



# SILVA CELL 2

ENGINEERED FOR GROWTH



**NATURAL  
HABITATS**  
*Gardening on a Grand Scale*



## ABOUT DEEPROOT & NATURAL HABITATS

PLANT A BIG IDEA.  
WATCH IT CHANGE  
A CITY.

It's simple: Natural Habitats mission is to create a healthier, more vibrant, and sustainable built environment by bringing green infrastructure like trees, soil, and on-site stormwater management to streets, plazas, parking lots, and other paved areas.

We live in an upside down world where healthy soil hasn't had a place – until now. The Silva Cell is a modular suspended pavement system that uses soil to nurture mature tree growth and provide powerful on-site stormwater management, bringing the function of the forest to the city.

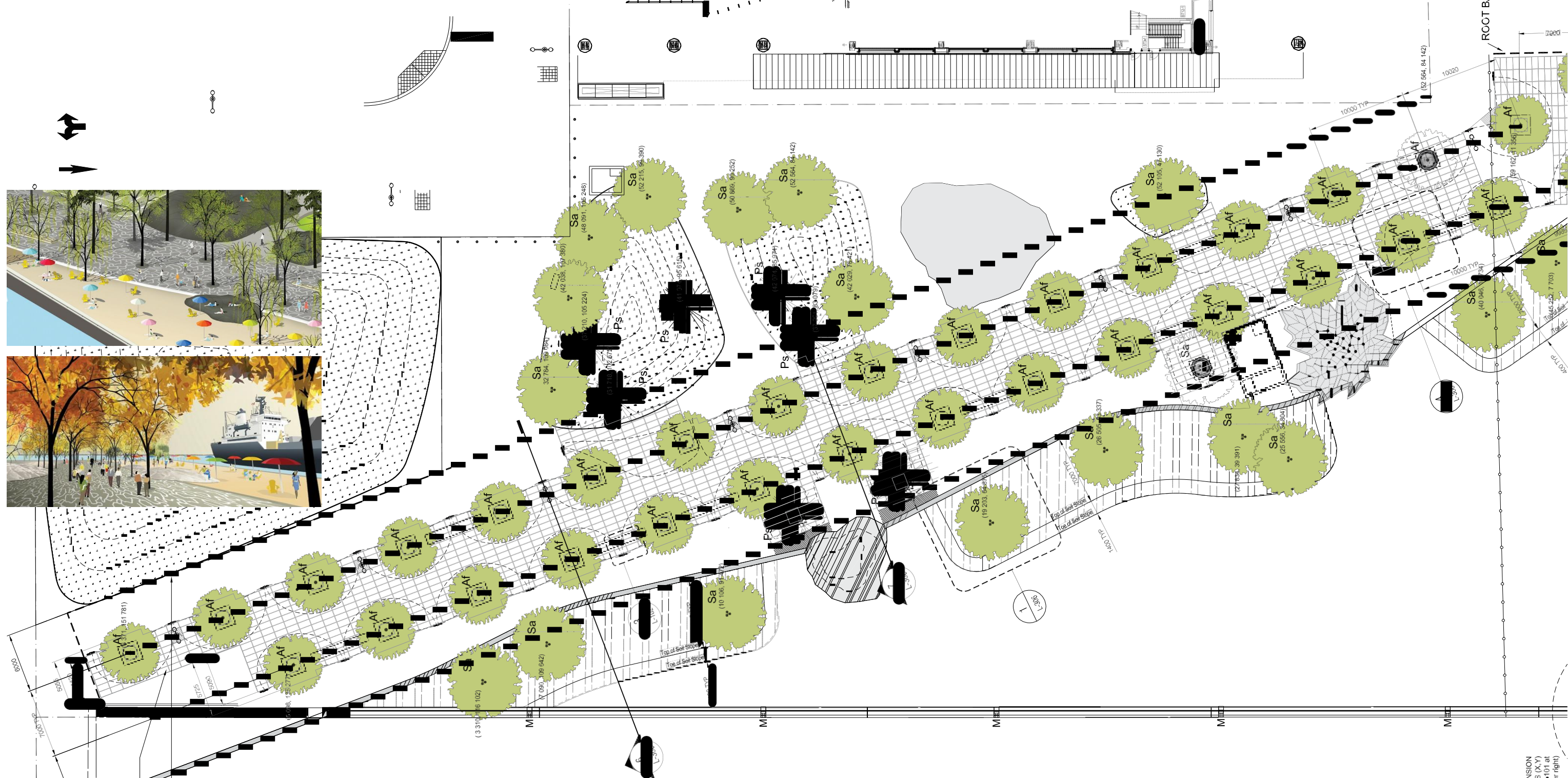
## INTRODUCTION SUGAR BEACH

The revitalization of Toronto's waterfront is one of the largest urban renewal projects ever undertaken. Waterfront Toronto, the organization that managed the effort, is a joint venture by the Federal, Provincial, and the City of Toronto governments.

Design firms Claude Cormier and The Planning Partnership specified the Silva Cells at Sugar Beach, one of the waterfront redevelopment sites, in order to achieve the City of Toronto's soil volume standards for street trees. There are 33 Maples at Sugar Beach, with a mix of Marmo, Jeffer's Red, and Autumn Blaze, each with access to over 1,236 cubic feet (35 cubic meters) of soil in the Silva Cells.

"I recently visited the trees at Sugar Beach – they look like they are on steroids – phenomenal growth that I have never seen before for an urban tree!"  
-Marc Hallé, Claude Cormier + Associés

As these trees mature, they will create a lush canopy over the plaza for those who wish to escape from the heat of the beach and relax in the cool shade. They will also serve as an enduring reminder of the City of Toronto's commitment to their urban forest.



SILVA CELL LAYOUT

ROOT BARRIER

Case Study: Sugar Beach, Toronto, ON, Canada

Installation Summary

Total soil per tree: 1,236 ft<sup>3</sup> (35 m<sup>3</sup>)

Installation date: Winter 2010

Project designers: Claude Cormier + Associés and The Planning Partnership

Owner: Waterfront Toronto

Contractor: Eastern Construction

From initial concept through planning stages and implementation, Natural Habitats supports you every step of the way.



# CREATING HIGH-PERFORMANCE URBAN LANDSCAPES



Silva Cell installation



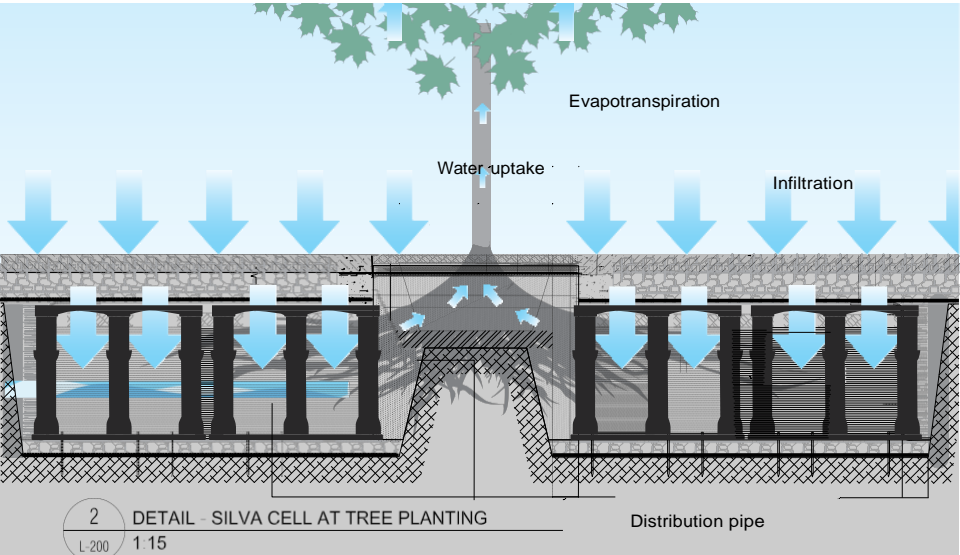
2010



2014

The integration of green utilities like soil, trees, and water into urban areas can help alleviate some of our most pressing ecological challenges – including air and water quality, rising temperatures, flooding, and erosion from daily rainfall events.

Trees and soils play a significant role in bioretention.



The Silva Cell is a modular suspended pavement system that holds unlimited amounts of lightly compacted soil while supporting traffic loads beneath paving. That soil serves two important functions: growing large trees and treating stormwater onsite.

**Interception and Evapotranspiration**  
Large trees intercept and evapotranspire significantly more rain than small trees. For example, a healthy 40 year old Hackberry tree is estimated to provide 14 times as much interception as a 10 year old Hackberry (McPherson et al 2006).

**Long-Term Infiltration**  
As roots grow and then decay, they leave open channels in the soil that restore and/or enhance porosity and infiltration rates. Several studies have found a significant increase in saturated hydraulic conductivity in bioretention with plants as compared to those without (e.g. Lucas and Greenway 2011).

**Water Quality Benefits**  
Vegetation is crucial to many water quality benefits, including removal or sequestration of dissolved nutrients, hydrocarbons, and Total Suspended Solids (TSS).

Plants also slow water flow, allowing more time for sedimentation to occur (Hunt et al 2012).

Silva Cells can be used on almost any type of site, including:

- Streets
- Plazas
- Parking areas
- Green roofs/on-structure
- “Break-out” zones

# UNDERGROUND BIORETENTION WITH THE SILVA CELL

Bioretention is an incredible tool for low-impact development, keeping water where it falls so that it can be cleaned, cooled, and recharged. Open bioretention presents challenges in dense urban areas, where land values and maintenance requirements are high. This is where underground bioretention systems like the Silva Cell are best suited.

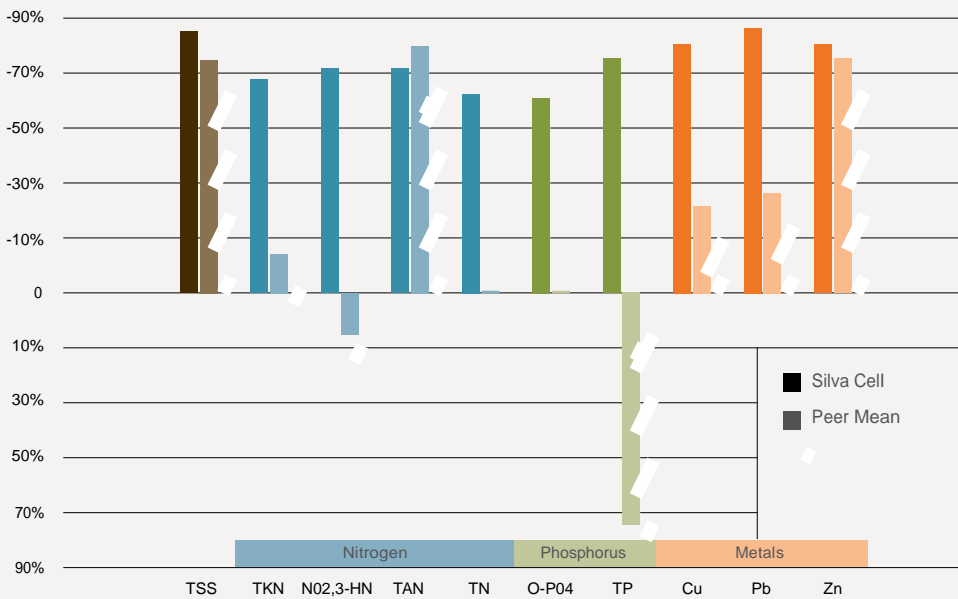
How do the stormwater benefits of the Silva Cell system compare to those of traditional bioretention systems? The mechanisms by which the tree and soil provide stormwater benefits are the same, and the benefits are too.

Final results from a performance monitoring study in Wilmington, North Carolina (USA) show that Silva Cells can provide stormwater benefits equal to, or better than, traditional bioretention. Read more about this on our website and blog.

Water quality benefits: For all of the pollutants monitored, the Silva Cell systems performed better or about the same as the mean for bioretention systems in peer reviewed literature (Page et al 2015).

## POLLUTANT REMOVAL LEVELS

Silva Cell compared to typical bioretention systems



Unlike some bioretention systems, which leach nutrients and negatively impact receiving water bodies, Silva Cell systems also provide nutrient removal. Additional low-impact development benefits of the system include:

- Water quality
- Peak overflow reduction
- Low/no maintenance
- May use any type of soil
- Efficient use of space

# PRODUCT DETAILS

The Silva Cell 2 is composed of a base, posts, and a deck. Each unit is 48" (1200 mm) long x 24" (600 mm) wide. The assembled cells, which transfer paving loads vertically downward to a compacted sub-base through the posts, are available in three heights: 1x (16.7"/424 mm), 2x (30.9"/784 mm), and 3x (43"/1092 mm).



**LOADING:** Supports vehicle loading equal to 32,000 lbs/14,500 kg per axle, which allows use in areas that accommodate 3 - 4 axle vehicles such as those used for emergency, delivery, and maintenance. Meets AASHTO HS-20 (USA) CSA-S6, 87.5 and OBC 54KN (Canada), and BS EN 1991-1-1:2002 BS EN 1991-1-2:2003 (UK) loading standards when used with standard paving profiles. Increased loading capacity can be achieved by adjusting the standard profiles.

**UTILITIES:** 14"/355 mm apertures easily accommodate new or existing utilities.

**STORMWATER IN/OUT:** Totally open interior allows for easy movement of water into and out of the system.

**FLEXIBILITY:** Independent units allow maximum flexibility around existing or planned site considerations.

**ROOT-FRIENDLY:** Vertically and horizontally contiguous soil ideal for spread of tree roots.

	SOIL CAPACITY	STORMWATER STORAGE
1x	~ 10 ft³ (.28 m³)	~ 2 ft³ (.05 m³)
2x	~ 20 ft³ (.56 m³)	~ 4 ft³ (.10 m³)
3x	~ 30 ft³ (.84 m³)	~ 6 ft³ (.15 m³)

## MATERIAL SPECIFICATIONS

Deck: fiberglass reinforced, chemically-coupled, impact modified polypropylene  
Base and post: homopolymer polypropylene

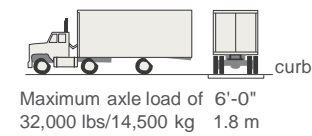


ENGINEERING

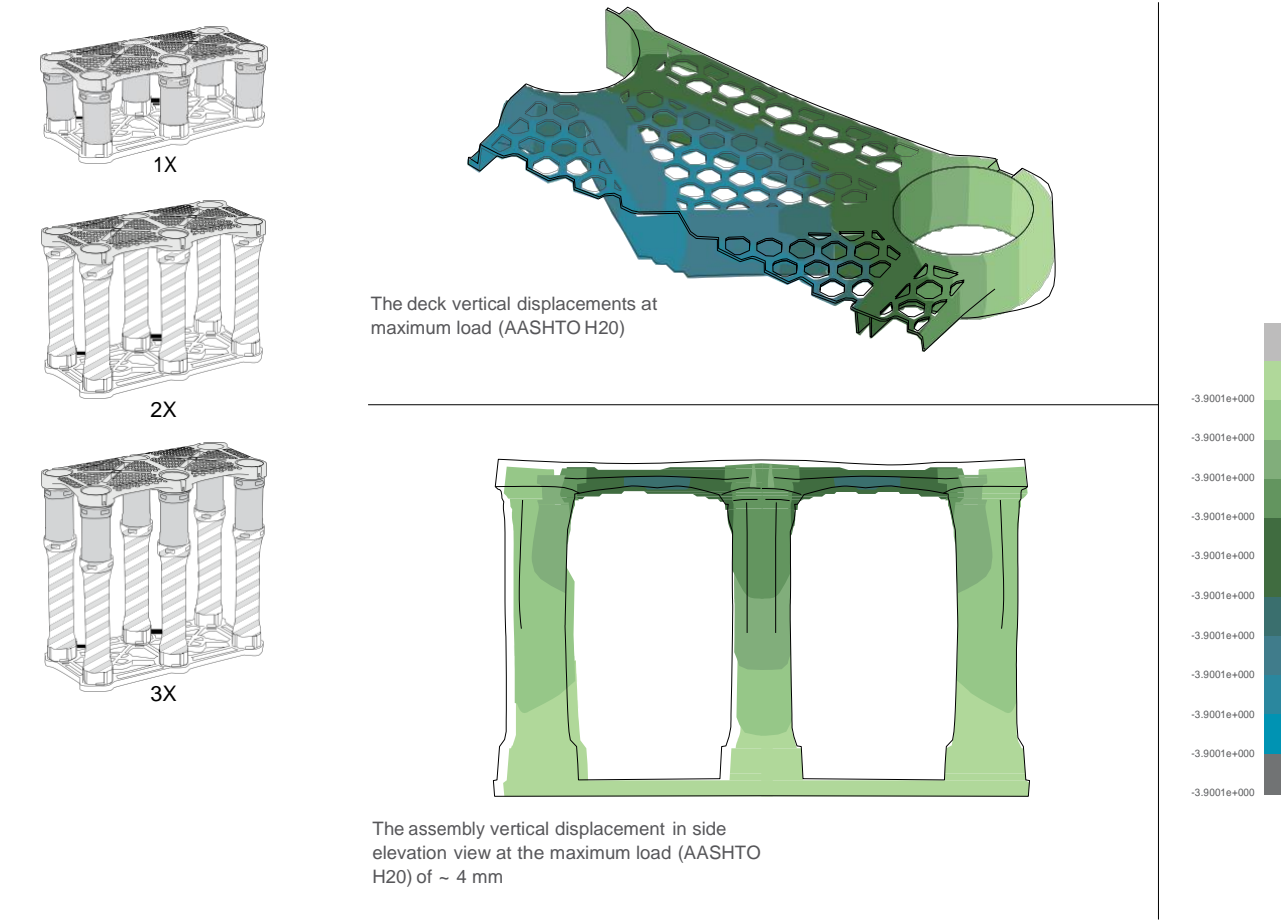
The Silva Cell has been meticulously engineered to handle multiple competing needs, including paving and related vehicle loads, providing maximum space for unimpeded soil volume, and ease of construction – including placement within areas of high utility use.

From initial concept, the Silva Cell was developed using a dual program of Finite Element Analysis (FEA) computer modeling and physical load testing. Using this approach, the FEA was used to predict the overall strength and response to loading, and the physical load testing was used to prove the strength and response. We have years of in-ground projects in multiple applications providing examples of daily use in high demand environments.

For more details, please contact us to discuss applications for your project.



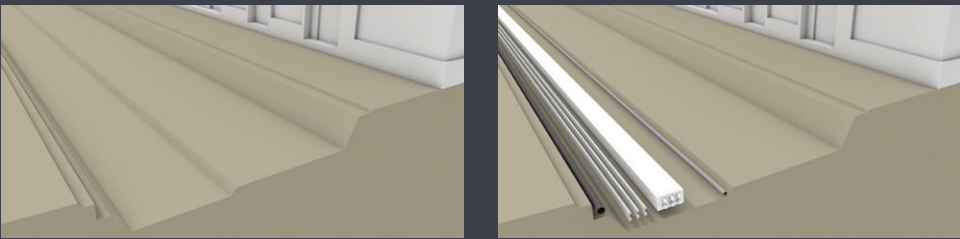
FEA MODELING OF SAMPLE UNDER TRUCK LOAD



INSTALLATION

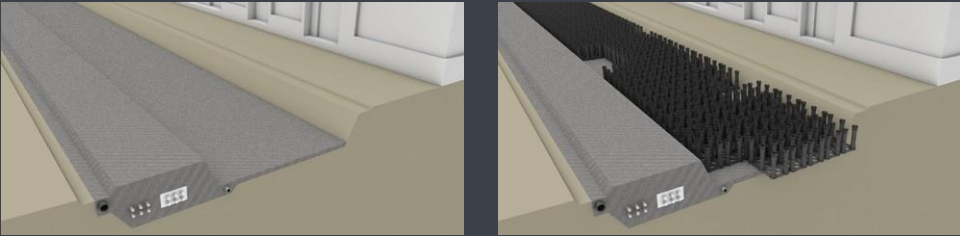
Left: Excavate the area for installation.

Right: Install utilities/services.



Left: Install aggregate base course.

Right: Install Silva Cells.



Left: Install soil (native, specified, or bioretention) and walk-through compaction in conjunction with placement of Silva Cells.

Right: Complete remainder of construction process.

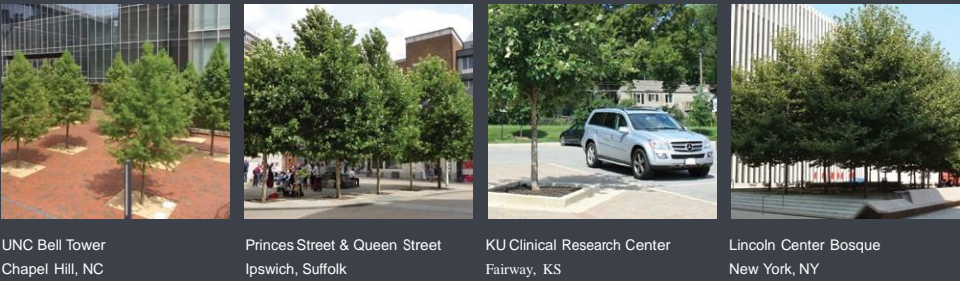
Graphics and streetscape design by planningAlliance.



DeepRoot & Natural Habitats is committed to making sure that every project is successful. As part of that commitment, we provide technical reviews, pre-installation training, and on-site visits at no cost.

We also supply a comprehensive Operations & Maintenance Manual that includes guidelines on maintenance, repairs (planned and emergency), programmatic and administrative information, and more.

Plazas, Streetscapes, Parking lots, On-structure.



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