DS.501
Street Trees

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Table of Contents

1 Introduction

1.1 Notes

a. This Design Standard explains design and use requirements for street trees, embracing current best practice. It is mainly concerned with the above and below ground design of Planting Spaces and other measures to secure and protect trees. It also considers: spacing and locating trees; the levels of canopy cover that need to be provided in streets and spaces; and general maintenance requirements (including commuted sums).

a. See the SSDM webpages at www.southwark.gov.uk/ssdm about the design of streets and spaces.

1.2 Discussion

a. Trees are highly valued by the public. The council recognises the substantial contribution that trees make to the character and quality of Southwark's streets as well as the additional benefits they can provide. These include:
   i. Reducing urban temperatures through the cooling effects of shading and, just as importantly, evapotranspiration.
   ii. Helping manage flood risk by intercepting and attenuating rainfall and returning it to the atmosphere through evapotranspiration (and other processes) whilst aiding ground water recharge by making it easier for surface water to infiltrate deep into the earth.
   iii. Helping improve the quality of surface water run-off by filtering or taking up pollutants through the soil and encouraging soil bacteria to develop that can break down other pollutants to develop.
   iv. Preventing photochemical smog from being generated and improving air quality by reducing urban temperatures and filtering particulates from the air.
   v. Supporting biodiversity by providing above and below-ground habitats, food and resources for other life.
   vi. Improving human physical and mental health by softening hard urban environments and providing everyday pleasure.
   vii. Providing a resource for environmental education.
   viii. Positively impacting property values.

b. Overriding principles:
   i. Consider trees from the outset: Designers must begin planning and designing for trees from the earliest stages of the development process. They require considerable space and will impact upon pavement engineering, vehicle parking layout and drainage). It should not be assumed that they can be fitted into whatever space is leftover after other design concerns have been resolved.
   ii. Put the tree first: Placing trees for wider townscape effect to create avenues or groves this should not be at the expense of any tree's basic need for adequate growing space and resources. A cramped tree will generally be short-lived and sickly.
   iii. Quality over quantity: Fewer, larger trees should be preferred over many smaller trees because of their comparative environmental benefits, greater longevity and the more stable long-term canopy cover they will provide.
   iv. Focus resources where they matter: Designs should maximise the likelihood of successful establishment by prioritising what is important: quality stock; adequate Rooting Zone volumes and composition; and sub-drainage. Expensive luxury features like grills and architectural guards should not be used.
   v. Plan for the long term: Designs should be produced on the basis of each tree's characteristics at maturity (including canopy area and Structural Root Plate extent). Trees should not be 'crammed' together to produce the effect of immediate canopy enclosure. Individual trees should be spaced to allow each to develop to maturity without overlapping significantly with the canopies of others.
   vi. Plant the easy places first: Wherever possible, create Planting Spaces with very large Openings, plant in existing green verges, or link modest Planting Spaces to nearby gardens (or other

existing soft landscaped areas) via 'breakout corridors' so that roots can access and exploit them. Below pavement Rooting Zone systems should only be considered when unavoidable.

vii. Maximise the potential for canopy growth: Effort should be made to locate trees as far away from buildings and other above ground constraints as possible. This way they can develop full canopies that will maximise their environmental contribution. It will also reduce the need for future pruning and other costly maintenance.

viii. Protect Rooting Zones from compaction: Use raised edges to Openings to protect the soil within Planting Spaces from being compacted by foot or vehicle traffic.

ix. Long term maintenance costs must be covered: Commuted sums must be provided to cover watering and other initial Aftercare during the Establishment Period. Besides initial Aftercare costs, all additional longer term costs owing to design decisions that require any Departure from Standards must be covered.

c. Removing existing mature trees will only be considered if they are in decline, ill health or posing a critical structural risk. They must pose some safety or accessibility risk, substantive evidence must be provided to demonstrate that it is not possible to carry out other works to address these.

d. If trees are removed as part of development works then direct like-for-like compensation for the lost canopy area and Stem Diameter must be provided through new replacement planting. All compensatory planting must be within the adopted Highway. In limited circumstances Project Teams may instead pay commuted sums so that the Highway Authority can carry out compensatory planting works in the surrounding area at some future date. The sum required is £4K per 50m^2 of missing canopy area plus a further £4K for each 250m^2 (or part thereof) to cover design and project management costs. In addition, the Project Team must provide financial compensation equal to ¼ of the assessed CAVAT value of each felled tree. The costs of any compensatory planting works (and associated Establishment Period basic maintenance contributions) may be deducted from this.

e. Trees perform important urban cooling functions that help maintain comfortable environments. This is achieved by a combination of solar shading and Evapotranspiration by their canopies. New streets and spaces must be designed to achieve 25-40% canopy cover at 30 years after planting. Lesser values are permitted for narrower streets, along with some trade-off between different new streets and spaces where several are being built at once. Street Fronting trees in nearby non-Highway land close to the Highway boundary (Supplementary Areas) may make a modest contribution.

f. Trees must not be located too close to buildings (≥ 5.5m required between trunk centres and façades/structures in new streets and spaces and ≥ 4.5m in existing in most instances). They must also not obstruct footways (minimum 1.8 - 2.4m effective width required beside Openings in most instances). The preferred location for new street trees is in Build Outs along the edge of the carriageway between lengths of kerb-side parking. Being further away from facades they will require less pruning and will be able to develop wider and more balanced canopies whilst shading a greater area of the street. Being isolated from areas of pedestrian use, potential accessibility risks are avoided. However, it should be noted that Build Outs must normally be ≥ 3.5m in length if they contain trees.

g. A minimum distance of around 0.75-1.5m must be kept between the canopies of mature trees and buildings/structures (including balconies). Similar distances also apply for lighting columns, traffic signals and traffic signs. Designs must be based on this maximum canopy area at maturity, not that of the young tree when it is planted out. Pruning or pollarding may be acceptable for certain species as a means of maintaining distances. The absolute smallest tree that is acceptable is one with a 4m mature canopy radius under normal growing conditions.

h. Openings to new Planting Spaces must normally be designed with a ≥150mm high raised edge. This deters pedestrian and vehicle overrun and helps prevent soil and other loose material spreading onto neighbouring surfaces. They must be surfaced with shredded bark mulch. The raised edge will normally be formed by raised kerbs, not narrow edging units. However, in some circumstances within existing streets and spaces, it may be acceptable to use wide timber edgings. If there is a significant risk of pedestrians or vehicles overrunning an Opening then double step-kerbs or, low railing enclosures may be considered. For smaller Openings in existing streets and spaces it may be permitted to use flush edgings and, eventually, a self-binding gravel surface - though shredded bark mulch and timber stockades will be required as transitional measures for the first 6-8 years before the final surface is installed to protect and sustain trees whilst their vulnerable young roots establish and strengthen. Surfacing with metal tree grilles that cover Openings will only be considered extreme circumstances. Existing Openings should be retro-fitted with preferred features wherever possible, with existing grilles removed as a priority.

i. Trees in new Planting Spaces need to be provided with Rooting Zones that are big enough to meet their moisture and Essential Element needs across a likely drought period of around 10 days.

j. Many of the borough's existing stock of large, broad leaved street trees are approaching the end of their natural lives. These trees lend much to the character of the borough and replacing them is a major concern in an age the tendency is to favour smaller trees. Climate change suggests the likely increase in severity of summer droughts and wet winters that will exacerbate existing problems with the way urban trees are planted. There is a need to diversify the types of trees planted in streets to combat the threat posed to individual species by diseases.

k. Proper planting design and construction is required to ensure benefits are realised. This is particularly important where trees are installed in hard surfaces like Highways Poor planting has resulted in:
   i. The need to repair pavements damaged by root heave because of inadequately sized Openings to Planting Spaces or inappropriately selected species.
   ii. Obstructing pedestrian access because of trees being planted in footways that were too narrow in the first place.
   iii. Obstructing light to windows (and the need for related excessive pruning) because of trees being planted too close to buildings without having anticipated their future growth.
   iv. The need to replace significant numbers of trees (due to immediate or premature failure or shortened life spans) because of poor planting practice, Planting Space design or vandalism.

2 Tree Design Statements (TDS)

a. A TDS should be included in Outline Design Packages and Detailed Design Packages that are submitted for Approval (see notes). The TDS should also consider any Street Fronting trees if these are relied upon to comply with:
   i. Future canopy cover requirements as sections 3.1.
   ii. Lost and compensatory canopy cover requirements as section 9.
   iii. Diversity requirements as section 3.3.3.

NOTE 1: Works to trees include planting new trees, removing existing trees, modifying existing Planting Spaces and any works taking place within the root protection zones of existing trees.

NOTE 2: Tree Design Statements are reports that explain the design logic for planting proposals and design choices. They must address: species selection; Rooting Zone volumes; drainage measures; Opening dimensions for Planting Spaces; means of achieving final surface grades within Openings; measures to stabilise trees; and Canopy Management. Supporting information (e.g. Arboricultural Impact Assessments, Arboricultural Methods Statements, Soil Resource Surveys or other advice from

specialist Tree Advisors or Soil Scientists) and calculations/plots (e.g. for Rooting Zone volumes, canopy cover/compensation, Canopy Management costs, and species diversity) must also be appended as appropriate. See section 11 for further information about Arboricultural Impact Assessments, Arboricultural Methods Statement and Soil Resource Surveys.

3 Providing and locating trees

3.1 Highway canopy cover requirements for streets and spaces

3.1.1 New streets and spaces

a. Where Projects create new streets or spaces that are Highways they should include enough street trees of an appropriate size to provide the following levels of canopy cover:
   i. 25-40% if > 12.5m wide.
   ii. 20-35% if ≤ 12.5m wide.
   This is estimated 30 years after proposed planting works are completed. Street Fronting trees within areas close to the Highway boundary may contribute partly towards.

NOTE: Increasing distances between trunk centres and building facades (and other structures like lighting columns) allows larger trees to be planted. This helps meet canopy cover requirements more efficiently. It is also likely to increase the amount of sunlight received by trees and reduce the likelihood of commuted sums being required for Canopy Management and other maintenance. Fewer larger trees should be preferred at all times to many smaller trees.

b. If a Project includes two or more new streets or spaces that will be Highways then, for those new streets that are ≤ 12.5m wide, a minimum of 10% canopy cover may be permitted if the missing 10% of future canopy cover is off-set within one or more other new or existing streets and spaces. These Increased Streets must be existing or proposed Highways too and must be within the Project Area. The normal maximum canopy cover of 35% for a given street or space still applies In order for such a Departure to be considered Designers must demonstrate that achieving the normal minimum of 20% is not feasible because of engineering or arboriculture constraints.

NOTE : For example, suppose 10% future canopy cover from a new Reduced Street (Highway area of 150m^2 / width ≤ 12.5m) needed to be off-set into a new Increased Street (Highway area of 300m^2 / width >12.5m). 10% of 150m^2 is 15m^2. If the proposed canopy area within the new Increased Street is 120m^2 then this represents 40% canopy cover. This is the maximum value permitted as 'a' based on its width. However, only that over 25% may count. 25% works out as 75m^2 meaning that the maximum area from the new Increased Street that may count as off-set canopy cover is 45m^2 (120m^2 minus 75m^2). This is more than the 15m^2 off-set cover that is needed. The proposal is therefore acceptable.

c. Exceptionally, if it can be demonstrated that it is not feasible to comply with 'a' and 'b' then it may be permitted to provide off-set planting outside of the Project Area in a nearby alternative location. The alternative location must be existing adopted Highway. The separate offset planting must be fully funded by the designer. They may either:
   i. Design and implement it themselves.
   ii. Provide commuted sums to the Highway Authority so they can arrange for another Project Team to do so.

3.1.2 Existing streets and spaces

a. Designers are not obliged to achieve particular levels of future Highway canopy cover to any existing streets and spaces that are within their Project Area

3.2 Location requirements and influences

3.2.1 Minimum distance between trunk centres and building facades

a. New trees should be positioned so that the distance from the centres of their trunks at ground level to any part of the facade of any building or high wall or fence is:
   i. ≥ 5.5m in new streets and spaces this may be reduced to ≥4.5m in very narrow new streets that are for mainly for pedestrians and pedal cyclists only (access for most motor vehicles being restricted).
   ii. ≥ 4.5m in existing streets and spaces.

However, this may exceptionally be reduced to 3.75m to allow existing Planting Spaces to be replanted if trees have failed or been felled. It must be demonstrated that:

- It is not technically possible to provide a new Planting Space in close vicinity that would allow the normal ≥ 4.5m to be achieved.
- All canopy design and management requirements as section 5 are satisfied.

NOTE: Whilst building facades include balconies and other projections, they do not include garden walls, railings and other simple free-standing structures lower than 1.8m that will not in reality conflict with canopies. However, it does not necessarily follow that canopies may project over these without consent.

3.2.2 Minimum mature size of new trees

a. The minimum acceptable size of new trees planted within the Highway depends on the width of the footway (or other non-carriageway area) in which they will be planted. Requirements are as per Table 1. Designers must demonstrate why planting a tree of the required minimum size or greater is not feasible.

Distance between carriageway edge and building facade/high walls (see note 1)	Minimum mature canopy radius of tree as oN_{RU} [MAX] (metres)
< 6.0m	4.0m (though see note 3)
≥ 6.0m but < 7.0m	4.5m
≥ 7.0m but < 8.0m	5.5m
≥ 8.0m but < 9.0m	6.5m
≥ 9.0m but < 10.0m	7.5m
≥ 10.0m but < 11.0m	7.75m
≥ 11.0m but < 12.0m	8.50m
≥ 12.0m	9.25m

NOTES
1) This does not apply to garden walls, railings and other simple structures lower than 3m. However, it does apply to balconies and beams/ pillars/ piers/ columns. If trees are planted in isolated Build Outs then the carriageway edge is the edge of the Build Out that is closest to the centre of the carriageway.
2) The estimated value of *oN*RU [MAX] for approved species of tree is its typical canopy radius.
3) Where existing Planting Spaces are replanted owing to failure or felling of stock then, a reduced value of 3.0m may be permitted. This will normally only be permitted at the same time as the related Departure explained in '3.2.1a.ii'.
4) These requirements do not apply to new Street Fronting trees that are planted in Supplementary Areas.

Table 1. Minimum acceptable size of tree based on width of footway between carriageway edge and building façade.

3.2.3 Passing widths for pedestrians beside Openings to Planting Spaces

a. New and existing Openings to Planting Spaces within the Highway should be located and designed to maintain the minimum effective width values for pedestrians:
   i. World centres and town centres: 2.4m general access (1.8m minimum).
   ii. Heritage, village, docks and general areas: 1.8m general access (1.5m minimum).

3.2.4 Underground services

a. If, as part of an application for Planning permission, it is proposed to plant new trees in existing Highways then, irrespective of the stage of development of those proposals (e.g. feasibility, outline or detailed design), Highway Authority consent is subject to the applicant either:
   i. Submitting with their proposals a sub-surface utility location survey. The survey information should:
      - Include trial pits to confirm horizontal and vertical location of utility apparatus for a square area centred on the trunk centre of each proposed tree. This should be ≥ 350mm wider than the proposed Root Package to each side. Indicative typical dimensions for Root Packages are provided in Table 2.
      - Be accurate to within 150mm on horizontal and vertical utility apparatus locations for the remaining area of proposed Rooting Zones.
   ii. Clearly and unambiguously committing within their Planning application to:
      - (If necessary) divert Statutory Undertaker and other underground services so that these will not conflict with or otherwise constrain their planting proposals.
      - Cover all costs associated with the above without limitation.

   In the absence of either of the above the Highway Authority will normally object to an Application's planting proposals in its comments to the Local Planning Authority as a Statutory Consultee.

b. If new major utilities that are intended to be adopted by Statutory Undertakers are proposed (e.g. to provide service connections to new developments) then designers should note that Statutory Undertakers will normally require fixed distance easements around them that are free from tree planting. Root Barriers and Root Deflectors are not always a solution as not all Statutory Undertakers will allow easement distances to be reduced if these are provided.

3.3 Choosing types of trees, stock and *meeting overall diversity requirements*

3.3.1 Species

a. The SSDM/SER/Tree palette lists species of tree that may be planted in existing or proposed Highways, Briefly they are as follows:
   i. **Aceraceae**: Field Maple, Field Maple 'Elsrijk', Globe Norway Maple, Norway Maple 'Princetown Gold', Norway Maple 'Emerald Green'
   ii. **Betulaceae**: Italian Alder, Alder, Grey Alder, Hornbeam 'Frans Fontaine', Silver Birch, Silver Birch 'Dalecarlica', West Himalayan Birch
   iii. **Cercidiphyllaceae**: Katsura Tree, Caramel Tree
   iv. **Carylacea**: Turkish Hazel
   v. **Carnaceae**: Handkerchief Tree, Ghost Tree, Dove Tree
   vi. **Fagaceae**: Cut Leaved Beach, Fern Leaved Beach, Copper Beach, Fastigate Beach, English Oak
   vii. **Ginkgoaceae**: Maidenhair Tree
   viii. **Hamamelidaceae**: Sweet Gum, Persian Ironwood
   ix. **Hippocastanaceae**: Horse Chestnut, Red Horse Chestnut, Yellow Buckeye
   x. **Leguminoaceae**: Judas Tree, Honey Locust, Black locust, False Locust, Silk Tree Mimosa, Japanese Pagoda Tree
   xi. **Lythraceae**; Crape Myrtle
   xii. **Magnoliaceae**: Tulip Tree, Yellow Popular
   xiii. **Pineacea**: Scots Pine
   xiv. **Platanaceae**: London Plane, Oriental Plane
   xv. **Roseaceae**: Snowy Mespilus,

Serviceberry, Juiceberry, Cockspur Thorn, Japanese Cherry, Whitebeam, Chinese Rowan Mountain Ash, Yellow Berried Rowan Mountain Ash, Wild Service Tree

xvi. **Sapindaceae**: Golden Rain Tree, Pride of India

xvii. **Tillaceae**: Small Leaved Lime 'Greenspire', Small Leaved Lime 'Winter Orange'

xviii. **Ulmaceae**: Nettle Tree, Honeyberry, Common Hackberry

3.3.2 Stock requirements

a. Table 2 below explains general stock requirements. Heavy standard trees should be used.

Form	Age, J_{YR} (yrs)	Girth (cm)	Assumed Canopy Area, J_{CA} (m^2)	Min clear stem height (m)	Root Packages – see note 1				Establish-ment Period, eJ_{YR} (yrs) – see note 3
					Permitted types	Min. depth (mm)	Min. size (litres)	Typical diameter (mm) for guidance only	
Heavy standard	3	> 12 to ≤ 14	1.0	1.5	Containerised/ Container-Grown preferred Root-balled may be used by Level 1 Departure - see note 2 Bare-root not permitted	400 (500 preferred)	65 litres (75 preferred)	450-500	3
Extra heavy standard	5	> 14 to ≤ 16	2.0	1.8		450 (550 preferred)	85 litres (100 preferred)	500	4
	7	> 16 to ≤ 18	3.5			500 (600 preferred)	125 litres (150 preferred)	500-600	5
Semi mature	9	> 18 to ≤ 20	5.5			600 (700 preferred)	200 litres (250 preferred)	600-700	6

NOTES
1) Fibrous roots should extend to all parts of the Root Package.
2) In order to obtain Departures to use root-balled stock, it must be demonstrated to the satisfaction of Approving Officers that container-grown or containerised stock is not available from any grower.
3) Notwithstanding the Establishment Period lengths stated above, in exceptional circumstances even longer periods may be instructed by Approving Officers. Examples include when trees with reduced Root Package to canopy ratios are permitted (as this is likely to extend the period of transplant shock).
4) Except for any varying requirements expressed in this Table, all stock should be as BS 3936-1 (or its successor standard) and grown in accordance with BS 8545:2014.
5) Trees with girths > 20cm are considered to be mature. If it is exceptionally permitted to use them then Approving Officers will agree stock requirements on a case specific basis.

Table 2. General stock requirements.

3.3.3 Diversity requirements

a. Increasing the diversity of the urban forest is essential to combat the threat posed to individual species by disease and climate change and so maintain canopy cover. The diversity requirements in Table 3 should be met. Street Fronting trees may contribute to this.

1. Species diversity (see note 1)
Tree planting proposals for the Highway should be developed so that, except for where (3) in this Table applies, at any point within a 200m radius (see note 1) there is - ≤ 10% from any one species (see note 2) - ≤ 20% from any one genus - ≤ 30% from any one family In addition, unless a Level 1 Departure is Approved, within a given street or space (measured junction to junction) - ≤ 3 trees of the same species may be planted immediately adjoining each another, be that along the same side of the street or to either side of the carriageway - ≥ 2 genus should be present - different trees should be mixed in with one another within a given street or space rather than planting each within distinct 'blocks'
2. Benefit to bio-diversity (see note 3)
≥ 33% of trees in any street or space should be from a species identified i as having significant biodiversity value (see note 3)
3. Conservation areas
As an exception from (1) and (2) in this Table, a limited number of streets in the borough of special character may be planted with a single species of tree on account of historic precedent identified in a Conservation Area Appraisal (see note 4)
NOTES 1) The reason for the 10-20-30 rule and the related requirements to mix different types of trees is to help improve ecological resilience against diseases that may blight individual species. If harmonious visual appearance is desired then the various specimens planted together should be of similar size, appearance and habit. 2) For the purposes of this Table only 'species' means the taxonomic rank of the same name used for the purposes of biological classification. Elsewhere in this Design Standard it is used to refer to the full biological classification of a tree including other higher and lower ranks too. 3) These are trees that (for a variety of reasons) play an important role in supporting insects, birds and other species. 4) This only applies where identified in both a Conservation Area Appraisal.

Table 3. Canopy diversity requirements.

4 Designing Planting Spaces and wider Rooting Zones

4.1 Planting Space dimensions, excavations and Root Deflectors

4.1.1 Shape of Openings and associated excavations

a. Openings to Planting Spaces should be square or rectangular in plan form. So should the Primary Rooting Zones below them. Round or elliptical openings will generally only be acceptable if a considerable distance (typically >1.8m) can be achieved between the centre of the tree trunk and the Opening/Primary Rooting Zone sides so as to reduce the risk of roots circling and ultimately becoming Girdling Roots.

4.1.2 Opening dimensions

a. The minimum distance between the centre of a tree's trunk and the edging to the Opening should be:
   i. 0.45m in existing streets and spaces
   ii. 0.75m in new streets and spaces

b. If trees are planted in Openings located in Build Outs positioned between Inset Parking Bays (or in any other circumstances where they are in the direct path of manoeuvring vehicles) then a minimum 1.5m distance should be kept between the trunk (based on the ultimate Stem Diameter see note 1) and the outer faces of the kerb steps to the edges of the Build Out (or other raised edge restraints) (see notes 2 and 3). This distance may be reduced if other physical measures to prevent the boots and bonnets of cars from overhanging the Opening are agreed (see note 4).

NOTE 1: The ultimate Stem Diameter is measured at 1.5m above ground. Values for approved trees can be found in the SSDM/SER/Tree palette.

NOTE 2: In the case of Build Outs this will apply only to the up-stream and down-stream ends facing traffic, not to sides.

NOTE 3: Designers should bear in mind that if Build Outs have trees planted in them then their main Body Section (i.e. the length of the Build Out between lead-in/out tapers) needs to be ≥ 3.5m long.

NOTE 4: Introducing fixed vertical items of street furniture like bollards and cycle stands as a means of preventing overrun will not normally be permitted and remains subject to the requirements of other Standards. Increased height single or double step kerbs should be preferred instead.

4.1.3 Excavations

a. Depths
   Excavations for Primary Rooting Zones should be ≥ 600mm deep. Depths > 900mm are not generally recommended as they tend to provide diminishing returns. The existing subgrade to the base of the excavation and any other parts of the Rooting Zone should be broken up to a further depth of ≥ 200mm prior to back-filling (though see 'f').

b. Widths
   Excavations for Primary Rooting Zones should be sized to allow a ≥ 250mm width of newly installed Growing Media to be provided to all sides of installed Root Packages.

c. Retaining surrounding pavements and preparing sides
   Adequate restraint is required to the sides of excavations for their full depth to prevent the surface edge restraints used to Openings and the lower courses of surrounding pavements from failing. One of the following methods should be used:
   i. Stepping and Repose Slopes
      If the formation levels of any of the surrounding pavements (or sub-formation levels if capping layers are present) are deeper than the base level of the footing to the surface edge restraint used to the Opening, then the parts of those pavement constructions between these levels must be stepped (extended) under and beyond the footing into the excavation. This should be done as per the following further requirements:
      - The thickness of the stepped pavement layers (and level of the pavement formation or sub-formation) should be planar with the main pavement construction.

However, the total thickness should be:
- ≥ 150mm if the surface edge restraint is within 300mm of the edge of a carriageway
- ≥ 100mm minimum in all other circumstances.

- The width of the stepped pavement layers beyond the inner face of the surface restraint (and any associated footing to this) should be:
  - ≥ 150mm if the surface edge restraint is within 300mm of the edge of a carriageway.
  - ≥ 100mm minimum in all other circumstances.

The prepared formation (or sub-formation if capping is present) should extend to the entire width of this whilst:
- Stepped pavement layers should be terminated with Repose Slopes. Slope gradients should be:
  - 2:1 (height:width) for unbound granular mixture layers (E.g. [U-Type 1A] or [U- SMS]).
  - vertical for concrete or hydraulically bound mixture layers.

Irrespective of whether or not it is necessary to step pavement layers beneath footings in the above way, the prepared formations (or sub-formations) of the surrounding pavements must extend a further 75mm beyond the inside edge of the:
- edge restraint footing.
- (if provided) stepped pavement layers.

Before any further excavation may be made into the subgrade. The angle of repose to the edges of those further excavations should be:
- 1:1 (height:width) for any part that occurs within 600mm of the edge of a carriageway or any other surface that will be trafficked by motor vehicles (e.g. a Vehicle Crossing).
- 2:1 (height:width) in other instances.

ii. <u>Rigid rectangular chamber</u>

The excavation is accommodated within a modular chamber construction with vertical walls. Chambers may be constructed using:
- Root Deflector systems backed with concrete.
- Precast concrete or preformed plastic manhole chamber systems (or similar). These may be with or without concrete backing depending upon the structural capacity of the product. However, only rectangular products may be used (not circular).
- GCU assemblies.

Whichever chamber system is used the further requirements of 'd' should also be met. Suitable chamber, deflector and GCU products will be agreed.

d. If a rigid chamber construction as '4.1.3c.ii' is used then:

i. Deflectors and chamber sections should be backed with a minimum 150mm thickness of concrete of a minimum C12/15 compressive strength class (e.g. [A-ST3] ancillary concrete or [H-CBGM-B/R-C15]). In the case of modular manhole chamber systems and the like (but <u>not</u> Root Deflector systems) this may be left out by Level 1 Departure if it can be demonstrated to the satisfaction of Approving Officers that the proposed product is suitable for use when retained by unbound granular engineering materials only (e.g. [U-Type 1A] or [U-SMS]). The need for concrete or other backing to GCU assemblies will be agreed on a case specific basis.

ii. If modular manhole sections or timber block/sleeper assemblies are used then Root Deflectors as section 4.1.5 should still be provided to the inner tree-facing sides of the chamber. This is important as the joints between chamber sections/blocks/sleepers may otherwise encourage roots to circle. Roots are also likely to attempt to gain access between joints.

iii. If GCUs are used to construct chambers then the need for Root Deflectors and other geotextiles to prevent or restrict access for roots will be agreed on a case specific basis with Approving Officers. This will be product and application specific and will also depend upon the fill used within the units. If the Growing Media within the excavation is extended into units as fill then Root Deflectors may only be necessary on the outer side of the chamber to protect any neighbouring pavement

constructions. However, in some instances it may be necessary to encapsulate the inner side of the chamber with a geotextile filter or separator as '4.5.4e' to prevent potentially damaging larger Lateral Roots from developing within all or parts of these. Providing they are correctly specified then those geotextiles may still permit access for Fine Absorbing Roots so that these can exploit any soil fill within.

iv. Whatever chamber option is selected, care must be taken to both:
- Provide a suitable bedding of engineering material.
- Maintain an open interface as section 4.1.4 towards the base of the chamber to connect with any Secondary Rooting Zones.

These requirements are likely to be met most easily by:
- Bedding chambers on non-rootable engineering material (which might include rootable and free draining [U-SMS] Structural Soil depending upon the requirements of the proposed chamber system).
- Perforating the base of deflectors or lower chamber sections/walls with regular minimum 150mm diameter holes. If necessary then brief plastic pipes should be inserted to pass through any concrete backing.

e. Prior to back-filling a Rooting Zone excavation, the base and sides of any exposed soil faces should be scarified to promote free drainage.

f. Root Package support mounds and subgrade falls

Root Packages should be positioned within Primary Zones on mounds of heavily compacted material (see note 1) to serve as stable bases and to raise them above below-ground areas that may become saturated. Mounds should be:

i. ≥ 200mm above the base of excavations
ii. At least as wide as the Root Package.

Repose Slopes should be provided to the sides. The maximum slope gradients should be as explained in '4.1.3c.i' appropriate to the material used. That material may be:

iii. Undisturbed subsoil.
iv. The same Growing Media used to back-fill the opening.
v. Other soil reclaimed from site.

As all the above materials will be heavily compacted their AWHC for the purposes of determining required Rooting Zone volumes (see section 4.5.1) should be assumed as a maximum of 3% (meaning that, in practice, it may be easier to ignore them in calculations). However, if [U-SMS] Structural Soil is used (see Table 5 and Table 6) then the normal lower AWHC value for that material may be assumed as it will remain free draining despite heavy compaction. For this reason designers are encouraged to use [U-SMS] Structural Soil wherever practical.

NOTE: Such materials should be compacted to ≥ 90% of their peak dry density.

g. The base of all parts of Rooting Zones (including Secondary Rooting Zones) should be set to a fall of 1:100 or steeper to shed water laterally away from Root Packages and towards sub-drains or other outlets.

4.1.4 Interfaces between different parts of Rooting Zones

a. Where different parts of Rooting Zones meet (see note 1) an open interface of Growing Media that is ≥ 375mm high and wide should be provided (though see note 2). Neither Root Deflectors, Root Barriers, chamber sections, concrete surrounds nor any other non-rootable material should obstruct this (see note 3).

NOTE 1: For instance, the interface between a Primary Rooting Zone and a Secondary Rooting Zone, or the interface between two separate Secondary Rooting Zones.

NOTE 2: If a rigid chamber construction is used to a Primary Rooting Zone to retain the pavement surrounding the Opening, and access is required for roots beyond this to a Secondary Rooting Zone, then regular minimum 150mm diameter perforations are acceptable. If concrete backing is provided to the chamber then any associated pipes passing through the chamber walls should be as brief as possible.

NOTE 3: GCU assemblies may be used providing the units are suitably open-sided so that large Lateral Roots can develop through

them without risking damage. [U-SMS] Structural Soil is appropriate if the interface is with a wider volume of that material. However, using Structural Soil should be avoided in other instances as the stone matrix will prevent larger roots from developing. For instance, if the interface was between (1) a soil filled Primary Rooting Zone and (2) a Secondary Rooting Zone within a GCU Soil Vault assembly, then using [U-SMS] Structural Soil to support the Root Barrier at the interface would not generally be appropriate as it would prevent larger roots from ever developing within the Soil Vault.

4.1.5 Root Deflectors and Root Barriers

NOTE: Root Deflectors are used to direct tree roots downwards to preferable rooting areas. This need not exclude them passing under and beyond the deflector providing they do so at a depth where they will not trouble vulnerable areas (and surfaces) above. They are most commonly used to the edges of Openings and associated Primary Rooting Zones. Root Barriers are used to exclude roots entirely from passing beyond a given line – irrespective of depth. They are most commonly used along utilities corridors and to protect vulnerable building foundations.

Use requirements

a. Where new Planting Spaces are created then Root Deflectors should be provided to the edges of their Openings and associated Primary Rooting Zones to guide roots downwards. If Planting Spaces are replanted then Deflectors should be retrofitted to them if they are absent.

b. The need for Root Barriers will be agreed/instructed on a case specific basis. Possible circumstances when Root Barriers may be required or justified include to protect: (a) major underground utility lines (especially if these have associated easements); and (b) vulnerable basement structures. However, it does not necessarily follow that Statutory Undertakers will allow easement distances around major utilities to be reduced if Root Barriers are installed. Designers are advised to check with Statutory Undertakers for their policy on this matter at an early stage

Design requirements

c. See the Southwark Highway Specification for specifications for both Root Deflectors and Barriers.

d. Root Deflectors should extend down ≥ 400mm beneath the top surface of Growing Media within the Opening. If conventional pavements that do not have Secondary Rooting Zones beneath them abut the Opening then the Deflectors should extend down to cover at least the top 100mm of their subbase.

e. If Root Deflectors extend > 900mm beneath the top surface of the Growing Media within an Opening then – notwithstanding any other features that have been included– it should be assumed for the purposes of designing and estimating Rooting Zone volumes as section 4.5 that roots will be unable to access any Secondary Rooting Zone beyond them (unless the Deflectors are cored through as explained elsewhere).

f. Root Deflectors should be positioned on a small Horizontal step of either compacted engineering material or prepared subgrade (see note). If it is engineering material then it should be ≥ 100mm thick. However, in either case it should be:
   i. ≥ 75mm wide.
   ii. terminated with a Repose Slope. The slope gradient should be as explained in '4.1.3c.i'.

NOTE: [U-SMS] Structural Soil is acceptable for these purposes.

g. Root Barriers should extend to the greater of:
   i. ≥ 1000mm below surface level.
   ii. ≥ 400mm below the top of the subgrade beneath the pavement structure.

h. Root Barriers should not be used within 2.45m of trunk centres. In exceptional circumstances where very small trees are permitted, this may be reduced to 1.75m.

NOTE: Root Barriers will obstruct the development of structural root plates they may undermine the stability of trees when they are mature and the risk of wind throw increases.

i. Both Root Deflectors and Root Barriers should:
   i. Be positioned so that their top edge is 10-25mm above the surface grade of any Growing Media. Ideally they

should extend similarly above any organic mulch surfacing. However, providing the Deflector/Barrier is located hard up against edge restraints and their footings then Approving Officers have discretion to waive this further requirement.

ii. Be installed vertically.

iii. Include vertical ribs. The ribbed side should always face the tree. Ribs are provided to direct roots downwards and to prevent them from circling not for structural reinforcement purposes. Without these, deflectors are likely to be ineffective.

4.2 Surfacing and edging to Openings

4.2.1 General

a. Surfaces to Openings should be fully or semi-permeable. This is to allow moisture to infiltrate the Growing Media and gaseous exchange to take place within it.

b. Openings and excavations for Primary Rooting Zones should be temporarily backfilled and capped if trees cannot be planted in them before a site is opened to public. When the Opening is later reopened/de-capped for planting out, any Growing Media within the Primary Rooting Zone excavation should be replaced. It may not be reused.

4.2.2 Establishing surface design levels within Openings

a. Before installing surfaces, the grade of the top of the Growing Media back-fill within the Opening/Primary Rooting Zone should be set so that the upper-most root of each tree's Root Package is exposed by 10-15mm at the Trunk Flare. Care should be taken not to mistake grafting or budding lines for upper roots. Grafting and budding lines will be above these. If soil in the Root Package of a delivered tree is mounded above the uppermost root then the tree should generally be rejected.

b. The appropriate grading profile for the surface of Openings will vary. Designers should carefully explain their proposed approach for each Planting Space in Tree Design Statements. They must demonstrate how this balances the competing objectives of:

i. Maximising the amount of surface water that will collect and infiltrate around and over the Root Package.

ii. Avoiding saturated conditions around the Root Package, both at surface level and below ground.

c. It is important that the effect of shrinkage and natural consolidation of Growing Media is taken into account when establishing surface levels to Openings. Installing to the target design grade and then topping up with further soil mix (if required) to reinstate this grade after shrinkage/consolidation has completed is recommended, but must be taken not to create a trip hazard.

d. In exceptional circumstances where it is permitted to use bound or unbound granular surfaces to Openings (e.g. resin bound gravel or self-binding gravel) they should not be installed until the back-fill Growing Media has shrunk and consolidated fully.

e. If grass or turf surfaces (including wildflower or woodland-flower mixtures) are used to Openings or over Rooting Zones in general (see '4.2.3a.ii' and Standard DS.500) then:

i. Final surface grades within Openings and other areas should be designed to be 25mm higher than any bounding edge restraints in order to allow for mowing. They should slope down over the final 150mm before the restraint to be flush (0mm upstand) with it (though see note).

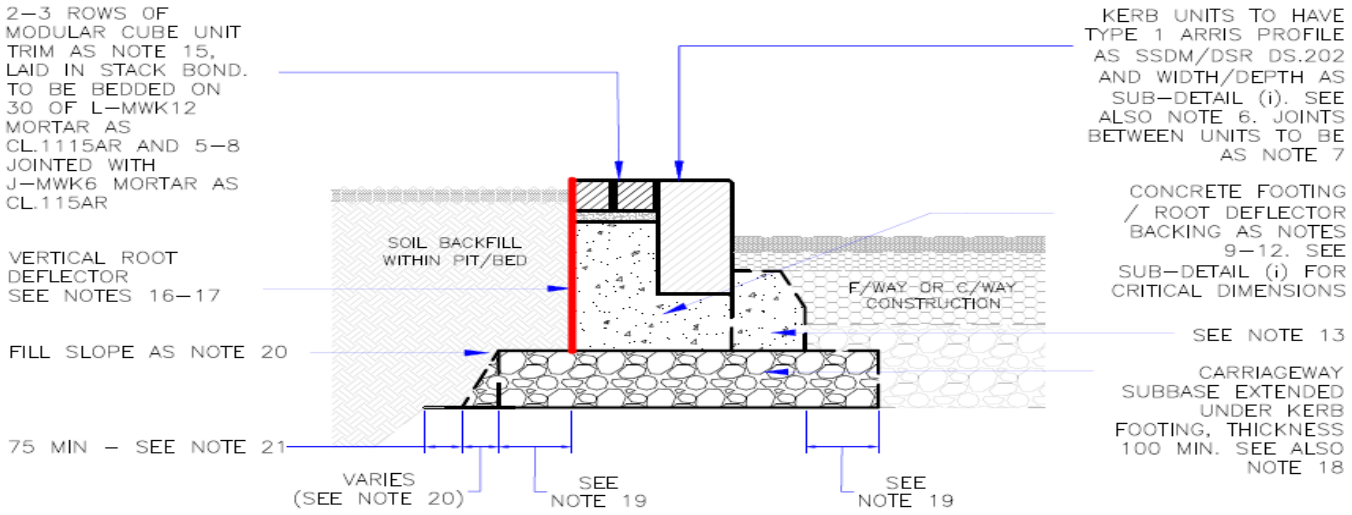
ii. Soil cover should be ≥ 150mm deep over footings to edge restraints in order to allow vegetation to establish.

4.2.3 Surfacing and edging options for openings to new Planting Spaces

<u>In new streets and spaces</u>

a. Openings to new Planting Spaces should be:

i. edged to all sides with full-section single-step or double-step raised edge upstand kerbs. These should be designed as per the detail below (see note and extract of drawing below)



ii. surfaced with 60-70mm thick [M-BM1] shredded bark mulch. The top of the installed layer should be 20-30mm beneath the top of the kerb in order to prevent it spreading onto any neighbouring pavement. Alternatively,
   - a self-binding gravel or (exceptionally) resin bound gravel surface may be permitted. However, commuted sums are then required.
   - areas that are further than 1.2m from the trunk centre may be sowed with a woodland or wildflower mix. A suitable maintenance regime must be agreed. Commuted sums may be required.

NOTE: In general, edges of Openings that are within or bound footways need only use a 150-175mm high single-step edge. Edges that bound carriageways will typically need to use higher double-step edges

b. As alternatives to 'a' other edging solutions that achieve the key objective of deterring pedestrian and vehicle overrun of the Opening may be permitted. Commuted sums are likely to be required in all instances. Examples include
   i. low walls. These might be natural stone, rendered or clad brick, rendered or clad slip- formed concrete or composed from sheet metal. They might also be designed to provide formal or informal seating opportunities.
   ii. architectural railings. These are unlikely to be permitted within 450mm of the carriageway edge. However, they need not necessarily be installed to all sides of an Opening (or even to the entire length of a side). The height and width requirements for upright street furniture in DS.219 apply if proposed walls and railings bounding are <1.1m high and the surface of the Opening behind them is >40mm lower than their tops.
   iii. robust structural hedge planting. A suitable maintenance regime must then be agreed.

<u>Existing streets and spaces</u>

c. Edging and surfacing to Openings should be as for new streets and spaces. However,
   i. in General, Docks and Village SSDM/RP/Specification Areas (but not elsewhere), either
      - modular timber block edging
      - full section timber sleeper edging may be used as alternative means of achieving the required raised edge to the Opening – but only where these are located outside of the carriageway. In order for either option to be Approved, it must be demonstrated that
      - it is visually appropriate within the context of the wider character of the street or space
      - the construction is not at risk of being struck by vehicles
      - the specified timber will not pose a hazard to passing pedestrians due to splintering as the timber ages
      - the proposed detail is robust enough to retain the surrounding pavement will not warp
   ii. If it can be demonstrated that it is not feasible or appropriate to install permanent raised edges, then it may

be permitted to install a flush edging using another detail as SSDM/TDR Drawing LBS/2600/01 - 04 (though these may require some further modification to include Root Deflectors). However

- given the vulnerability to overrun of the backfill Growing Media in the Primary Rooting Zone below the Opening, it must be protected by a timber stockade for a period extending not less than 3 years whilst roots are first re-establishing and then thickening below the Opening.
- after the stockade is removed the Opening must be resurfaced with self-binding gravel at a minimum thickness of 100mm (normally over an underlying minimum 100mm thickness of [U-Type 1A/F] unbound granular mixture).
- commuted sums are required to maintain the stockade and to install and maintain the final surface.

NOTE: Any timber used outside needs to have high durability (EN 113 Class 1 in Use Class 4 as EN 335 if used below ground and Class 3 if used above it). If it will serve as a retaining edge to a pavement construction then it also needs to have high dimensional stability in the same conditions (average ≤0.69% radial and ≤1.47 tangential from oven dry to saturated). This same stability requirement and a sawn finish (not wane edged) is also generally necessary where it is used above ground in order to reduce the risk of potentially dangerous splinters and shakes developing as the wood ages.

4.2.4 Re-surfacing and edging Openings to existing Planting Spaces

a. If existing Planting Spaces are replanted after trees fail or are felled then their Openings should be re-edged and re-surfaced at the same time with one of the options permitted in section 4.2.3.
b. If existing Planting Spaces that have existing trees in them are encountered within Project Areas then their Openings should be re-edged and re-surfaced with one of the options permitted in section 4.2.3. An example of a circumstance when an alternative edging solution may be required is where there are existing established mature tree roots within the Opening that extend under or through the surrounding pavement at a shallow depth. This is likely to mean using staked timber edging boards – albeit with occasional sections 'cut out' or 'notched' to accommodate larger roots (see drawing LBS/1100/06).

4.3 Staking and stabilising trees

Use requirements

a. All trees other than semi mature stock should be stabilised using simple stake-and-tie above-ground guying methods as 'b'. The most common alternative technique is likely to be below-ground guying. This is only likely to be appropriate for semi-mature stock as Table 2.

Design requirements

b. Stake and tie above-ground guying systems should be designed as follows.
   i. 3 x pressure treated soft wood stakes should be installed within the Opening to the Planting Space in an evenly spaced array about the trunk centre. For heavy standard stock (but not larger stock), the number of stakes to be reduced to 2 if accommodating 3 stakes will lead to an unacceptable risk of these being struck by vehicles.
   ii. The stakes should be firmly driven in vertically to a depth of ≥ 400mm below formation level at the base of the excavation before beginning backfilling. The top of each stake should be 1.2m above the intended final surface level within the Opening.
   iii. Trees should be stabilised using elastic fabric-mesh ties. One tie should be provided between each stake and the tree at the height specified in Table 4. Each tie should be looped in a Horizontal figure of 8 around the trunk and secured at each end to the stake using staple or nail fixings. Ties should be tensioned just enough that they will stay within 5-10° of Horizontal when the installed tree is firmly shaken. Care

should be taken to avoid over-tensioning. Ties should not be secured higher than the stated values in Table 3 as this will prevent loads from being transferred to the Structural Root Plate and so discourage necessary stress response wood from developing there. This is essential to the long term stability of trees after their stakes and ties are removed.

Stock type (as Table 3)		Height at which ties to be fixed between each stake and the tree
Heavy standard (or smaller)		400-500mm
Extra heavy standard	> 14 to ≤ 16cm girth	650-750mm
	> 16 to ≤ 18cm girth	800-900mm
Semi mature		Not appropriate – use below-ground guys and ground anchors instead

Table 4 - Staking requirements for trees

4.4 Protecting trunks

Use requirements

a. Trunks should be protected using high guards composed of simple, powder-coated wire-mesh. Alternatives include using more robust metal tree guards (that do not require support from wooden stakes) hessian wraps, or bio grease. The first of these may sometimes be preferred for visual reasons or where there is a significant risk of vehicle strike. The latter two options are only likely to be effective in protecting trunks from dog attack but require complicated maintenance and carry certain risks for the tree. They too may be preferred for visual reasons in some circumstances (e.g. where designers wish to avoid the introducing any type of guard).

Design requirements

b. Trunk protectors using simple wire-mesh guards secured to stakes should be designed as follows.
   i. Prior to planting out the tree, two or more stakes should be installed at 1.2m above final surface level within the Opening to the Planting Space. They should be located so that the wire-mesh guard attached to them can surround the tree.
   ii. A length of mesh to suit the required circumference should be cut from a 1.5m gauge roll. The mesh should be
      - shaped around the stakes to form a 1.5m high cylinder surrounding the tree. A minimum 200mm clearance should be maintained from the trunk. The base of the cylinder should be 100mm above surface level within the plating area (leaving a small gap below the guard helps street cleansing operatives to remove any litter that collects within.
      - lapped by 75-125mm
      - staple-fixed to each stake within 10mm of the outer end of the roll. Fixings should be located within 50-100mm of both the top and bottom of each stake and at 200-250mm intervals between.

4.5 Rooting Zones

4.5.1 Volume requirements

a. New trees need to be provided with a Rooting Zone that can hold enough moisture at plant available levels to meet their moisture demand through a typical summer dry spell when they are at peak maturity.

b. If Growing Mediums are located at depths beneath soil surface level of
   i. > 1200mm for [U-SMS] Structural Soil
   ii. > 900mm for all other Growing Mediathen the assumed available water holding content (AWHC) for that portion should be discounted by 20% to account for likely increased Bulk Density (owing to self-compaction from the weight of the soil above).The discount should be increased by a further 10% for each additional 100mm of depth.

c. Growing Media only counts as contributing to meeting the critical period moisture demand of a tree where it is ≥ 380mm deep, with the exception of
   i. that beneath Root Deflectors at interfaces between different parts of the Rooting Zones. This may be ≥ 360mm deep.
   ii. [U-SMS] Structural Soil (see Table 5 and Table 6). This should be ≥ 625mm deep.

4.5.2 Secondary Rooting Zones below pavements

a. Table 5 explains the two systems as Standard DS.602 that may be used to achieve Secondary Rooting Zones below pavements (see notes). See also section 4.6.1 about introducing pervious block surfaces over Secondary Rooting Zones if they extend below Inset Parking Bays. It is always preferable and less expensive to plant trees in wide Openings/Primary Rooting Zones and/or connect these to other existing soft landscaped Secondary Rooting Zones like gardens and verges.

b. If System B (Structural Soil) as Table 5 and Table 6 is used to a Planting Space then the minimum installed volume of normal soil Growing Media (not Structural Soil) provided within the Primary Rooting Zone should be
   i. 2.5m^3 per tree in new streets and spaces
   ii. 1.75m^3 per tree in existing streets and spaces

c. At least 45% of that normal soil volume must have a Soft Organic Material (SOM) value > 2%. Much greater volumes should be provided wherever possible.

<table>
<tr><th rowspan="2">System
(see note 1 and 2)</th><th rowspan="2">Comment</th><th colspan="2">Use requirements – see note 1</th></tr>
<tr><th>New streets and spaces</th><th>Existing streets and spaces</th></tr>
<tr><td rowspan="2">A.
[Type GT1] GCU Soil Vault assembly (see note 3)

Filled with [E-Class 5C2] topsoil and [E-Class 5B3] subsoil mixtures (see note 4)</td><td rowspan="2">The best currently existing option as it allows large volumes of high quality, lightly compacted soil to be located beneath pavements. The open sided nature of the individual GCUs allows utilities to pass through assemblies if necessary. However, assemblies require a lot of room</td><td>Should be used in all instances</td><td>If trees are planted in pavements ≥ 4.5m wide then should be used

If trees are planted in pavements < 4.5m wide then use is not mandatory though it should nevertheless be preferred wherever practical</td></tr>
<tr><td colspan="2">Should normally be located under footways, verges or Cycle Tracks only, though use under protected Inset Parking Bays at the edge of the carriageway may be acceptable in many circumstances. See Standard DS.602 for further information</td></tr>
<tr><td rowspan="2">B.
[U-SMS] Structural Soil</td><td rowspan="2">Avoids using GCUs or other below- ground structures entirely. Though not as effective as System A, is cheaper, much easier to install and can be used in much the same way as a normal unbound granular pavement subbase mixture</td><td>Designers must demonstrate that using System A is not possible (though see also note 5)</td><td>If trees are planted in pavements ≥ 4.5m wide then use requires Level 1 Departure (though see note 5). Designers must demonstrate that using System A is not possible

Use is unrestricted in other circumstances</td></tr>
<tr><td colspan="2">Should normally be located under footways, verges, Cycle Tracks and Inset Parking Bays only. However use under other areas of carriageways may be acceptable in some circumstances. See Standard DS.602 for further information. See also ‘4.5.2b’</td></tr>
<tr><td colspan="4">NOTES
1) Standard DS.602 includes further use and design requirements for both systems. These are likely to determine when Departures as per the requirements of this Table will be provided.
2) Various other types of ancillary GCUs can be incorporated into the design of both systems. These include: (a) [G-GW2] units with floating geo-textile bio-retention matt inserts to improve the quality of surface water before this is allowed to enter Rooting Zones; and (b) [G-GW3] units with high capacity foam inserts to store large quantities of water at plant available levels. (a) may be necessary if Rooting Zones are used as part of surface water sustainable urban drainage management systems. (b) may be used in certain circumstances to reduce the required size of the Rooting Zone (see section 4.5.1).
3) Designers are advised that not all GCU products marketed as providing below pavement Rooting Zone solutions for trees will meet the [Type GT1] specification. Standard DS.602 provides related guidance.
4) Using other soil mixtures may be appropriate in some circumstances (e.g. [E-Class 5C4]), like when a Rooting Zone will be used for bio-retention of surface water and a more free draining mixture is required. See Table 8 for further details.
5) Using [U-SMS] Structural Soil as a secondary material to small areas of System A (GCU Soil Vault assembly) designs is acceptable.</td></tr>
</table>

Table 5 - Use requirements for different under-pavement Secondary Rooting Zone systems

NOTE: Though Structural Soil provides much improved rooting conditions for trees, it is no substitute for large volumes of normal soil as can be accommodated within a System A assembly (GCU Soil Vault) or a very large Opening/Primary Rooting Zone. Rather, Structural Soil should be thought of as a compromise for constrained urban

environments where over compaction of soil resources remains a constant threat to trees. Maximising the volume of quality soil within the Primary Rooting Zone is essential to its successful use.

4.5.3 Growing media requirements

General

a. Table 6 explains the types of Growing Media for street trees that should be used in different circumstances. See the Southwark Highway Specification for full specification details for each of these mixtures and related testing and approval requirements.

b. As per Southwark Highway Specification Clause 618SR, soil mixture Growing Media should be spread and firmed in 100-200mm lifts, except if it is installed into a System A assembly (GCU Soil Vault) as Table 5, in which case it should be spread and firmed in 150- 250mm lifts. Firming should be by heel only and should be sufficient to remove large voids without causing compaction. No mechanical compaction equipment should be used (including hand compaction equipment). See the Southwark Highway Specification for details about spreading and compacting [U-SMS] Structural Soil. Over-compaction of soil typically occurs at >80-85% peak dry density depending upon the soil type.

Contributions from existing nearby native soil resources in gardens, verges and the like

c. Existing nearby gardens, verges, parks and other green spaces may serve as Secondary Rooting Zones and the native soil Growing Media within them may be factored in for the purposes of meeting the critical period moisture demands of trees as section 4.5.1. However
   i. the maximum AWHC of Growing Media from these areas should be assumed to be 5.0%
   ii. the depth of such Growing Media should be assumed to be 700mm
   iii. suitable connection should be provided to the Primary Rooting Zone to allow access for roots. If the areas between are paved then 'breakout corridors' should be constructed as conduits for roots beneath them.
      - A linking breakout corridor should be provided for each 10m^2 of top surface of other existing resource with at least two to any isolated resource.
      - If resources are located outside the Highway behind private boundary walls or other structures then the Project Team must obtain the freeholders legal written consent to permit works to that wall or structure, as may be necessary to provide breakout access for roots. All such works must be funded and arranged by the Project Team
      - Using [U-SMS] Structural Soil within breakout corridors is not generally acceptable as the stone matrix will limit and obstruct larger Lateral Roots from developing
   iv. no part of any resource that is located further from the trunk centre at ground level than a distance 1.25 times the tree's canopy may be factored in.

Contribution of assumed Remnant Soil beneath paved areas

d. Assumed Remnant Soil may be included within Rooting Zones by Level 1 Departure. This may be permitted on the reasonable assumption that there is good Remnant Soil somewhere beneath an existing pavement. The Highway Authority will work to survey and map streets and spaces in the borough and identify areas where such assumptions may be adopted. However
   i. only that within a distance from the tree's trunk centre that is 1.5 times its canopy may be included
   ii. a depth of 450mm and AWHC of 3.5% should be assumed
   iii. notwithstanding the agreed extent, it may only account for ≤ 40% of the required critical period moisture demand of the tree

Ref.	Brief description (see note 1)	Comment	Use requirements (see note 2)
[E-Class 5C1]	'Loamy sand to sandy loam' topsoil with 60-65% coarse to medium sand content and 10-15% clay and a fine granular structure. 2-3.75% SOM level.	A reasonably fast draining soil with reasonable compaction resistance (due largely to the dominance of larger particles in the sand fraction). The best 'compromise' mix for urban sites. Likely AWHC 7-13% by volume.	Should be used as the normal back-fill material to the entire depth of Primary Rooting Zones (see note 2) unless Departure to use another option below is Approved. Should not be used to System A (GCU Soil Vault assembly) Secondary Rooting Zones as Table 5 that extend below pavements, for which other options here are better.
[E-Class 5C2]	'Sandy loam to clay loam' topsoil that has a significant % of medium size peds and a granular structure. 5-12% SOM level.	A soil mixture with high Essential Element availability and AWHC (15-20% by volume). The best mix for use within the upper section of under pavement 'Soil Vaults' that will protect it from further compaction.	Should be used within the upper 550mm of System A (GCU Soil Vault assembly) Secondary Rooting Zones as Table 5 that extend below pavement. Subject to Level 1 Departure may also be used to the upper 450mm of Primary Rooting Zones - providing permanent measures to protect these from pedestrian overrun are included to their edges.
[E-Class 5C3]	'Sandy loam to clay loam' subsoil that has a significant % of large peds and a blocky structure. 0.5-2% SOM level.	A mineral soil mixture designed for use as a subsoil within under pavement 'Soil Vaults' at depths where heavier [E-Class 5C2] would be inappropriate because of the risk of self-compaction. Maintains a reasonable AWHC (11-14% by volume).	Should be used within System A (GCU Soil Vault assembly) Secondary Rooting Zones as Table 5 that extend below pavements at depths below 550mm of the surface level within them. Subject to Level 1 Departure may be used to depths below 450mm within Primary Rooting Zones - providing permanent measures to protect their Openings from pedestrian overrun are included.
[E-Class 5C4]	Bespoke soil mix. All aspects of specification, (including assumed AWHC) to be agreed on a case specific basis.	Allows bespoke topsoil or subsoil mixes to be developed in situations where either (a) other options here would be inappropriate; (b) favourable conditions mean it is feasible to use other highly desirable mixes that are too risky for the majority of situations; or (c) it is wished to incorporate existing soil won from site into a mixture (see note 3).	Use requires Level 1 Departure
[U-SMS]	Structural Soil. See section 5 of Standard DS.602 for further information about this material.	A fully load bearing mixture of soil and crushed rock that can be compacted to normal civil engineering densities (≥95% peak dry density). Can be used to foundations of trafficked pavements without other forms of protection and is rapid draining. However, many trees tend to fare less well than in other Mediums. An AWHC of 5.75% by volume should be assumed (see note 4).	Should not be used within Primary Rooting Zones other than directly beneath Root Packages to support these (see note 5). May be used to Secondary Rooting Zones below pavements subject to the requirements of Table 5. See also '4.5.2b' about requirements for minimum volumes of normal soil mix to be provided within the Primary Rooting Zone. See Standard DS.602 for further information about this material.

NOTES

1) In all instances, the pH of Growing Media should be appropriate to the proposed species and cultivar.

2) The maximum depth of Primary Rooting Zones using this material should not exceed 700mm as, despite its sand-based greater compaction resistance, it remains a topsoil with reasonable SOM levels.

3) An example of (a) is where is where Rooting Zones will be used as part of a surface water bio-retention system or where trees have extreme pH and nutrient requirements. An example of (b) is where soils can be guaranteed to be protected from compaction, in which case it may be feasible to use 'silt loam' or 'sandy silt loam' soils. These are normally too sensitive to compaction to risk using.

4) Though [U-SMS] Structural Soil has a typical AWHC of 7-9% the reduced value of 5.75% is needed to partially correct for its low overall soil content (soil only making up 20% by mass of the mixture). Exhaustion of the available soil within the mixture has been implicated in the reduced performance of trees planted in the medium as they approach maturity.

5) See section 4.1 for information about the materials and techniques to be used directly beneath Root Packages to isolate them from likely shrinkage/consolidation of the surrounding soil and prevent saturation.

Table 6 - Growing mediums and use requirements

4.5.4 Other requirements to help with rooting

Irrigation and ventilation systems

a. An above-ground watering-bag with a capacity of ≥ 50 litres should be installed with each newly planted tree to provide controlled release of moisture during the Establishment Period (see note). The bag should be located around the base of the trunk within any surrounding guard to the Opening. This will be regularly topped-up as part of routine Aftercare during the Establishment Period and removed at its end

b. If a Secondary Rooting Zone extends beneath a pavement then, to irrigate and ventilate it, further loops of perforated pipes that are fed from surface inlets are required as follows.
   i. If a System A (GCU Soil Vault assembly) design as Table 5 is used then the pipes should feed directly into the [G-GT1] GCU assembly so that air and water can circulate over the top of the topsoil within it (which will always settle leaving an air gap for this). Surface inlets should be located on an approximate 1.5m grid with not less than 2 to any assembly.
   ii. If a System B (Structural Soil) design as Table 5 is used then pipes should feed loops located directly within the [U-SMS] Structural Soil layer, 150mm beneath the top level of this. Loops should be arranged so that no part of the [U-SMS] Structural Soil Rooting Zone is further than 750mm from a pipe loop or a permeable surface when measured in the Horizontal plane. A surface inlet should be provided for each 2m of pipe loop in the system with not less than 2 for any single loop.
   ii. In either of the above instances it may permitted to omit the pipe loops if using a pervious pavement design above the Secondary Rooting Zone. See Standard DS.601 for details of when this may be allowed.

   Where possible, inlets should be located in valleys within the pavement surface in order to allow some surface water to shed into them.

c. All surface inlets to perforated pipe loops as ‘b’ should be capped. In addition, if inlets are located within
   i. hard surfaces, they should have an open metal grill cap that is fixed flush within the surface.
   ii. soft landscaped areas or loose self-binding gravel surfaces, then there is a risk that gravel, soil or other particles may enter and block them. To prevent this whilst still allowing for air exchange and moisture ingress, the inlet should be secured above surface level through staking or similar methods and covered with an open metal grille cap. However, in order to avoid inlets becoming a trip hazard this is only appropriate if the area is not likely to be trafficked by pedestrians.

Geotextiles

d. If either of the Systems discussed in section 4.5.2 and Table 5 for Secondary Rooting Zones that extend below pavements are used then further geotextiles are likely to be required. This could be for wide range of purposes including
   i. separating different materials
   ii. preventing access for larger Lateral Roots to certain parts of a Rooting Zone
   iii. creating impermeable tanks
   iv. lagging constructions to protect them from sharp objects.

4.6 Drainage and water quality design of Rooting Zones

4.6.1 Above-ground measures

a. The percentage of permeable or semi-permeable cover over the Rooting Zone associated with each new Planting Space (when seen in plan from above) should be
   i. ≥ 30% in existing streets and spaces
   ii. ≥ 70% in new streets and spaces

   Much greater values are desirable if they can be achieved. However, if Planting Spaces include Secondary Rooting Zones that extend below pavements then designers should note that, as per Standard DS.601, using pervious surfaces to those pavements is acceptable in limited circumstances only, being generally restricted to pervious block surfaces over Inset Parking Bays that are set to falls so that (if infiltration fails) run-off will still shed to a conventional gully.

b. If new Planting Spaces are created (but not otherwise) then surrounding pavement surfaces *may* be set to falls to shed surface water run-off towards permeable surfaces over Rooting Zones. However, this is subject to the following.
   i. Planting Spaces may not receive surface water from carriageway surfaces unless full hydraulic and water quality design as Standard DS.700 is carried out. See also note 1 about water quality treatment.
   ii. The total area of the contributing surface (including the surface of the Opening) should be ≤150% of the top surface of the receiving area of the Rooting Zone.
   iii. Run-off from contributing surfaces should be evenly distributed to and around the Rooting Zone for erosion and sediment control purposes. If
      - run-off is introduced at surface level (rather than collected by gullies and drains and introduced below-ground) and
      - raised edge treatments are used to edge the Opening

      then regular 250-300mm wide kerb-notch inlets should be introduced around the edge to the Opening. Notches should be combined with flow spreader plates and splash-pads to prevent erosion and to collect coarse sediment. Irrespective of the design of inlets
      - ≥ 200mm wide trench diaphragms of [U-Type 3/20] open graded material should be introduced along those edges of the Opening that include inlets. This will help to distribute inflows and make it easier for maintenance operatives to clean out sediment from time-to-time.
      - if run-off is permitted from carriageway surfaces, then a small sediment forebay should be provided locally within the Opening in front of each receiving inlet. It should be separated from surrounding areas by an appropriate filter geotextile. No planting may take place in forebay areas as the soil within will need to be replaced and removed from time-to-time by maintenance operatives to dispose of sediment/pollutants.
   iv. As discussed in 'a', if pervious block surfacing is used then, as per Standard DS.601, that surface must itself be set to falls towards a gully.
   v. Sub-drainage lines must be provided at the base of the Rooting Zones in all instances to reduce the risk of road salts accumulating (see section 4.6.2).

NOTE 1: Any run-off from carriageway surfaces must first pass via at least one water quality treatment feature to remove coarse sediment and the worst pollutants from it. Normally this will be a solids and hydro-carbon separator gully or similar feature (though within Planting Spaces a soil or gravel sediment forebay directly within the Opening fed by kerb-notches and spreader pads may be acceptable).

4.6.2 Below-ground measures

General

a. Below-ground drainage is as essential to creating successful Planting Spaces as is providing adequate Rooting Zone volumes. For all new Planting Spaces, designers must explain how this will be provided within Tree Design Statements and associated Pavement Design Statements.

Use requirements

b. For new Planting Spaces, given both
   i. difficulties in accurately determining subgrade permeability before construction work begins
   ii. the variability of subgrade permeability over small areas in disturbed urban conditions,

proposals should be progressed including one of the features as Table 9, appropriate to circumstance. However, if either
   iii. alternative proposals to perforate an inadequately permeable subgrade layer and so permit infiltration into an adequately permeable layer beneath (e.g. boring or slip trenching through London clay to access gravel sands below)
   iv. later more detailed investigations during Construction demonstrate that the subgrade is more permeable than the planting back-fill and that further drainage measures are therefore unnecessary then the sub-drainage features may be deleted. This decision will normally be made immediately prior to preparing the subbase when the condition of the subgrade (following site trafficking and other related disturbance) can be verified.

Circumstance		Required sub-drainage feature to Rooting Zone (though see '4.6.2b' about omitting these in certain conditions)
1	New Planting Spaces in new streets and spaces	Gravel perforated pipe drains as '4.6.2c' (see note)
2	New Planting Spaces in existing streets and spaces	Gravel perforated pipe drains as '4.6.2c' (see note) However, it may be permitted by Level 1 Departure to use a granular drainage layer as '4.6.2d' instead (or approved load bearing alternative). It must be demonstrated to the satisfaction of Approving Officers that it is not possible to connect a gravel perforated pipe drain to a suitable soakaway or other outlet because of invert levels and gradients or other physical constraints
3	Existing Planting Spaces in existing streets and spaces	No retrofitting of features is required. However, introducing either of the features permitted for (2) is encouraged if it is possible
NOTE Where gravel perforated pipe drains are required then, for the sake of efficiency, efforts should be made to locate trees in corridors so they can share the same drains.		

Table 7 – Required sub-drainage features for Rooting Zones

Design requirements

c. Gravel perforated pipe drains should
   i. consist of slotted plastic pipes orientated so that the slots face downwards to the base of the pipe
   ii. be surrounded with Type A or Type B filter drain material. Geotextile filters should not be provided - either to the perforated pipe or the aggregate surround (see note 1). Instead, pipe runs should be provided with rodding eyes/clean-out risers at their heads and at ≤20m spacings thereafter so that they can be cleansed by rodding if they become blocked
   iii. pass via a catch-pit manhole, silt-box or other solids interceptor chamber before outfalling to a public sewer or other part of the Highway drainage system
   iv. be vertically arranged immediately below the base of the Rooting Zone within the subsoil, so that the top of the surround of Type A or B filter material connects to it
   v. be horizontally arranged and spaced in one or more runs so that the entire area under the Rooting Zone is drained. Spacing of runs should be appropriate to how free draining the sub-soil is (see note 2). Evidence to support the proposed spacing must be provided within Tree Design Statements.

NOTE 1: This is because water moves laterally in the soil to the point of saturation before it begins to flow under gravity into drains. In heavy fine grained soils (e.g. clays or loamy clays) a 3m spacing between drain line centres is likely to be appropriate, increasing to around 10m in lighter sandy soils

NOTE 2: Any geotextiles will invariably clog over time with fines from the surrounding earth or engineering materials. When this occurs, the only way to restore permeability is to excavate and replace the entire drain. This is likely to be costly and difficult given their depth and the overlying constraints. Because of this, the preferred strategy is to leave out the geotextiles and accept the gradual build-up of fines and root ingress within the drain. Providing the drain is roddable, it can be cleaned out from time to time.

d. Granular drainage layers should
   i. be composed of [U-WS1] washed sand. However
      - if parts of the Rooting Zone consist of System A assemblies as Table 5 (GCU Soil Vaults) then [U-WS1] washed sand may not always be appropriate as some GCU products require more robust load-bearing granular layers to support them.
      - using [U-SMS] Structural Soil as Table 5 may also be appropriate in some instances.
   ii. be ≥ 450mm deep. However, if the interface between the base of the Rooting Zone and the filter layer is < 450mm wide then the depth should increase to ≥ 600mm
   iii. extend to the entire area immediately below the base of the Rooting Zone. Where a part of the Rooting Zone above consists of soil then, unless it is a sandy soil, the two materials should be tilled together to a depth of 50mm where they interface
   iv. include one or more perforated pipe loops that connect to surface inlets if the subgrade is a clay or silty clay (see note 2). These should be
      - horizontally arranged, and the inlets designed, in accordance with the requirements in section 4.5.4
      - vertically arranged 200mm beneath the interface with the Rooting Zone above.

NOTE 1: Sharp changes in the texture of soils create barriers to drainage. Water will not drain through into lower layers until upper layers are saturated, and will instead first move horizontally through the soil for a considerable distance - even if the lower layer is more permeable.

NOTE 2: These pipes are necessary to ventilate any water that may build up over less permeable subgrades and so prevent this from stagnating. They may also help improve soil quality within the Rooting Zone above and so encourage the greater downwards development of roots.

e. Irrespective of whether gravel perforated pipe drains (or other collector sub-drains) are provided, subgrades should be sculpted at1:100 falls so water drains naturally away from around the bases of Root Packages (and towards pipes and/or outfalls where these are provided).

NOTE: This Clause aims to avoid sharp changes in soil texture and compaction as these impede drainage and make it hard for roots to penetrate. Because of this, designers should always take care to draw changes between soil mixtures with a jagged line in Detailed Design drawings to draw the attention of construction operatives to the need for such tilling/scarifying. Notwithstanding this, occasionally, setting up an impediment to drainage may actually be desirable. An example is when a fast draining sand soil mix is installed over a heavier soil. Given that the sand soil will retain moisture poorly, creating a false 'perched water table' by intentionally keeping a sharp interface between the materials can help keep moisture closer to the surface where it can be used by roots.

5 Designing for and managing canopies

5.1 Canopy Overlap

5.1.1 General

a. Table 8 explains requirements about overlap by tree canopies with structures, different land areas and the canopies of other trees (Canopy Overlap). It distinguishes between Major Canopy Overlap and Minor Canopy Overlap. Requirements about Canopy Overlap with structures defined in Table 9.

5.1.2 Additional provisions about Canopy Overlap caused by overhanging land

New trees

a. Subject agreement the canopies of new trees may overhang private
   i. gardens and yards
   ii. free standing boundary walls, railings fences and the like that extend ≤ 1.8m above Highway surface level
   iii. single storey buildings (and parts of buildings) that extend ≤ 3.0m above Highway surface level. This may include the ground floors of buildings if their upper storeys are set back appropriately.
   iv. Agreement is subject to the freeholders of the private property
      - indemnifying the council for perpetuity against liability for possible future related above-ground damage to their property by the tree
      - agreeing in perpetuity that neither they nor any occupiers will prune/reduce any part of the tree that overhangs their property.
   v. that indemnification and agreement must be confirmed before design proposals will be approved. Notwithstanding that agreement, the council will continue to carry out Nuisance Abatement Pruning to prevent contact between the tree and these structures when notified of a nuisance and subject to consent to access the property.
   vi. the usual Canopy Overlap requirements as Table 8 still apply to any parts of any structure that exceed the above permitted heights.

<table>
<tr><th rowspan="2">Type of Canopy Overlap</th><th rowspan="2">Tree Type</th><th colspan="3">Criteria</th><th rowspan="2">Consequence and Requirements</th></tr>
<tr><th>Overlap with Clear Areas to structures (as Table 11 – though see ‘5.1.2a’)</th><th>Overlap with the canopy of another tree (see notes 1 and 2)</th><th>Overhanging non-Highway land (i.e. gardens and private hard standings – though see ‘5.1.2a’)</th></tr>
<tr><td rowspan="2">Major Canopy Overlap</td><td>New tree</td><td>Overlap of a Key Clear Area by the tree’s maximum canopy area</td><td colspan="2">Overlap exceeding the lesser of
- 20% of the tree’s maximum canopy area
- 1.0m</td><td rowspan="2">Requires Level 1 Departure. Designers must demonstrate that such overlap is unavoidable through evidence of reasonable exploration of alternative design options. In addition
- a Canopy Management Programme must be proposed in an AIA/AMS and agreed. See section 5.2
- commuted sums are required to cover the costs of the Canopy Management Programme. See section 8.2.2</td></tr>
<tr><td>Existing retained tree</td><td colspan="2">Any overlap of the tree’s
- Maximum canopy if it is not already subjected to routine Canopy Management (see note 4)
- average canopy if it is already subjected to routine Management (see note 5)</td><td>N/A</td></tr>
<tr><td rowspan="2">Minor Canopy Overlap</td><td>New Tree</td><td>Overlap of a Preferred Clear Area by the tree’s maximum canopy area</td><td colspan="2">Overlap not exceeding the lesser of
- 20% of the tree’s maximum canopy area
- 1.0m</td><td rowspan="2">- Whilst such overlap is to be avoided, where this is not possible then it is acceptable. It will be managed by the council in accordance with the council’s tree management strategy at no additional cost to the Project Team</td></tr>
<tr><td>Existing retained tree</td><td colspan="2">N/A – any overlap with the canopy of an existing tree is Major Canopy Overlap</td><td>N/A</td></tr>
<tr><td colspan="6">NOTE
1) The canopy of the other tree is based on
- maximum canopy area if it is a proposed new tree
- maximum canopy area if it is an existing tree that is not already subjected to routine Canopy Management.
- average canopy area if it is an existing tree that is subjected to routine Canopy Management
- average canopy area if it is an existing tree that is and which will also be subjected to Additional Canopy Management in order to resolve Major Canopy Overlap as per other columns of this Table.
2) See ‘5.2b’ about locating proposed new trees in relation to retained existing trees to avoid Major Canopy Overlap of the canopies of the later trees.</td></tr>
</table>

Table 8 – Canopy Overlap

Existing trees

b. For the avoidance of doubt it is not Canopy Overlap for the canopies of existing trees to overhang non-Highway land, providing they do not encroach on Clear Areas to buildings and other structures as Table 8. Moreover, where changes are proposed to the locations of building lines and other structures on non-Highway land, the council will not take action to address any new Canopy Overlap as Table 8 that may follow from this. That is for the title owners and occupiers of that land to resolve at their own expense (see note).

NOTE: Occupiers of land have a common law right to prune/reduce parts of trees that overhang their property. However, they may not climb a tree to do so and must leave it in a safe, stable and healthy condition. Tree canopies typically need to be reduced to all sides at the same time to maintain stability. If they are reduced on the private land side they will consequently also generally need to be reduced on the Highway at the same time by agreement with the council – funded by the occupier. The extent of reduction that individual trees can stand whilst remaining healthy will also vary from species to species.

Type	Horizontal distance from Structure	Consequence of Canopy Overlap with Area
Preferred Clear Area	Within 0.75m of structures	The canopies of trees may not overlap this zone at any point in their growth. If proposals result in this then Departures must be agreed. In addition, the Project Team is then responsible for funding a Canopy Management Programme as section 5.2 to maintain the canopy outside the zone.
Key Clear Area	0.75-1.5m from structures	Whilst it should be avoided wherever possible, overlap of this zone by canopies is acceptable and will be managed by the council at no further cost to the Project Team.
NOTES See also '5.1.2a' about Canopy Overlap by proposed new trees of lower free standing boundary structures (e.g. garden walls or fences) and single story structures (e.g. garages or ground floors of buildings that have recessed upper stories).		

Table 9 – Types and extents of Clear Areas from buildings or structures

5.2 Action to manage predicted Major Canopy Overlap (Canopy Management Programmes)

a. If the proposed location of a new tree or structure will result in Major Canopy Overlap as per Table 8 then
   i. a Canopy Management Programme to prevent this must be proposed in an Arboricultural Methods Statement as section 10.1. For each affected tree, the author must provide the information described in Table 10
   ii. the extent of the proposed Canopy Management Programme may not exceed the Pruning Tolerance Value (*P*TV) of the species of tree. See section 3.3.1 about agreeing values for unapproved species. Table 11 provides some typical values for guidance only.

b. Major Canopy Overlap as per Table 8 of existing trees by the canopies of proposed new trees is not acceptable. New trees should be positioned to avoid this unless Major Canopy Overlap of the canopy of the existing tree occurs anyway due to it encroaching on buildings and structures.

c. See '5.1.2b' about managing the canopies of existing trees where they overhang non-Highway land.

Requirement	Details
Date of first action	The date and number of years growth at which it is Additional Canopy Management will first become necessary
Description of recommended Canopy Management work	A full description of the required Additional Canopy Management work - the proposed type of work - the areas and approximate volumes to be reduced (which may vary with age) - the interval at which any repeat works should occur (e.g. cyclical pruning or pollarding) - any related traffic management or safety precautions likely to be required during the works The proposed management work must not leave the tree structurally unbalanced and must not result in unacceptable disfigurement
Estimate of life time management works costs	An estimate of the additional cost of the Additional Canopy Management Work across the life of the tree verses any existing routine it is subjected to. This sum will directly inform required commuted sums as per section 8.2.2
Estimate of managed canopy area	An estimate of the plotted extents of the *maximum canopy, minimum canopy and average canopy* that will occur owing to the Additional Canopy Management.

Table 10 – Information requirements for AMS Canopy Management Programmes

General tolerance	Typical species having this tolerance – see note 1	Typical *P*TV value – see note 2
High	Plane, Willow, Poplar, some Maples, Hawthorn, Sycamore, Eucalyptus	33-50% - see note 3
Moderate	Ash, Oak, Walnut,	20- 30%
Low	Birch, Rowan, Sorbus, Cherry, Alder, some Maples, Pears, Apples, Magnolia, Horse chestnut, Beech, Liquidambar	10-20%

NOTES

1) The information in this Table is for general guidance purposes only. Actual *P*TV values for approved trees or if using other types of tree is proposed, then *P*TV values will be agreed on a case specific basis, with reference to the recommendations of an Arboricultural Impact Assessment as section 10.1.
2) *P*TV values are stated as the maximum reduction that will normally be permissible on either:
   - (for new trees) the *maximum* canopy radius.
   - (for retained existing trees that are not already subjected to routine Canopy Management) the existing canopy radius to any side of that tree. For instance, if a tree has an estimated *maximum canopy* of 6.0m then, where the *P*TV for that tree is 0.3, the maximum acceptable reduction on that max. canopy as a result of the proposed Canopy Management Program would be 1.8m.
3) Canopy reduction exceeding ~50% by *volume* is considered to be 'Pollarding'. Typically this will correlate to a *P*TV of ~30% or greater.

Table 11 - Typical Pruning Tolerance Values (*P*TV) for different species of tree

6 Planting

6.1 Planting windows

a. Table 12 below explains when different types of stock may be planted.

Root Package Type	Stock Size (as Table 3)	Permitted Planting Window	
		Deciduous	Coniferous
Containerised/ Container-grown	≤ Heavy Standard	At Any time (Oct to 31 Apr preferred)	15-Oct to 31 Apr
	≥ Extra Heavy Standard		
Root-balled	All	01 Nov to 14 Feb	
Bare-root			

NOTE

If Planting Spaces are constructed outside of the permitted planting window for the Stock type that will be used then Openings/Primary Rooting Zones will typically need to be temporarily back-filled with non-Growing Media materials and capped. See section 4.2 for further details.

Table 12 - Planting windows for different types of stock

7 Addressing access, road safety and construction issues caused by existing trees

7.1 Corrective works to existing footway pavements obstructed or disturbed by trees (including by their roots)

a. If lengths of footway are encountered in Project Areas where either
   i. the surface or edge restraints (including those to the Opening and/or those to the carriageway edge) are disturbed by the roots of Highway trees
   ii. < 1.8m effective width as Standard DS.208 for passing pedestrians is achieved (see note) because they are obstructed by Highway trees (including by their roots and/or associated Pavement Heave)

   then works to resolve these problems as per one of the eight Options listed below should be carried out to the Openings of the Highway trees and to the surrounding pavements. The Options are listed in the order they should be investigated, preferred Options come first. For approval to use a lower preference Option it must be demonstrated to (to the satisfaction of the Board Chair where indicated) that all higher preference Options have been thoroughly investigated.

NOTE: If trees are obstructing footways but not disturbing pavement surfaces then, in some instances, it may be possible to resolve the obstruction by removing or relocating other features that are restricting the effective width for passing pedestrians. Examples include sign posts, lighting columns, pedal cycle stands. If there are obstructing hedges along the rear of Highway boundary then enforcement action can be taken against frontagers to require them to cut back and maintain these at the Highway boundary.

Option 1 **-Enlarge and re-edge/ re- surface the Opening to encompass the entire disturbed area whilst maintaining a slightly reduced effective passing width for pedestrians within the existing footway alongside it**

   i. Check that accepting a lower effective passing width than desirable for pedestrians beside the Opening is necessary)
   ii. Extent of expanded opening to encompass all existing cracked or visibly disturbed areas attributable to the trunk or roots plus a further 100mm beyond. Undertake a Widening Assessment (see note 2) to determine the need to further expand beyond the above, anticipating the on-going growth of the tree's Structural Root Plate
   iii. Surfacing and edging as described in section 4.2.4
   iv. Minimum effective passing width for pedestrians ≥ 1.5m

Option 2 **-Widen the footway (normally to the carriageway side of the tree) to create an alternative path around it that is close to the desirable minimum effective passing width for pedestrians**

   i. Check that accepting a lower effective passing width than desirable for pedestrians beside the Opening and/or the cost and complexity of footway widening works is necessary)
   ii. Extent of expanded opening to encompass all existing cracked or visibly disturbed areas attributable to the trunk or roots plus a further 100mm beyond. Undertake a Widening Assessment (see note 2) to determine the need to further expand beyond the above, anticipating the on-going growth of the tree's Structural Root Plate
   iii. Surfacing and edging as described in section 4.2.4
   iv. Minimum effective passing width for pedestrians ≥1.5m along the new path (1.8m preferred wherever achievable). The old path to the other side of the tree should de-paved and reduced as much as necessary to avoid any future disturbance to it. However, retaining 1.2m along it is preferable if it can be achieved.

v. Access to properties must be maintained. This option may not be possible if accesses are located along the old path and ≥ 1.2m effective width cannot be maintained along it. Implementing this option may also require changes to the carriageway drainage and parking.

Option 3 **-As per Option 1 but achieving the absolute minimum effective passing width for pedestrians alongside the expanded Opening**

i. Check that accepting a lower effective passing width than desirable for pedestrians beside the Opening is necessary)
ii. Extent of expanded opening to encompass all existing cracked or visibly disturbed areas attributable to the trunk or roots plus a further 100mm beyond. Undertake a Widening Assessment (see note 2) to determine the need to further expand beyond the above, anticipating the on-going growth of the tree's Structural Root Plate
iii. Surfacing and edging as described in section 4.2.4
iv. Minimum effective passing width for pedestrians ≥ 1.2m

Option 4 **-As per Option 2 but achieving the absolute minimum effective passing width for pedestrians along the alternative path**

i. Check that accepting a lower effective passing width than desirable for pedestrians beside the Opening and/or the cost and complexity of footway widening works is necessary)
ii. Extent of expanded opening to encompass all existing cracked or visibly disturbed areas attributable to the trunk or roots plus a further 100mm beyond. Undertake a Widening Assessment (see note 2) to determine the need to further expand beyond the above, anticipating the on-going growth of the tree's Structural Root Plate
iii. Surfacing and edging as described in section 4.2.4
iv. Minimum effective passing width for pedestrians ≥ 1.2m along the new path. The old path to the other side of the tree should be de-paved
v. Access to properties must be maintained. This option may not be possible if accesses are located along the old path and ≥ 1.2m effective width cannot be maintained along it. Implementing this option may also require changes to the carriageway drainage and parking.

Option 5 **-Accept that it is not possible to maintain any distinction between the Opening and the rest of the footway by removing any existing edging and resurfacing the entire footway (including disturbed areas) with a flexible material right up to the base of the trunk**

i. Check that this more complicated and marginal solution is unavoidable and if local views are the main reason for discounting any higher preference Option where it is technically feasible and affordable on balance (see note 3). This must be counter-signed by the Board Chair given the need for a program of regular on-going work to maintain the new surface and the related long-term costs
ii. Resurface entire width around tree, no distinction between footway and Opening
iii. Bituminous mixture surface as section 10 of Standard DS.601 used to the entire width of footway right up to the Trunk Flare. This should be reasonably smooth and level such that it can be trafficked by a wheelchair user, and provide a ≥ 1.2m effective passing width for pedestrians
iv. If a reasonable smooth, level 1.2m wide surface cannot be achieved (i.e. because of severe pavement heave by the structural root plate) then the footway will be inaccessible to pedestrians and this option is not feasible.
v. If this option is implemented the resurfaced area will inevitably be disturbed again fairly quickly. It will therefore require a planned

programme of on-going work to maintain it. Because of this, the 'short and long-term cost to the council' component of the Options Assessment required by Table 14 must include an assessment of the projected 20 year design and implementation costs of that on-going maintenance works programme. If this Option is proposed ahead of other preferred Options that are technically feasible then the other considerations (cost and local views) will need to clearly counter-balance these in favour of Option 5.

Option 6 **Close and de-pave the footway to its entire width for the disturbed length. Provide Formal Crossings for pedestrians shortly before and after so they can go around the tree by crossing to the other side of the street and back**

i. Ensure that the inconvenience for pedestrians that will be created by the diversion is unavoidable
ii. Depave the entire width of the footway to its entire width, resurfacing with [M-BM1] shredded bark mulch
iii. Access must be retained to properties. Where properties have accesses along the disturbed length that would be closed, this option is unlikely to be feasible.
iv. The alternative path along the other side of the street must also provide for an effective width of 1.2m for this option to be feasible.

Option 7 **-Fell the existing tree and replace it with a smaller, more appropriate tree in a newly constructed replacement Planting Space somewhere nearby on the Highway in the same street or space**

i. Check that felling is unavoidable and all other Options have first been fully investigated
ii. However, ≥1.5m may be acceptable by further Level 1 Departure. It must be demonstrated to the satisfaction of Approving Officers that the normal minimum cannot be achieved either at the location of the existing Planting Space or nearby elsewhere in the same street or space
iii. New Planting Space to be designed in full accordance with the requirements in this Design Standard for any other new Planting Space.
iv. All requirements as section 8.1.3 regarding approval to fell and compensation for the lost tree shall also apply.

Option 8 **-Fell the existing tree (grinding out the stump) and remove the existing Planting Space altogether, backfilling and paving over it**

i. Check that felling is unavoidable and all other Options have first been fully investigated
ii. Resurface entire width of footway locally where Planting Space is removed with normal footway surfacing as per the SSDM/ Materials palette for the relevant SSDM/RP designation
iii. All requirements as section 8.1.3 regarding approval to fell and compensation for the lost tree.

Note 1. Most of the permitted values are less than those required. The requirements in this Table override those in DS.127 (for this instance only).

Note 2. The Widening Assessment must be developed in consultation with the Manager of the council's Tree Service. The judgement should be based on the likelihood of footway surfaces being disturbed within the next 15-20 years. This will depend upon the growth rate and ultimate size of the tree's Structural Root Plate (which is age, health and species dependant). If the tree is stunted then growth may be much slower than normal and the ultimate extent smaller.

Note 3. Normally this will be demonstrated by providing a Consultation Summary Report from an Informal Consultation with local people on the other higher preference Options.

b. If carriageway edge restraints are disturbed by roots then, subject to arboriculture assessment (see note) those edge restraints should be
   i. (wherever possible) relocated ≥450mm out into the carriageway by widening the footway pavement within the affected length. Greater distances should be provided if possible. Existing parking at the edge of carriageway should be removed or relocated where possible to accommodate this.
   ii. replaced with 150mm wide kerb units (even narrower steel section edging details to be used instead) if the existing are wider than this.

   A careful check of falls along the edge of carriageway channel should be made at the same time since Pavement Heave may also have lifted the carriageway pavement (so preventing positive drainage). Any disruption found should be corrected.

NOTE: This assessment should be undertaken by a Tree Advisor. They should be engaged at the Project Team's expense. In some instances removing kerbs close to very mature trees may undermine their overall stability. It may therefore be necessary to leave them in place.

1. Design Investigations Report
This should include Design Drawings for the proposed Option and all higher preference Options. Where necessary these should be supported by Survey Information to prove alleged constraints (e.g. Sub-Surface Utility Surveys to demonstrate that it is not possible to relocate an edge restraint to an Opening or widen a footway). If the issue is that a footway is obstructed or a footway pavement surface is disturbed then it should investigate Options 1 to 8 above in descending order until a solution is identified. For other issues (e.g. obstructed Highway visibility or damage to private property) a minimum of 3 Options should be explored.
2. Options Assessment
A comparison of the various Options resulting in a final recommendation. The comparison should consider the following matters (these are listed in the order that they should be weighted when developing a final recommendation). - design and construction feasibility - short and long term cost to the council (including liability risk where private property may be affected) - local views If it is proposed to fell a tree then the second matter must also consider the - financial value of the tree based on its assessed CAVAT value - environmental value of the tree based on an Environmental Assessment provided by Highway Tree officers
3. Tree Survey (TS) – Only required where Options include those to fell a tree
A Tree Survey as section 11.1. This must be produced by and at cost to the Project Team. It must incorporate as a CAVAT assessment as an Appendix (see section 8.2.2). The council's Tree Service hold CAVAT assessments for all Highway trees. They will provide this to Project Team upon written request at no cost. The Project Team may, at their own expense, instruct the Author of the Tree Survey to include a further CAVAT assessment of their own to compare against this. In the event of any discrepancy between the assessed values, the final values should be negotiated between the parties, not being less than the lowest value in either of the assessments. Approving Officers shall have regard to the assessment and category assigned to the tree when determining whether, on balance with Highways issues, removing it is appropriate

Table 13 - Information to accompany Departure requests relating to sections 7.1 and 8.1.3

8 Removing existing street trees

8.1 Circumstances when removing trees may be acceptable

8.1.1 Removing very young trees to enable other changes to the Highway

a. Subject to Level 1 Departure, existing young trees within Project Areas that
   i. were Planted ≤ 5 years ago; and
   ii. have a stem diameter of ≤ 150mm (when measured at 1.5m above ground)

   may be removed and replaced with a new tree in a new replacement Planting Space in order to allow other changes to be made the Highway. This is subject to the following further conditions.
   iii. The replacement Planting Space must be
      - nearby within the Highway in the same street or space
      - created as part of the same Project.
   iv. It must be demonstrated to the satisfaction of Approving Officers that
      - the other changes to the Highway that require the Planting Space to be removed are unavoidable or highly desirable
      - the proposed replacement Planting Space will provide improved growing conditions for the tree.
   v. Before confirming such a Departure the Approving Officer must consult with the Manager of the Tree Service of the council's Public Realm division.

8.1.2 Removing trees on the basis of their condition or size

a. Table 14 explains when it may be acceptable to remove older trees on the basis of their assessed size and condition. That assessment must be provided within a Tree Survey as section 10.1.

b. Following internal consultation with the Manager of the Tree Service from the council's Public Realm division, if the Approving Officer is minded to Approve a request to fell a tree under one of the Scenarios in Table 14 then they will provide this initially In Principle Only. They will provide Final Confirmation only when
   i. agreement in writing to provide compensation (where required) for the loss of the tree as section 8.2 is confirmed (see note) and
   ii. (if the tree is subject to a TPO) approval under relevant Town and Country Planning legislation is obtained.

NOTE: The extent of compensatory planting required as per that section depends upon the categorisation of the tree as summarised in Table 14.

<table>
<tr><td rowspan="3">Scenario</td><td colspan="3">Tree Survey categorisation of tree</td><td colspan="4">Felling requirements</td></tr>
<tr><td>Cate-gory</td><td>Remaining Contribut-ion</td><td>Age</td><td>Type of Approval required</td><td colspan="3">Broad summary of required compensation via replacement planting as section 9.2.1 (see also section 9.2.2 about additional financial compensation)</td></tr>
<tr><td colspan="2">Stem Diameter</td><td colspan="2">Canopy area (including multiplier factors)</td></tr>
<tr><td>1</td><td>U</td><td>N/A</td><td rowspan="3">N/A</td><td>None. Fell in all instances as tree is dead, dying or diseased</td><td colspan="4">No compensation required</td></tr>
<tr><td>2</td><td rowspan="2">C</td><td>< 10 years</td><td rowspan="2">May be removed by Level 1 Departure subject to ‘8.1.2b’ (see also note 1)</td><td rowspan="4">Like-for-like (existing measured at date of removal, replacement measured at date of planting out</td><td rowspan="4">(size of both existing and proposed replacement to be assessed and compared at Assessment Date 15 years after planting out</td><td>1.00 times existing</td></tr>
<tr><td>3</td><td>≥ 10 years but < 20</td><td rowspan="2">1.25 times existing</td></tr>
<tr><td>4</td><td rowspan="2">C or B</td><td rowspan="2">≥ 20 years but < 40 years</td><td>Young</td></tr>
<tr><td>5</td><td>Semi-mature</td><td>May be removed by Level 1 Departure subject to ‘8.1.2b’ (see also notes 1 and 2)</td><td>1.50 times existing</td></tr>
<tr><td colspan="7">NOTES
1) Where requests are received to fell trees under Scenarios 2-5 then Approving Officers (in consultation with the Manager of the Tree Service) shall have regard to the overall category assigned to the tree in the Tree Survey.
2) Where requests are received to remove trees under Scenario 5 then Approving Officers (in consultation with Highway Tree officers) shall review the findings of an Arboricultural Impact Assessment (see section 10.1). They should be satisfied from this that the proposed development works would have an appreciable negative impact on the tree that could not be avoided by reasonably modifying them.</td></tr>
</table>

Table 14 – Scenarios where existing trees may be felled further to a Tree Survey as section 11.1

8.1.3 Felling trees because of Highway safety or accessibility concerns

a. Other than as permitted in section 8.1 no existing tree may be felled that either
   i. obstructs Highway visibility (see note
   ii. disrupts Highway drainage
   iii. obstruct effective passing widths along a footway or cycle track
   iv. disrupts the surface of a footway pavement
   v. disrupts the surface of a carriageway pavement until substantial design Options have been investigated in detail to demonstrate that other physical changes could not be carried out cost effectively to resolve the issues and so avoid the need for felling. Where the issue is as ‘iii-iv’ then the requirements in section 7.1 also apply.

NOTE: Examples of measures to improve Highway visibility without felling might include: moving forward junction stop lines or narrowing carriageways to improve visibility splays for road users and/or; carrying out improvements to junctions and their approaches to slow vehicles and so reduce stop sight distances.

b. A request for a Level 2 Departure allow a mature tree to be felled, shall include the information in Table 13. Approving Officers will consult with the Manager of the Council's Tree Service. They (and ultimately the Board Chair– see below) must be satisfied that
   i. the design proposals in the Design Investigations Report and the Options Analysis are reasonable
   ii. the Options Analysis supports, on balance, the recommended Option.

   If they are satisfied and are therefore minded to Approve the Departure then
   iii. they will provide this Approval initially In Principle Only if
      - compensation is required as section 8.2
      - the tree is subject to a TPO under relevant Town and Country Planning legislation. Final Confirmation will be provided only when compensation works/sums and/or Planning Approval is confirmed to them in writing.

   iv. all Departure Approvals (including any In Principle Only) must be counter-signed by the Board Chair.

NOTE: The extent of compensatory planting required as per that section will vary depending with how the tree has been categorised in a Tree Survey.

8.2 Compensation for removing or reducing trees

NOTE: The requirements in this section do not apply to works carried out by the council's own Tree Service in their actions managing and maintaining the borough's existing tree stock. This includes circumstances when it is necessary for them to fell, remove or replace dead, diseased or unsafe trees.

8.2.1 Compensation for lost canopy area and Stem Diameter

NOTE: Shading and evapotranspiration from the canopies of trees performs important urban cooling functions. This contributes towards addressing increasing temperatures in urban areas and is important to maintaining a comfortable walking and cycling environment.

Where trees are to be felled

a. Where a Project Team propose to remove one or more trees for any reason (other than it being categorised as U in a Tree Survey) then they should provide enough replacement tree planting to compensate for both of the following.
   i. Stem Diameter

   The total Stem Diameter of the existing trees being removed (as recorded in a Tree Survey - see section 10.1). The extent of compensation should be like-for-like. The Stem Diameter of proposed new replacement trees shall be that at planting out, which is derived from Table 2 based upon the normal girth of the size of stock used (see note). Neither the diameter of the existing trees nor the proposed replacement trees should be projected forwards for future growth.
   ii. Canopy Area

   The lost canopy area of the existing trees being removed (having applied any multiplier factors as Table 14). An Assessment Date should be used that is 15 years after the compensatory planting scheme is completed

NOTE: The Stem Diameter of new replacement trees should be calculated using the equation

Stem Diameter = (Girth / 3.142) / 0.9

where Girth is the mean average Girth within the permitted range for the stock size as Table 3. The 0.9 discount factor corrects for the fact that Girth is measured at 1m above ground level whereas Stem Diameter is measured at 1.5m. Trunk flares develop closer to the ground.

Where existing trees are to be subjected to Additional Canopy Management

b. If as a result of works within a Project Area it is proposed to subject any existing retained trees to Additional Canopy Management then the Project Team should provide sufficient replacement tree planting to compensate on a minimum like-for-like basis for the lost canopy area owing to this. An Assessment Date should be used that is 15 years after the compensatory planting scheme is completed.

Compensatory planting

c. Where it is proposed to fell or reduce by management trees located on adopted Highways compensatory tree planting as 'd' may be provided in a number of ways.
   i. Project Teams may undertake works to locate compensatory trees
      - anywhere nearby within that existing street or space that is within the Project Area
      - (subject to advance written agreement by Approving Officers) nearby other existing streets and spaces that are within the Project Area. They must first demonstrate that they have exhausted opportunities to plant within the street or space where the tree is being felled or reduced.

      The resulting canopy cover in each street or space should not exceed the maximum permitted in section 3.1.
   ii. Project Teams may locate compensatory trees within new streets and spaces that will be adopted via section 38 of the Highways Act 1980. However,
      - this is subject to Level 1 Departure. Project Teams must first demonstrate that they have exhausted all opportunities to locate compensatory street trees within existing streets and spaces having considered the extending the boundary of their Project Area by a further 75m in all directions. To do so they must provide details of the multiple designs and options tested. Designs should be informed by a full utilities survey as section 3.2.4 to prove them and constraints
      - any compensatory street trees that are permitted in new streets and spaces only count towards achieving the projected canopy cover requirements for those new streets and spaces as section 3.1.1 after these have first achieved the minimum projected canopy cover required.
   iii. In development related Projects that require works under sections 278 or 38 of the Highways Act 1980 (or similar) - Project Teams may off-set a shortfall in compensatory street tree planting by providing commuted sums to the Highway Authority so that it can introduce further compensatory street trees within adopted Highways in the surrounding area outside the Project Area at a future time of its choosing. However
      - this is subject to Level 2 Departure. Project Teams must demonstrate within request that both 'i' and 'ii' above are not feasible. To do so they must provide details of the multiple designs and options tested. Designs should be informed by a full utilities survey as section 3.2.4 to prove them and constraints
      - the values of the commuted sums to be provided are
        - £4,000 per Instance of the following (as appropriate)
        - For felled or reduced existing Highway trees: increment of $50m^2$ of projected canopy area lost
        - For felled non-Highway trees replaced with a tree on the Highway (This is to cover the value of future works to construct new Planting Spaces and plant trees within them.)
        - a further £4,000 pounds for each increment of 5 Instances as above. This is to cover design and project management costs.

d. All compensatory tree planting in existing Highways should be provided in new Planting Spaces. Locating compensatory

planting in existing Planting Spaces requires Level 1 Departure. It must be demonstrated that these features already meet SSDM design requirements or can be improved to do so at full cost to the Project Team. For the avoidance of doubt the associated Rooting Zones (and Growing Media within them) must be able to supply the critical period moisture demand of the tree.

8.2.2 Financial compensation

a. If removing a tree is proposed for any reason then the council's Tree Service must be compensated for the residual of ¼ of the assessed monetary value of each removed tree (see note 1). This is established using the Capital Asset Value for Amenity Trees (CAVAT) assessment methodology (though see note) from which is deducted
   i. all construction costs (see note 2) associated with any replacement planting as section 8.2.1
   ii. all basic maintenance contributions as section 9.2 associated with any compensatory street tree planting as section 8.2.1

NOTE 1: This financial compensation is additional to the compensatory tree planting required in section 8.2.1 for lost Stem Diameter and canopy area.

NOTE 2: The sums to be deducted will be agreed with Approving Officers on a case specific basis using cost estimates provided by the agreed Term Contractors of the Highway Authority and the council's Tree Service to implement the proposed designs. Standard Contract Price List rates will be used wherever suitable operations exist. In addition, for each such tree an additional approval fee of £225 must be paid to cover the time of officers and contractors in assessing such costs. That approval fee is non-deductable against the CAVAT value. Works shall be the physical works only and shall not include any traffic management, laboratory or other costs.

NOTE 3: No costs associated with any tree located in a street or space that is not part of the council's adopted Highway (existing or proposed new as part of the Project) shall be deducted.

9 Maintaining trees

9.1 General

a. Unless otherwise noted, all sums required by this section should be paid to Highway Development Management Officers from the council's Public Realm division. This must occur in advance of, or at the same time as, Approval of Detailed Design Packages and any related agreement under Section 278 of the Highway Act 1980. The sums will then be redistributed to relevant other teams within the council who are responsible for maintenance or repair (e.g. the Tree Service who look after trees and the Highways Maintenance team who maintain pavements).

9.2 Aftercare following planting out

9.2.1 Aftercare requirements

a. For each newly planted tree, the following package of Aftercare must be provided at each Aftercare Visit, for the duration of their Establishment Period (and until such time as Final Acceptance is confirmed.
   i. Fill the watering bag to its maximum level.
   ii. Remove rubbish and dog-waste from the Opening and dispose of this at an approved facility.
   iii. Weed the Opening, removing any planting not in the agreed plan.
   iv. Check the stakes and ties and adjust if required.
   v. Assess the tree for pests and diseases.
   vi. Assess the tree for snapped or damaged branches.
   vii. Asses the tree for dog damage to the trunk or other parts.
   viii. Check that the guard is secure.
   ix. Re-top mulch to design levels/grades (noting that this should normally be approximately 25mm below the level of the bounding edge restraints).
   x. Clean any mulch from surrounding pavement surfaces if it has migrated from the Opening onto these.
   xi. Complete the Aftercare monitoring sheet and submit it for Approval to the council's Tree Service.

b. At the end of the Aftercare Period) the Aftercare Contractor shall complete the following further tasks.
   i. Remove ties (including any subsurface ties but excluding dead-man weights).
   ii. Remove any superfluous stakes that are not supporting an above-ground guard.
   iii. Remove any watering bag/s.

9.2.2 Frequency of Aftercare Visits

a. For the duration of the Establishment Period, newly planted trees must be visited at the frequencies stated in Table 15 to deliver the package of Aftercare

Size of stock (as Table 3)	No. monthly Aftercare Visits		Min/max duration between Aftercare Visits	
	1 May – 30 Sept	01 Oct – Apr 30	01 May – 30 Sept	01 Oct – Apr 30
Heavy standard	2	2	Min 10 days Max 18 days	Min 10 days Max 18 days
Extra heavy standard	3	2	Min 8 days Max 12 days	Min 10 days Max 18 days
Semi Mature	4	3	Min 7 days Max 9 days	Min 8 days Max 12 days

Table 15 – Frequency of Aftercare Visits during the Establishment Period

9.2.3 Quality Control Inspections

a. Before delivering any Aftercare, the Aftercare Contractor must agree in writing with the council's Tree Service
   i. a programme of Aftercare Visits for the duration of the Establishment Period, including for each Visit
      - date
      - time (within a 2 hour window)
   ii. a name and mobile phone number for the member of staff who will be carrying out the Aftercare at the site.

Note: At their discretion (and without any forewarning) representatives of the council's Tree Service may make Quality Control Inspections of the site to confirm that the required Aftercare has been delivered to the agreed specification. Where upon such Inspection it is discovered that the required Aftercare has not been satisfactorily delivered or that the tree is found to be in ill-health then Remedial Action as per section 9.2.5 may be instructed by them.

b. The Aftercare Contractor may amend the previously agreed information as 'a'. However, they must notify the council's Tree Service about any amendments a minimum of 3 working days in advance of the next Visit.

9.2.4 Final Acceptance

a. In the penultimate month before the end of the Establishment Period, the Aftercare Contractor and a representative of the council's Tree Service shall conduct a Joint Inspection to confirm that all Aftercare Tasks have been properly completed and that the tree and its Rooting Zone has been maintained in acceptable health and condition without damaging surrounding structures. Subject to written confirmation from the council's Tree Service that these things have been achieved, then
   i. the Highway Authority accepts future maintenance responsibility for the tree
   ii. the Project Team's Aftercare responsibilities cease.

b. In the event that
   i. it is necessary to replace a new tree owing to failure, and
   ii. the replacement tree has not yet reached the end of its Establishment Period when most other trees have

   then subject to formal written agreement and compensation the Highway Authority may agree to take on responsibility for Aftercare for the residual Establishment Period.

9.2.5 Remedial action if trees fail during the aftercare period

a. If during the Establishment Period (and prior to Final Acceptance of a tree as per

section 9.2.4 either

i. a tree dies as a result of a lack of suitable maintenance and care
ii. a tree is confirmed to the Aftercare Contractor by the 'Tree Service' of the council's Public Realm division as being in such ill health or condition (owing to failure of planting practice or aftercare) as to require replacement

then the Aftercare Contractor must supply and plant a new tree in that Planting Space in accordance with this and other Standards. They are responsible for all costs associated with doing so. The replacement tree must be supplied as soon as possible in the next available planting season. Further Aftercare for the full usual Establishment Period must again be provided for the replacement tree. (see 9.2.4.b about potential buyout of this responsibility).

9.2.6 Responsibility for providing Aftercare

Planting associated with private development works

a. If new trees are planted as a result of works under section 38 or 278 of the Highways Act 1980 then the Aftercare as section 9.2.1 should be provided by the Project Team (normally by directly appointing a suitable contractor to deliver it). However, subject to the Project Team agreeing in writing to provide commuted sums, the Highway Authority may agree to provide that Aftercare instead as per 'c'. If they do then the Project Team's responsibility for the tree during the Establishment Period ceases.

b. Private Aftercare as per 'a' may sometimes also be considered if planting is proposed by other private bodies (e.g. Tree Planting Charities). However, this requires the advance written agreement of the Head of Service for Public Realm.

Other circumstances

b. Aftercare as section 9.2.1 will be provided by the Highway Authority in most circumstances other than 'a'. See however section 9.2.7 about necessary Project Team contributions towards this.

9.2.7 Contributions towards Aftercare where this is provided by the Highway Authority

a. If Aftercare as section 9.2.1 is provided by the Highway Authority as '9.2.6c', then the Project Team must provide for each tree a commuted sum as Table 16. These sums will be distributed to the council's Tree Service.

NOTE: This applies to trees planted in association with both section 278 and section 38 of the Highways Act 1980.

Size of stock at planting out (as Table 3)	Basic maintenance contribution (per tree)
Heavy standard	£300
Extra heavy standard	£450 for 14-16cm girth
	£600 for 16-18cm girth
Semi-mature	£1000

Table 16 – Basic Aftercare contributions (where Aftercare provided by the council)

9.3 Additional commuted sum for where over/under standard design is permitted

a. If Departures are Approved to allow trees (and associated Planting Spaces) to be introduced that do not meet aspects of this Design Standard then the Project Team is required to provide in advance the additional commuted sums in Table 17 (as appropriate).

b. If new Planting Spaces are designed and constructed by the Public Realm division of the Council then, if Departures are Approved to allow Opening dimensions smaller than required by section 4.1.2, the relevant sums required as Table 147 do not need to be paid as this would be the division paying itself. However

i. all such Departures must be counter-signed by the Board Chair. They must consult the Manager of the Public Realm division's Asset Management business unit before doing so

ii. if the Board Chair approves such a Departure they must notify the Manager of the Asset Management business unit before doing so in order that they have visibility of the inherited liability and can budget for it.

A. Sub-standard Opening dimensions
As per section 4.1, Openings/Primary Rooting Zones must be wide enough to accommodate the ultimate structural root plate of the trees that will be planted within them. Any Departure to construct narrower Openings/Primary Rooting Zones are subject to payment in advance of the following sums on a per tree basis (see note 1). - For trees with ultimate Stem Diameters of <300mm: £2000 - For trees with ultimate Stem Diameters of >300mm but <600mm: £2500 - For trees with ultimate Stem Diameters of >600mm: £3000 These sums will be distributed to the council's Street Care team. This is to cover costs associated with repair works to neighbouring pavement surfaces as a result of likely future damage by the structural root plate. See also note 2.
B. Non mulch surface to an Opening
If it is Approved by Departure to permit a non-mulch surface to be used to an Opening (including self-binding gravel, resin bound gravel or tree grilles) then a sum of £450 per Opening basis is required to cover the maintenance and/or eventual removal/replacement of that surface with mulch at some point in the future when it becomes unacceptably disturbed by collar rise. For each increment of 1.5m^2 of Opening surface area above 2.25m^2 per Opening basis this sum increases by a further £250.
C. Temporary timber stockade to protect Opening
If installing a temporary timber stockade to the edge of the Opening, as a temporary transitional measure, is Approved by Departure as '4.2.3c.ii then a sum of £850 per stockade is required to maintain and, eventually, remove it. The sum does not cover the cost of maintaining or, eventually, replacing associated transitional surfaces.
D. Additional irrigation to compensate for deficiency in available water capacity in Rooting Zone
If there is expected to be a deficit in the Available Water Holding Capacity of the proposed Rooting Zone design compared to the volume estimated to be required as section 4.5.1 and the Project Team wish to make up this deficit by paying for manual supplementary irrigation via a bowser or similar and a Departure permitting this is Approved as section 4.5.1 then a sum of £50 is required per 40 litres of water for each year (or part thereof) of the tree's remaining predicted design life expectancy after it has grown to the point that its Evapotranspirative Demand is estimated to exceed the available moisture capacity of the Rooting Zone. If automatic irrigation is proposed (rather than manual irrigation) then a commuted sum will be agreed on a case specific basis. This will need to account both for the maintenance of irrigation lines/machinery and the mains supply of water.
E. Canopy Management Programme
If a Canopy Management Programme as per section 5.2 is required owing to expected Major Canopy Overlap, then commuted sums to cover the costs of this are required. Those sums will be as per the cost estimate for the Canopy Management Programme provided in the necessary Arboricultural Methods Statement. See section 5.2 for further details.
NOTES 1) For approved species of tree, the ultimate Stem Diameter will be as advised by the Council's arboricultralist. The ultimate Stem Diameter is measured at 1.5m above ground. 2) The sums required as per this Table are not required for any works carried out by the council's own Tree Service (since in most cases the necessary sums would be distributed to them). However, see '10.3b' about where sub-standard Openings are permitted.

Table 17 - Additional commuted sum requirements for over/under standard design.

10 Protecting trees and soils during construction works

10.1 Protecting existing trees (TS, AIA, AMS and TPP)

NOTE: Trees and their important below-ground Rooting Zones are easily damaged by construction activities. BS 5837:2012 explains requirements for a number of assessments and plans to avoid this throughout the design and construction process.

a. If works under sections 278 or 38 of the Highways Act 1980 are in the vicinity of existing trees then
   i. an Arboriculture Impact Assessment (AIA) and a Tree Survey (TS) must be produced and appended to the TDS. It must include a tree constraints plan
   ii. if works to any of the trees are proposed as an outcome of the AIA then an Arboricultural Methods Statement (AMS) must be produced and appended to the TDS.
   iii. if it is proposed to retain any existing trees then a Tree Protection Plan (TPP) should be produced and Approved prior to any demolition, site clearance, or access works.

   All the above documents should be produced in accordance to BS 5837:2012 by a Tree Advisor.

10.2 Protecting soils (SRS and SRP)

NOTE: Soil is an important resource that is often taken for granted. It is frequently damaged by construction activities, or wastefully removed and disposed of. Soil Resource Surveys (SRS) are reports that consider the state of existing soils found on site via a combination of desk study and on-site and laboratory testing. The aim is to inform decisions about how to use, improve and/or protect soils. SRS are distinct from geo-technical and geo-environmental site investigation reports. These examine soil from an engineering perspective (i.e. its potential role and impact upon foundations for constructions) whilst the SRS does so from a soil science perspective and considers issues related to suitability for future plant growth and natural management of water. Soil Resource Plans (SRPs) build upon the work in SRS, explaining proposals to use, improve and protect soils during the works.

a. Unless agreed otherwise, if within a Project Area, works under sections 278 or 38 of the Highways Act 1980 are proposed that include either
   i. works to or around existing Highway trees that will be retained
   ii. works to or around existing other unpaved areas (e.g. green verges etc.)

   then both a SRS and a subsequent SRP should be prepared for the site before any earthmoving activities or other construction or clearance works begin.

b. Irrespective of the nature of works within a Project Area (e.g. whether or not they require agreements under sections 278 or 38 of the Highways Act 1980) both an SRS and SRP should be prepared and supervised if
   i. it is proposed to incorporate stripped topsoil or subsoil from the site into a soil mix contributing towards meeting Rooting Zone volume requirements and/or
   ii. it is proposed that any existing undisturbed soil within the area (within verges, gardens or other areas) may contribute to meeting Rooting Zone volume requirements and/or
   iii. it is proposed that alleged unseen Remnant Soils beneath pavements within the area of works may contribute towards meeting Rooting Zone volume requirements

   Approving Officers have discretion to waive this requirement for very minor works

c. Both the SRS and SRP should be prepared in accordance with the recommendations in the 'Construction Code of Practice for Sustainable Use of Soils' (DEFRA, 2009)

d. The SRS should be Approved before any demolition or other site clearance or access works begin and separate to any Geotechnical Site Investigation Report.

e. If an SRP is not followed to the satisfaction of the s council then the Approving Officer may instruct that
   i. the assumed plant available water holding capacity of the relevant soil is significantly discounted by not less than 50%; and/or
   ii. the relevant soil is remediated to a

specification in order to make it acceptable to be included within Rooting Zones; and/or

iii. the relevant soil is not included within any Rooting Zone; and/or

In any event, if existing soil resources located with the Highway are damaged during the works then the Highway Authority reserves the right to require the Project Team to replace these with imported natural soils at the Project Team's full cost.