

A Tree Planting Design Guide

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Notes to accompany the 'street tree planting design master plan' (option 1 and 2)

Substantive source document for ideas, see <http://www.lrrb.org/pdf/200832.pdf>

1. Public Attitude and the Physical Environment

Undertake a physical environment survey to determine suitable tree species. Ask residents and business owners directly affected by tree planting whether they favour tree planting and ask them to select their preference (priority 1, 2 and 3) of tree species from the list of approved trees [trees species assigned to groups according to categories of physical environment taking account of space and soil - including subsidence risk].

Option 1: We test public attitude to tree planting first ie before undertaking detailed assessments but do test preference for certain tree species from a group selected as suitable for the physical environment.

Advantage: most involving and means don't waste time working up schemes that have been rejected by the community

Disadvantage: to be meaningful would need to give choice of tree species that would suite the site, but this requires judgements about Function, Diversity and Species choice reflecting design options.

Option 2: We test public attitude to tree planting following judgements about function, diversity, and species choice taking account of following design options, but before decisions about final placement.

Advantage: public are asked to comment on trees that are proven suitable for a given locality ie don't encourage choice of technically unsuitable trees.

Disadvantage: consultation compromised due to narrower choice

Question 1: Should we select Option 1, or Option 2 or something else?

2. Function

Street tree planting is the art and science of arranging the best possible relationship between the formative factors (e.g. function, species and site), based on the evidence of a sound analysis and thorough understanding of the relevant issues.

The eventual selection and placement of trees into a street scape should be based on the intent that they will perform predetermined functions. Functions may vary between communities, streets within the same neighbourhood and sections of the same street.

Function groups include: Architectural, Aesthetic, Engineering, Climatic (as Table 1).

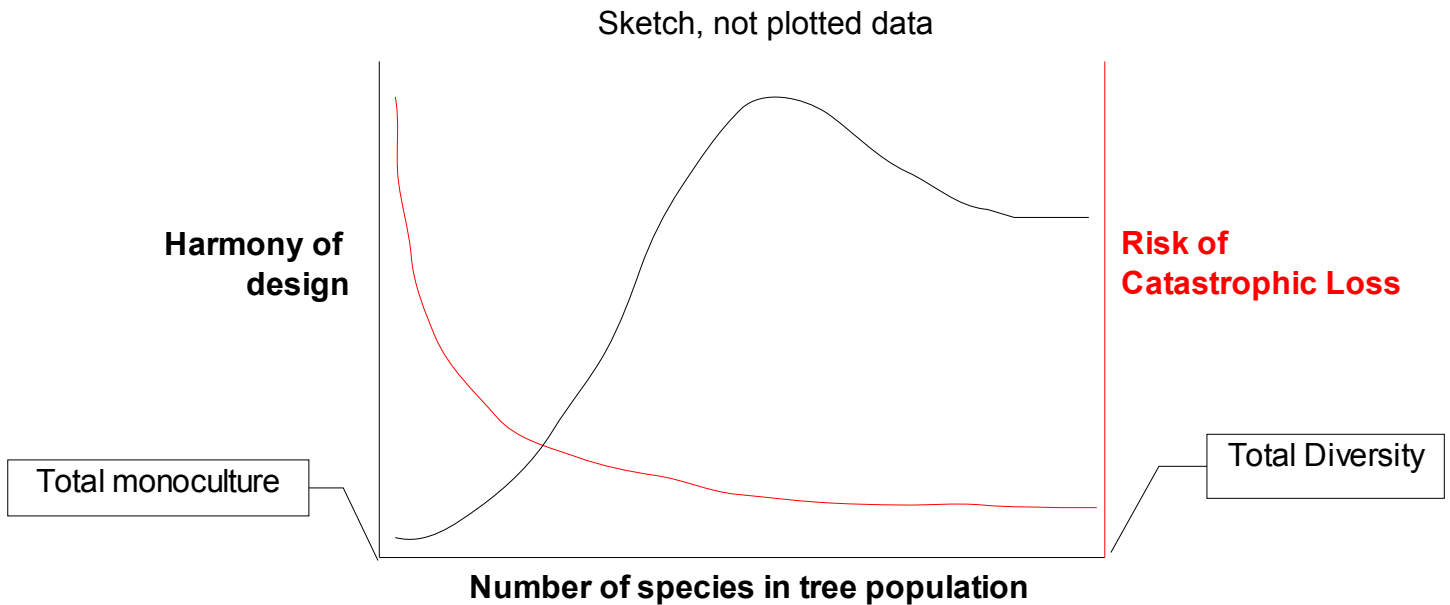
Question 2: Are we happy with the function groups? And can we use better descriptors especially for the 'Engineering' and 'Architectural' functions?

3. Diversity

What is the practical degree of species diversity for a street tree population? We need to achieve a rational level of species diversity within the street tree population.

The use of too few species may heighten the vulnerability of the street tree population to

disastrous loss of one or more species (e.g. as a result of disease) and the use of too many species may diminish the perceived continuity and harmony within the population. A conscious effort should be made to prevent an over dependence on a few species. The accepted level of species diversity should evolve as a compromised position on the continuum resulting from the actual match-up of **proven-adaptive species** with established design objectives and existing conditions and situations, rather than the produce of a predetermined species richness standard or diversification model.



Rules of thumb can be used, such as the no more than 30% from any one Family, 20% from any one Genus and 10% from any one Species but this should not compromise the doctrine that 'the degree of species diversity should be the direct result of correlating existing site conditions and limitation with **proven adaptability**, suitability and tolerance of available species'.

Species diversity should be the variable product of the interrelationship between:

- Existing character of respective street corridors;
- Proven adaptability and suitability of tree species (influenced by respective growth habits and tolerances);
- Availability of selected tree species (influenced by market supply), and
- Fulfilment of design functions (influenced by respective species characteristics).

Inevitably certain species and genres may dominate the population. The Bristol street tree population is 'dominated' by just two species: London plane - *Platanus x acerifolia* (13%¹) and common lime *Tilia x europaea* (19%). London plane continues to be planted. Common lime is generally no longer planted because of the problems of aphids and basal (epicormic) shoots. The apparent dominance of a certain species can be countered by selecting **other proven** alternative species that will perform as well as 'over-used' species and limiting to those streets where they are the best choice.

¹ See breakdown of BCC Highway population which details number of species, species as a percentage of the total population and ditto for genus, family, native and trees described as 'large' ie achieving > 15 m mature height.

Streets with the same species should be somewhat evenly dispersed throughout the community.

Question 3: Are we happy that species choice should be ruled by what works and what is appropriate rather than adherence to quotas? But equally, are we happy to select other species than current dominant species (such as London plane) if they otherwise deliver the

same or similar benefits?

Note: London plane is a High biogenic emitter of volatile organic compound (VOC) i.e. this species will contribute to poor air quality, which I do not believe we take much into account when selecting this species.

4. Design

In most cases the decision to initiate a street tree planting programme presupposes or implies that the trees will be planted at uniform spacing in rows parallel with the adjacent street.

For row planting or linear groupings unity is achieved only when the planting is perceived as continuous row rather than as individual elements.

The four basic design principles include: **repetition**, **sequence**, **balance** and **scale** but also including **accentuation** (Table 2).

The four physical characteristics that have the greatest influence on planning and design decisions are: **size**, **form**, **texture** and **colour** (Table 3).

Question 4: Are we happy that we focus on a design guide for streets? Any design guide for parks and green spaces would follow a similar logic (what function?, what diversity?, what design?, what species?), but I would suggest that site by site designs are prepared reflecting local circumstances. I would set one rule that we should not be planting trees where we have not prepared a design plan that has been through some sort of consultation.

5. Species choice

For each 'tree friendly street' select the tree species or combination of species that is the most suitable proven-adaptive choice.

Tree friendly streets = those that will accommodate the placement and flourishing of trees with the street corridor.

Suitable and proven-adaptive tree species are those acclimatised to the region, compatible with the surroundings, tolerant of existing conditions, resistant to biotic threats and responsive to design objectives.

'Experimental' trees should only be used on 'friendly' or favourable sites i.e. not on marginal sites.

Beneficial to develop specialised reference lists that group species that show the same attributes e.g. ecological relationships, visual characteristics or cultural requirements.

I believe that we need to produce a Bristol Tree Selector database for streets. This would include all species of tree that we believe are suitable and proven. We would also include some 'experimental' and otherwise interesting but unproven species. The data base would assign searchable attributes including relating to Function, Physical characteristics,(inc height, spread, form, foliage, atmospheric pollutants, water absorption etc), Site tolerance (inc. hardiness, soils, drainage), cost (to buy, to maintain).

Question 5: Can we do this for a range of species we use and are likely to be successful in Bristol? Or do we rely on the 'Right Place, Right Tree' database?

6. Placement

Positioning decisions will vary depending on factors such as the width of the street, width of the pavement (grass verge if present), location of intrusive elements, proximity of adjacent buildings and design strategem.

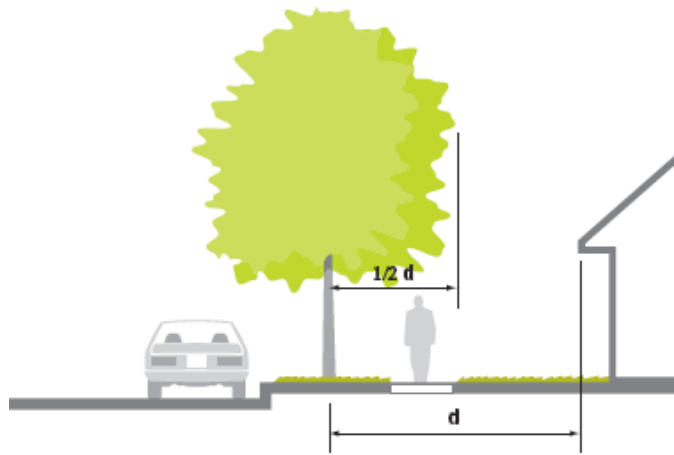
Define spacing relationships (tree size and minimum recommended spacing) (Table 4).

Define minimum offset standards for typical intrusive elements in and adjacent to the street (Table 5).

Define standards may be discretionary.

Closer spacing / changing species towards junction to create the illusion of driving speed and hence a means to encourage deceleration.

Figure 1 Proximity to adjacent buildings taking account of anticipated mature crown diameter **of unrestricted tree**



Question 6: The decision to restrict choice of tree on the basis of scale relationship with adjacent structures will have a significant influence on what gets planted where. Are we happy with this standard? The alternative, of course, is to plant trees that grow big but then need pruning to restrict their size (as is typically the inherited case), but this comes at some cost and this ultimately means that fewer trees are planted. Many street trees currently would break this rule. We need a proper debate about this.

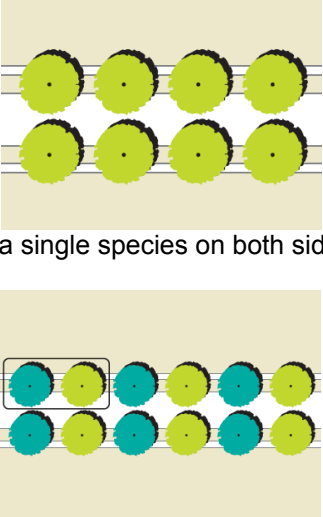
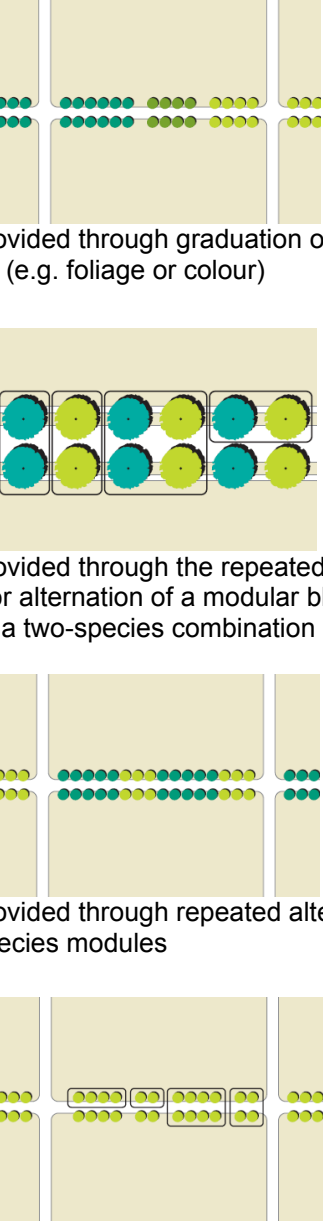
Question 7: Can we set standards for 'spacing relationships' ie recommended tree spacing based on projected size of mature tree?

Question 8: Can we set standards for avoiding intrusive elements - will need guidance from BCC Highway's.

Table 1 Potential street tree function descriptions (amended from Robinette, 1972)

Function	Category	Definition	Contributing Tree Characteristics
Architectural	Community continuity	Unification or connection of divergent community segments	All
	Screening	Blocking visual perception of an objectionable object, activity and / or view	Size Form Mass Foliage texture Foliage duration
	Architectural complement	Repetition of building scale, colours and shapes	Size Form Foliage Colour
Aesthetic	General beauty	Stimulation of visual pleasure	All
	Wildlife and habitat connection	Encouraging wildlife into street and connecting green spaces / fragmented habitats	Species
	Complement existing tree character	Maintaining unity and coherent design	Size Form
Engineering	Pedestrian safety	Strengthening of the physical and perceived separation between vehicles and pedestrian ways. Using trees to slow traffic.	Size Form Mass
	Road alignment reinforcement	Strengthening of the linear character of the roadway corridor	All
	Noise abatement	Attenuation through deflection, reflection, refraction and absorption of traffic noise	Size Mass Foliage texture Foliage duration
	Air pollution control	Atmospheric purification through cleansing and conditioning of the air	Size Mass Foliage texture
	Water surface run off control	Interception of rainfall by affecting its velocity	Size Form Mass Foliage texture Foliage duration
	Accentuation	Emphasis locations, announce or provide advanced notice of an entrance or intersection	Size Form Foliage colour
	Glare and reflection control	Interception of bright light from sun or artificial light (street lights, vehicle headlights, windows) sources	Size Mass Foliage texture
Climatic	Moderation of air temperature	Interception of direct and reflected solar radiation and casting of shadows	Size Mass Foliage texture
	Wind control	Obstruction, guidance, deflection and filtration of air flow by affecting its velocity, turbulence, momentum or direction	Size Form Mass Foliage texture Foliage duration

Table 2 Principles of Design: definitions, comments with pictorial examples

Design Principle	Comments	Pictorial Examples
<p>Repetition</p> <p>Produced by duplication or repeated use of identical or similar units, or combinations of units</p>	<ul style="list-style-type: none"> • Most fundamental and frequently used form of order • Shared characteristics except variation of one quality (e.g. two species each of same colour and form but different texture) • Absolute repetition = total harmony, but can be monotonous • Variety provides visual relief via changing a characteristic or adding sequential patterns 	 <p>Repetition of a single species on both sides of street</p> <p>Repetition comprised of two species duplicated on opposite side of street (also basic Sequence)</p>
<p>Sequence</p> <p>Produced by consecutive or successive interchange of differing units or modules</p>	<ul style="list-style-type: none"> • Achieved through: <ul style="list-style-type: none"> - <i>Repetition</i> - the simplest form of sequence - <i>Graduation</i> - progressive change of characteristics in uniform or gradual steps - <i>Alternation</i> - repetition of modules establishing a rhythm • Should be logical connection and relationship between units • All characteristics should not be changed at once as the change will not appear to be sequential • As an effect, sequence suggests movement, direction and cadence • Rhythm relies on anticipation of change and continuation of regularly occurring breaks or accents • Sequential change can lead to an ending or emphasis 	 <p>Sequence provided through graduation of a physical characteristic (e.g. foliage or colour)</p> <p>Sequence provided through the repeated alternation of two species or alternation of a modular block comprised of a two-species combination</p> <p>Sequence provided through repeated alternation of a two single-species modules</p> <p>Sequence provided through repeated alternation of single species modules with repeated uniform gaps between modules</p>
<p>Balance</p>	<ul style="list-style-type: none"> • Exact inverted repetition on one 	

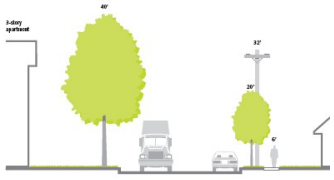
<p>Produced by equal distribution or symmetrical placement of unites about a horizontal axis (centre line of composition)</p>	<p>side of the axis (e.g. street) every unit that occurs on the other side</p> <ul style="list-style-type: none"> • Symmetrical units need not be identical provided they are similar 	
<p>Scale</p> <p>Produced by complementary relationship between the size or mass of a unit and other units or its surroundings or passersby</p>	<ul style="list-style-type: none"> • Size of unit should be controlled by rather than controlling the design 	 <p>Scale relationships within street corridor</p>

Table 3 Primary physical characteristics: appearance factors of healthy, mature tree species under normal conditions

Physical Characteristics	Comments
<p>Size mature dimensions that will be achieved in an indigenous open area</p>	<ul style="list-style-type: none"> • Tree height, crown spread, trunk diameter • function of rate of growth • cause of spatial conflicts • basis for scale and proportion relationships • affected by variable environmental conditions
<p>Form Crown shape a species will develop in an open area</p>	<ul style="list-style-type: none"> • Outline or silhouette of mature crown • volumetric description • influenced by dimensional relationship between height and spread or horizontal and vertical axis • usually changes as trees matures • habit of growth • strongest design element
<p>Texture Aggregation of leaf forms</p>	<ul style="list-style-type: none"> • Size, shape, pattern and proportion of leaves • Also influenced by tips and margins, stiffness, veining, thickness and surface quality of leaves • influences density and mass of crown • course texture is dominant over other textures
<p>Colour Colouration of summer foliage-graduations</p>	<ul style="list-style-type: none"> • Green is the predominant plant colour in nature • influenced by nutrition and soil conditions • colour can affect emotions • coloured foliage is an excellent accent

Table 4 Spacing relationships

Mature crown spread	Recommended spacing	Example species
Very narrow < x m	?	
Narrow xm - xx m	?	
Intermediate xx m - xxx m	?	
Wide xxx m - xxxx m	?	
Very wide xxxx m - xxxxx m	>	

Table 5 Offsets from intrusive elements

Intrusion	Recommended minimum offsets	Comments
Light standard		
Driveway		
Street sign		Allows for trunk / root flare and typical width of walk behind mower. Sign posts could be relocated forward of proposed tree location
Traffic light		
Underground gas utility?		
Underground water utility		
Underground electricity utility		
Underground telephone fibre utility		
More?		