Recommended soil volumes for trees of different sizes

People have been building tree pits for over a century and deciding how big to build them has always been a trade-off between how much space the tree needs and how much can be afforded in the design. Sadly, the trees often lose out in the deal. The most limiting factor in the growth of urban trees is the lack of usable soil for root growth, and inadequate underground rooting space is one of the main contributors to the premature mortality of urban trees. Small and short-lived trees do not provide significant green infrastructure benefits, and nor do they contribute to long-term increases in canopy cover. Therefore, when designing urban spaces we need to make sure that the species that we wish to plant is provided with enough soil to be healthy and reach a degree of maturity that will deliver benefits to the local community.

In the scientific literature a majority of studies have used the typical crown projection area of a tree species to estimate the volume of soil that it requires. These studies inform us that a very small urban tree requires a minimum of 6m^3 uncompacted loam soil in order to be healthy at maturity and the largest trees require in excess of 36m^3. Adjacent trees can share soil because root systems can overlap (as any woodland stand demonstrates); in design terms this means that the volume of soil/rooting medium required by each tree can be reduced. In the main, tree pits created using load-bearing soils need to be larger than tree pits filled with loam soils because they contain a high rock component and consequently a smaller proportion of usable soil, however other rooting mediums that are not based on typical soils could potentially challenge this established wisdom. The minimum volume of soil recommended for trees of different sizes is provided in Table 1.

In most urban situations the most critical role of the soil in the tree pit is to store water for tree growth. Factors external to the tree such as air temperature, wind speed, relative humidity, and light help determine how fast water is lost from the leaves. Therefore, trees planted in exposed locations will require larger volumes than the minimums recommended in Table 1.

The volume of soil available to the tree needs to be calculated by landscape professionals before they specify which species are appropriate for a particular location. Site factors can be limiting, for example it may be that the depth of underlying bedrock limits how deep a tree pit can be made. Similarly, the presence of underground services may reduce the amount of space available for load-bearing soils, and so underground features must be accounted for when calculating the volume of soil that will be available to the tree once the tree pit has been constructed.

STOCKHOLM TREEPITS

There is a direct relationship between the volume of below ground growing space and how a tree is likely to develop, the greater the soil volume:

+ the faster the tree will grow

+ the bigger it will become

+ the healthier it will be

+ the better it will look

+ the longer it can be expected to live

GUIDANCE

Further guidance on the use of structural soils to grow urban trees can be found at **www.stockholmtreepits.co.uk**

HERE TO HELP

We offer an expert consultancy service call us now on **01373 832 778.**

Recommended volumes for tree pits

Table 1: *Minimum requirements for tree pit specifications.*

	Mature Size of Tree*†				
	Very Small (<5m)	**Small** (5–10m)	**Medium** (10–15m)	**Large** (15-25m)	**Massive** (>25m)
Recommended minimum volume of **uncompacted loam soil**	**6m³** (5m³ if shared)	**12m³** (9.5m³ if shared)	**20m³** (16m³ if shared)	**28m³** (24m³ if shared)	**36m³** (30m³ if shared)
Recommended minimum volume of **stone-based structural soil**	**8m³** (6m³ if shared)	**15m³** (12m³ if shared)	**26m³** (20m³ if shared)	**36m³** (28m³ if shared)	**45m³** (35m³ if shared)
Recommended number of **air/water inlets‡**	**1** (0.5 if shared)	**1** (0.5 if shared)	**1**	**2** (1.5 if shared)	**2**

Mature tree sizes are listed in Tree Species Selection for Green Infrastructure - a guide for specifiers* ***http://www.tdag.org.uk/uploads/4/2/8/0/4280686/tdag_treespeciesguidev1.3.pdf.*

†Fastigiate trees will require less rooting space than trees with wide canopy shapes. As a rule of thumb, one should assume that a tree with a narrow and columnar crown form would require half as much soil volume as a tree of the same height that has a wide crown.

‡Ideally the surface of the tree pit should be open, rough in texture, and protected from compaction. If there is hard surfacing above the tree pit designers must provide pathways for water ingress and gaseous exchange. This could be provided by a permeable surface over the whole of the tree pit or by using a non-permeable surface with specially designed inlets. Suitable inlets would be substantially larger than an irrigation tube and service the whole of the tree pit.