

Since 2004 there have been new products and soil mixes developed.

Some of these were installed in a new plot at the Bartlett Laboratory in 2014.

New Urban Plaza



Gravel Based Structural Soils



80% gravel, 20% soil.

Compacted to 95% Proctor. Based on Cornell Structural Soil

Sand Based Structural Soil



Gravel layer below and above sand, ring irrigation
Compacted to 95% Proctor

Silva Cells from Deep Root



Strata Cell from City Green



Craig Melvin

Filling Strata Cells



Stata Cell – vibrating to work soil into cells



Installing concrete



Soil Under Pavement Plot
July 23, 2015
Bartlett Tree Research Laboratories
Charlotte NC



(c) E. Thomas Smiley 2015

Large differences in growth during the summer of 2015. One year after planting.



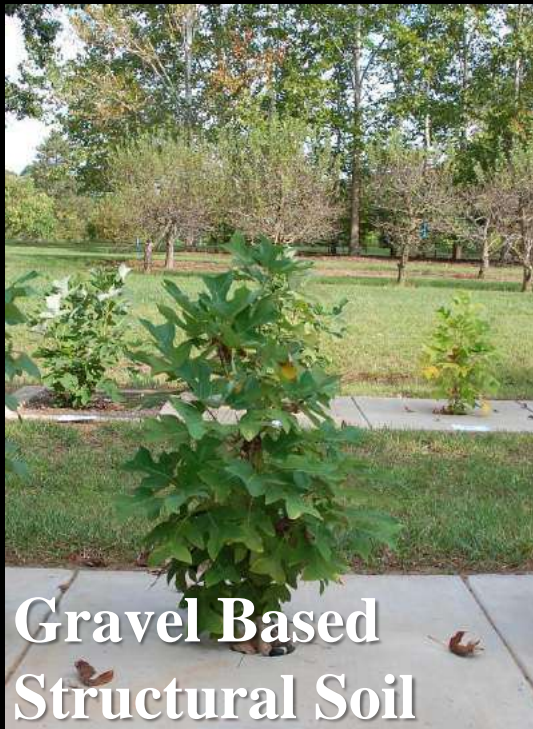
**Sand Based
Structural Soil**



Strata Cell



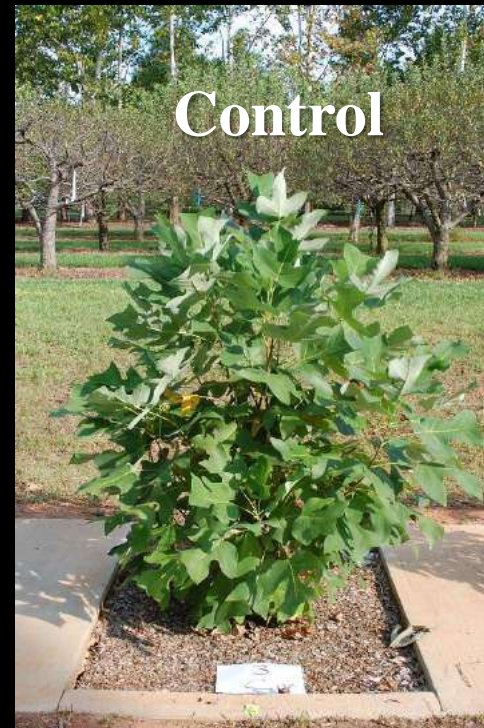
Silva Cell



**Gravel Based
Structural Soil**



Compacted Control



Control



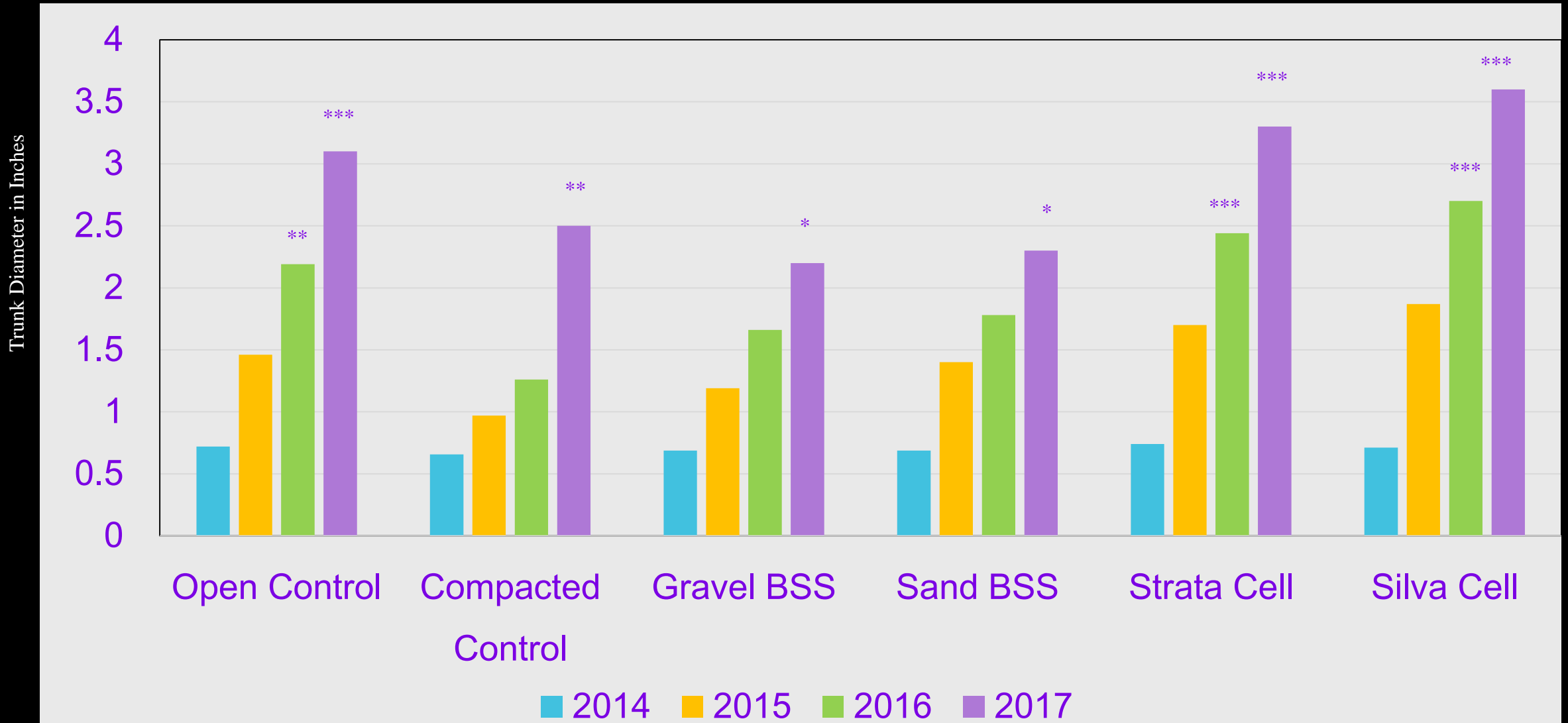
Plot in Summer 2016

Soil Subsidence

Treatment	Subsidence in Inches
Compacted Control	0.0 a*
Gravel BSS	0.04 a
Sand BSS	0.12 a
Silva Cell	0.62 b
Open Control	0.87 b
Statacell	1.46 c
	*Values with the same letter are not significantly different S-N-K $\alpha = 0.05$



Soil Under Pavement Trunk Diameter in inches



Plot Removal

October 23, 2017





Measuring Soil Moisture at 15 cm intervals



Soil Moisture (% volumetric)

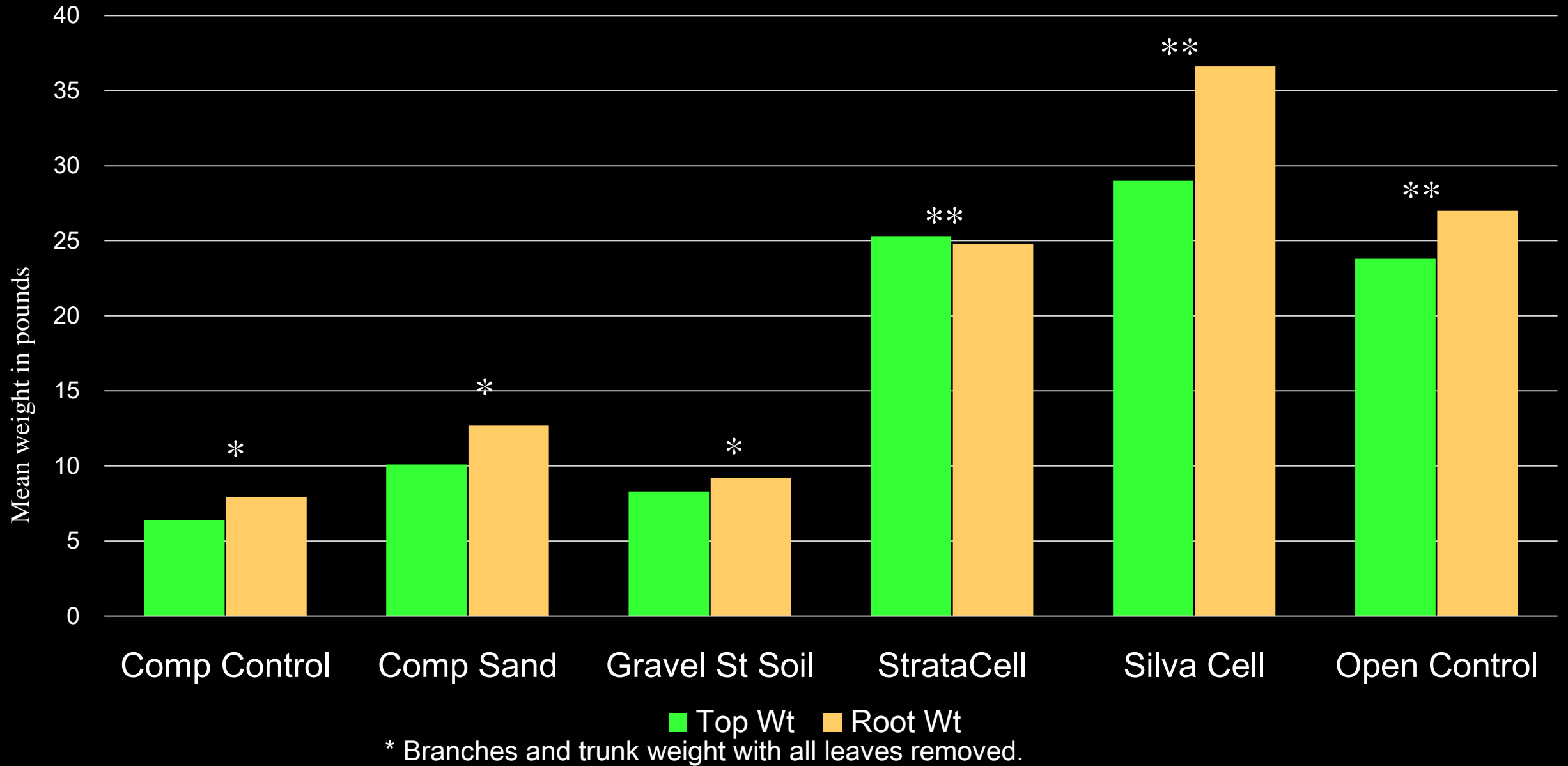
Treatment	Surface	15cm	30 cm	45 cm
Comp Control	33***	34**	30**	20
Comp Sand	13*	15*	17*	13
Gravel St Soil	NA	NA	NA	NA
StrataCell	22**	19*	20**	20
Silva Cell	23**	23*	24**	19
Open Control	29***	23*	25**	19

Removed plot and Weighed tops and roots



Which Weighs More, the tops or roots?

Weight of the Tops* and Roots





**Successful Suspended
Pavement, Uptown Charlotte**

Comparison of Willow oak planted the same year in a suburban neighborhood vs. Uptown

Uptown



Ridgeloach Neighborhood



Measurements

Summer 2013

30 years

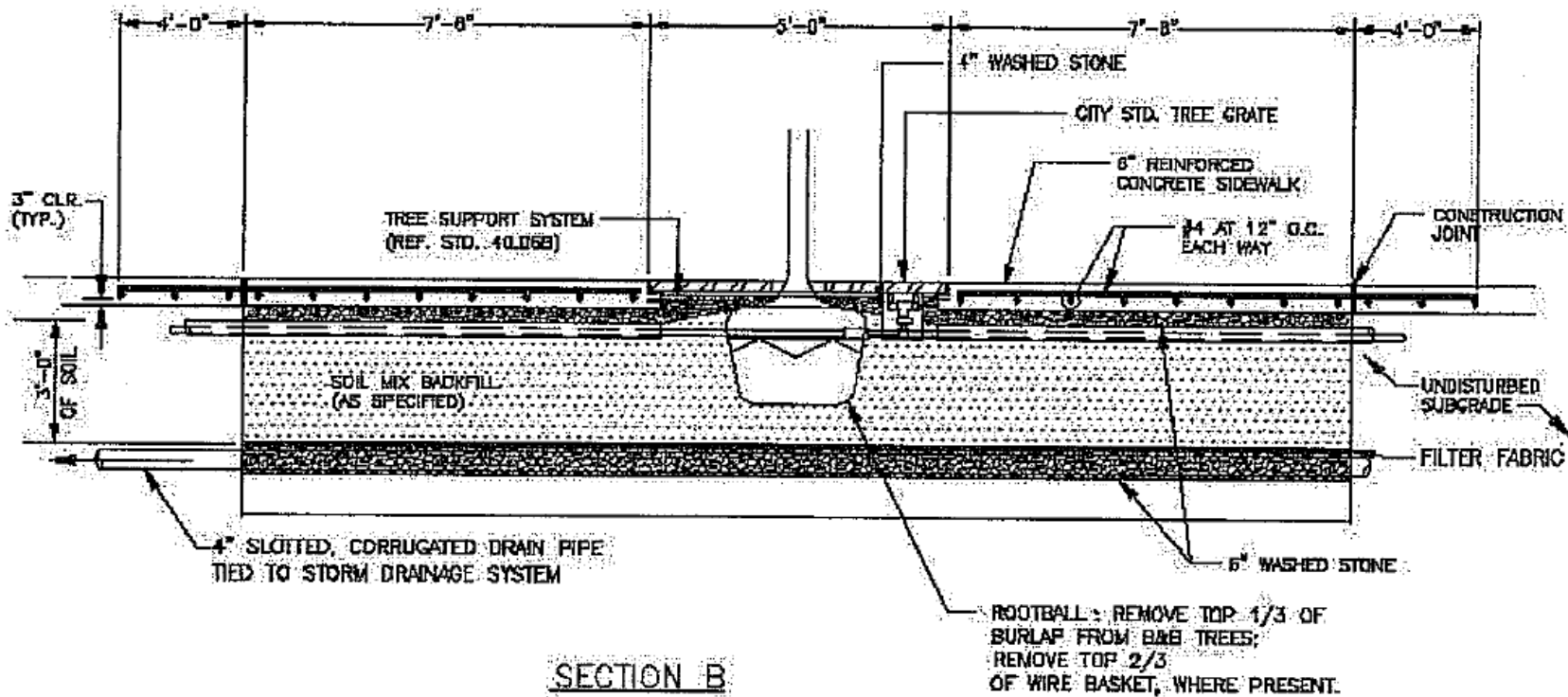
DBH

Height (laser)



Results

Location	DBH inches	Height feet	Condition 1= Good 2=Fair 3=Poor	Number of trees
Uptown	18	70.2	1.45*	151
Ridgeloach				161



SECTION B

REVISIONS		
NO.	DATE	DESCRIPTION
1	12/88	SECTION "B"

APPROVED DATE _____

**CHARLOTTE - MECKLENBURG
LAND DEVELOPMENT
STANDARDS**

**TREE PIT WITH
GRATE IN SIDEWALK (SECTION)**

40.03B	REV.

Installed fall/winter 1983

Overall Research Results

Greatest tree growth with:
Supported Pavement
(including concrete, Silva
Cells and StrataCells)
Open surface

Least tree growth with:
Structural soil (gravel,
expanded slate)
Compacted soil (including
sand and loam)

ISA BMP for Soil Management

Published in 2014

Bryan Scharenbroch senior
author

Available from the Chapter or ISA
Champaign for about \$10 for
member

Best Management Practices

Soil Management for Urban Trees



Special companion publication to the ANSI A300 Part 2: Tree, Shrub, and Other Woody Plant Management—Standard Practices (Soil Management a. Modification, b. Fertilization, and c. Drainage)

Results of pavement / root interactions



Why do roots damage sidewalks?

Roots grow where moisture, oxygen, density, nutrients allow

Good environment under some pavement – condensation

Normal cracks allow entry of water, oxygen and nutrients

Root diameter increases rapidly near the trunk ZRT



Sidewalk Trials

Established
1996
Suburban
sidewalk
design and
construction
London
Planes



©1999

Treatments

Deep Root Barrier

450mm 18"

Black Poly 450mm 18"

Styrofoam 100mm 4"

Gravel 100mm 4"

Structural soil -

Soil/Gravel Mix 100mm

Control



Sidewalk Plot

Sidewalk
lifting
appears in
2000

Four years
after
installation



Sidewalk Plot After 10 Years



Sidewalk Removal



Evaluating Root Growth Under Pavement



Sidewalk Results

Control – no barriers or subbase treatment

Sidewalk Results

A photograph showing a tree trunk on the left side. The ground is a mix of mulch and soil. The soil is dry, brown, and has numerous cracks. Several roots are exposed and lifted out of the ground, particularly in the center and right side of the frame. The text 'Sidewalk Results' is overlaid in large, bold, yellow letters at the top.

Control – Not a good treatment – associated with lifting

Gravel Soil Mix



One of the Worst Treatments for sidewalk lifting – Need more than 4"

Control next to Gravel Soil Mix



Black Poly



Second worst treatment for lifting pavement

Deep Root Barrier



One of the Best Treatments



Deep Root next to Control

Styrofoam

A photograph showing a dense network of tree roots exposed in a trench. The roots are thick and gnarled, with many smaller, thinner roots branching out. The scene is illuminated by a bright light source from the right, creating strong highlights and deep shadows. The soil is a reddish-brown color.

One of the Best Treatments

**Styrofoam next
to Control**





**Gravel (25-40mm, 1-1.5",
washed)**

One of the Best Treatments
Fewer, smaller and deeper roots

**Best treatments for
reducing lifting and root
growth under pavement
Reducing Sidewalk
Lifting**

Gravel

Styrofoam

Deep Root Barriers

For more information

Paper in Arboriculture and Urban Forestry

Also see Dr. Ed Gilman's paper

Arboriculture & Urban Forestry 34(3): May 2008

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Arboriculture & Urban Forestry 2008. 34(3):179-183.

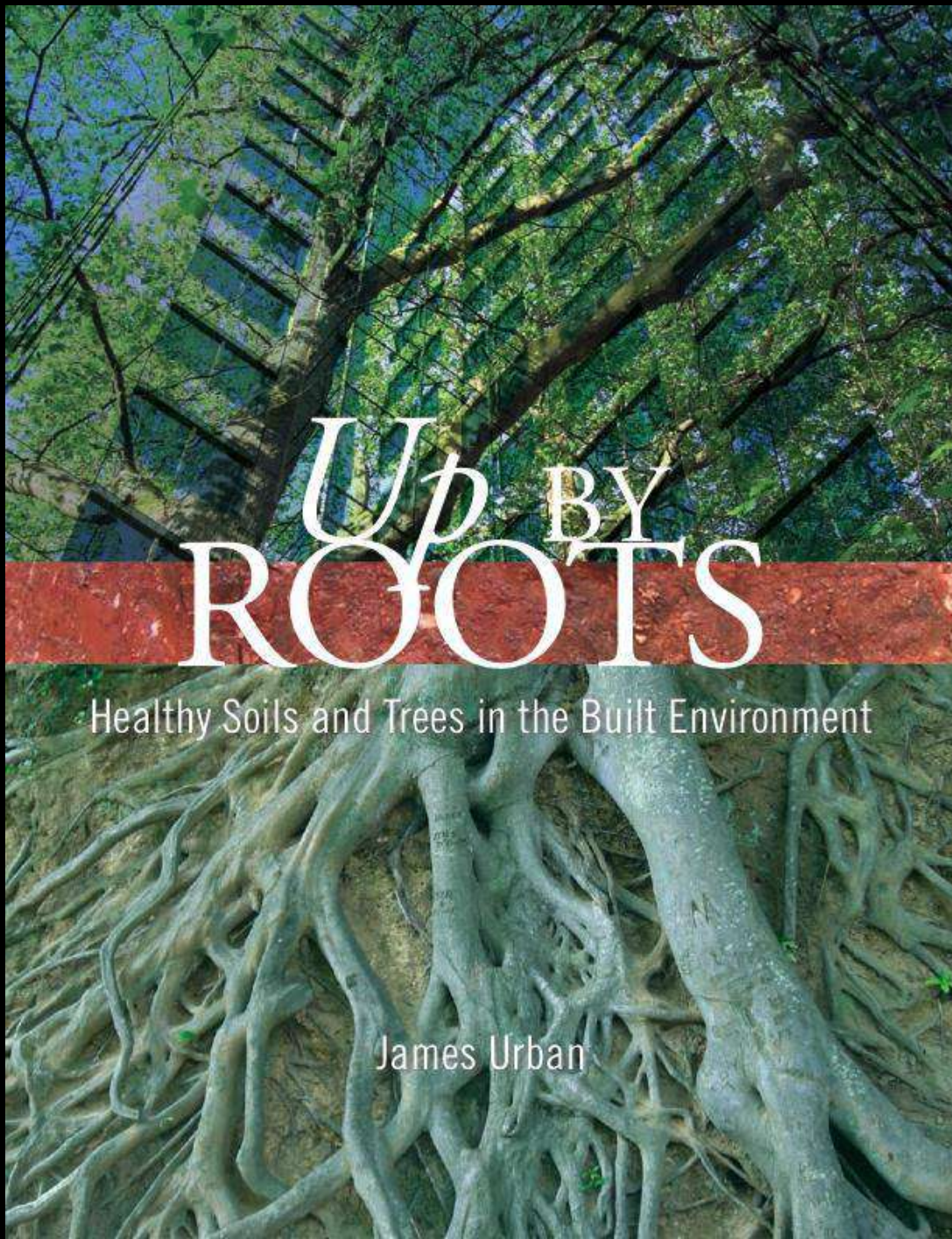


Comparison of Methods to Reduce Sidewalk Damage from Tree Roots

E. Thomas Smiley

Abstract. Tree roots growing under sidewalks are known to crack or lift pavement often creating a tripping hazard for pedestrians. This experiment was conducted to determine the long-term effects of below- and alongside-pavement treatments on tree root development and sidewalk damage. London, U.K., plane trees (*Platanus × acerifolia*) were planted next to sidewalks at the Bartlett *Platanus occidentalis* from 15 containers were planted 0.75 m (30 in) from sidewalks and irrigated regularly to encourage rapid growth. Identical studies were installed on one well-drained and one poorly drained site located about 18 km (11.2 miles) apart. Barriers included 30 cm (12 in) deep DeepRoot, Biobarrier®, polyethylene (6 mil), a clean gravel layer (15 cm [6 in] deep; 2 to

Barker (1995a, 1995b) showed that in an alluvial, well-drained, silty clay loam soil, roots deflected down by a polyethylene plastic sheet did not grow up toward the soil surface within 1 m (3.3 ft) of the barrier.



Up BY ROOTS

Healthy Soils and Trees in the Built Environment

James Urban

Up By Roots:
Healthy Soils
and Trees
In the Built
Environment

by James Urban

Available at
ISA-Arbor.com

Good Source for Sidewalk Information

Reducing Infrastructure Damage By Tree Roots:

A Compendium of Strategies



L. R. Costello ■ K. S. Jones

TRUNK FLARE
BY DIAMETER

ROOT ZONE

Questions or Comments?

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