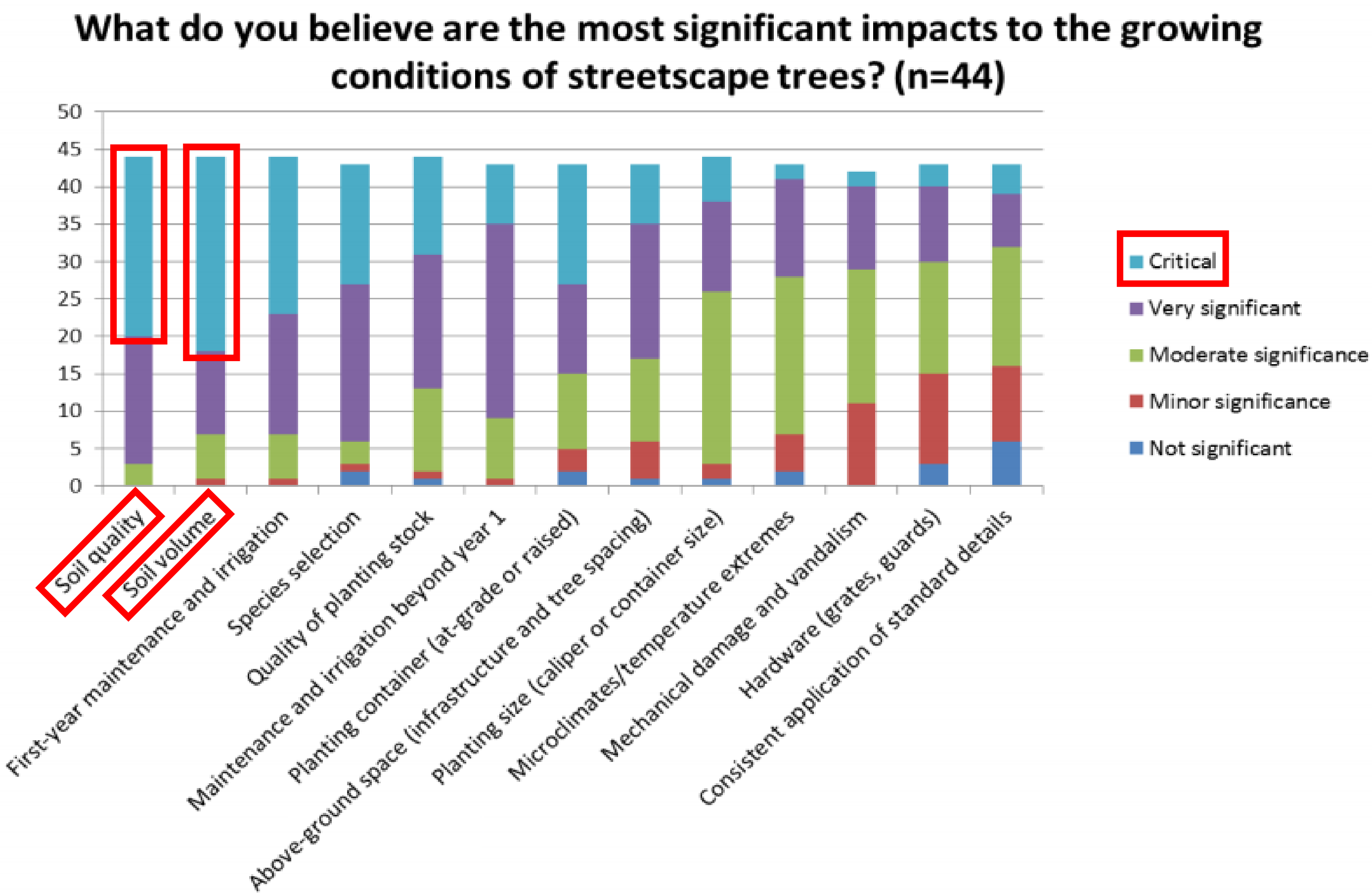
Growing Condition Improvements for Streetscape Trees

Phillip Kenny, Kevin Nicoletta,
Carlos Pizarro, Ning Zhang

Purpose

- To study and design options to improve the quality of growing conditions for streetscape trees in downtown Austin, with the primary focus being soil volume and quality

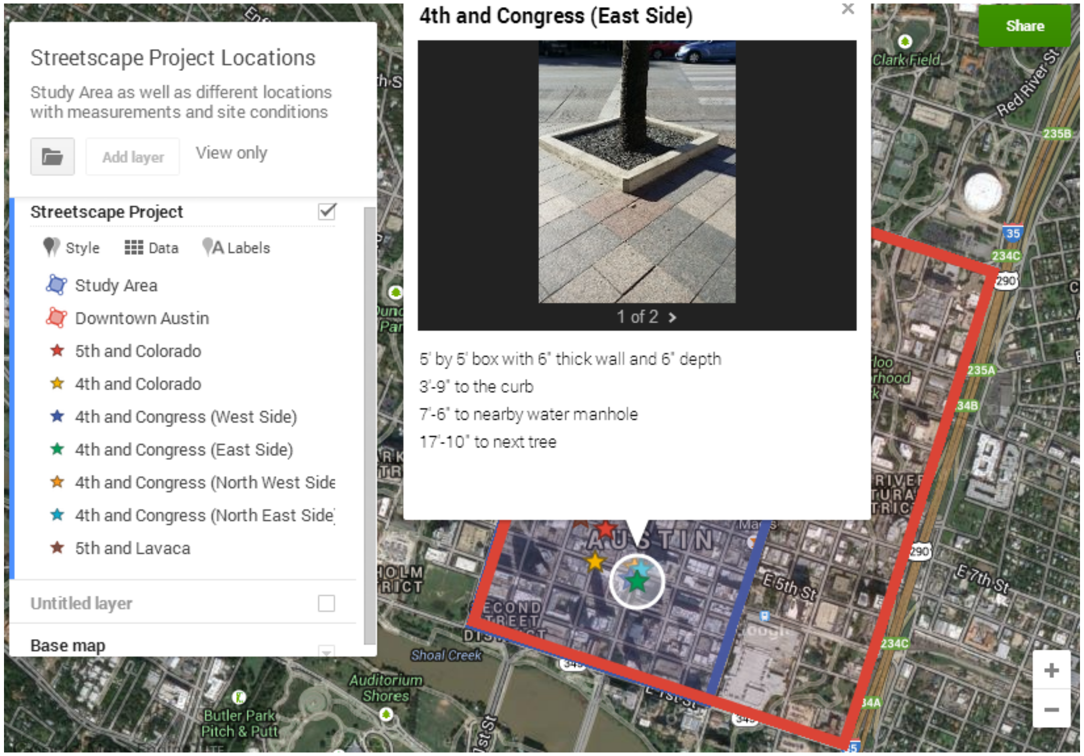


Current Situation

Current conditions and conflicts to resolve

Study Area

- Since this is a very large area, a study area was selected
- GIS Map →
- As seen by the GIS Map, there are many different growing conditions and tree types across downtown
- Due to these inconsistencies, many trees are not receiving the adequate space they need to grow as well as the required nutrients – causing the life of the trees to be shorter than planned



Growing Conflicts

- **Utilities:** Although many utilities are moved from locations where trees will be planted, it is important to take into consideration the mature size of a tree when it comes to utility conflicts

- **Soil Volume:** One major problem with growing conditions downtown, and the primary focus of this project is soil volume. Many trees are being planted in pits that are not big enough for the mature tree size. Because of this, many trees downtown are dying before their expected lifetime

- **Soil Quality:** Another problem affecting growing conditions of streetscape trees is soil quality. Soils are being compacted and lacking certain nutrients which hinders the potential for growth

Soil Volume

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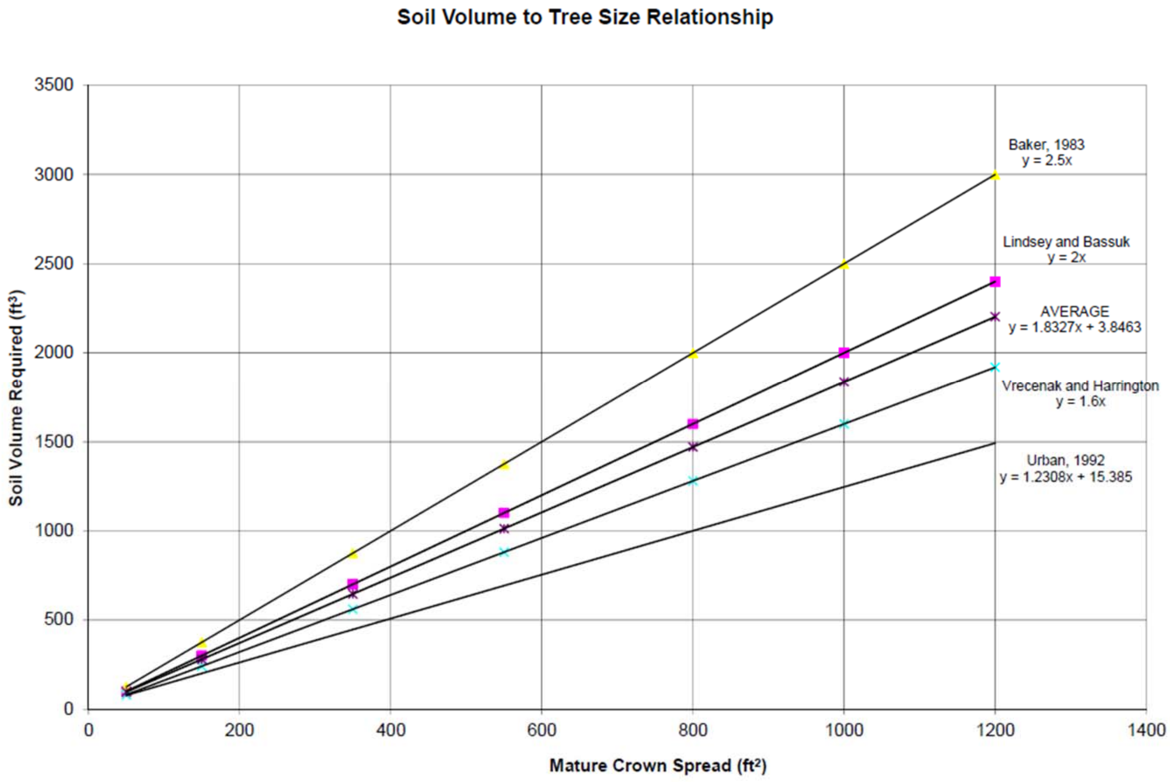
Tree Size and Soil Volume Comparison



- Different research was done when it comes to the relation between soil volume and mature crown spread.
- From the different research, an average was determined to show the required soil volume for any given tree size.
- This information was used to determine what trees are good choices for planting downtown

Different Trees and Requirements

- The city created a list of trees as well as their mature size and requirements
- This was compiled in the City's Environmental Technical Criteria Manual in Appendix F
- Great Streets currently plans on planting Cedar Elm, Big Tooth Maple, as well as Red Oak

Common Name	Canopy Area (ft^2) – ECM	Canopy Area (ft^2) – TAMU	Expected Soil Volume Requirement	Soil Volume Required (ft^3)
Cedar Elm	707	3,848	Very Large	885 – 4752
Big Tooth Maple	491	1,257	Large	620 – 1,562
Red Oak	491	N/A	Medium	620

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Soil Quality

Methods of improving soil quality for healthier and longer lasting trees

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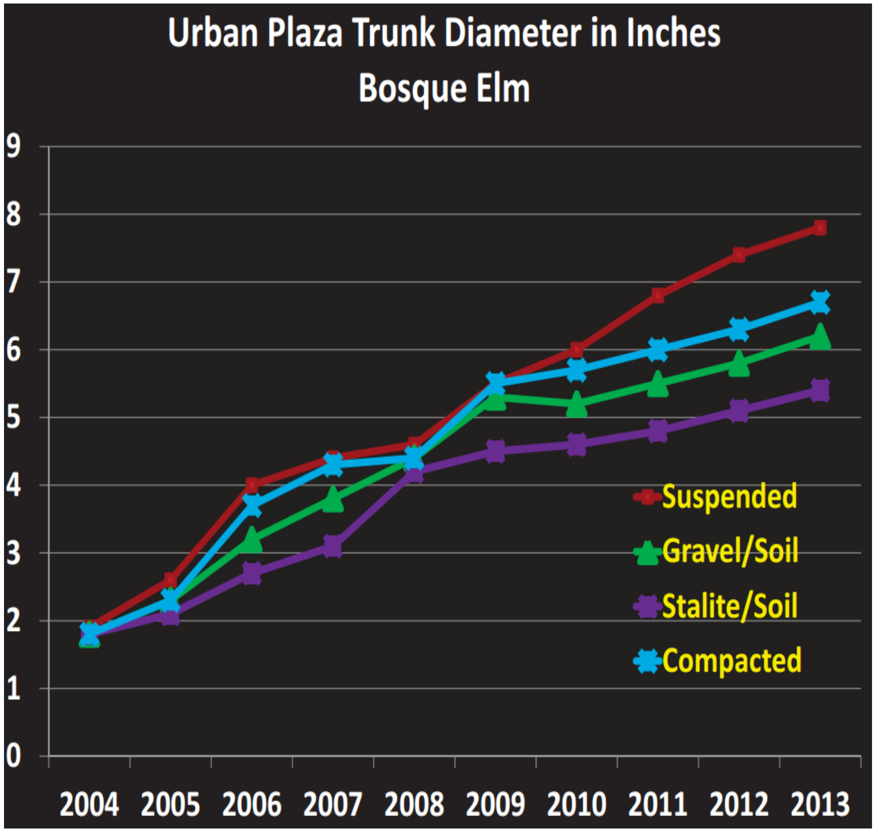
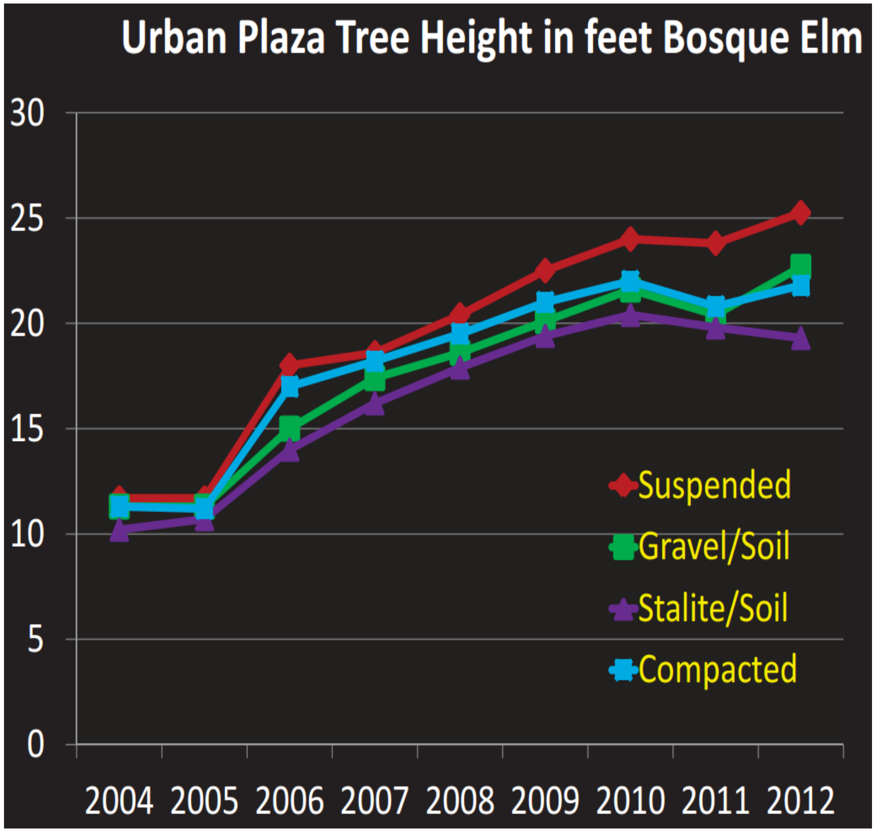
Differing Soil Systems





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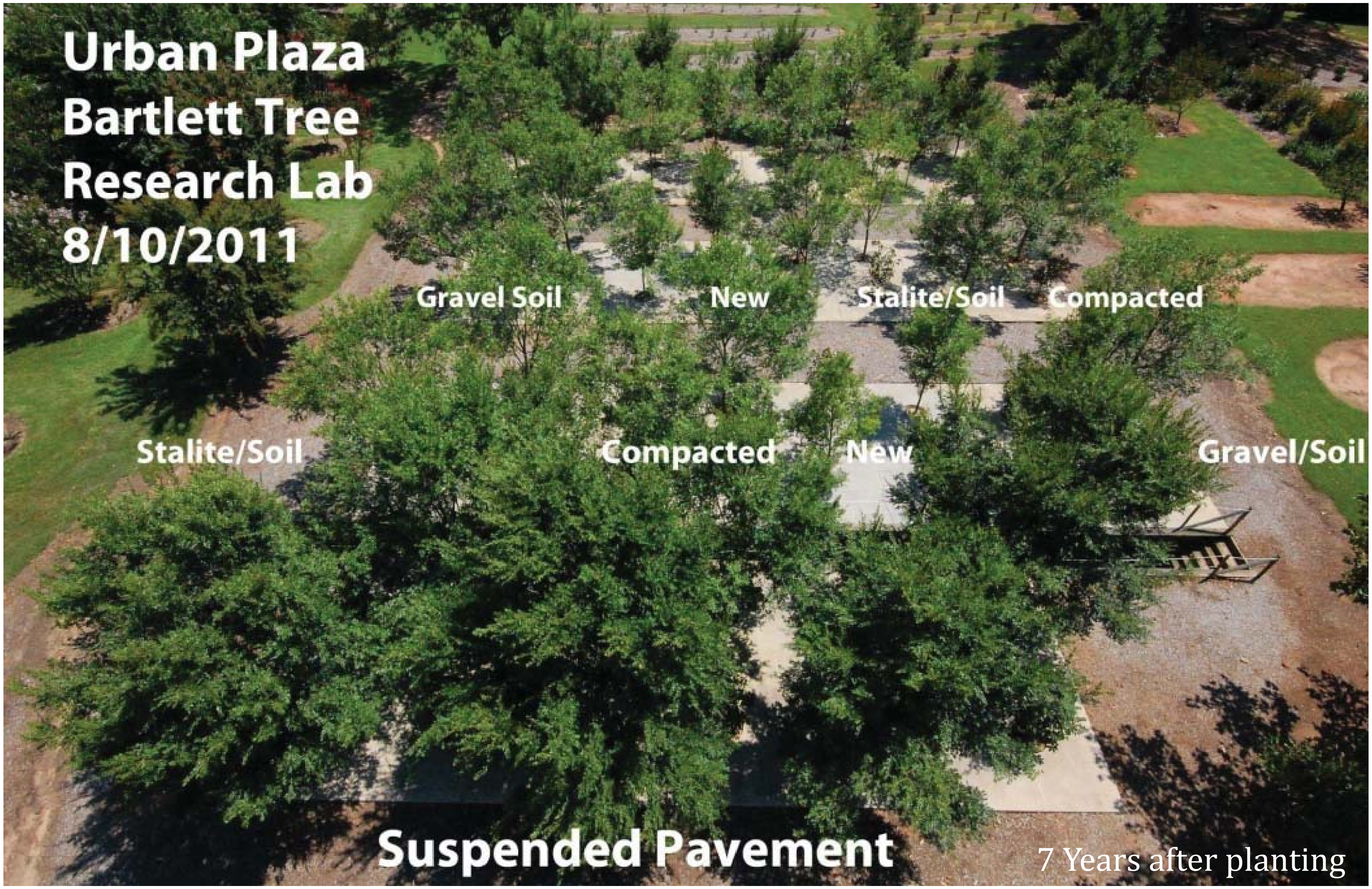
Urban Plaza
Bartlett Tree
Research Lab
8/10/2011
Gravel Soil
New
Stalite/Soil
Compacted
Stalite/Soil
Compacted
New
Gravel/Soil
Suspended Pavement
7 Years after planting

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Structural Soil Systems

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Silva Cell Modular Framework (Suspended Pavement)

- Filled with a sand / clay loam
- Each unit is ~ 92% void space, making it easy to accommodate utilities

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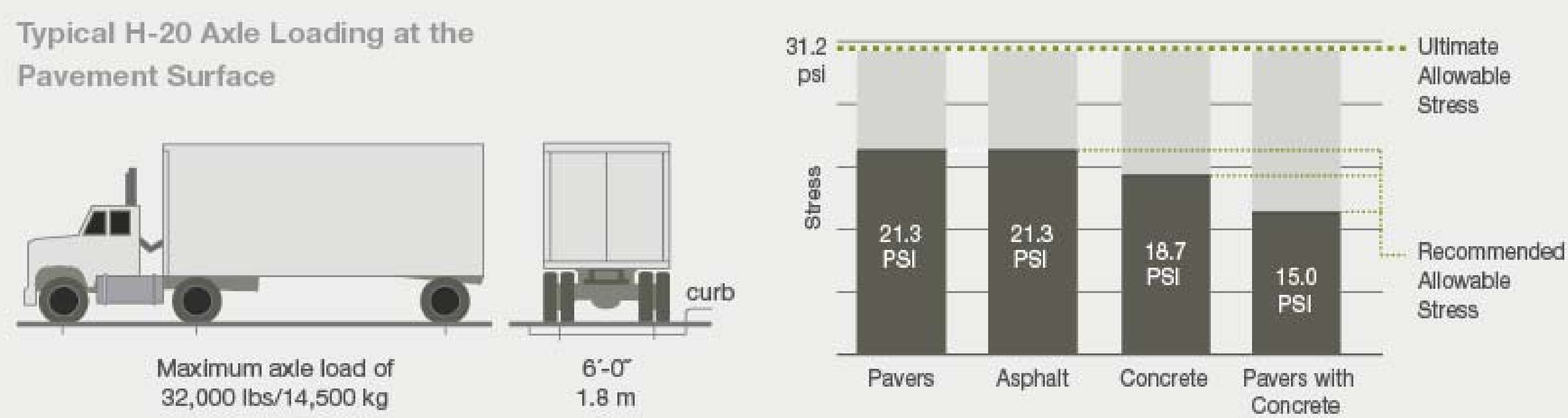
Silva Cell Modular Framework (Stresses)



	PAVERS	ASPHALT	CONCRETE	PAVERS WITH CONCRETE
ENGLISH	21.3 PSI - 3.15″ pavers - 1″ sand base - 12″ of aggregate	21.3 PSI - 4″ of asphalt concrete - 12″ of aggregate	18.7 PSI - 4″ of Portland Cement Concrete - 4″ of aggregate	15.0 PSI - 2.36″ pavers - 5″ of Portland Cement Concrete

- The Silva Cell can support vehicle loading up to AASHTO H-20 rating of 32,000 lbs. per axle


Lincoln Center Barclay Capital Grove
New York, NY


Lincoln Center Barclay Capital Grove
New York, NY

Urban Tree Lifecycle Costs and Benefits for a 50 Year Study Period, Based on Typical Costs and Benefits for Minneapolis, MN	Tree without Silva Cells: Estimated Lifespan 13 years	Note for Tree without Silva Cells	Tree with Silva cells: Estimated Lifespan 50+ Years	Notes for Tree with Silva Cells
Installation Costs	$4,000	Estimated at $1,000 per tree, installed 4 times over a 50 year study period	$14,000	Estimated at $14,000 per tree, installed 1 time over a 50 year study period
Total Benefits	$2,717.66	Includes savings from reduced building energy costs, stormwater interception, increased property values, and the net value of carbon sequestration in the tree	$41,769	Includes savings from reduced building energy costs, stormwater interception, increased property values, and the net value of carbon sequestration in the tree, bioretention, and stormwater utility fee credit.
Total Maintenance Costs	$1,211.95	Includes estimated costs for pruning, pest and disease control, infrastructure repair, irrigation, cleanup, liability and legal costs, and administration costs.	$2,341.75	Includes estimated costs for pruning, pest and disease control, infrastructure repair, irrigation, cleanup, liability and legal costs, administration costs, and bioretention maintenance
Removal Costs	$600	Estimated at $200 per tree, 3 times over a 50 year study period	$0	Removal Costs
Net Lifecycle Cost	**$3,094.29**		**$ - 25,427.25**	

Soil Additives

- Biochar
  - Soil amendment that increases food security, improves water quality, and reduces irrigation and fertilizer requirements
- Granular Acrylic Polymers
  - Reduces the frequency of irrigation and ensures adequate hydration. These work by absorbing large quantities of water and increasing to several times its original size, thus increasing water holding capacity
- Bentonite
  - A clay which has a high tendency to absorb and retain water, in result, swelling to bigger than its original size

Root Barriers

Typical Root Barriers vs. “BioBarrier”

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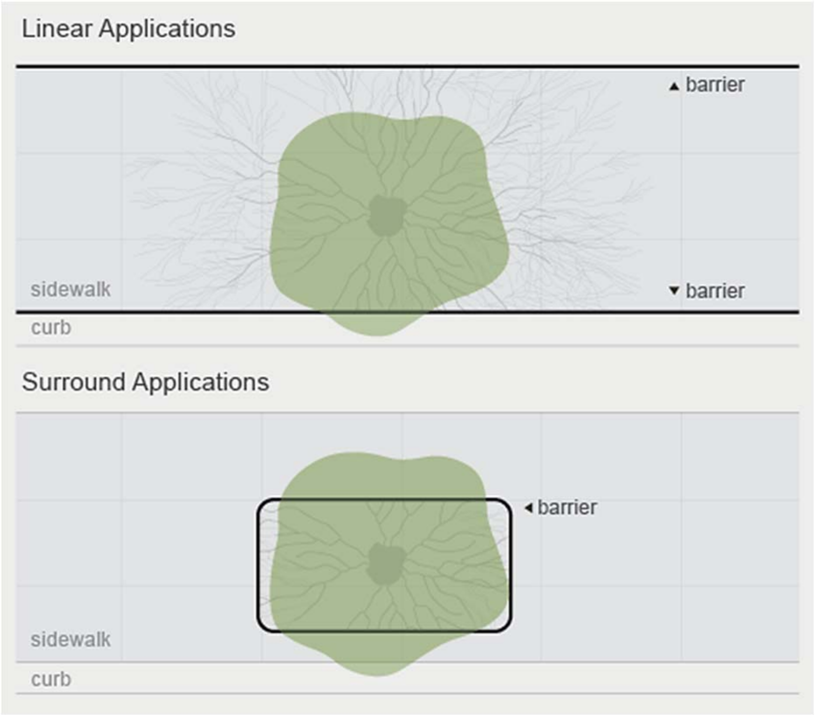
Typical Root Barrier (DeepRoot)

- Protects surrounding hardscapes with permanent impermeable recycled plastic
- Provides linear / surround applications

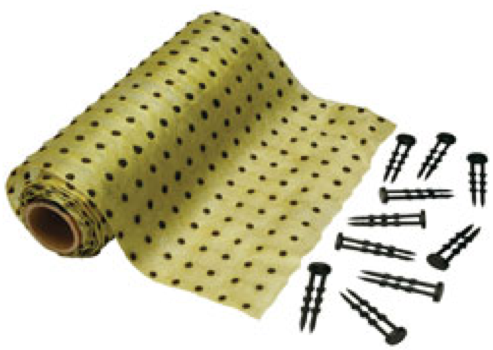
36"x24"	24"x24"	18"x24"	12"x24"
$205 / 20	$170 / 20	$121 / 20	$77 / 20



BioBarrier

- Prevents root tip cell division by slowly releasing Triflrualin, a herbicide, at its nodules
- Barrier is made of a standard drainage fabric which allows water and nutrients to pass through
- Guaranteed protection for 15 years

24''x20 ft. Roll - $140 →



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Ideal Streetscape

Ideal design and conditions for healthy, large, long lasting trees

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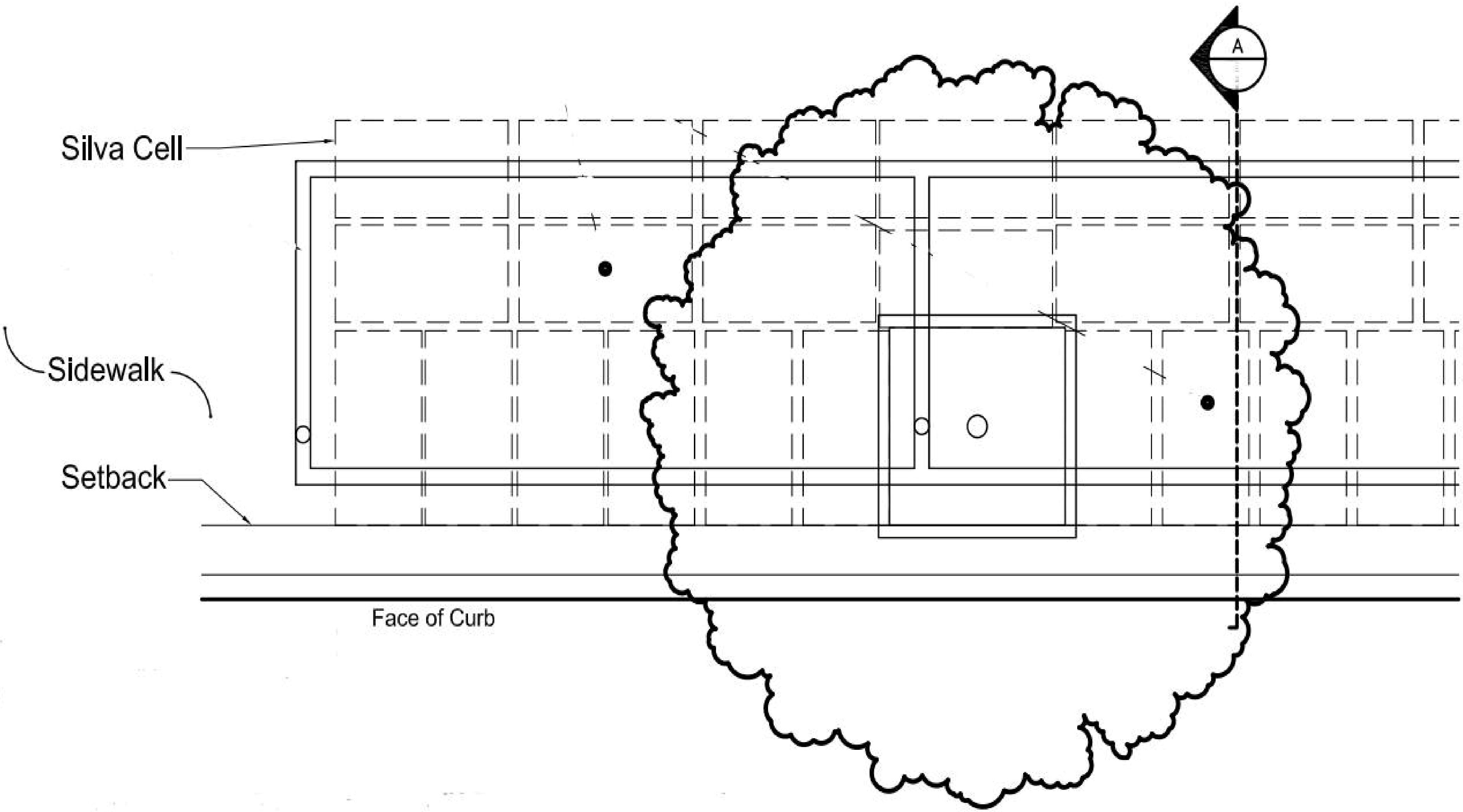
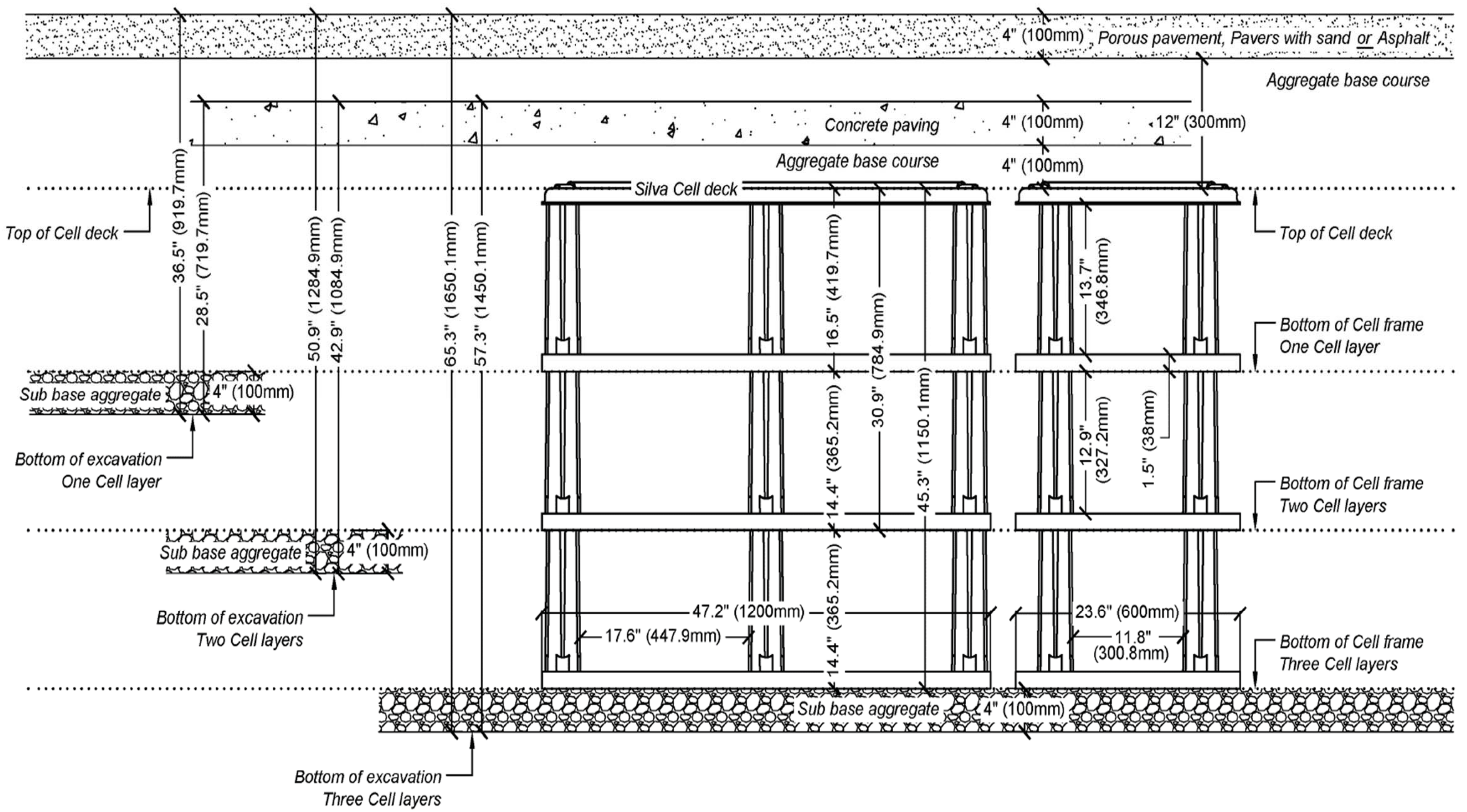
Ideal Solution

- Silva cells are approximately 16” high. Stacked three high, this gives a height of about 48”
- Averaging data from the study area allows available soil volume of 640-670 ft^3
- The ideal choice is the Texas Red Oak with the use of Silva Cells and Biochar in a connected soil system outlined with BioBarrier.
- In other locations where more space is available (18’ trench width), Big Tooth Maple trees can be planted
- Cedar Elm is not recommended given its excessive size and demand for soil volume

*Taken from the average of all locations surveyed



A
Silva Cell
Sidewalk
Setback
Face of Curb



4" (100mm)
Porous pavement, Pavers with sand or Asphalt
Aggregate base course
Concrete paving
4" (100mm)
12" (300mm)
Aggregate base course
4" (100mm)
Silva Cell deck
Top of Cell deck
Top of Cell deck
36.5" (919.7mm)
28.5" (719.7mm)
50.9" (1284.9mm)
42.9" (1084.9mm)
65.3" (1650.1mm)
57.3" (1450.1mm)
16.5" (419.7mm)
30.9" (784.9mm)
45.3" (1150.1mm)
13.7" (346.8mm)
Bottom of Cell frame
One Cell layer
Sub base aggregate
4" (100mm)
Bottom of excavation
One Cell layer
14.4" (365.2mm)
12.9" (327.2mm)
1.5" (38mm)
Bottom of Cell frame
Two Cell layers
Sub base aggregate
4" (100mm)
Bottom of excavation
Two Cell layers
47.2" (1200mm)
14.4" (365.2mm)
23.6" (600mm)
17.6" (447.9mm)
11.8" (300.8mm)
14.4"
Bottom of Cell frame
Three Cell layers
Sub base aggregate
4" (100mm)
Bottom of excavation
Three Cell layers