L. Peter MacDonagh and E. Thomas Smiley, Ph.D.

Forest Floors under Downtown Pavements: Quantitative Measurements and Trends of Trees in Suspended Pavement 27 Years after Planting

Magical thinking for Trees in the City

Here are the myths that lead to a great urban forest, as told to us by non-arborists:

Anyone can plant a tree. Trees fix everything. Trees are in the way. Trees attack utilities. Trees can't live in the city. Trees do fine with compaction. Tree roots don't need much soil. Trees need to be planted good and deep. Trees are cheap. Trees, trees, plant lots of trees everywhere and any place.

Which is it? NONE of the above. Why? We have an obsession with stem count: one million trees this, two million trees that. We need a trillion leaf program or a billion cubic feet soil program. The roots and the leaves are where the action is, the stem is simply the tube that connects them together.

This presentation will share long term quantitative data on the high performance of trees planted in to suspended pavement 27 years ago with large soil volumes in downtown Bethesda, Maryland, and Charlotte, North Carolina, demonstrating the imperative of oxygen-rich soil volume to grow large trees in ultra-urban areas—in this case, 600 and 700 cubic feet per tree, respectively.

Here are two large scale tree plantings, in two different east coast cities. They have many similarities: the same amount of precipitation, the same type of rainfall patterns, and similar temperature conditions (Charlotte has a slightly higher average annual temperature but Bethesda has a higher average annual wind speed, balancing EVT rates). Charlotte was planted with a single species and received minimal maintenance , whereas Bethesda was planted with multiple species that received a high level of maintenance. Both are highly successful tree plantings based on tree size and vigor. The key variable is soil.

	Bethesda, MD	**Charlotte, NC**
Rainfall per year	41.9"	41.6"
# of Wet Days	116	110
June Rainfall/Rain days	3.5"/11	3.7"/10
July Rainfall/Rain days	4.1"/10	3.7"/11
August Rainfall/Rain days	3.3"/9	4.2"/10
Summer Rain/Rain Days	10.9"/30/100%	11.6/31/106%
Summer Temperatures	65˚F/100	71˚F/108
Winter Temperatures	45˚F/100	49˚F/108
Sunny Days	57%	62%
Wind Speed	8.7 mph/115%	7.4 mph/100%
Cubic feet of soil/tree	600	700

Tree Species	London Plane (*Plattanus* X), Poor Man's Tree	Willow Oak (*Quercus phellos* L.)
Tree Size (DBH)	Under review	Under review
Soil Mix – Native with:	Under review	Under review

Providing adequate amounts of root-able soil for the tree to grow to large size is crucial to maximizing all environment benefits, including on-site stormwater management: e.g. 22" DBH Plane Tree intercepts 0.79" of a 1"/24 hour storm within its drip line (1,000+/- sq ft) a 40-year-old hackberry tree in Minneapolis is expected to intercepts 40 times as much rain as a 5-year-old hackberry, and 14 times as much as a 10-year-old hackberry (McPherson et al 2006). Long term data from a second study comparing growth of trees grown in structural soil vs. compacted soil vs. suspended pavement in an urban plaza study also will be presented.

Fixing the Broken Urban Forest
Twenty-seven years of data from a large number of trees under pavement, in large loose soil volumes, indicates that access to adequate soil volume is the most important determining factor for urban tree success that people can control.

After all is said and done, the most successful tree planting approach is the old saw, "A $10 tree in a $200 hole."

L. Peter MacDonagh
Peter MacDonagh co-founded the Kestrel Design Group in 1990 and today serves as its Director of Design + Science. He had been adjunct faculty at the University of Minnesota since 1999, where he teaches courses in ecological restoration and sustainable design. In addition to being a registered landscape architect and horticulturist, MacDonagh is a certified professional arborist and LEED AP.

He has successfully led more than 200 public and private projects for local, regional, provincial and national governments such as municipalities, park districts, watershed districts, schools, universities, corporations, energy utilities and manufacturers.

He is a recognized authority on sustainable landscape architecture, and is widely sought for his expertise in urban stormwater, green roofs, and urban trees.

E. Thomas Smiley, Ph.D.
Dr. Tom Smiley is an arboricultural researcher at the Bartlett Tree Research Laboratory in Charlotte, North Carolina, and an adjunct professor of Urban Forestry at Clemson University.

Dr. Smiley is active in the arboriculture industry and has co-authored the International Society of Arboriculture's *Best Management Practices* for Tree Risk Assessment, Lightning Protection, Fertilization, Support Systems and Construction Management. His research has led to improved methods of increasing sidewalk longevity near trees, protecting more trees from lightning damage, improving tree root growth in compacted soil using the patented *Root Invigoration* process, and better predicting trees failures.

When not traveling, Dr. Smiley continues his studies on tree biomechanics, plant growth regulators, and developing more efficient tree support systems.