



# Concrete Products for Low Impact Development



# Low Impact Development

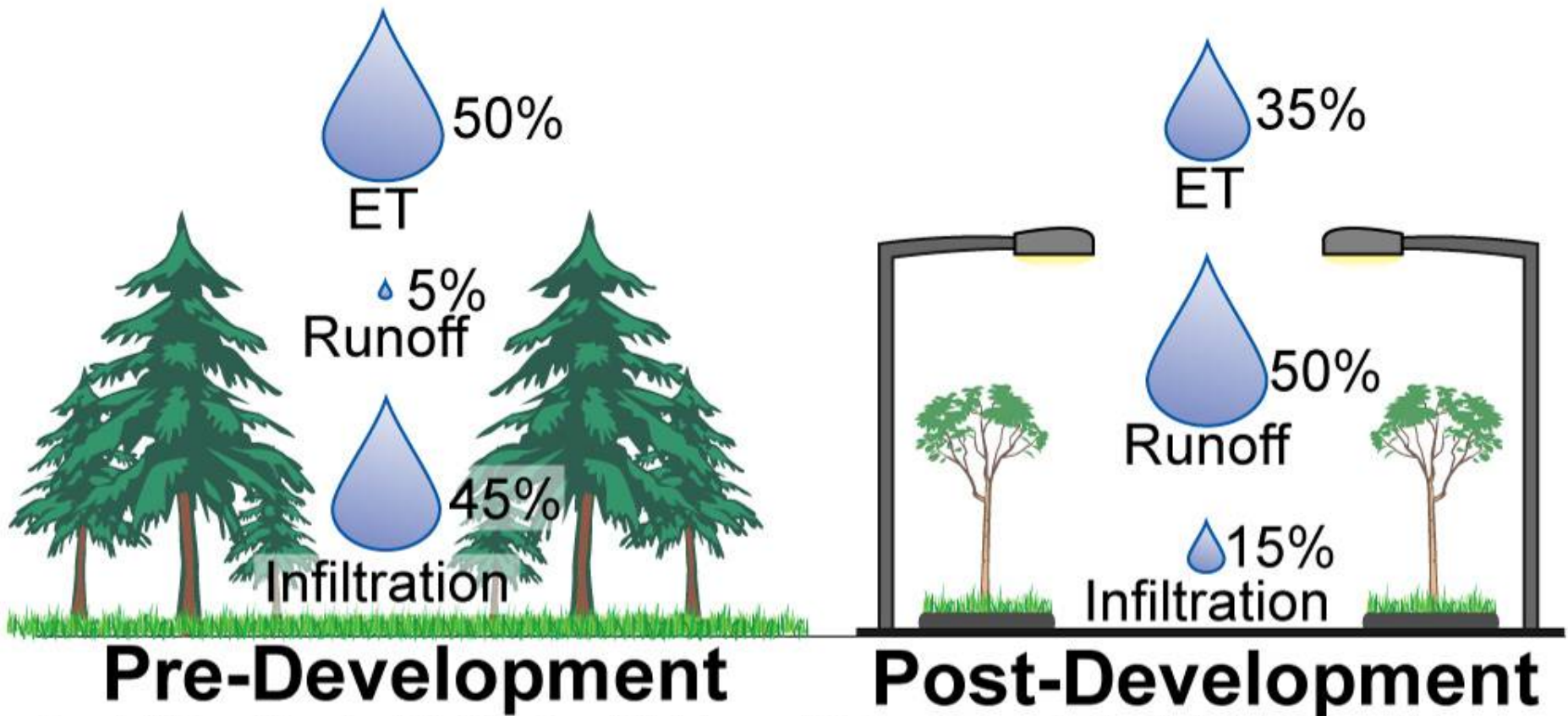
“LID is an approach to land development (or re-development) that works with nature to manage stormwater as close to its source as possible”

Source EPA



# Low Impact Development

## Annual Hydrology



Swank, W.T., and Crossley, D.A. 1988. *Forest Hydrology and Ecology at Coweeta*. New York, NY: Springer-Verlag.



# Maximum Impervious

## City of Montgomery Smart Code

“New developments will not allow for impervious area to exceed 50%”



# Perpetual Taxes

“Building owners will pay a monthly tax based upon their stormwater runoff into the city sewer system”



# The Historical Approach to Stormwater





# Pre Affordable Care Act





# Post Affordable Care Act





# The Problem







**First Baptist Church  
Montgomery, Alabama**



# Overview

Pervious Concrete and Permeable Pavers

Benefits

Basic Construction Techniques

Common Questions and Maintenance

Green Building



# Pervious Concrete

- ◎ A No-Fines Concrete Mix
  - Coarse Aggregate
  - Portland Cement
  - Water
- ◎ Intended for use as an open-graded drainage material



















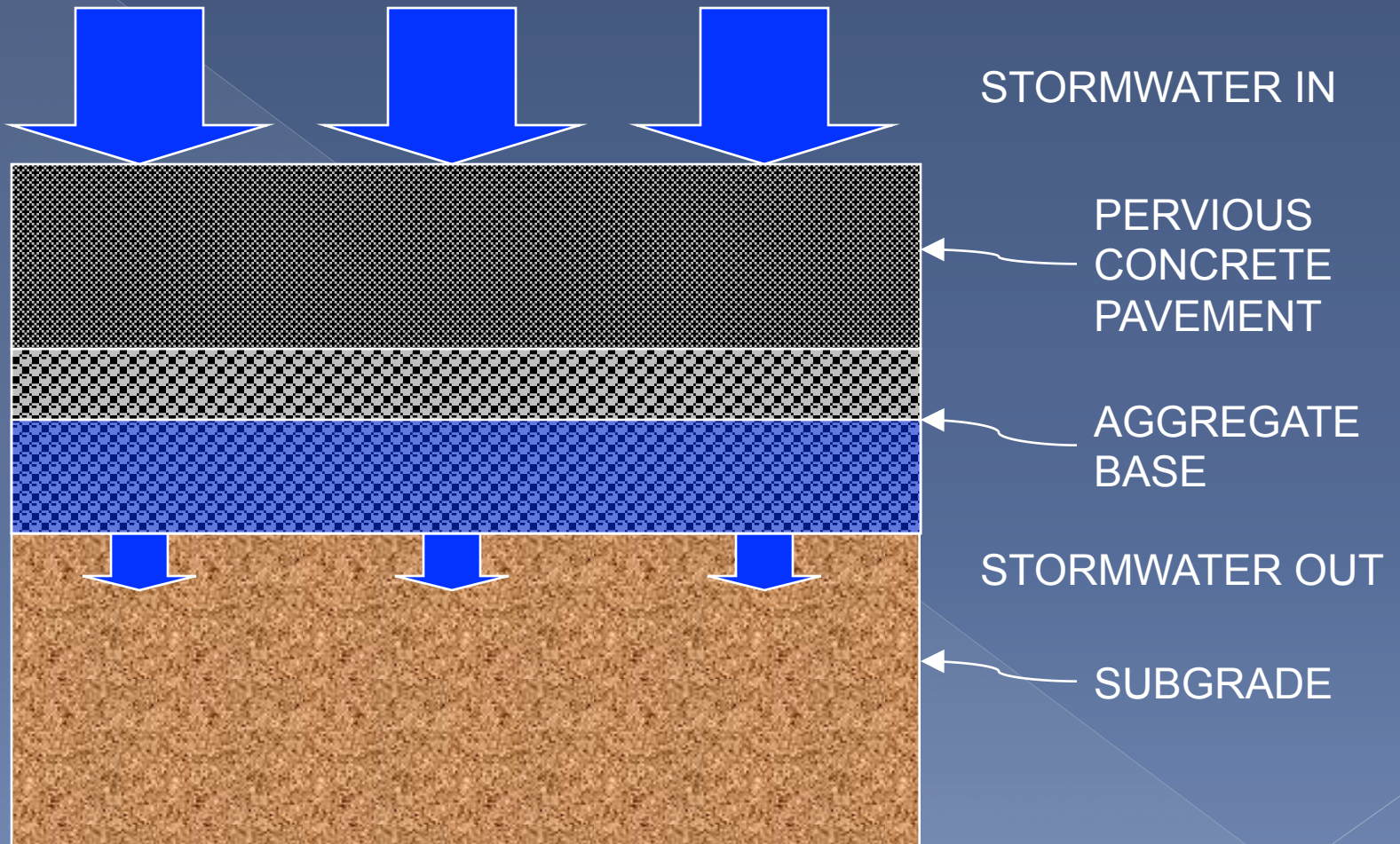














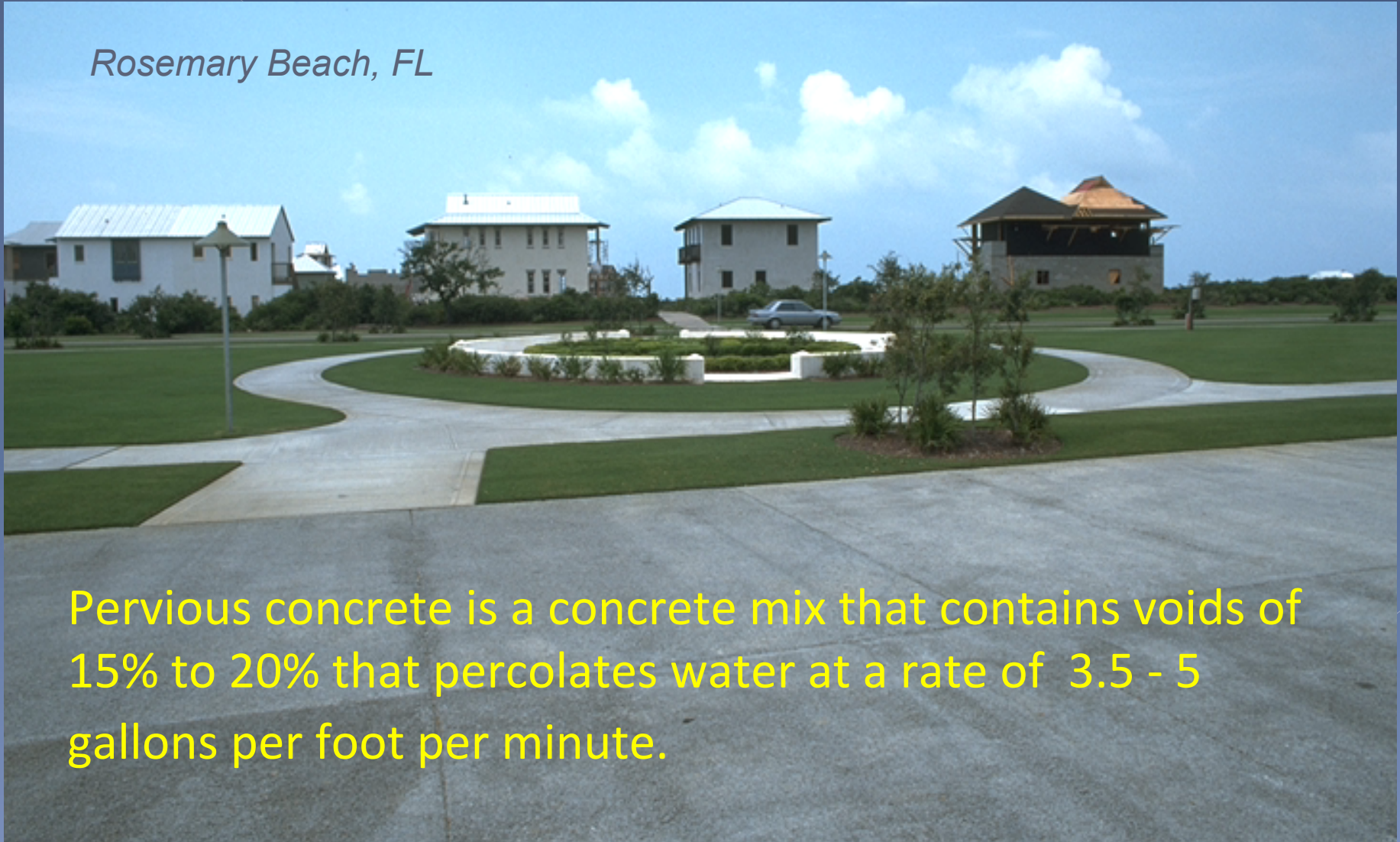
# History of Pervious Concrete

- Pervious pavements in place throughout the Southeast for over 25 years with successful results.
- Used sparingly in Alabama over last fifteen years, mainly in standard applications (sidewalks, parking lots...)
- Recent renewed interest in broad applications with emphasis on environmental benefits (LEED, Green Building Council...)



# Pervious Overview

*Rosemary Beach, FL*



Pervious concrete is a concrete mix that contains voids of 15% to 20% that percolates water at a rate of 3.5 - 5 gallons per foot per minute.





# Permeable Pavers

“Do I have to cut my  
parking lot?”





Permeable Pavers





**Permeable Paver Application**





**Beach Boat Ramp**

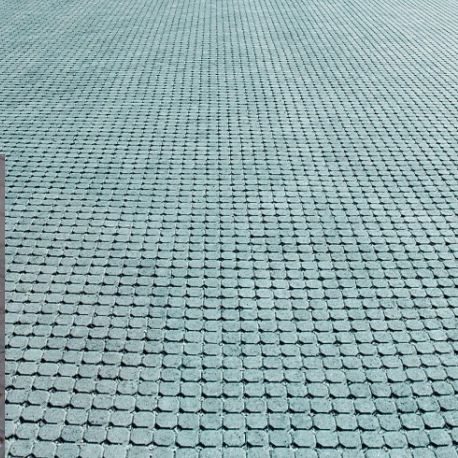
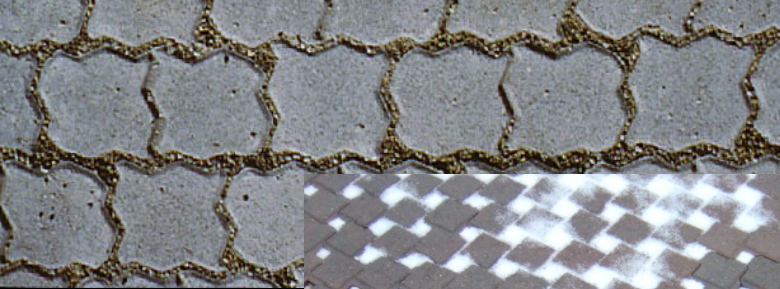
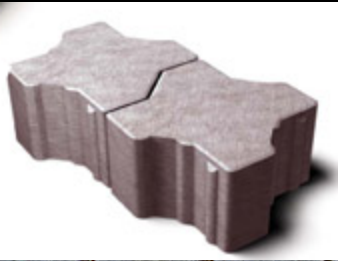




**Hutchinson  
Baptist Church  
Montgomery,  
AL**



# Permeable Paver Shapes

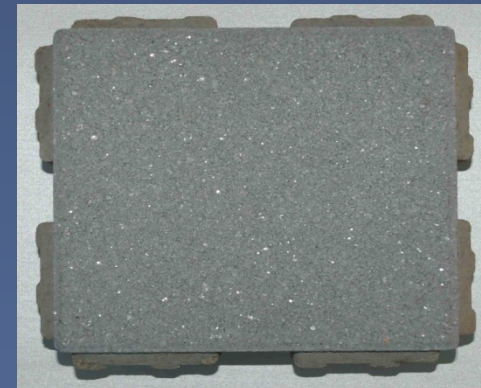




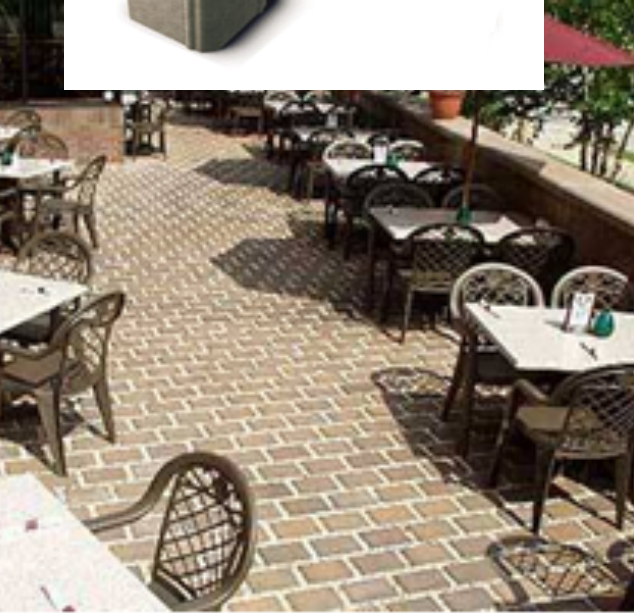
# Permeable Paver Shapes



Enlarged  
Joints:  
up to  $\frac{1}{2}$  in.  
(13 mm)

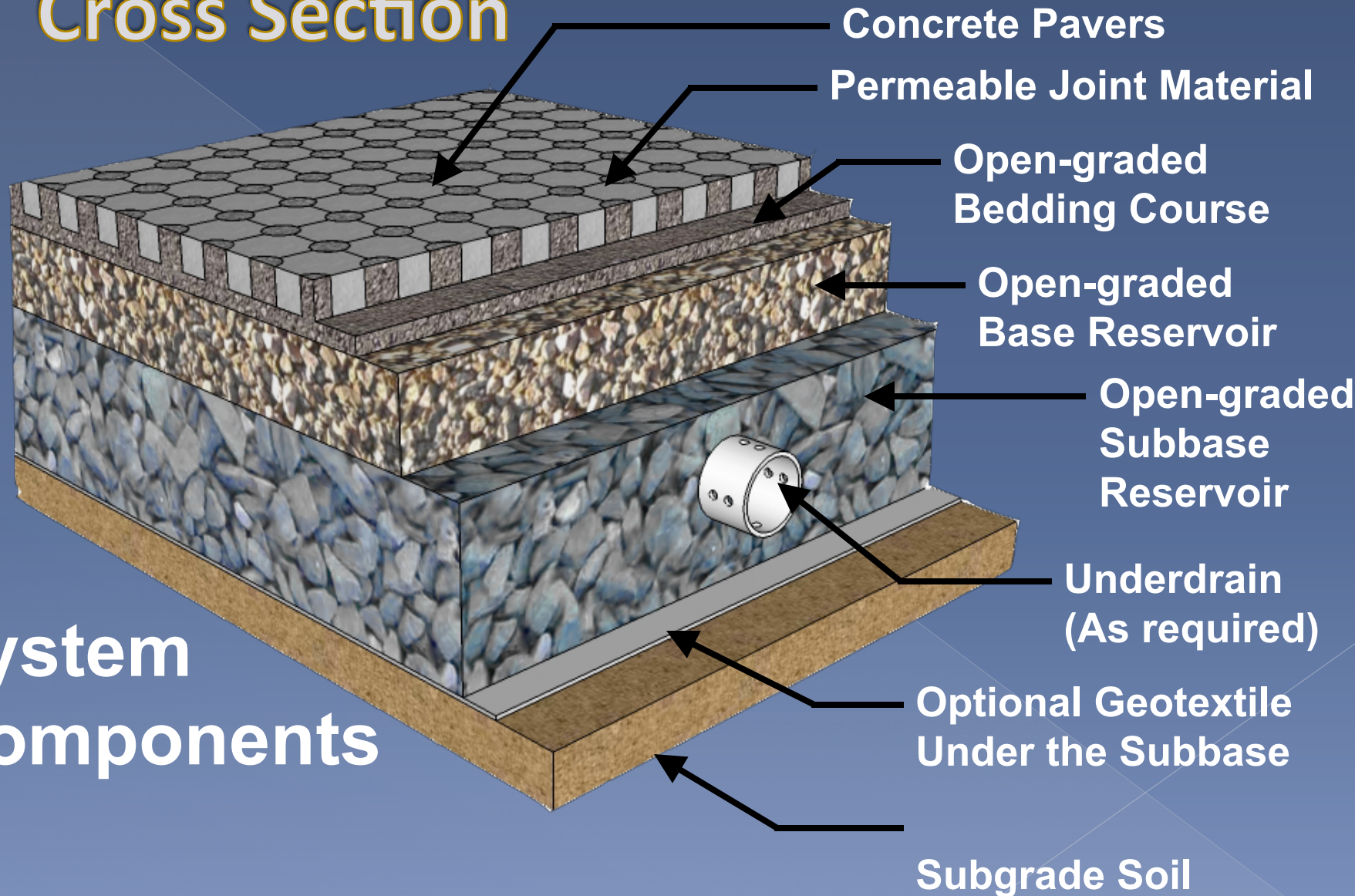


Built-In Concrete  
Joint Spacers





# Permeable Paver Cross Section



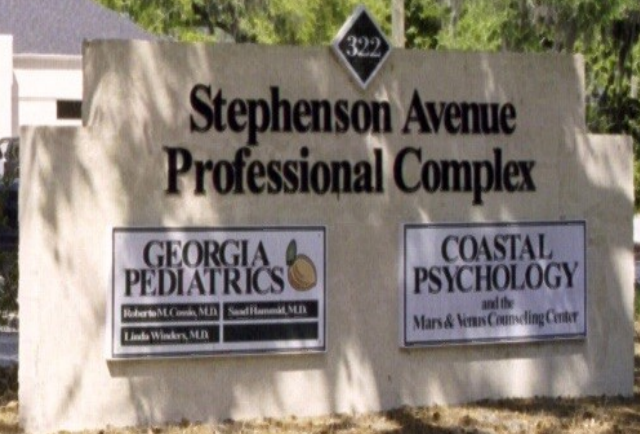


# Benefits of Pervious and Permeable Pavers?

- Reduce the need or get rid of costly retention ponds
- Many cities have implemented impact charges for water runoff by allowing only allowing only a certain % of a given property to be covered with impervious materials.
  - *Most building sites 50-80% impervious surfaces (pavement, roof...)*
  - *Maintenance issue to homes and business when mud or sand are continually deposited on carpets or wooden floors.*
- Storm water quality is improved
  - *Eliminates non point pollution*
  - *Non point pollution affects 26,000 miles of rivers and streams*
  - *EPA notes:*
    - 80-95% reduction in sediment*
    - 65-75% reduction in phosphorus*
    - 80-85% reduction of nitrogen, zinc, lead*



**Tree Protection and Stormwater  
Management are Important  
Issues in Savannah**





# Trees











HomeGoods



# Construction



Bunyon Roller



**Rolling Joint Tool**





# Construction Specification

**ACI 522.1-08**

**Specification for Pervious Concrete Pavement**



# Construction



- Paver
- Bedding Course
- Open-graded Base Course
- Open-graded Sub base Reservoir on uncompacted subgrade



# Subgrade Preparation





# Paver Installation





# Paver Installation







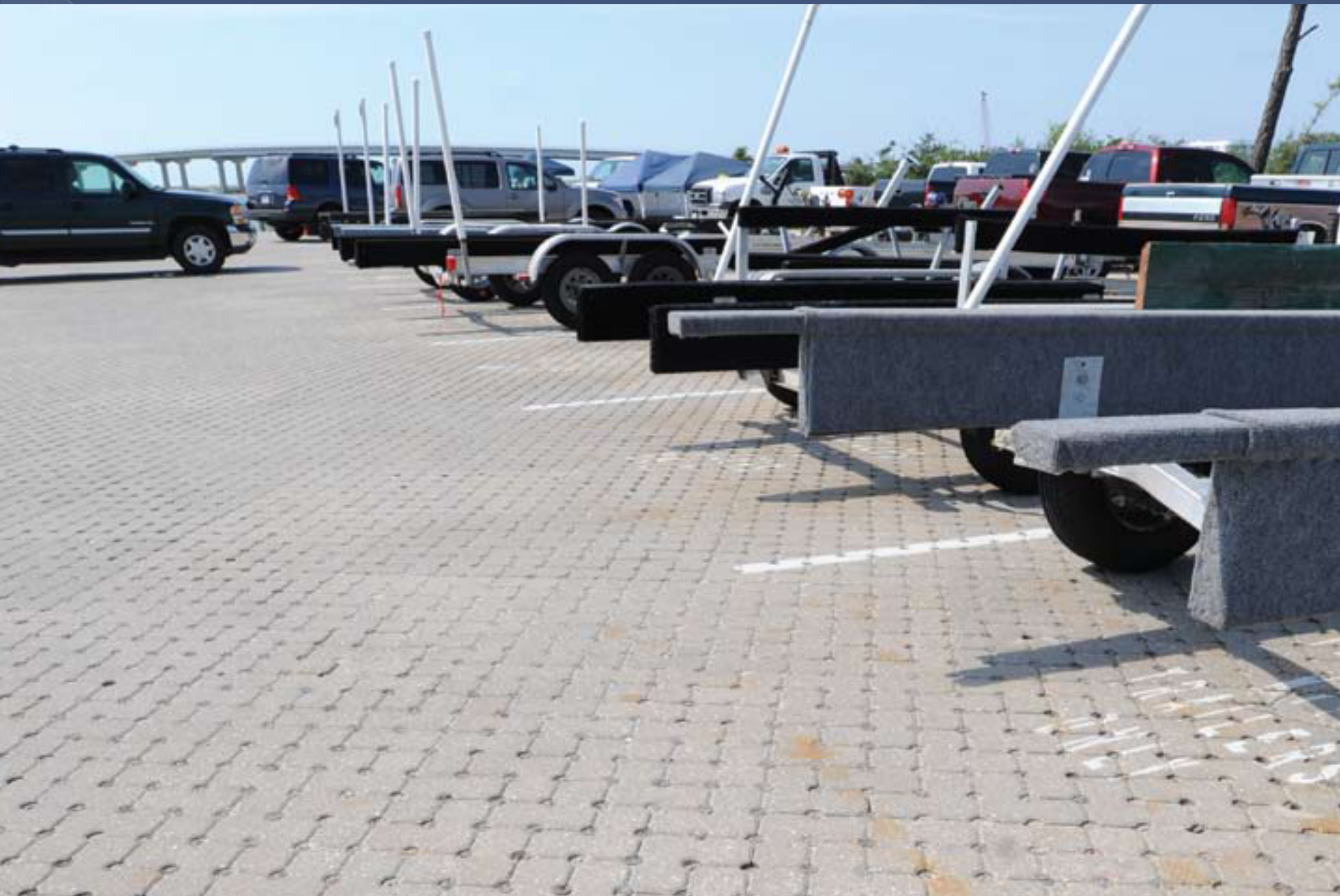


# Common Questions of Permeable Pavements



Can pervious be painted?







# Common Questions of Permeable Pavements

A photograph of a parking lot. In the foreground, there is a dark asphalt surface with white parking lines. In the middle ground, a rectangular section of the parking lot is paved with a light-colored, textured material, likely permeable pavement. A green SUV and a silver pickup truck are parked in this section. To the left, there is a row of parked cars. In the background, there are trees and a clear sky.

Can it be used with  
other pavements?





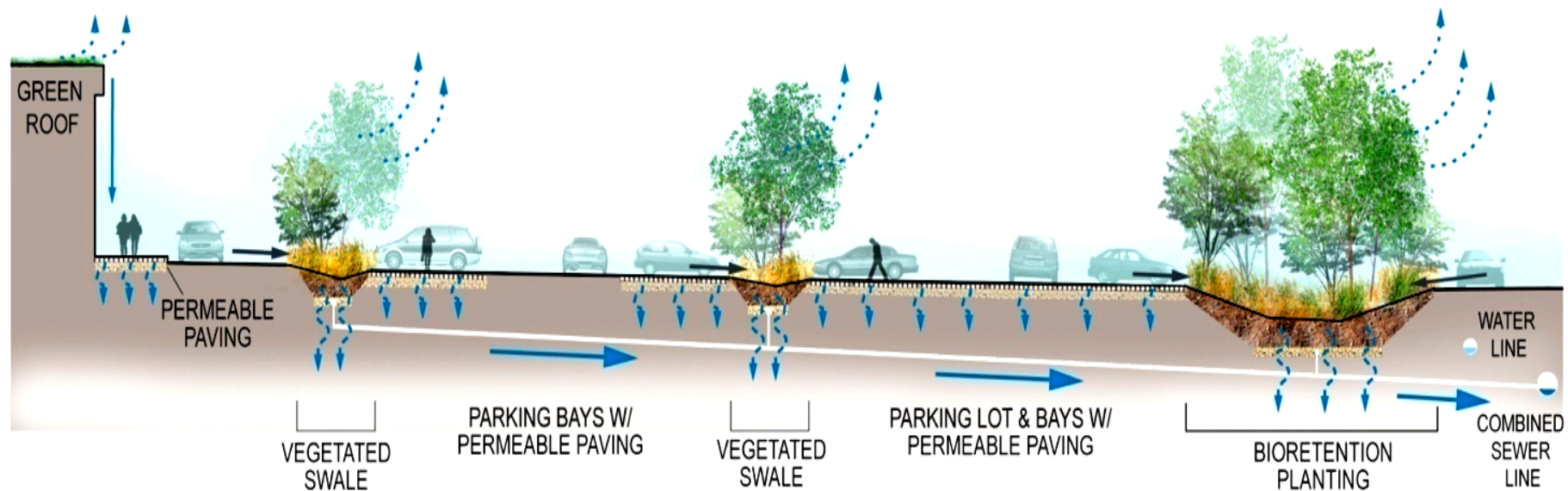


# Common Questions of Permeable Pavements



Can it be used with other stormwater techniques?



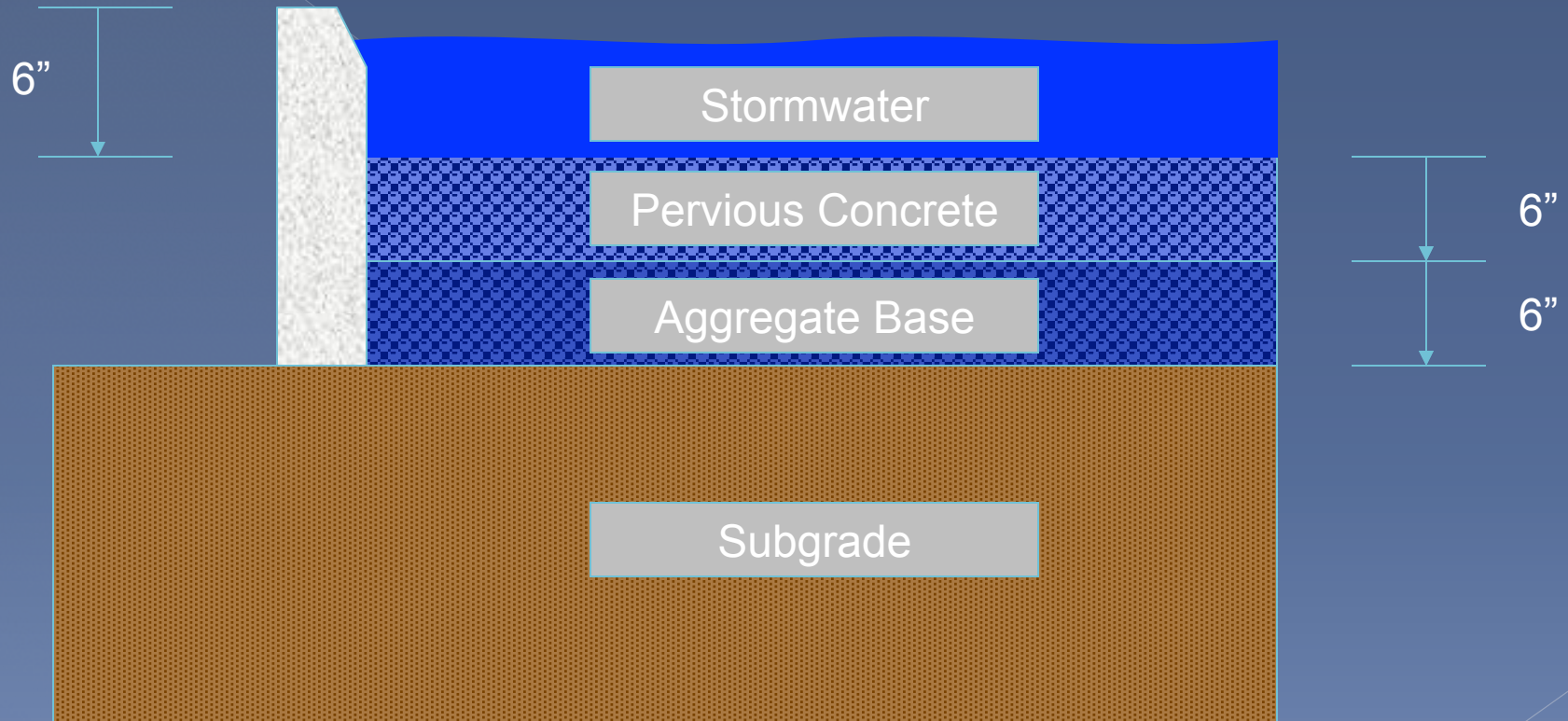


SECTION

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# Where can pervious be used?



Minimum of .5 inch per hour



# Common Questions of Permeable Pavements

Will permeable pavements meet ADA compliance requirements?

Will I have problems with freeze thaw?

What will permeable pavements cost the owner?



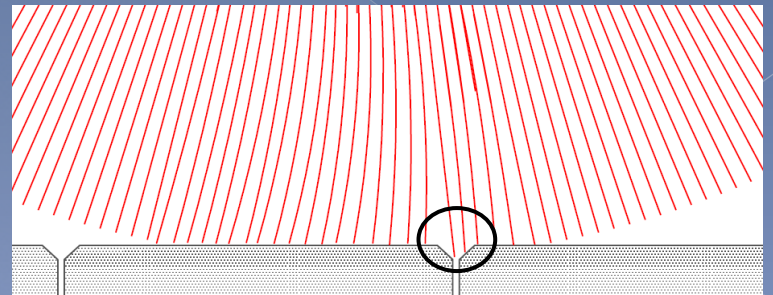
# Cleaning of Permeable Pavements

Best: Vacuum sweeper (no water)

OK: Regenerative air (broom  
sweeper  
(no water)



Vacuum essential as brush  
bristles clean  $\sim \frac{1}{4}$  in. into surface







# PICP Contributes to LEED Credits



- Decrease pollution through sustainable sites (SS)
- Increase building water use efficiency (WE)
- Conserve materials and resources (MR)
- Innovative ideas and designs (ID)





# Decrease runoff through Sustainable Sites

LEED Points

## Credit 6.1 Stormwater design: Quantity control

1

<50% site imperviousness

Reduce to pre-development peak discharge & quantity for a 2 year, 24-hour storm

>50% site imperviousness

25% volume decrease from 2 year, 24-hour storm

Achieve both objectives with PICP





# Decrease runoff through Sustainable Sites

LEED Points

Credit 6.2 Stormwater design: Quality control

1

Capture & treat 90% of average annual  
Rainfall (0.5 to 1 in. depending on region)  
Remove 80% of total suspended solids

Achieve 80% TSS removal with permeable  
Interlocking concrete pavements – proven by research





## LEED Points 1

### Credit 7.1 Heat Island Effect: Non-roof

50% of site hardscape using

Tree shade in 5 years

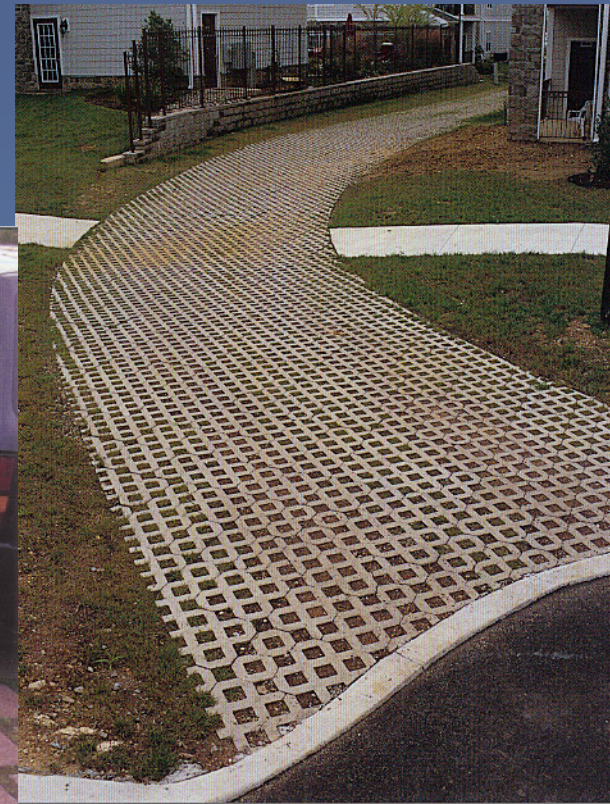
Paving with minimum 29 Solar Reflectance Index (SRI)

Grid pavement

OR

Place parking under roof or ground

Minimum 29 SRI on roof or deck





# Water Efficiency

## Credit

## LEED Points

**1.1 Water Efficient Landscaping  
Reduce by 50%**

**1**

**1.2 Water Efficient Landscaping  
No Potable Water Use**

**1**

**3.1 20% potable water use reduction**

**1**

**3.2 30% potable water use reduction**

**1**



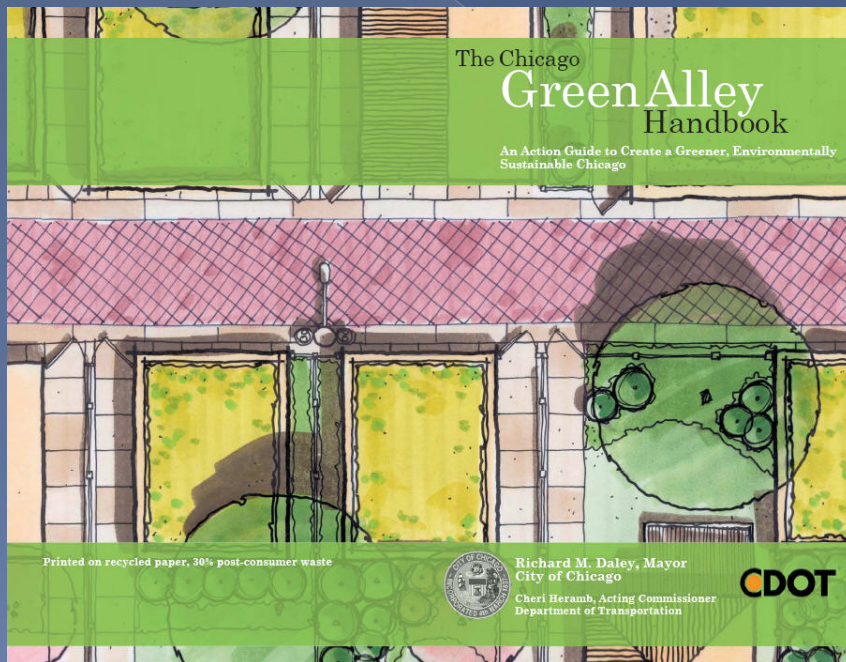
# Conservation of materials and resources

Credit	LEED Points
3.1 5% reused content (i.e. crushed concrete)	1
3.2 10% reused content	1
4.1 10% recycled waste content (e.g. flyash)	1
4.2 20% recycled waste content	1
5.1 10% extracted & produced regionally (<500 mi.)	1
5.2 20% extracted & produced regionally (<500 mi.)	1

*See ICPI Tech Spec 16 on LEED points from pavers*



# Municipal Design Strategies: Pilot Programs









[www.alconcrete.org](http://www.alconcrete.org)