

StormTank® Urban Root System Soil Capacity

Background

Have you ever noticed manufacturers promote 90% or greater soil storage capacities and wonder how they calculated it? Generally, you would think that it is all the space not taken up by the structural components themselves. This document will take a greater look at the calculation of soil capacity in the structural soil cell market.

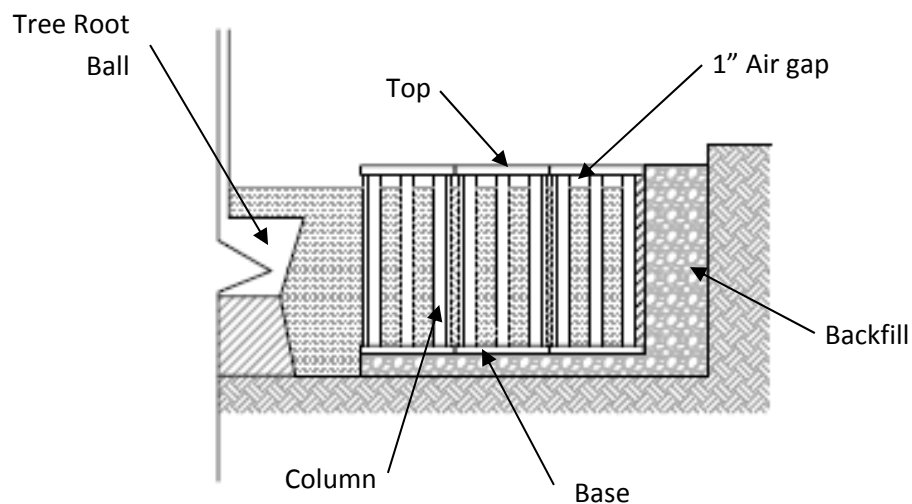
Definitions

Void Space

Void space is defined as all space not filled by the physical components of the product. This is what the manufacturers typically publish as the 90%+ value.

Soil Capacity

Soil capacity is the space usable for filling with soil. This would exclude the components' physical material the void space within columns that provide no benefit or ability to fill, and the required air gap provided at the top of the system to install the top plate.



Structural Soil Cell Product Soil Capacities

StormTank Urban Root System

For the StormTank Urban Root System, Brentwood has 5 sizes and a footprint of 18" x 36". These are the published values (including 1" air gap) by Brentwood for the URS application.

Soil Capacity Table:

| Module Height | Base (in ³) | Column (in ³) | Top (in ³) | Component Volume (in ³) | Theoretical Volume (in ³) | Total Void (in ³) | As a % of Theoretical |
|---------------|-------------------------|---------------------------|------------------------|-------------------------------------|---------------------------------------|-------------------------------|-----------------------|
| 18" | 196.5 | 455.77 | 2,592 | 3,244.27 | 11,664.00 | 8,419.73 | 72% |
| 24" | 196.5 | 668.42 | 2,592 | 3,456.92 | 15,552.00 | 12,095.08 | 78% |
| 30" | 196.5 | 881.06 | 2,592 | 3,669.56 | 19,440.00 | 15,770.44 | 81% |
| 33" | 196.5 | 987.39 | 2,592 | 3,775.89 | 21,384.00 | 17,608.11 | 82% |
| 36" | 196.5 | 1,093.71 | 2,592 | 3,882.21 | 23,328.00 | 19,445.79 | 83% |

Silva Cell 2.0

For the Silva Cell 2.0, Deeproot has 3 sizes and a footprint of 24" x 48". These values are not provided by Deeproot but are a calculation based on the following assumptions: bottom plate of 10% material by volume, 4" diameter columns, and the top 3" not being filled (top plate plus 1" air gap).

Soil Capacity Table:

| Unit Height | Base (in ³) | Column (in ³) | Top (in ³) | Component Volume (in ³) | Theoretical Volume (in ³) | Total Void (in ³) | As a % of Theoretical |
|-------------|-------------------------|---------------------------|------------------------|-------------------------------------|---------------------------------------|-------------------------------|-----------------------|
| 16.7 | 230.4 | 1258.51 | 3,456 | 4,944.91 | 19,238.40 | 14,293.49 | 74% |
| 30.9 | 230.4 | 2328.62 | 3,456 | 6,015.02 | 35,596.80 | 29,581.78 | 83% |
| 43 | 230.4 | 3240.48 | 3,456 | 6,926.88 | 49,536.00 | 42,609.12 | 86% |

StrataVault

For the StrataVault, CityGreen has 1 stackable size and a footprint of 24" x 24". These values are not provided by CityGreen but are a calculation based on the following assumptions: bottom plate of 5% material by volume, 3.5" diameter columns, and the top 3" not being filled (top plate plus 1" air gap).

Soil Capacity Table:

| Unit Height | Base (in ³) | Column (in ³) | Middle Layer (in ³) | Top (in ³) | Component Volume (in ³) | Theoretical Volume (in ³) | Total Void (in ³) | As a % of Theoretical |
|-------------|-------------------------|---------------------------|---------------------------------|------------------------|-------------------------------------|---------------------------------------|-------------------------------|-----------------------|
| 16 | 57.6 | 615.75 | 0 | 1,728 | 2,401.35 | 9,216.00 | 6,814.65 | 74% |
| 32 | 57.6 | 1231.5 | 11.52 | 1,728 | 3,028.62 | 18,432.00 | 15,403.38 | 84% |
| 48 | 57.6 | 1847.26 | 23.04 | 1,728 | 3,655.90 | 27,648.00 | 23,992.10 | 87% |

Structural Soil Cell Comparable Soil Capacities

Now, let's do an example system. We'll use a 6' x 12' installation of the shortest height for each manufacturer.

| Manufacturer | Footprint (ft ²) | Number of Units | Total Soil Capacity (ft ³) |
|--------------|------------------------------|-----------------|--|
| Brentwood | 72 | 16 | 77.96 |
| Silva Cell | 72 | 9 | 74.45 |
| StrataVault | 72 | 18 | 70.99 |

Brentwood

$$\text{Soil Capacity} = \frac{6' * 12'}{4.5 \text{ ft}^2} * \frac{8,419.73 \text{ in}^3}{1728 \frac{\text{in}^3}{\text{ft}^3}} = 16 * 4.87 = 77.96 \text{ ft}^3$$

Silva Cell 2.0

$$\text{Soil Capacity} = \frac{6' * 12'}{8 \text{ ft}^2} * \frac{14,293.49 \text{ in}^3}{1728 \frac{\text{in}^3}{\text{ft}^3}} = 9 * 8.27 = 74.45 \text{ ft}^3$$

StrataVault

$$\text{Soil Capacity} = \frac{6' * 12'}{4 \text{ ft}^2} * \frac{6,814.65 \text{ in}^3}{1728 \frac{\text{in}^3}{\text{ft}^3}} = 18 * 3.94 = 70.99 \text{ ft}^3$$

Conclusion:

Though the true void space of each product is greater than 90%, the usable space within each unit is much less once you subtract not just the material of the components, but areas that cannot be filled. The center of the hollow column provides no beneficial root growth space, nor can it be filled because of the structures needed to support all three products during the filling stage. The other key factor, comes from the top piece itself, which cannot be filled during the filling stage because it still needs to be placed.

As with all designs, the objective needs to remain the key. A structural soil cell is designed to support the surface above and provide void space for loose or semi-compacted material. Sizing the system needs to provide enough units of usable soil for the anticipated growth size of the root structure within its perimeter.