

SHEFFIELD CITY COUNCIL
HIGHWAY TREES SPECIFICATION

This document aims to provide a set of guidelines and details for tree planting within or adjacent to the public highway and for the various situations and conditions that are likely to be encountered.

CONTENTS

	SECTION	PAGE NUMBER
1.	Introduction	2
2.	General Guidance	3
3.	Specifications	9
4.	Recommended Tree Species	11

1 INTRODUCTION

THE CASE FOR HIGHWAY TREES

- 1.1 Sheffield is well known for being a green city that has benefitted from tree planting across many areas. Historically, age profiling shows three major tranches of planting which make up our current “tree stock”. The forest trees of the Victorian Era that line many streets, such as Lime and London Plane make up the first wave, which was then followed in the post-war era with extensive planting of Cherry, Rowan and other fruiting and flowering varieties, typically on wild root stock. The final wave of planting from the early 2000’s to date incorporates many new varieties, cultivars and species as commercial availability of new proven trees for the highway environment allowed for diversification in species selection and a movement away from monoculture. A 2007 audit of the urban forest established that around 75% of the highway tree stock was nearing the end of its natural life as both the historical tranches of Victorian and Post War planting enter the over-mature phase in their life. The 2007 survey suggested that unless a programme of sustained replanting commenced on the city’s highways, a catastrophic decline in tree numbers would occur on Sheffield’s highways. It is with the threat of a decline in tree numbers that this Guide has been produced to enable designers and developers to plant appropriate trees in and adjacent to the highway to safeguard a tree legacy in Sheffield for future generations to enjoy.
- 1.2 It is quite easy to demonstrate that trees have a powerful impact on people’s perceptions of the visual quality of streets and urban spaces. Not only do people feel better in a tree-lined environment (whether or not the individual recognises this) but they are prepared to pay to live in one.
- 1.3 Conversely, damage to paving from root tracks and mechanical root pressure as well as problems caused by fallen leaves and branches, damage to services and adjacent buildings and safety issues have all been cited at one time or another as a reason not to plant trees. This is intended to show how new planting can be carried out in a manner which embraces inclusive mobility, takes into account the philosophy of “right tree – right place” and, ensures a tree that will thrive in the challenging constraints of the highway environment whilst minimising these issues in the future.
- 1.4 Trees are important in the Sheffield street scene, improving amenity and biodiversity; it is now imperative to take action to reinvigorate the legacy of tree planting that makes Sheffield a green and attractive city.
- 1.5 Large, mature trees are the most valuable and the developer should consider the largest, longest-lived species suitable for the given space and their landscape impact. Neither can the survival of newly planted trees be left to chance. Trees are generally highly adaptable to hostile environments and with the correct specifications, choice of species, and variety and attention to detail at all stages of the project, there is no reason why survival and subsequent growth should not be comparable to a non-urban situation.

2 GENERAL GUIDANCE

The following section gives general guidance proposing methods for successful tree planting in situations that are commonly encountered in highway areas and provides background information to the specifications.

Where specific guidelines are given then reference should be made to the relevant specification and drawn detail as indicated. The developer is encouraged to seek advice from qualified arboriculturists and discuss tree-planting proposals as early as possible with Sheffield City Council's officers including arboriculturists, landscape architects, lighting engineers, highways engineers and development control to agree the most suitable solution.

2.1 THE PLANTING HOLE

Existing Ground

2.1.1 Excavate one planting pit to act as a trial pit that will enable the following to be established:

- Quality of topsoil
- Possible drainage problems
- The presence of underground services

Quality of topsoil – (as defined in BS 3882: 2015)

2.1.2 It is possible to assess the quality of soil by using a simple 'finger and thumb' test as outlined in the BS but essentially a light, sandy and 'open' texture is required. Where the excavated topsoil from the planting pit, and the surrounding soil, is of a suitable quality then it is of little benefit to add any other medium during the planting operation with the exception of a slow release fertiliser (such as Bonemeal or Scotts 'Enmag') applied at the time of planting and at manufacturer's recommended rates.

2.1.3 If the soil has a poor texture then it is possible to improve this with conditioners such as peat-free compost made from recycled organic materials incorporated in the planting pit not exceeding 5% of backfill volume (if a greater content is required then this should be added to the surface as a dressing - research for amenity trees No 8 - 2006). It is not possible to make long-term improvements to, say, pH or nutrient content, to such an extent as to benefit the tree for more than its initial establishment period. It is also important to recognise that digging a pit in clay soils and backfilling with a lighter, free draining planting medium, is likely to result in the creation of a sump into which water from the surrounding ground will flow. In these circumstances, a drainage layer at the base of the planting pit should be provided, or, connection to an established drainage system via pipe work. Alternatively, in developments where SUDS systems are being employed, consideration may be given to incorporating moisture/wetland tolerant species such as Alder into the system itself.

New ground

- 2.1.4 In new ground, or in areas of major excavation, it is possible to create conditions that will give new trees the best possible start and minimise future disruption to the surrounding area. This will include:
- Adequate soil volumes
 - Good quality topsoil
 - Protection to surrounding paving and adjacent services
 - Drainage provision, if necessary, in urban areas where little or no existing soil is within reach of growing roots. The size of the planting pit and the quality of soil are the two most important factors that will have a bearing on the future growth of the trees.

Pit size - soil volumes

- 2.1.5 The volume of soil required to support a mature tree depends on type and ultimate size of the tree, water availability and ground water storage, particularly during drier seasons. While formulae are available to calculate the volume of soil required, 20 cubic metres appears to be required to maintain reasonable growth in a paved situation. When planting into existing areas this volume may be difficult to achieve but, it must be recognised that trees planted in a lower volume of soil may not reach their ultimate mature size and maintain good leaf growth/shoot extension, unless their roots can extend beyond the pit into adjacent soil areas, e.g. grass verges, gardens, etc.
- 2.1.6 Where possible, a minimum soil volume of 5 cubic metres should be provided. The shape of the soil area need not be regular and can be altered to suit site conditions including constraints due to remediation. Volume cannot be achieved by providing extra depth. The maximum useful depth of topsoil for tree planting is 900mm. It is acceptable for more than one tree to utilise the same soil. For example, a tree pit 900mm deep x 3 metre wide x 8 metre long containing 21 cubic metres of soil could support two trees planted at 6 metre centres. A similar pit 16 metres long containing 43 cubic metres would support three trees, and so on.

2.2 SOIL

- 2.2.1 Imported topsoil shall be of good quality, with a light texture, and conform to BS 3882 *General Purpose Category*. If a topsoil not compliant with BS 3882 is proposed for use on site, then the following tests are required:
- pH - the soil pH should be between 5.5 – 7.8 - organic matter - which should be greater than 5%
 - Nitrogen (N) - which should be greater than 0.2%
 - Phosphorous - which should be greater than 45 mg/kg
 - Potassium - which should be greater than 240 mg/kg
 - Magnesium - which should be greater than 80 mg/kg

More involved tests for phytotoxic elements (e.g. copper, nickel, zinc) and zootoxic elements (e.g. arsenic, lead, mercury) need only be undertaken if there is any doubt regarding the origin of the topsoil. The tests must be undertaken by a recognised testing laboratory, and presented to the client prior to importing topsoil to the site.

- 2.2.2 The planting pit shall be backfilled only when the weather is dry and the soil in a relatively dry condition. The pits should be backfilled in layers not exceeding 300mm and lightly 'settled' rather than compacted between each layer. As long as the soil is not wet or heavy, this is best achieved by light treading.
- 2.2.3 There are two alternatives for a planting medium - topsoil or, where significant vehicle loads on a surface paving material are expected, a "manufactured" soil (often referred to as 'Amsterdam' or 'load bearing tree soil') can be used to ensure that optimum conditions for root growth are maintained, to the approval of the City Council.
- 2.2.4 If the organic content is low or the structure of the soil can be demonstrated to be poor then a peat-free planting compost should be added at the supplier's recommended rates. Alternatively, compost from a reliable source can be added at a rate not exceeding 5%, by volume, ameliorant to topsoil (if a greater content is required then this should be added to the surface as a dressing). In all cases, the mixing must be done before adding the soil to the excavated tree pit in order to obtain a homogenous mix. It is important to realize that the gradual decomposition of organic material in the soil, resulting in a series of small but linked voids, is one cause of settlement in surface paving adjacent to tree pits. For this reason, 'load bearing' tree soils are exceptionally low in organic matter, not exceeding 5% by volume with the subsequent need for regular soil management.

2.3 STATUTORY UNDERTAKER'S EQUIPMENT

- 2.3.1 At design stage, developers are encouraged to design tree planting and landscaping schemes in a manner that allows ease of access for future maintenance to underground services, such as gas and water pipes and electricity cables.

This is best achieved by not planting trees over or within 2 metres of statutory undertaker's equipment. Intelligent design and advanced planning should allow for highway trees to be positioned in the optimum locations, whilst also minimising future disruption for utilities contractors and allowing any future maintenance works to be undertaken in accordance with BS 5837:2012 and National Joint Utilities Group guidelines.

2.4 DRAINAGE

- 2.4.1 It is a prime requirement of any tree-planting situation that planting pits do not hold water and become waterlogged. In new construction, the minimum requirement is a layer of stone consisting of 200mm deep of clean aggregate 50mm nominal size in the base of the pit topped with a geotextile blanket, to reduce contamination of the drainage layer by fines. This will allow surplus water to drain freely from the rooting zone.
- 2.4.2 Particular care must be taken when excavating tree pits in clay soils where there is a danger of creating a sump and the subsequent water logging of tree roots. It may be necessary in these situations to provide active drainage to remove excess water away from the tree-rooting zone.
- 2.4.3 The minimum layer of aggregate may also need to take into account constraints due to remediation.

2.5 TREE SUPPORT - STAKING AND GUYING

- 2.5.1 The purpose of staking and guying is to anchor the tree and stabilise the root ball until new roots are established into the surrounding soil. This shouldn't be seen as a method of protecting from vandalism or physical damage. For this reason, support is required until the roots, damaged during the lifting process, have made sufficient new growth. In reasonable growing conditions, this should happen within three seasons after planting.
- 2.5.2 Above ground, supports shall be restricted to private areas and open spaces where vandalism to the supports is unlikely.
- 2.5.3 Below ground, support may be used in paved areas to remove the need for above ground guying. This is achieved using specialist proprietary ground anchor systems, such as Platipus or Greenleaf products. Alternative methods of anchoring the trees such as timber or concrete dead man system in the base of the pits may also be considered. Below ground, support must be placed at the time of pit excavation and fitted with all necessary wire cables prior to back filling the pit and planting the tree. Tensioning of the wire is by turnbuckle or ratchet systems. Refer to BS 8545:2014 Trees: from Nursery to Independence in the landscape – Recommendations
- 2.5.4 Tree protection guards may be used in areas of potential vandalism or where their use would be appropriate. Grilles however, are not designed to provide support and this must be achieved using appropriate underground or above ground systems.
- 2.5.5 The developer should agree the best method of tree anchoring with planning to ensure that the best method is used in the context of the setting.

2.6 TREE SELECTION

The following issues must be considered when making a choice of trees for planting adjacent to the public highway.

2.6.1 Ultimate Mature height

- Small – to approximately 10 metres
- Medium – to approximately 15 metres
- Large – greater than 15 metres

2.6.2 Ultimate shape and spread

- In general, when planting adjacent to highways, particularly where high sided vehicles regularly pass, it is preferable to select a variety with relatively upright growth that will not require pruning or be damaged by the passage of vehicles. Alternatively, select species whose crown will be, or can be, formed above headroom constraints. Away from the immediate kerb line, a broader crown could be considered. For the purposes of safety, in areas to be used by pedestrians and other non-vehicular street users, select species that would allow crown lifting to a minimum of 2 metres above the pavement with a clear stem.

2.6.3 Site conditions

- As long as the soil is free-draining and near-neutral pH, then most commonly specified street trees will grow well. Exposure, particularly to strong and cold winds, may be a problem for some trees i.e. those with large leaves, or a weak branch structure of brittle wood.

2.6.4 Species specific or varietal features

- e.g. a tree that has good spring flowers, autumn berries or autumn colour may be positive aesthetically, but consideration should be given to such fruit and blossom falling on pavements which may be considered a hazard. Therefore, the suitability of these features in each given situation should be carefully thought through.

A list of suitable trees for planting next to the highway in Sheffield is included in Section 4, below.

2.6.5 Size of Planting

For street tree planting trees will be selected from one of the following girth sizes:

Heavy Standard	12-14cm	Likely to require protection in a public situation but will provide a greater initial impact.
Extra Heavy Standard	14-16cm	More resistant to casual damage and generally the preferred minimum size in a public location.
Semi Mature	16-35cm	Trees of this size will provide good resistance to casual damage and provide excellent initial impact. However, they require specialist handling and greater attention during the establishment period.
Mature	35cm+	The above comments apply. Trees planted in these sizes and above would be considered suitable for planting in the city centre or in a development where a strong focal element is required. Advice should be sought from the city council landscape architect.

2.6.6 It is generally accepted that the smaller the tree is at planting the quicker it will establish and start into new growth.

2.6.7 Improvements in modern nursery practice and recognition of the importance of site evaluation or assessment to identify species compatible with the physical properties offered by the site has changed this situation. Therefore, it is always important to consider the source of the stock, its size and the species used to mitigate any potential problems that could occur.

2.6.8 In most urban situations, a minimum girth of 14cm will suffice for newly planted trees. However if there is a high risk of vandalism or other damage then 18cm girth trees must be planted. However, it should be remembered that larger root stock of this size is more likely to fail and trees of this girth should be either, containerised stock or root-balled. Refer to BS 8545:2014 Trees: from Nursery to Independence in the landscape – Recommendations

Root type – Which to use: bare root, root-balled or containerised?

2.6.9 Bare-root stock is usually the cheapest available and, when the correct practises are followed, they will establish at a faster rate. This is the preferred option for trees below 18cm in girth. It is highly recommended that a root dip mycorrhizal inoculant treatment be used when planting smaller bare rooted trees to ensure that the trees are best prepared to survive the first planting season.

2.6.10 Trees above 18cm girth should either be, containerised stock or root-balled. The advantage of containerised over root-balled trees is that they can be planted any time of year as long as a proper irrigation plan is in place. Choice of stock type will also depend on the species. In an ideal situation, all trees will be planted between October and March for optimal chances of successful establishment.

2.7 AFTERCARE AND MAINTENANCE

2.7.1 Maintenance of newly planted trees for at least 3 years after planting is essential to their long-term survival and growth. Larger trees, in particular those above 25cm girth, can take several years to finally die, living off stored resources rather than newly acquired ones. A guarantee period of at least 3 years (5 years for trees of 35cm girth and above), must be imposed on all new tree planting.

2.7.2 Incorrect handling at any stage of the works, failure to prepare the planting pit correctly, poor planting techniques and lack of moisture at first bud-burst can lead to poor establishment during the first 12 months of the tree in its new position. A tree may be in leaf at the end of its first growing season but unless it has made sufficient growth to sustain it well into the next season, it is likely to be on a downward spiral from which there is no return. A tree showing lack of vigour at the end of its first season should be treated the same as a dead tree and scheduled for replacement.

2.7.3 Operations to be carried out during the maintenance period must include:

- **Watering** – A minimum of 90 litres per tree shall be applied at fortnightly intervals in the period 1st May to 30th September. If April is dry, newly planted trees should be watered during this month at the same frequency. If particularly wet weather occurs, supplementary watering may not be necessary. The use of larger quantities of water at greater time intervals is not an adequate alternative and is not acceptable.
- **Pruning** – at the time of planting any damaged branches must be cut back to a main junction or stem. Also beneficial to the tree is the reduction of crown growth by removing weaker side branches. At the end of the first growing season, any branches showing signs of dieback must be cut back to live wood. Pruning must take place during the dormant period except for Prunus species when mid-summer pruning is recommended to reduce the likelihood of disease. Pruning cuts shall not be painted with any type of wound sealing paint.
- **Support** – check trees for stability and if necessary re-tie or expose underground supports to tighten the wires.
- **Tree pits** – keep clear of weeds. Where trees are planted in grass, a bare circle of soil at least 1m in diameter should be maintained around the trunk. This reduces competition from grass and the likelihood of damage from mowing machines.

2.7.4 Long-term management and maintenance of the trees should not be neglected after the defects liability period has expired. Growth should be monitored for damage by storm, vehicles or vandalism on a regular basis and any necessary remedial action taken. Timber stakes must be removed three years after planting and when the tree is showing signs of strong growth. Maintenance of an area of bare soil around the base of a tree helps reduce damage by mowers and other grass maintenance equipment.

3 SPECIFICATIONS

3.1 SPECIFICATION – TREES IN PAVING AREAS, UNDERGROUND SUPPORT BS 8545:2014 & BS 4428:1989 apply

3.1.1 Pit size and construction

Pits shall be 600mm wider than the diameter of the root ball with a minimum size of 900 x 900mm. Minimum depth to be 750mm, subject to any limits imposed by site constraints. Where necessary, the depth shall be increased to accommodate the depth of the root ball and to obtain the correct planting level. Break up bottom of pit to 150mm deep and scarify the sides of the pit with a fork.

3.1.2 Planting

Remove any moisture-retentive material used to prevent the root ball drying out during transport from the nursery but protect the root ball from sun and wind during the planting operation. Move the wire mesh support and root packing away from the trunk of the tree but do not cut away from the main root ball, the integrity of the wire mesh must not be damaged. Do not cut the wire mesh. Plant trees upright and, unless otherwise instructed, in the centre of the pit.

3.1.3 Planting depth

The natural thickening between the trunk and the root collar shall be at the finished top surface of the planting medium. A straight edge placed across the pit at finished surface level and adjacent to the tree will assist in gauging the correct level. If necessary, the depth of the pit must be adjusted to ensure the correct planting level.

3.1.4 Drainage

Below-ground irrigation and aeration systems such as Greenleaf 'Root Rain Urban' should be installed where required in hard surfaced areas and for any trees in hard or soft areas above heavy standards or with girth above 25cm. Ensure that the top of the filler pipe is flush with finished surface levels. Backfill around the root ball with specified material in 150mm layers, treading lightly to compact each layer to a level approximately halfway up the side of the root ball. The underground support should be installed prior to completing the backfilling of the pit. Immediately after planting, the tree shall be watered with approximately 25 litres of water to ensure that the contact of soil between the root ball and backfill material is uniformly moist.

3.1.5 Underground support

Underground ground anchorage system such as: 'Root-ball Guying Kit', as supplied by Platipus Anchors Limited, Greenleaf urban tree and landscape products or equivalent approved, or alternatively, Deadman System comprising 2 no. dead man anchors of timber or concrete located at opposite sides of the root ball, rectangular in section and of sufficient mass to prevent movement when buried below the soil. The dead man anchors and root ball fixing wires must be fixed prior to backfilling the pit or placing the tree. Multi-strand wire, 5mm diameter, shall be stapled around each anchor and shall be tensioned by turnbuckle or ratchet devices or 'grippler' system after the tree is in its final position.

3.1.6 Grilles

Check with the local authority about their specific policies on the use of tree grilles. If used, tree grilles should have removable inner rings and, should be detailed to reduce drainage into tree pits by water contaminated by de-icing salts.

3.2 SPECIFICATION - TREES IN PAVING - ROOT DIRECTOR / ROOT BARRIER BS 8545:2014 & BS 4428:1989 apply

3.2.1 Pit size and construction:

Pit size and construction: the minimum size of the tree pit will be 1200 x 1200 x 1100mm deep. Excavate a planting hole 600mm wider than the diameter of the root ball. The depth of the excavated pit will be sufficient to accommodate the root ball and to obtain the correct planting depth. Install a layer of clean stone or granular material such as reclaimed broken bricks to a settled depth of 200mm. Cover with a geotextile sheet to filter fine particles. Granular material (if used) should be free of fines.

3.2.2 Installation of root director / root barrier

Supply and install a root director (product code RD1050A or equivalent approved) as supplied by GreenBlue Urban Ltd, Northpoint, Compass Park, Junction Road, Bodiam, Hastings, East Sussex TN32 5BS. Installation shall be in accordance with the supplier's instructions.

4 RECOMMENDED TREE SPECIES

- 4.1 The following list of tree species is considered suitable for planting in Sheffield. Trees may be selected from the following list taking note of species considered not suitable. Inclusion in the list does not mean that all species are suitable in all situations. Selections must be based on a match between the habitat and requirements of the species and the conditions of the specific location.
- 4.2 Alternative species or new varieties may be acceptable. The developer should discuss the suitability of the species for the scheme with the authority at an early stage in design, whether selected from the list or offered as an alternative.

Sheffield City Council - Highway Trees Specification

This list is not designed to be an exhaustive selection of trees. If a species not shown on this list is to be considered it should be referred to the relevant authority for approval.

Tree Species (Common Name)	Size	Height m	Growth rate	Root Depth	Wind firm?	Autumn leaf colour	Flower colour	Form	Notes
Species recommended for narrow verges or tree pits									
Acer campestre 'Elegant'	S/M	6-10	Slow		Y	G > Y	Green	Ovoid	Bee friendly
Acer campestre 'Lineco'	S/M	6-10			Y	G > Y	Green/Yellow	Ovoid	Bee friendly
Acer campestre 'Louis Red Shine'	S/M	8-10			Y	G > Y	Green/Yellow	Conical	Bee friendly, tolerates salt
Acer monspessulanum (Montpellier maple)	S	6-10	Slow		Y	G > Y	Unremarkable	Globular	Sensitive to salt
Alnus cordata (Italian alder)	M	10-15	Fast		Y		Unremarkable	Conical	Can disrupt tarmac in compacted planting medium
Alnus glutinosa 'Laciniata' (Cut-leaved alder)	M	8-12			Y		Unremarkable	Conical	Withstands hard pruning
Alnus x spaethii (Spaeth alder)	M/L	10-20	Fast		Y	G > R	Violet	Conical	
Amelanchier arborea 'Robin Hill' (Juneberry)	S	5-10	Slow		Y	G > Y/R	White	Globular	Bird friendly
Betula ermanii (Ermans/Gold birch)	M/L	15-20	Fast		Y	G > Y	Yellow	Irregular	Light-loving, susceptible to drought
Cercis siliquastrum (Judas tree)	S	6-10			Y		Pink	Broad	Flowers grow on old wood
Corylus colurna (Turkish Hazel)	M/L	15-20		Shallow	Y	G > Y	yellow	Conical	Edible fruits
Crataegus laevigata 'Paul's Scarlet'	S	5-10		Deep			Pink	Globular	Bee/Bird friendly
Crataegus lalvaei 'Carrierei'	S	5-7		Deep			White	Globular	Bird friendly
Crateagus monogyna (Common hawthorn)	S	6-8		Deep		G > Y	White	Globular	Bee/Bird friendly, Native
Gleditsia triacanthos 'Sunburst'	S	6-10		Deep	Y	G > Y	White/Yellow	Columnar	Bee friendly, tolerates salt
Koeleruteria paniculata (Golden rain tree)	S/M	5-15				G > Y/O	Yellow	Irregular	Can suffer frost damage
Liquidambar styraciflua 'Worplesdon'	M	12-15		Shallow	Y	G > Y/O/R	Inconspicuous	Conical	Can disrupt tarmac in compacted planting medium
Malus 'Evereste'	S	5-8			Y	G > Y/O	White	Globular	Bee/Bird friendly
Malus 'Rudolph'	S	5-6		Shallow	Y		Purple/Red	Globular	Bee/Bird friendly, tolerates cold
Morus nigra (Black mulberry)	S	6-10					Unremarkable	Globular	Edible fruits, bird friendly
Morus alba (White mulberry)	S/M	8-15					Unremarkable	Globular	Edible fruits, bird friendly
Prunus cerasifera 'Nigra' (Purple leaved plum)	S	6-8				R/B	Pink	Globular	Bee/Bird friendly
Prunus dulcis (Almond)	S	3-7					Pink	Globular	Bee friendly, edible nut
Prunus Sunset Boulevard'	S	8-10				G > R/P	White/Pink	Vase	Bee friendly, does not produce fruit

Sheffield City Council - Highway Trees Specification

Tree Species (Common Name)	Size	Height m	Growth rate	Root Depth	Wind firm?	Autumn leaf colour	Flower colour	Form	Notes
Species recommended for narrow verges or tree pits (cont'd)									
Prunus 'Umineko'	S	6-8				G > O/R/P	White	Columnar	Bee friendly
Prunus x hillieri 'Spire'	S	3-7			Y	G > Y/O/R	Pink	Vase	
Pyrus calleryana 'Chanticleer'	S/M	8-10		Deep	Y	G > Y/R	White	Broad/Columnar	Prono to forming narrow forks
Sorbus 'Joseph Rock' (Hybrid Sorbus)	S	6-8			Y	G > R/P	White	Conical	Bee/Bird friendly, susceptible to Fireblight
Sorbus aucuparia 'Cardinal Royal'	S/M	10-15			Y		White	Columnar	Bee/Bird friendly
Sorbus x arnoldiana 'Schouten'	S	8-10			Y	G > O/R	White	Ovoid	Bee/Bird friendly
Sorbus x thuringiaca 'Fastigiata' (Hybrid Sorbus)	S	8-10			Y		White	Ovoid	Bee/Bird friendly, frost resistant
Syringa reticulata (Japanese tree lilac)	S	3-5				G > Y	White	Ovoid	Bee friendly
x Chitalpa tashkentensis (Chitalpa)	S	4-7				G > Y	Pink	Globular	Bell-shaped flowers persist through summer

Tree Species (Common Name)	Size	Height m	Growth rate	Root Depth	Wind firm?	Autumn leaf colour	Flower colour	Form	Notes
Species recommended for wide grass verges where root & crown development are not restricted or in pits provided there is adequate soil volume									
Acer buergerianum (Trident maple)	M/L	15-25	Slow			G > Y/O/R	Cream	Ovoid	Bee friendly
Acer cappadocicum (Caucasian maple)	M/L	10-20			Y	G > Y	Yellow	Ovoid	Can form root suckers, bee friendly
Acer platanoides (Norway maple)	M/L	15-25			Y	G > Y	Unremarkable	Globular	Some resistance to air pollution
Acer platanoides 'Deborah'	M	10-15			Y	R/G > O/Y	Green/Yellow	Conical	Bee/Butterfly friendly
Acer rubrum 'October Glory'	M	10-15				G > R	Unremarkable	Conical	Can form root suckers, bee friendly
Carpinus betulus (Hornbeam)	M/L	15-20				G > Y		Ovoid	Native
Castanea sativa (Sweet chestnut)	L	20-30			Y	G > Y	Cream	Irregular	Edible fruits (Roasted Chestnut)
Catalpa bignonioides (Indian bean tree)	M	10-15	Fast		N		White	Globular	Bee friendly
Celtis australis (Hackberry)	M	10-15			N		Green	Globular	Bee friendly
Eucommia ulmoides (Hardy rubber tree)	M/L	20			Y		Green	Broad	Latex exudes from broken leaf

Sheffield City Council - Highway Trees Specification

Tree Species (Common Name)	Size	Height m	Growth rate	Root Depth	Wind firm?	Autumn leaf colour	Flower colour	Form	Notes
Species recommended for wide grass verges where root & crown development are not restricted or in pits provided there is adequate soil volume (cont'd)									
Ginkgo biloba (Maidenhair tree)	L	15-35			Y	G > Y		Irregular	Fossils date back 270 million years, 6 trees withstood Hiroshima A-Bomb
Metasequoia glyptostroboides	L	25-35	Fast		Y	G > O	Unremarkable	Conical	Soons develops wide buttress
Ostrya carpinifolia (Hop hornbeam)	M/L	14-20	Slow		Y	G > Y	Yellow	Globular	Fruits resemble hops
Paulownia tomentosa (Foxglove tree)	M	10-15	Fast		N		Lavender blue	Broad	Flower buds susceptible to frost
Pinus nigra subsp. Austriaca (Black pine)	XL	20-40	Fast		Y		Unremarkable	Broad	Dense crown, potentially huge tree
Pinus pinea (Stone pine)	L	15-25	Fast		Y		Unremarkable	Umbrella	Bird friendly, edible pinenuts
Pinus sylvestris (Scots pine)	L/XL	10-40	Fast		Y		Unremarkable	Umbrella	Native, hardy
Platanus x hispanica (London plane)	L/XL	20-40	Fast		Y		Green/Yellow	Broad/Irregular	Pollution tolerant, leaves carry trichomes
Platanus x hispanica 'Trémonia'	M/L	15-20	Fast		Y		Green/Yellow	Columnar	Pollution tolerant, leaves carry trichomes
Pterocarya fraxinifolia	L	15-20	Fast		Y		Green	Globular	Can sucker up to 20m away, large verges only
Quercus cerris (Turkey Oak)	L	20-35	Fast		Y		Gold	Globular	Host to Knopper Gall Wasp
Quercus palustris (Pin oak)	L/XL	20-40	Fast		Y	G > R	Gold	Globular	Lower branches droop over time
Quercus patraea (Sessile oak)	L/XL	25-40	Fast		Y		Yellow/Brown	Globular	Native
Quercus robur (Common oak)	L/XL	25-40	Fast		Y		Yellow/Brown	Globular	Native
Sorbus aria (Whitebeam)	M	12-15			Y		White	Broad/Ovoid	Bee/Bird friendly, native
Sorbus intermedia (Swedish whitebeam)	M	10-15			Y	G > Y/O	White	Broad/Ovoid	Bee/Bird friendly, frost resistant, resistant to Fireblight
Sorbus intermedia 'Brouwers'	M	10-12			Y	G > Y/O	White	Globular	Bee/Bird friendly, frost resistant, resistant to Fireblight
Sorbus torminalis (Wild service tree)	M	10-15			Y	G > R/P	White	Globular	Bee/Bird friendly, frost resistant, native
Styphnolobium japonicum (Japanese pagoda tree)	M/L	15-20	Fast				White	Vase	Bee friendly, resistant to frost, resistant to salt
Taxus baccata (Common yew)	M	10-15			Y		Unremarkable	Ovoid	Bee/Bird friendly, native, long lived, poisonous seed
Tilia americana 'Redmond'	M	12-20	Fast		Y	G > Y	Yellow	Conical	Bee friendly, frost resistant
Tilia cordata 'Rancho'	M	10-15	Fast		Y	G > Y	Yellow	Conical	Bee friendly

Sheffield City Council - Highway Trees Specification

Tree Species (Common Name)	Size	Height m	Growth rate	Root Depth	Wind firm?	Autumn leaf colour	Flower colour	Form	Notes
Species recommended for wide grass verges where root & crown development are not restricted or in pits provided there is adequate soil volume (cont'd)									
Tilia cordata x mongolica 'Harvest Gold'	M	12-17			Y	G > Y		Ovoid	Bee friendly, frost hardy
Tilia tomentosa (Silver lime)	L	20-30	Fast		Y	G > Y	Yellow	Broad/Conical	Bee friendly, less attractive to aphids
Tilia x europaea (Common lime)	L/XL	20-40	Fast		Y	G > Y	Yellow	Broad	Bee friendly, attracts aphids, UK's tallest broadleaf tree, profuse suckering
Ulmus 'Columnella'	M/L	15-20	Fast		Y			Columnar	One of the most resistant to DED
Ulmus 'New Horizon' (Resista-elm)	L	20-25			Y		Violet	Broad/Conical	DED resistant elm
Ulmus 'Rebona' (Resista-elm)	L	20-25			Y		Violet	Broad/Conical	DED resistant elm, same parentage as 'New Horizon'
Zelkova serrata 'Green Vase'	M	15-18	Fast			G > Y/O/R	Unremarkable	Broad/Vase	DED resistant (Ulmaceae family)

Tree Species (Common Name)	Size	Height m	Growth rate	Root Depth	Wind firm?	Autumn leaf colour	Flower colour	Form	Notes
Species recommended for large verges in prominent positions									
Cedrus atlantica 'Glauca' (Blue Atlas cedar)	XL	40			Y		Unremarkable	Broad	Tolerates pollution and dry soils, very large tree when mature
Fagus sylvatica (Common beech)	L/XL	30		Shallow		G > O		Globular	Native
Liriodendron tulipifera (Tulip tree)	L	20-35	Fast		Y	G > Y	Green/Yellow	Ovoid	Tulip-shaped, attractive flowers
Parrotia persica (Persian ironwood)	M	7-12		Shallow	Y	G > Y/O/R/P	Red	Irregular	Unrivalled autumn colour, requires large verge
Sequoia sempervirens (Coastal redwood)	XL	40-50	Fast		Y		Unremarkable	Broad/Columnar	Potentially massive tree
Sequoiadendron giganteum (Giant sequoia)	XL	40-50	Fast		Y		Unremarkable	Broad/Columnar	Potentially massive tree

FURTHER INFORMATION

Direct and indirect problems, and possible solutions for establishing trees in public locations to be considered by the developer.

Problem	Possible solutions
Direct	
1. Irrigation	Planting maintenance techniques Develop irrigation plan Balance planting quantity with resources
2. Soil compaction or poor quality	Species selection Site selection and assessment Trench planting
3. Direct damage	Planting style (physical barriers) Location selection Site assessment Care during transport and storage
4. Poor planting	Reduce extent of planting Monitor planting techniques
5. Poor tree quality	Develop quality purchase system Build relationships with suppliers Mix suppliers periodically
6. Maintenance (lack of)	Plant in accordance with available resources Maintain accurate records
7. Planting logistics	Plan planting exercise
Problem	
Possible solutions	
Indirect	
1. Physical damage (from other service delivery, e.g. grass cutting)	Notification of planting sites Interdepartmental consultation Pre-planning
2. Limited finance / resources	Planting style/quantity Establish priority requirements Explore sources of finance Contract management Adopt a tree-planting strategy
3. Development / refurbishment	Interdepartmental consultation/agreements Planting awareness, advertising Accept scheme has a limited "shelf life"
4. Neglect	Establish sense of ownership Satisfy requests for trees Plant for personal reasons, e.g. commemorative Promote maintenance by residents
5. Vandalism, people pressure	Public consultation Establish the level of tree desirability