to place the tree into the appropriate **SULE** category and record it on the tree schedule. Each **SULE** category has a number of sub-divisions which help to clarify the reasoning behind that particular assessment. It is important to record the relevant sub-division to aid interpretation of the information. Suggested categorisations and sub-divisions are included as Appendix 1. There will always be cases that do not neatly fit into one category. It is quite acceptable to indicate this in the 'Category' column of the tree schedule and record the problem with allocation in the 'Comments' column. Remember, the objective is to provide reliable information and that means accepting that no methodology is going to be able to realistically cover every possible situation. Sometimes, long hand descriptions are the only way!

Even for experienced SULE users it is still necessary to have an aide memoir when working in the field as a reminder of the principles and category descriptions. The category descriptions in Appendix 1 should be carried all the time and will need to be frequently referenced. Sometimes it is useful to have a reminder of the key points of the methodology and a summary of this is included as Appendix 2. These Appendices can be photocopied and used as field sheets. They must also be included with the written report to provide the reader with sufficient background to adequately interpret the information. For the less experienced SULE assessors, it is often useful to record all the steps in the SULE assessment outlined in 4.6 above on the form included as Appendix 3. Only the final SULE categorisation would normally be included in the tree schedule but the forms would be retained on file. These would be useful references in situations of disputed information such as planning inquires where it may be necessary to explain the categorisation in detail.

THE FUTURE

It is no longer acceptable to just bulldoze trees on development sites and there is a legal obligation for planners to give existing trees due consideration. **SULE** is the cutting edge of pre-development tree assessment and the natural progression from the existing inadequate BS 5837 methodology. It is now more widely used, better documented and more effective than any other method currently available. **SULE** is an absolute basic pre-requisite in all construction site situations if trees are to be given due consideration. **SULE** is tried and tested in practise and is here to stay.

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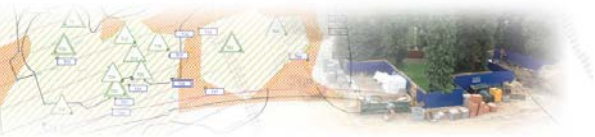

Pre-development tree assessments

Figure 1

Where pre-development tree assessments fit into the planning process

Stage in Development	Arboricultural Advice
Decision to Develop	
Land survey	
Tree survey	Pre-development tree assessment
Preliminary layout design	
Fine tuning	Advise on minor adjustments to layout to minimise effects on retained trees
Finalisation of preferred layout	• Prepare schedule of tree works • Advise on positions of protective fencing
Submission to Municipal Authority	
Negotiations and possible modifications to comply with municipal authority requirements	Advise on impact of further layout changes
Consent to Develop	
Construction of development	Site control: • supervision of tree works • supervision of protective fencing
Completion of construction	Signing off tree responsibilities
Occupation of Finished Development	

Figure 2

Example Tree Schedule for a Proposed Construction Site

Tree No	Species	Height (m)	Crown Radius (m)				Diameter (cm)	Maturity	Vigour	Assessment Category	Comments
			North	South	East	West					
18	Oak	20	5	3	3	3	90	Mature	N	3d	Significant storm damage in upper crown but retainable in short term providing valuable boundary screening
19	Beech	20	12	10	3	7	95	Over mature	L	4c	Severe die-back in upper crown and extensive advanced decay in lower trunk
20	Beech	14	14	10	6	2	24*	Young	N	1a	Slightly suppressed by T19 but well formed with good future potential

Explanatory Notes

- **Botanic Tree Names:** Beech : *Fagus sylvatica*; Oak : *Quercus robur*

- **Abbreviations:** m : Metre; cm : centimetre

- **Height** - tree height is normally visually estimated and recorded in metres. If appropriate, it can be measured optically and these measurements are indicated with a '*' after the number.

- **Crown Radius** - the average crown radius from the centre of the trunk to the tips of the live lateral branches is estimated and recorded in metres.

- **Diameter** - trunk diameter at 1.3 m above ground level is measured with a diameter tape and recorded in centimetres. Where trees have multiple stems this will be recorded as an 'M' or the diameter of each stem will be listed separately, whichever is most appropriate.

- **Maturity** - the maturity was broadly assessed as over mature (beyond normal life expectancy or in an age related state of decline), mature (last one third of life expectancy), maturing (one third to two thirds life expectancy) and young (less than one third life expectancy) to comply with the definitions in Table 1 of BS 5837.

- **Vigour** - an indication of the health of the tree for use with Table 1 of BS 5837. N = normal vigour and L = low vigour as used in that table.

- **Assessment Category** - the contents of this column above and the explanation here depend on the type of assessment being carried out. In all cases a description of all the categories used must be included at this point. Some further explanation of the methodology employed as background information may also be useful to the end users of the above data.

FIGURE 3

Typical site plan illustrating points on presentation