Using Porous Asphalt and CU-Structural Soil®

Cornell University

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UHI

Founded in 1980 with the explicit mission of improving the quality of urban life by enhancing the functions of plants within the urban ecosystem, the Urban Horticulture Institute program integrates plant stress physiology, horticultural science, plant ecology and soil science and applies them to three broad areas of inquiry.

They are:

• The selection, evaluation and propagation of superior plants with improved tolerance of biotic and abiotic stresses, and enhanced functional uses in the disturbed landscape.

• Developing improved technologies for assessing and ameliorating site limitations to improve plant growth and development.

• Developing improved transplant technologies to insure the successful establishment of plants in the urban environment.

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Porous Asphalt on CU-Structural Soil™ Parking Lot, Ithaca, NY.

The Case for Porous Asphalt Pavement:

Why do we need it, what is it, and how is it used?

Phase I and II National Pollution Discharge Elimination System (NPDES) guidelines serve to eliminate runoff from both point and non-point source pollution by mandating that the first half inch of runoff caused by storm events remain on site. Traditionally, solutions to this problem include retention/detention ponds and/or the use of bioswales (Figs. 1.3 & 1.4). However, these solutions require space ordinarily allotted to other uses.

Fig. 1.1 Section of Six Mile Creek, Ithaca, N.Y. Local runoff generated during a 1" rain storm. High water is due to runoff generated by upstream impervious surfaces like parking lots and building roofs.

Fig. 1.2 Same Section of Six Mile Creek, Ithaca, N.Y. Note base flow conditions of this section of the creek during dry conditions.

However, a porous asphalt system allows for water to flow through the pavement and into a reservoir of gravel beneath the surface. Once inside this gravel reservoir, the water slowly filters into the subgrade below, naturally recharging groundwater levels.

Fig. 1.3 Example of a retention/detention pond adjacent to a surface lot at Cornell University, Ithaca, NY. This treatment uses space that could be otherwise directed towards other uses.

Fig. 1.4 Example of a bioswale in a surface parking lot in Chicago, IL. This treatment uses space that could be otherwise directed towards other uses.

What Is Porous Asphalt?

Porous asphalt is similar to traditional asphalt in every way but the mix specification. Unlike traditional asphalt, porous asphalt leaves out the fine particles in the mix. Leaving out these finer particles leaves gaps within the profile of the asphalt that allow water to flow through the pavement, rather than over the pavement (Figs. 1.5 & 1.6). A comparison of the two types show that porous asphalt looks less finished when compared to traditional asphalt (Figs. 1.7 & 1.8).

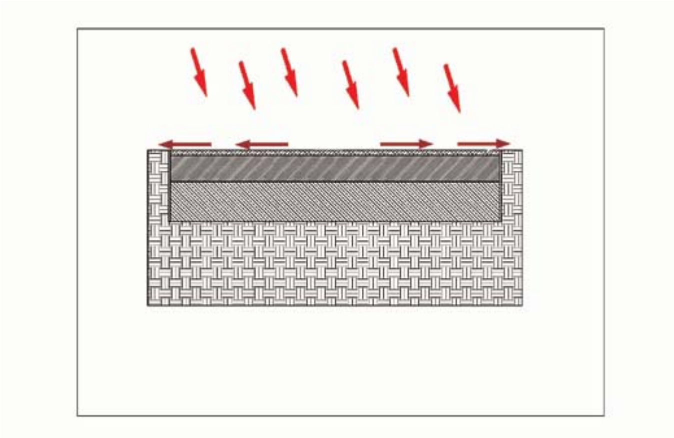


Fig. 1.5 Rain on a traditional asphalt parking lot hits the surface and typically runs off into a storm sewer system.

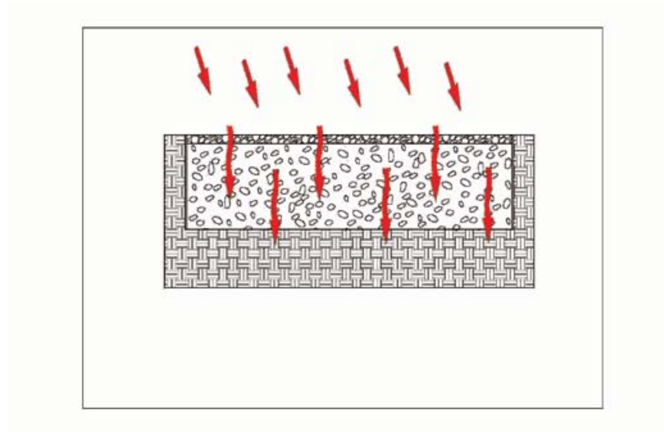


Fig. 1.6 Rain on porous asphalt parking lots hits the surface and runs through pavement into a gravel reservoir below. Water then infiltrates into the ground, recharging groundwater over time.

Why is the Cornell University porous asphalt system different than traditional porous asphalt?

The Cornell University porous asphalt system is different than traditional porous asphalt installations because of the material used in the gravel reservoir underneath the pavement surface. Traditional porous asphalt technology approaches the problem only from a water quantity and quality standpoint and calls for the use of uncompacted gravel (Fig. 1.9) in the reservoir underneath the pavement.

Rather than a base course of gravel, the Cornell porous asphalt system uses CU-Structural Soil®, which has two benefits (Fig. 1.10). The first is that CU-Structural Soil® is designed to be compacted, making it easier for contractors to install. Second, CU-Soil® is engineered for healthier tree growth in the toughest of urban environments, resulting in better plant establishment in and adjacent to pavements. This has been proven over fifteen years of study and actual installations.

The combination of porous asphalt and CU-Structural Soil® allows both water and air to infiltrate the base course underneath the pavement surface. Increased water and air not only allows for healthier root and tree growth, but also allows the tree to aid in further reducing water levels through plant transpiration. This combination, then, not only serves the environment from a water quantity and quality standpoint, but also adds a "sustainably green" component to the porous asphalt and CU-Structural Soil® infrastructure.

Fig. 1.7 A comparison of traditional asphalt (left) and porous asphalt (right) when dry. The gaps in the porous asphalt make it appear more coarse and unfinished.

Fig.1.8 A comparison of traditional asphalt (left) and porous asphalt (right) when wet. The gaps created by leaving out the finer particles in porous asphalt allow water to infiltrate pavement and into a gravel reservoir below. As a result, porous asphalt appears dull when wet, because the water runs through and does not pond, also creating a high friction surface.

Fig. 1.9 Gravel used under traditional porous asphalt system.

Fig.1.10 CU-Structural Soil® Matrix. Soil particles within the media adhere to gravel.

CU-Structural Soil® Basics

CU-Structural Soil® (U.S. Patent # 5,849,069) is a two-part system comprised of a rigid stone "lattice" to meet engineering requirements for a load-bearing soil, and a quantity of soil, to meet tree requirements for root growth. The lattice of load-bearing stones provides stability as well as interconnected voids for root penetration, air and water movement (Fig. 1.11). The narrow graded 0.75"-1.5" angular crushed stone specified for CU-Structural Soil® is designed to ensure the greatest porosity. Crushed or angular stone compacts easily and has more pore space than round stone. Because stone is the load-bearing component of structural soil, the aggregates used should meet regional or state department of transportation standards for pavement base courses.

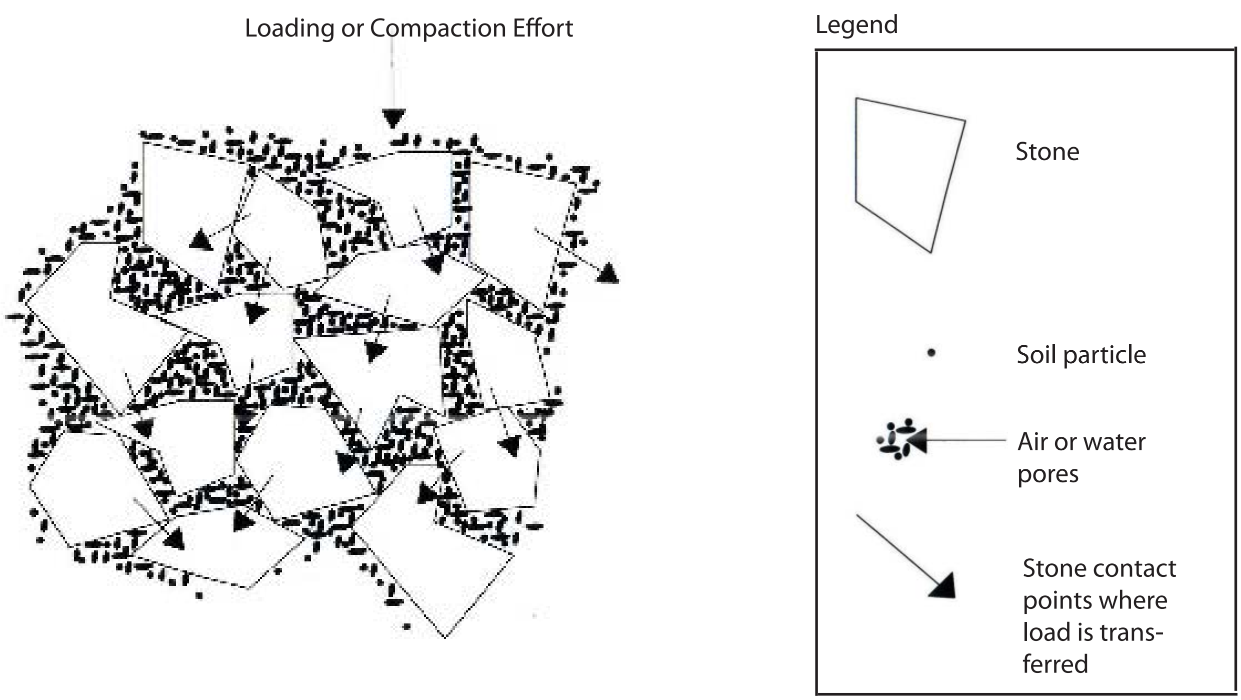


Fig.1.11 Conceptual diagram of CU-Structural Soil® including stone-on-stone compaction and soil in interstitial spaces used as a base course for pavements.

Since among soil textures, clay has the most water and nutrient-holding capacity, a loam to clay loam, with a minimum of 20% clay, is selected as the soil component for the CU-Structural Soil® system. CU-Structural Soil® should also have organic matter content ranging from 2%-5% to ensure nutrient and water holding while encouraging beneficial microbial activity. A minimum of 20% clay is also essential for an adequate cation exchange capacity.

Fig.1.12 Grading of CU-Structural Soil® used as the reservoir base course for porous asphalt lot in Ithaca, NY. For this lot, 2' of CU-Structural Soil® was used to hold a 100 year storm event of 6" in 24 hours.

CU Structural Soil® is a carefully chosen aggregate with the proper stone to soil ratio which creates a medium for healthy root growth that can also be compacted to meet engineers' load-bearing specifications (Fig. 1.13 and 1.14). The intention is to "suspend" the clay soil between the stones without over-filling the voids, which would compromise aeration and bearing capacity. CU-Structural Soil® utilizes Gelscape® hydrogel as a non-toxic, non-phytotoxic tackifier, in addition to stone and soil components to help adhere soil to the stone creating a uniform mix.

Fig.1.13 Compaction of CU-Structural Soil® in a test plot on the Cornell University campus. A vibrating tamper compacts CU-Soil™ so that pavement may be laid on top.

Fig.1.14 Compaction of porous asphalt on CU-Structural Soil® in a test plot on the Cornell University campus.

Soil Compaction and the Importance of Macropores

Both new and ongoing construction disturbs and compacts soil (Fig. 1.15), crushing the spaces in between the soil particles. These spaces are called pores, and are made up of different sizes: small pores are micropores, while large spaces are called macropores (Fig 1.16). Water and air travel through the larger macro-

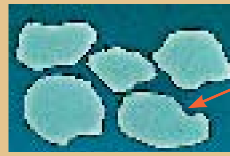
Fig. 1.15 Typical construction environment where compaction and construction activities create difficult conditions for post construction landscapes.

Macropores

• the relatively large spaces between soil aggregates

• water drains quickly through macropores

• air diffuses through macropores



Macropores are the spaces between the soil aggregates

Fig. 1.16 Macropores are spaces between soil aggregates that allow water, air and subsequently root growth.

pores. Loss of macropores has three negative consequences (Fig. 1.17): restricted aeration within the soil profile, diminished water drainage from the soil profile, and the creation of a dense soil that is difficult for roots to penetrate (Fig. 1.18). These effects all limit useable rooting space in urban environments.

	CU-Structural Soil™	Soil Alone
Mean Total Porosity @ 95%-100% Proctor Density:	26%	34%
Mean Macropores Based on Total Pore Volume @ 95% Proctor:	30.9%	2.2%
Infiltration rate:	>24"/hr	0.5"/hr

Fig.1.17 Table of Porosity and Infiltration Rates for CU-Structural Soil® and Clay Loam Soil Compacted to 95% Proctor Density. Notice that Macropores make up 31% of CU-Structural Soil® pores, but only 2% of a traditional soil. As illustrated, this reduces drainage and infiltration in a natural soil, but not in the CU-Structural Soil®.

Fig. 1.18 Compacted soil from a typical construction site. Lack of structure prohibits root penetration and growth.

Fig. 1.19 Roots near pavement adapt and change direction when they hit the side of the paving profile.

What happens when roots encounter dense, compacted soil?

When roots encounter dense soil and pavement, they change direction, stop growing, or adapt by remaining abnormally close to the surface (Fig. 1.19). This superficial rooting makes urban trees more vulnerable to drought and can cause pavement heaving (Fig. 1.20). However, if a dense soil is waterlogged, tree roots can also rot from lack of oxygen. When CU Structural Soil® is installed beneath porous asphalt, water and air can move through the pavement and into the soil macropores. This circulation not only prevents root rot, but also allows rooting deep within the CU-Structural Soil® media.

Using CU-Structural Soil® for Porous Asphalt Parking Lots

CU-Structural Soil® is intended for paved sites to provide adequate soil volumes for tree roots under pavements. It can and should be used under porous asphalt parking lots (Fig. 1.21), low-use access roads, pedestrian mall paving, and sidewalks. Research at Cornell has shown that tree roots in CU-Structural Soil® profiles grow deep into the CU-Structural Soil® material, away from the fluctuating temperatures at the pavement surface. One benefit of this is that roots are much less likely to heave and crack pavement than with conventional paving systems.

Fig. 1.20 Sidewalk heaving caused by superficial tree root growth, Ithaca, NY

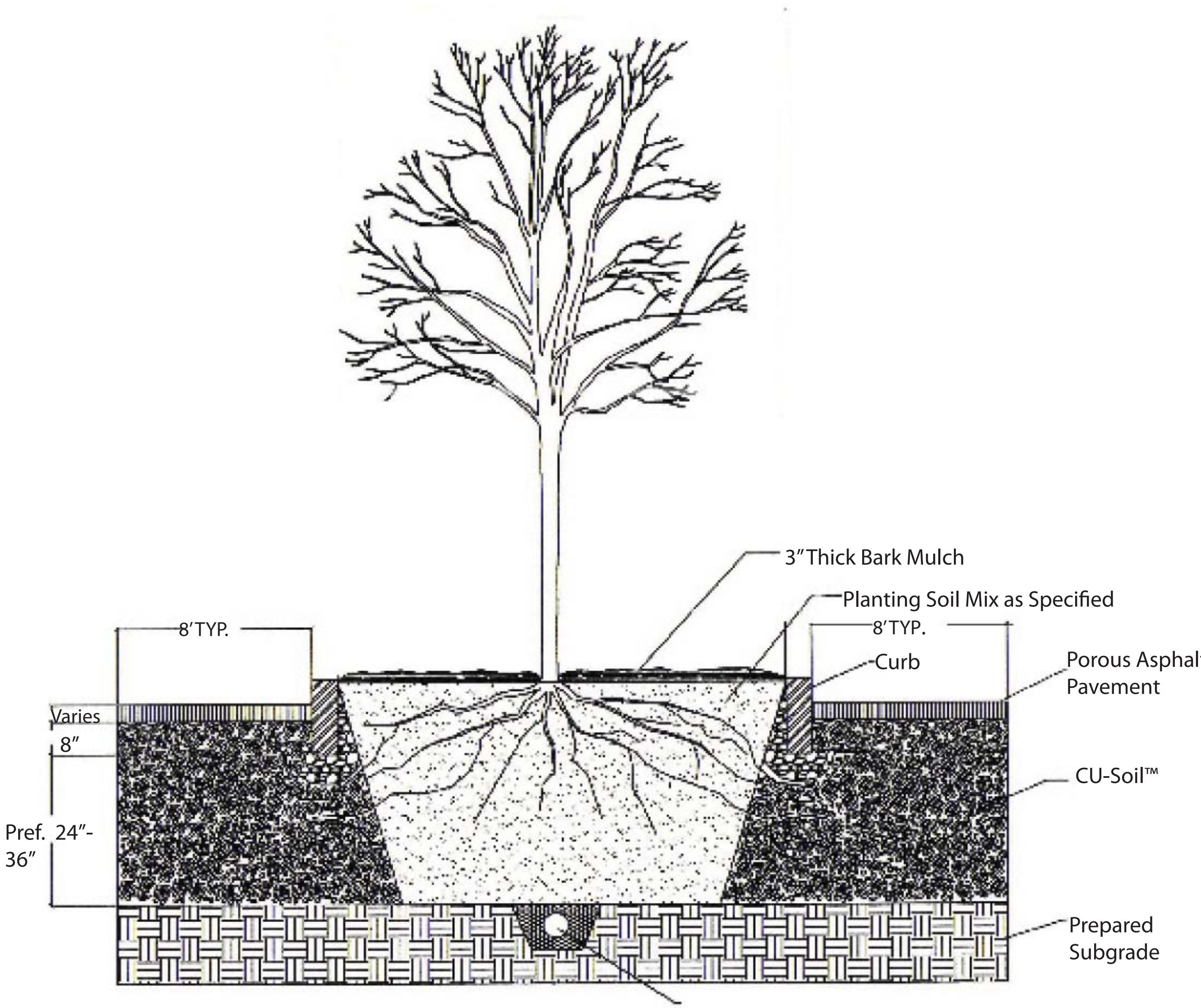


Fig. 1.21 Bare root tree in typical porous asphalt and CU Structural Soil® parking lot island or plaza

Trees in Parking Lots and Plazas:

CU-Structural Soil® may also be used to enlarge a ‘tree island’ within a parking lot. With a large tree planting area, good, well draining topsoil can be used in the island and CU-Structural Soil® added as an unseen rooting medium underneath the porous asphalt (Figs. 1.22 - 1.23).

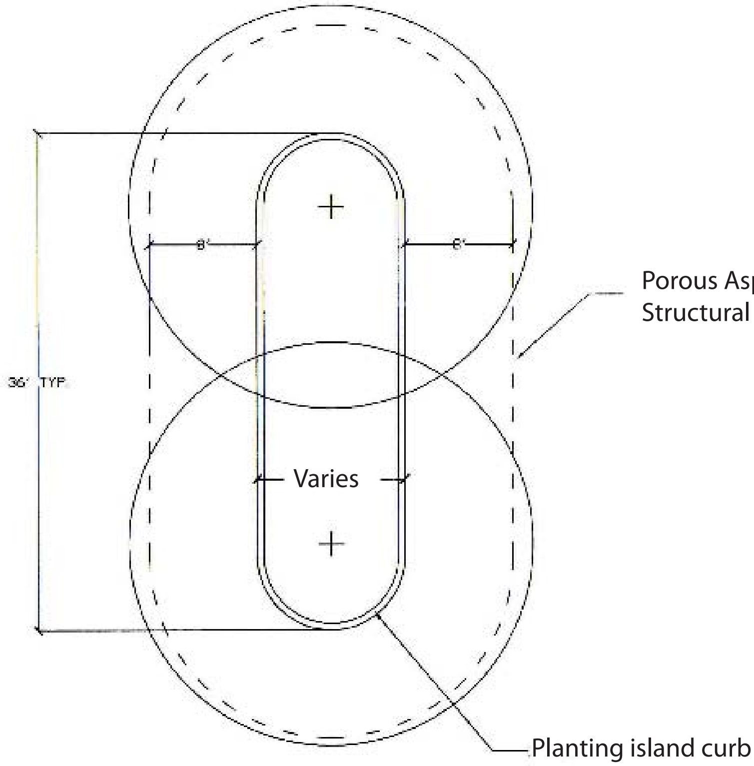


Fig. 1.22 Plan view of planting island

Fig. 1.23 Potential use of CU-Structural Soil® to enlarge planting islands in parking lots without taking up parking space.

Trees in parking lots, as well as paved plazas, benefit from the use of CU-Structural Soil®. Whether there is a curb or not, good, well-drained topsoil may be used around the tree where the opening is at least 5’ x 5’. If the opening is smaller, CU-Structural Soil® should be used right up to the tree ball (Fig. 1.24 & 1.25).

Given the large volume of CU-Structural Soil® for tree roots to explore, irrigation may not be necessary after tree establishment—the decision depends on the region of the country and on site management. While there is less moisture in CU-Structural Soil® on a per-volume basis than in conventional soil, the root system in structural soil has more room for expansion, allowing for increased water absorption. Supplemental water should be provided during the first growing season as would be expected for any newly planted tree. In regions where irrigation is necessary to grow trees, low-volume, under-pavement irrigation systems have been used successfully. Fertilizer can be dissolved into the irrigation water if necessary, although to date, nutrient deficiencies have not been noted, probably due to the large volume of rooting media.

Fig. 1.24 In this parking lot, there is only a 3 foot opening for tree planting. Here CU-Structural Soil® was installed underneath the asphalt to extend the rooting volume for the trees. Once the pavement was cut, bare root Accolade Elms were planted in November 2005.

Designing with CU-Structural Soil® and Porous Asphalt for Parking Lots

When using CU-Structural Soil® and porous asphalt in parking lot design, there are a few things that are important to keep in mind:

- Porous asphalt has it's own mix specification. The specification Cornell used for their research can be found on the next page of this booklet.
- The depth of the gravel reservoir underneath the porous asphalt depends on the size of the storm event that you want to mitigate (Fig 1.30 on page 10).
- Infiltration rates for ground water recharge vary greatly and depend on the type of soil underneath the gravel reservoir. Because of this reality, it is necessary to perform a soil test to find out the soil type and it's characteristics underneath the reservoir.
- Conventional storm drainage may be required by regulation. If this is the case, french drains or a traditional PVC drainage system may be installed below the porous asphalt surface to insure that water does not back up through the pavement profile.
- Porous asphalt needs maintenence. It should never be sealed. To keep porous asphalt porous, it should be vacuumed once every two years to remove silt and dirt particles.
- Proper sediment control measures such as silt fencing should be used during construction to keep surrounding sediment off of the porous asphalt. If not, pores in the asphalt may clog and become less effective.
- Tree pits should not have solid curbs. Additionally, the asphalt should be cut for the tree pits in the later stages of construction. Trees and other landscape elements should be planted last to ensure there is no damage to them during construction.

Fig. 1.25 Students planting bare root *Ulmus japonica* x *Ulmus wilsoniana* 'Accolade' (Accolade Elm) in the apron containing CU-Structural Soil® surrounding the porous asphalt parking lot in Ithaca, NY in November 2005.

Fig. 1.26 Students planting bare root *Ulmus japonica* x *Ulmus wilsoniana* 'Accolade' (Accolade Elm) in the 3' by 18' CU-Structural Soil® tree pit cut into the porous asphalt parking lot in Ithaca, NY in November 2005. 3" of bark mulch was added on top of the CU-Structural Soil®

Fig. 1.27 Porous Asphalt straight off the truck for installation at the Cornell Test Plots. Note the absence of fine particles within the asphalt mix.

Porous Bituminous Asphalt Specification
Ithaca, NY Porous Asphalt Medium Duty Parking Lot

1. Bituminous surface course for porous paving shall be two and one-half (2.5) inches thick with a bituminous mix of 5.5% to 6% by weight dry aggregate. In accordance with ASTM D6390, draindown of the binder shall be no greater than 0.3%. If more absorptive aggregates, such as limestone, are used in the mix then the amount of bitumen is to be based on the testing procedures outlined in the National Asphalt Pavement Association's Information Series 131 – "Porous Asphalt Pavements" (2003) or NYSDOT equivalent.

2. Use neat asphalt binder modified with an elastomeric polymer to produce a binder meeting the requirements of PG 76-22. The elastomeric polymer shall be styrene-butadiene-styrene (SBS), or approved equal, applied at a rate of 3% by total weight of the binder. The composite materials shall be thoroughly blended at the asphalt refinery or terminal prior to being loaded into the transport vehicle. The polymer modified asphalt binder shall be heat and storage stable.

3. Aggregate in the asphalt mix shall be minimum 90% crushed material and have a gradation of:

U.S. Standard Sieve Size		Percent Passing
½"	(12.5mm)	100
3/8"	(9.5mm)	92-98
4	(4.75mm)	32-38
8	(2.36mm)	12-18
16	(1.18mm)	7-13
30	(600 mm)	0-5
200	(75 mm)	0-3

4. Add hydrated lime at a dosage rate of 1.0% by weight of the total dry aggregate to mixes containing granite. Hydrated lime shall meet the requirements of ASTM C 977. The additive must be able to prevent the separation of the asphalt binder from the aggregate and achieve a required tensile strength ratio (TSR) of at least 80% of the asphalt mix.

The asphaltic mix shall be tested for its resistance to stripping by water in accordance with ASTM D-3625. If the estimated coating area is not above 95 percent, anti-stripping agents shall be added to the asphalt.

Designing with CU-Structural Soil® and Porous Asphalt for Parking Lots

With the specifications outlined on the previous page, a few simple construction details will provide the bulk of the information needed for specifying, bidding, and installation of a porous asphalt construction project. While the simple drawings below (Figs. 1.28 & 1.29) are helpful, keep in mind that every design is different and will necessitate the level of detail appropriate for each different design scenario. Additional details will be needed for ADA compliance, curbing, tree protection, signage and additional drainage, if necessary.

Reservoir Sizing: How Deep is Deep Enough?

The depths specified for the CU Structural Soil® reservoirs below the pavement in the adjacent details (Figs. 1.28 and 1.29) were created to mitigate a 100 year storm of 6" in 24 hours, based on local rainfall data for Ithaca, N.Y. This level of mitigation is quite high, but keep in mind that precipitation is both regional and highly variable from location to location.

In order to properly mitigate any storm, exact rainfall data must be obtained from local sources such as state university extension agencies and local meteorological stations. To help design the proper reservoir depth to accomodate for any rain event, the chart below (Fig. 1.30) can be used as a general aid. This information is based on the known void space for CU-Structural Soil® of 26%. It is important to note that while depths less than 24" will mitigate a storm event up to 6.25" in 24 hours, it will not support large tree growth because the reservoir will be too shallow to accomodate healthy tree root growth. For healthy trees, a reservoir depth of 24" to 36" is optimum.

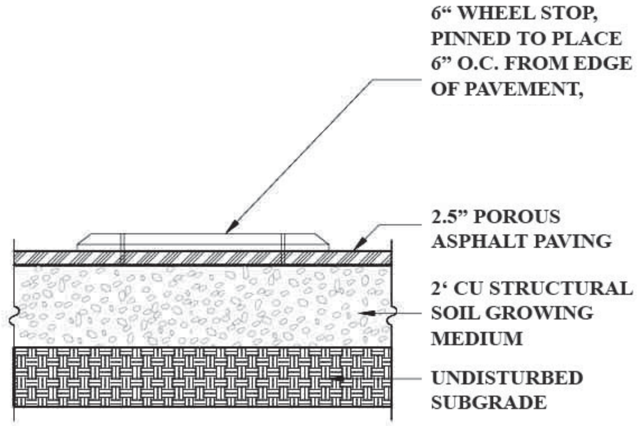


Fig. 1.28 Construction detail for the porous asphalt profile used in the porous asphalt parking lot in Ithaca, N.Y. Note that the 2' reservoir depth was based on local rainfall data and will vary by region.

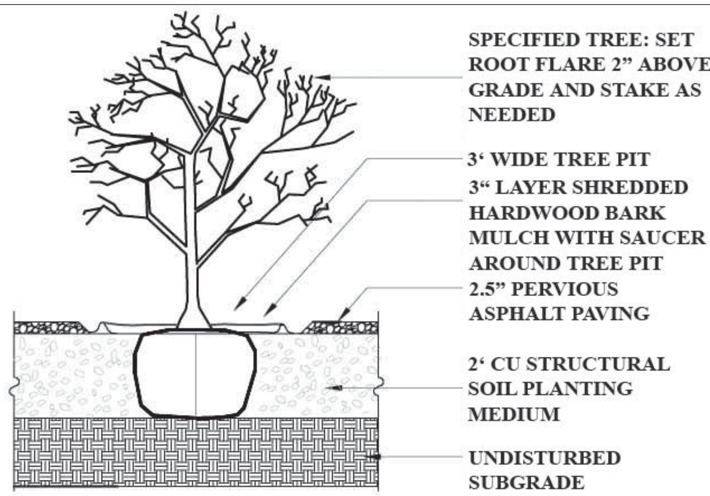


Fig. 1.29 Construction detail for the tree pit cut into the porous asphalt profile in Ithaca, N.Y. Note that a 24" to 36" of Stgructural Soil is optimum for healthy root development within the reservoir. A 24" to 36" reservoir depth will accomodate a rain event between 6.25" and 9.36" of rain in 24 hours based on the 26% void space of the CU-Structural Soil®.

Size of Rain Event	Depth of Reservoir Needed to Mitigate Rain Event
1.56"	6"
3.12"	12"
4.68"	18"
6.25"	24"
7.8"	30"
9.36"	36"

Fig. 1.30 Reservoir depths and the corresponding levels of mitigated rain events based on the 26% void space within CU-Structural Soil® mix. Numbers in gray box illustrate the depths necessary to accomodate optimum healthy tree root development.

Realities of Working With Porous Asphalt: Lessons Learned

Porous Asphalt is not a new technology. It has been used successfully for over thirty years and is gaining popularity as a construction technique. Despite this, there is resistance to it's manufacturing and use:

> Regulators don't like it specified because it embraces water. Rather than working with new ideas, regulators are sticking to the decades old technology that it is better to remove water completely from the site through storm sewers rather than include it as part of the system. With the new NPDES regulations, this is slowly changing.
>
> Some planning agencies force designers to add traditional drainage systems in case of failure. This is not a bad idea for shallow profile reservoirs and extreme rain events. Although we can plan all we want, there is no accounting for Mother Nature. In this case we recommend additional drainage systems set just underneath the pavement surface (Fig. 1.31).
>
> Manufacturers don't like it because they are forced to shut down their asphalt bins and clean them out before and after mixing. Because of this, costs may be more per ton, but can vary greatly depending on the manufacturer.
>
> Contractors don't like it because it is not only messy, but porous asphalt also cools quicker, demanding a shorter delivery schedule with less time for installation.

Even with this resistance, porous asphalt and CU-Soil™ is a proven technology. Attendance at porous asphalt conferences has risen and includes DPW officials, regulators, engineers and designers. As with any new technology, there is some initial reluctance to embrace new ways. However, the more that porous asphalt is used, the more its benefits will be realized. When used in combination with CU-Structural Soil®, it can be an effective method for reducing runoff and point source pollution, lowering urban temperatures, recharging groundwater levels, and growing healthier trees.

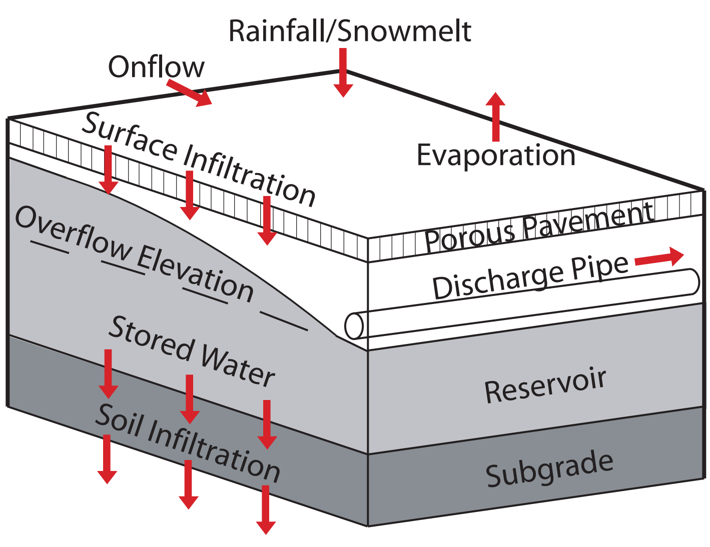


Fig. 1.31 Subsurface drainage installation. Note that drain pipe should be placed 1/3 to 1/2 the depth of the reservoir profile. This will ensure reservoir retains water and allows infiltration into subgrade below as well as ensuring that reservoir does not flood and flow back through the porous asphalt.

Some Street Trees Appropriate for Use in CU Structural Soil®

Botanic Name	Common Name
Acer campestre	Hedge Maple
Acer miyabei	Miyabei Maple
Acer nigrum	Black Maple
Acer platanoides	Norway Maple
Acer pseudoplatanus	Sycamore Maple
Acer truncatum	Painted Maple
Carpinus betulus	European Hornbeam
Celtis occidentalis	Hackberry
Cercis canadensis	Redbud
Cornus foemina (Cornus racemosa)	Gray Dogwood
Corylus colurna	Turkish Hazelnut
Crataegus crus-galli	Cockspur Hawthorn
Crataegus phaenopyrum	Washington Hawthorn
Crataegus viridis	Green Hawthorn
Eucommia ulmoides	Hardy Rubber Tree
Fraxinus americana	White Ash
Fraxinus excelsior	European Ash
Fraxinus pennsylvanica	Green Ash
Ginkgo biloba	Ginkgo
Gleditsia triacanthos	Honey Locust
Gymnocladus dioicus	Kentucky Coffee Tree
Koelreuteria paniculata	Goldenrain tree
Maclura pomifera	Osage Orange
Malus spp.	Crabapple
Platanus x acerifolia	London Plane
Pyrus calleryana	Callery Pear
Pyrus ussuriensis	Ussurian Pear
Quercus macrocarpa	Mossy Cup Oak
Quercus muehlenbergii	Chinkapin Oak
Quercus robur	English Oak
Robinia pseudacacia	Black Locust
Styphnolobium japonicum (Sophora japonica)	Japanese Pagoda Tree
Syringa reticulata	Japanese Tree Lilac
Tilia cordata	Littleleaf Linden
Tilia tomentosa	Silver Linden
Tilia x euchlora	Crimean Linden
Ulmus americana	American Elm
Ulmus carpinifolia	Smooth-Leaf Elm
Ulmus parvifolia	Lace Bark Elm
Ulmus spp.	Elm Hybrids
Zelkova serrata	Japanese Zelkova

(Names in parantheses reflect recently changed botanical names)

Frequently Asked Questions

Are CU-Structural Soil® and porous asphalt systems susceptible to frost heave?

Observation of porous asphalt throughout the US and Canada shows that a minimum of 24" for a CU Structural Soil® reservoir depth negates any heaving due to consequent freezing and thawing. Additionally, there have been no observed instances of freeze/thaw damage in any CU-Structural Soil® installations in the fifteen plus years since its inception. Based on drainage testing and swell data on this extremely porous system, CU-Structural Soil® appears quite stable.

What is the recommended depth for CU-Structural Soil® underneath porous asphalt?

We suggest a minimum of 24", but 36" is preferred to encourage healthy tree root development within the soil. Reservoir depths of CU Structural Soil® between 24" to 36" will mitigate between 6.25" and 9.36" of rain in a 24 hour period. A base course of gravel between the CU-Structural Soil® reservoir and the porous asphalt is not needed because it was designed to be as strong as a conventional stone base course. Properly compacted to 95-100% Proctor Density or Modified Proctor Density, it has a CBR of 50 or greater.

What is the recommended length and width for CU-Structural Soil® and porous asphalt installation?

CU-Structural Soil® was designed to go under the entire porous asphalt pavement area. This homogeneity would ensure uniform engineering characteristics below the pavement, particularly in regard to frost heaving and drainage and also to ensure proper root development. Since the root system of trees installed within the porous asphalt/CU-Structural Soil® system helps to remove water from the reservoir base course, it would be best to use CU-Structural Soil® for the entire base course reservoir.

How does the porous asphalt and CU-Structural Soil® system deal with pollutants such as oil?

Research shows that 97.9%-99% of the hydrocarbons found in pollutants such as oil are suspended within the first few inches of the surface. During suspension, microorganisms biodegrade the hydrocarbons into their constituent parts of simple chemical components which cease to exist as pollutants, and render them harmless to the environment.

What type of maintenance is needed for a porous asphalt and CU-Structural Soil® system?

The best maintenance for any type of porous pavement is a vacuum treatment every two to five years to remove sediment from the pores within the pavement, although the oldest installations have never been vacuumed and show little effects of clogging. Porous asphalt systems should not be pressure washed since this treatment further embeds sediment within the surface. Additionally, porous asphalt systems should never be sealed. Once a sealant is applied, the system will not work ever again.

Won't the soil migrate down through a CU-Structural Soil® profile after installation?

The excavation of a seven-year-old installation did not show any soil migration. The pores between stones in CU-Structural Soil® are mostly filled with soil so there are few empty spaces for soil to migrate to.

What happens when roots expand in CU-Structural Soil®?

There will come a time when the roots will likely displace the stone, but if the roots are, as we have observed, deep down in the profile, the pressure they generate during expansion would be spread over a larger surface area. We have seen roots move around the stone and actually surround some stones in older installations, rather than displace the stones.

Can you add normal soil in the tree pit and CU-Structural Soil® under the pavement?

If the tree pit is sufficiently large, greater than 5' x 5', a conventional soil could be used in the open tree pit surrounding the root ball with CU-Structural Soil® extending under the pavement. It would be desirable to use CU-Structural Soil® under the tree ball to prevent the root ball from sinking. Planting trees directly in CU-Structural Soil® provides a firmer base for unit pavers close to the root ball than does conventional soil.

Can you plant balled-and-burlapped, bare root, or containerized trees in CU-Structural Soil®?

Trees from any production system can and have been used. It is important to water the newly planted tree as would be expected when planting in any soil.

Should CU-Structural Soil® be used in urban areas without pavement over the root zone?

CU-Structural Soil® was designed to be used where soil compaction is required, such as under sidewalks, parking lots, medians, plazas, and low-access roads. Where soils are not required to be compacted, a good, well-draining soil should be used.

Can you store large quantities of CU-Structural Soil®?

CU-Structural Soil® is produced only by licensed companies and is preferably not stockpiled. It is mixed as necessary and should be delivered and installed in a timely manner. If any stockpiling is required, protection from rain and contamination should be provided.

What are the oldest installations of CU-Structural Soil®, and porous asphalt and where are they?

CU-Structural Soil® and porous asphalt are a new combination of 15 and 30 year old technologies. As such, the first installation of this combination exists in Ithaca, NY and was installed in 2005. Porous asphalt parking lots are numerous and the oldest include the Walden Pond Reservation in Concord, MA, the Morris Arboretum in Philadelphia, PA, as well as an ever expanding list of corporations and universities across the U.S. CU-Structural Soil® has been used extensively without porous asphalt pavement and the two oldest installations date to 1994; the first is a honeylocust planting at the Staten Island Esplanade Project in NYC, the second is a London Planetree planting on Ho Plaza on the Cornell campus, Ithaca, NY. There are now hundreds of installations of various sizes across the United States and Canada. For more information about installations, visit www.structuralsoil.com or contact Brian Kalter at Amereq, Inc. (see below).

Obtaining CU-Structural Soil®

CU-Structural Soil® is patented and has been licensed to qualified producers to ensure quality control; its trademarked names are CU-Structural Soil® or CU-Soil™. When obtained from a licensed producer, the contractor is guaranteed to have the material mixed and tested to meet research-based specifications. There are licensed producers throughout the US and in Canada. To find the one in your region or to become a licensee, contact Brian Kalter or Fernando Erazo at Amereq Inc., 19 Squadron Blvd. New City, New York 10956. (800) 832-8788 or (info@amereq.com).

Further Information

See the Urban Horticulture Institute website:
www.hort.cornell.edu/uhi and go to Outreach > Structural Soil

A DVD showing research, installation, and tree growth in CU-Structural Soil® is available at:
www.hort.cornell.edu/uhi/outreach/csc/index.html

Or, contact Dr. Nina Bassuk (nlb2@cornell.edu), (607) 255-4586

Research papers supporting this work:

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Fig 1.32 Research Parking Lot in Ithaca, N.Y. The foresection is traditional asphalt on CU-Structural Soil® while the back section of the lot is constructed of porous asphalt on CU- Structural Soil®.