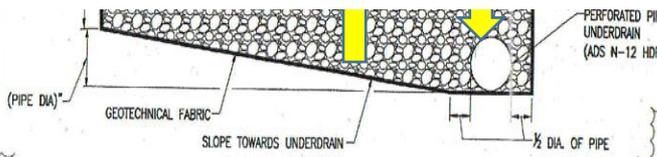


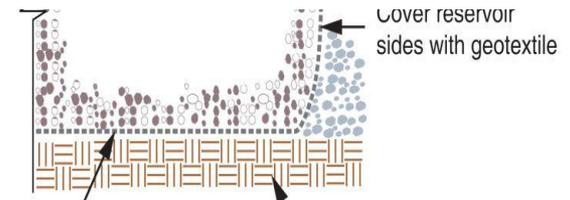
NOTES:  
 1. SEE LANDSCAPING PLAN FOR "PLANTING SOIL" SPECIFICATIONS

01 PROPOSED CROSS SECTION A - A  
 C3.0 NOT TO SCALE



PERVIOUS CONCRETE SECTION

SCALE: NONE  
 NOTE: GEOTECHNICAL FABRIC IN ACCORDANCE WITH IDOT SPECIFICATIONS FOR GEOTECHNICAL FABRIC FOR FRENCH DRAINS.



Optional geotextile on bottom of reservoir

Soil Subgrade









# Pervious Concrete: A Concrete Solution to Storm Water Runoff



Philip Kresge  
Sr. Director, National Resources  
National Ready Mixed Concrete Association

# What is Pervious Concrete?

A No-Fines  
Concrete Mix  
Coarse Aggregate  
Portland Cement  
Water

Intended for use  
as an open-graded  
drainage material



# Pervious Concrete Properties

15% to 35% air void content

Field studies show 18-25% average

100 to 125 lbs/ft<sup>3</sup> unit weight

2000 to 3000 psi strength\*

compressive strength typically not used as acceptance criteria. Air void structure and unit weight are used instead.

# Pervious Concrete Properties

Drainage rate

3-5 gal/min/ft<sup>2</sup>

Equivalent of 275" to  
450" of rain per hour!

*More than half of all  
rainfall is provided in  
rain events that total  
one inch or less.*



---

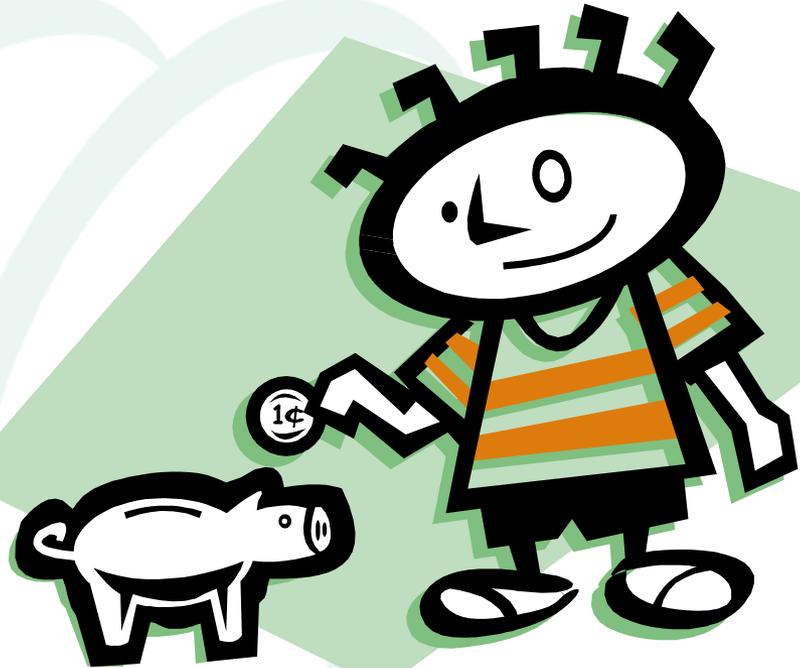
# Why Specify Pervious Concrete?

---

# Savings to Owners/Developers

Eliminates costly  
stormwater  
management  
practices

Provides for more  
efficient land  
development





How Many Cars Can You Park  
on a Detention Pond?

# For Example: 100,000 ft<sup>2</sup> parking lot

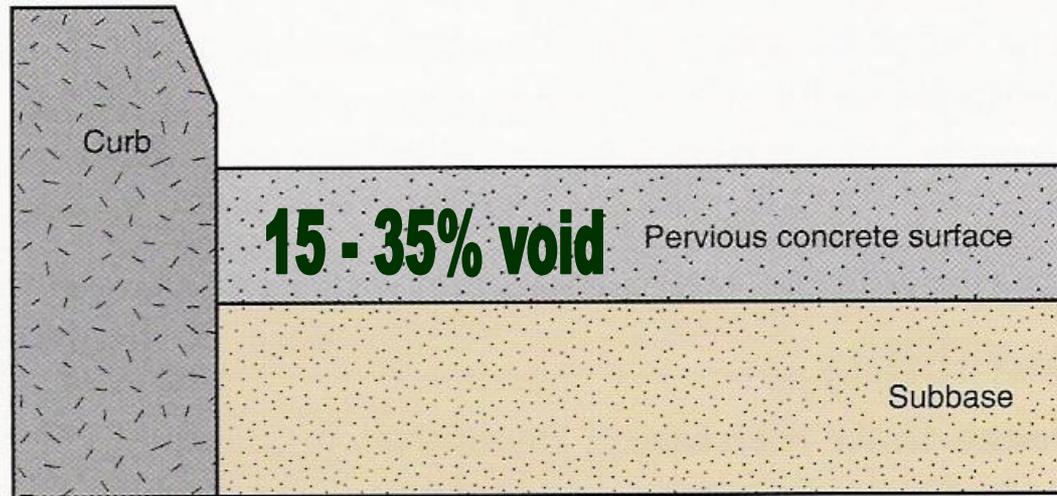
- **6" Pervious Concrete**
- **12" Aggregate Detention Layer**
- **\$355,000 Installed**

- **4" Asphalt Pavement**
- **8" Aggregate Base**
- **\$285,000 Installed**
- **Inlets = \$25,000**
- **18" Pipe = \$85,000**
- **1 acre detention pond  
\$135,000**
- **Total Actual Cost  
\$530,000**

---

# Pervious Concrete Design Guidelines

---



Pervious concrete: 4-8 inches typical  
Thickness based on intended use

---

# Structural Design – Experience

4” Sidewalks/Pathways

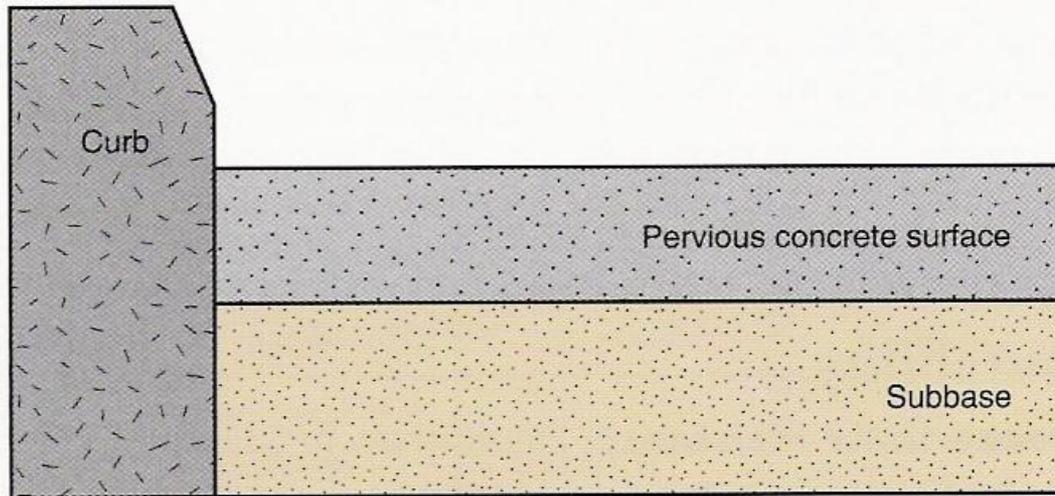
6” Parking Lots

6” Residential Driveways

8” Residential Streets

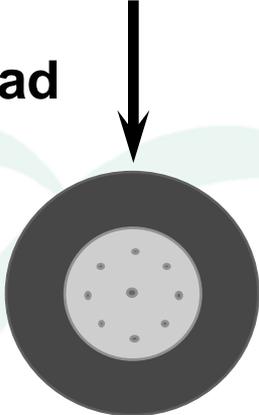
8” Commercial Driveways

---



- Subgrade maximum compaction
  - 95% Standard Proctor
  - 90-92% Modified Proctor

7000 lbs load



Asphalt Wearing Course

Asphalt Base Course

Aggregate Base Course

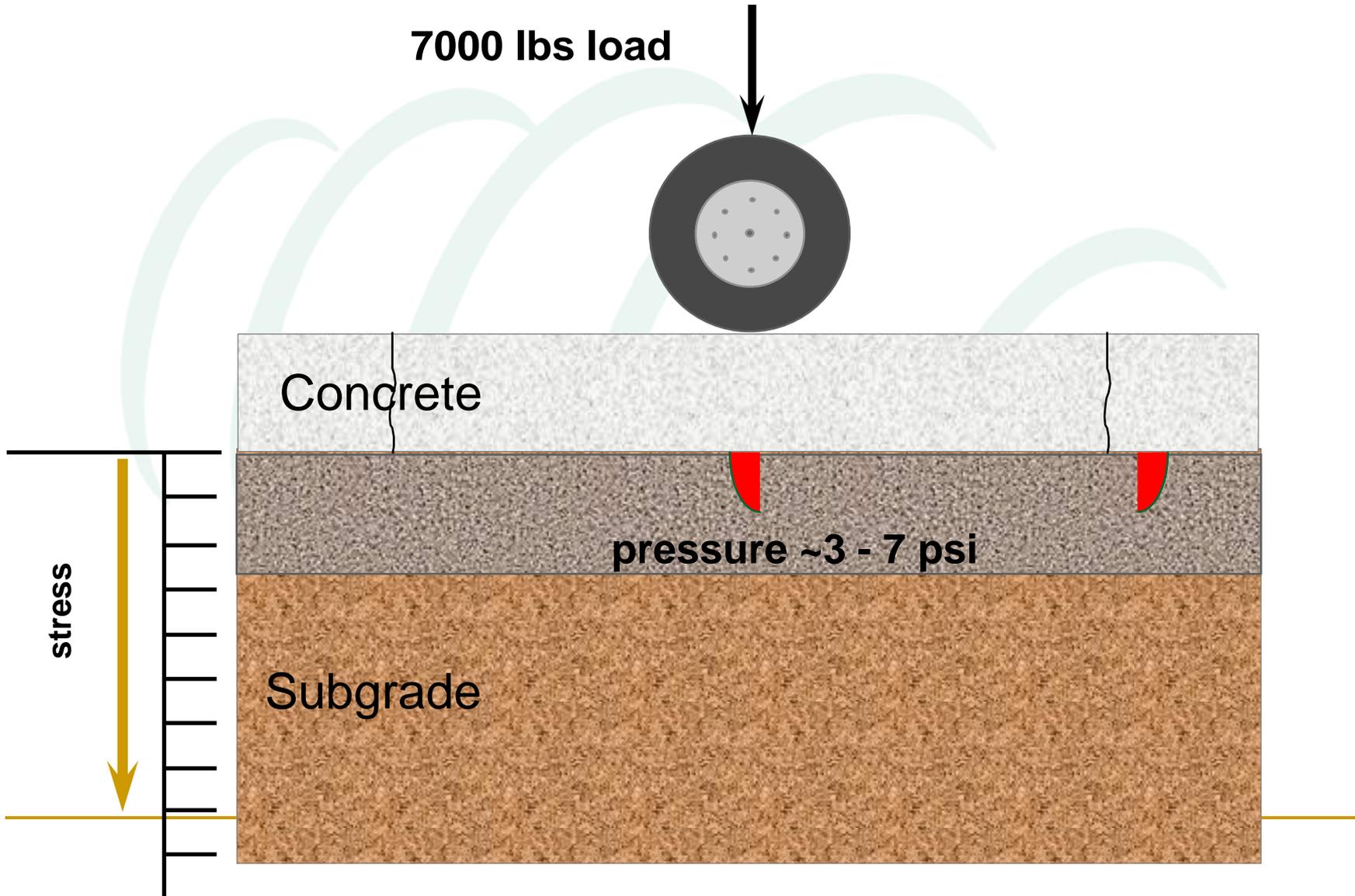
Subgrade

pressure  
~ 15 - 20 psi

stress



7000 lbs load

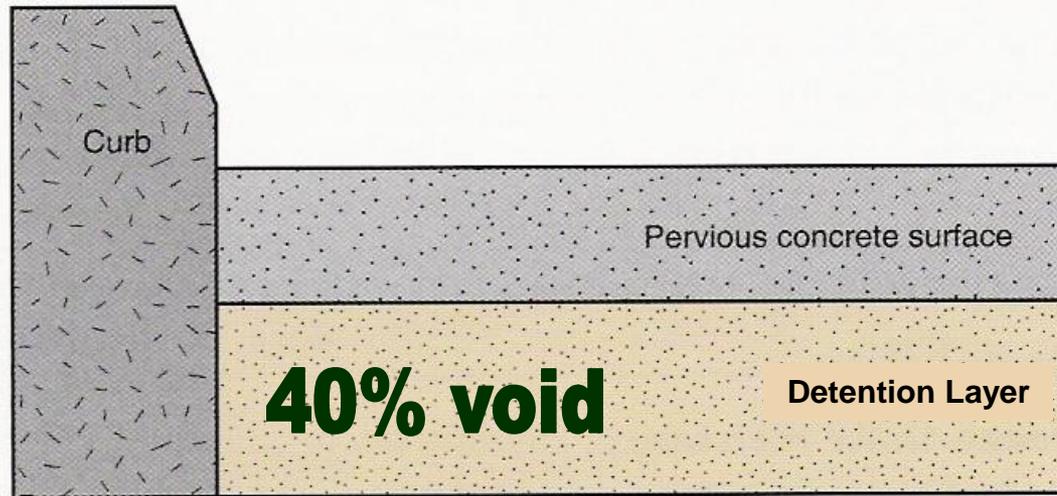


Concrete

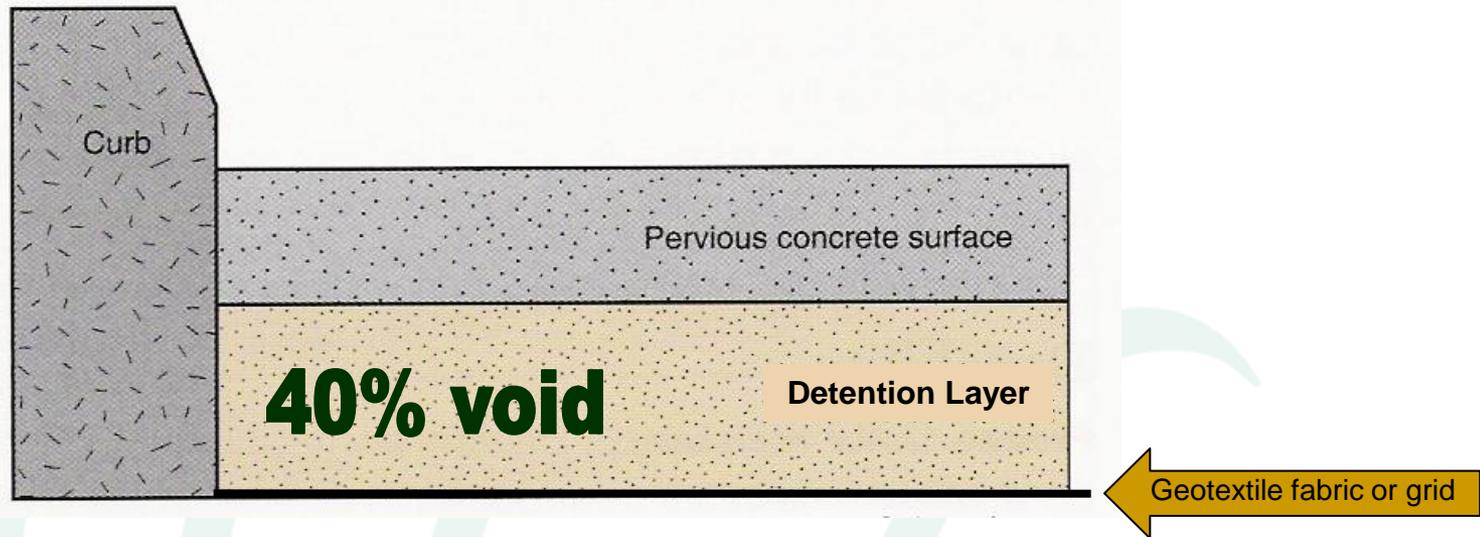
pressure ~3 - 7 psi

Subgrade

stress

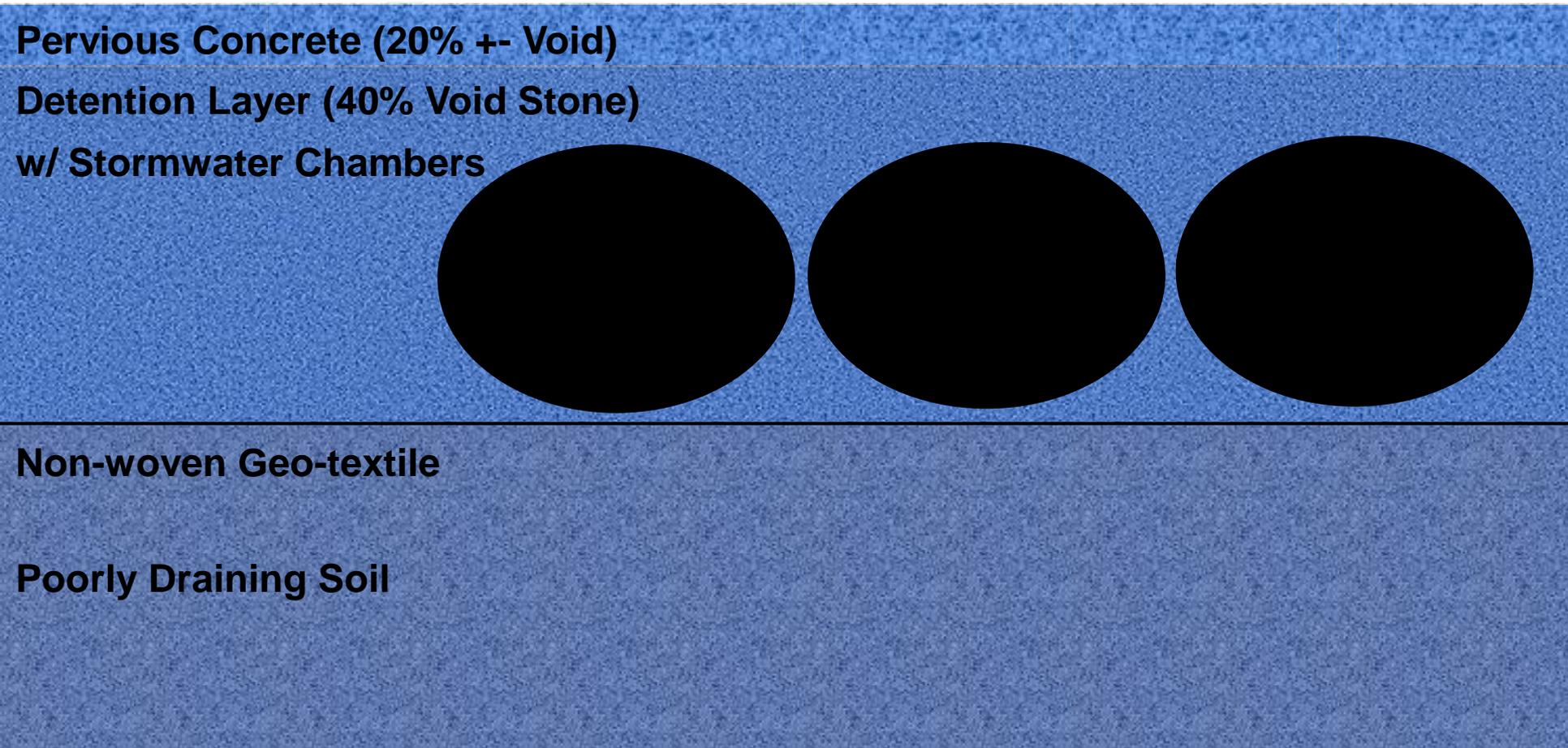


- Open-graded stone subbase: determined by local hydrologic conditions
  - Filter Bed
  - Storage Bed
  - Detention Layer



- Typical detention layer thickness  $\approx$  6 inches
- Thickness may be increased for certain conditions
  - Increased storage
  - Freeze/thaw
- No detention layer required in some cases
  - Well draining native soils
  - Minimize root damage
- Geotextile fabric or grid may be used at subbase interface

# Poorly Draining Soils



---

# Freeze-Thaw Resistance

- Depends on saturation level
- Avoid critical saturation
  - Design
    - Infiltration System
    - Secret of success is to provide the water a place to go
  - Maintenance
    - Cleaning, as needed, in severe climates



---

Conventional pavement  
sweeper/vacuum  
equipment can also  
be used





Cleaning can  
restore 90+%  
of original  
permeability



# Accommodating Heavy Traffic



# Transition to asphalt







**Seattle, WA**



SA

413F

W2016

292B



SAFEWAY  
SUNBELT WA

SP

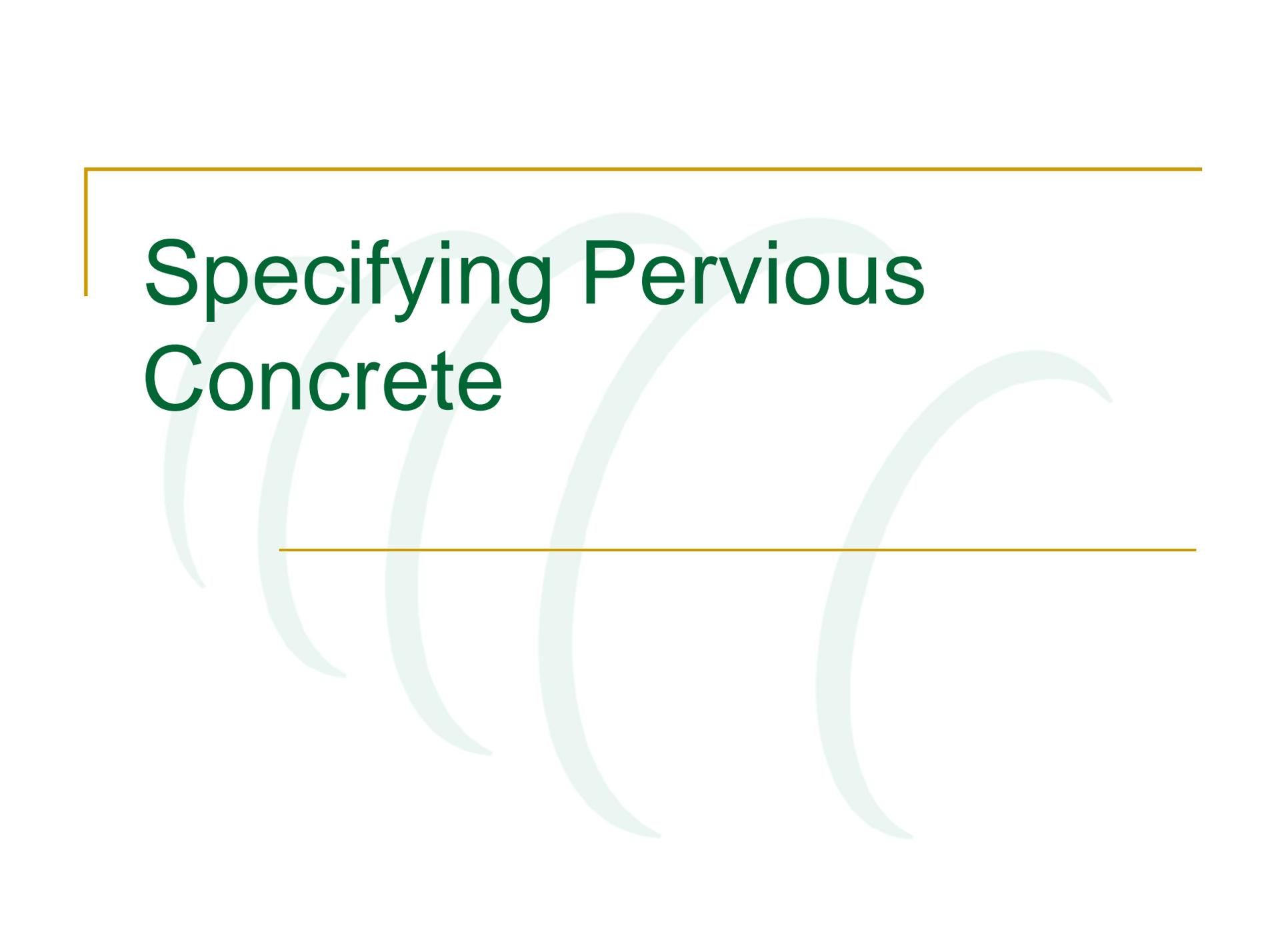




Cranbury, NJ

A long, straight asphalt road stretches from the foreground into the distance. The road is flanked by concrete curbs and sidewalks. On the right side, there are large mounds of snow piled up against the curb. In the background, there are trees, a white house, and a red stop sign. The overall scene is a quiet residential street in winter.

**Shoreview, MN**



# Specifying Pervious Concrete

---

# Typical Pervious Concrete Mix Design

**450-550 lbs. Portland Cement**

Fly Ash / Slag Cement substitute acceptable at standard rates

**27 ft<sup>3</sup> Coarse Aggregate**

Aggregate size will affect drainage rate

**0.35 – 0.40 W/C Ratio**

Sufficient water to display a wet, metallic sheen on the aggregate

**High Range Water Reducer, Viscosity Modifier, Hydration Stabilizer**

---

---

# ACI 522 – Pervious Concrete

## ACI 522R – 10

Provides technical information on pervious concrete's application, properties, and construction methods

## ACI 522.1 – 13

Specification for Pervious Concrete Pavements

---

# ACI 522.1-13

Performance specification

Provides Guidelines for

Quality Assurance

Materials

Acceptance Testing

Placement

Does not provide recipe for  
pervious concrete mix  
design

**Specification for  
Pervious Concrete Pavement**

An ACI Standard

Reported by ACI Committee 522



**American Concrete Institute®**

---

# Specification Recommendations

*Target void content of 15% to 25% as measured by ASTM C1688\**

*Minimum infiltration rate of 100 inches per hour*

***Suggested text - Not taken from ACI 522.1-13***

---

---

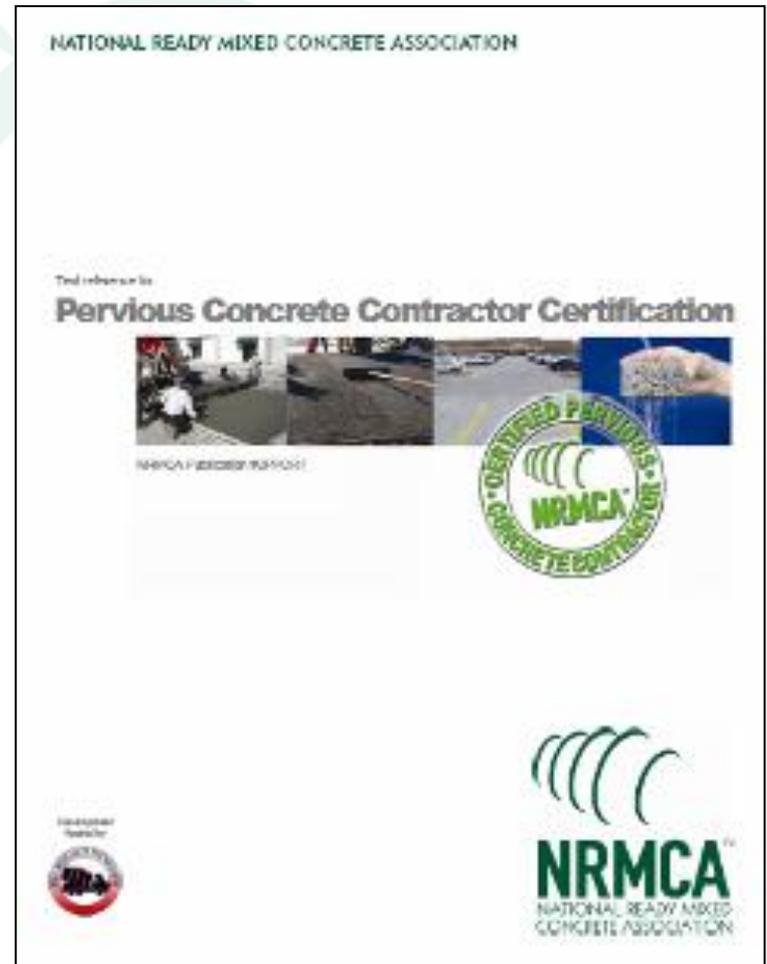
# Specification Recommendations

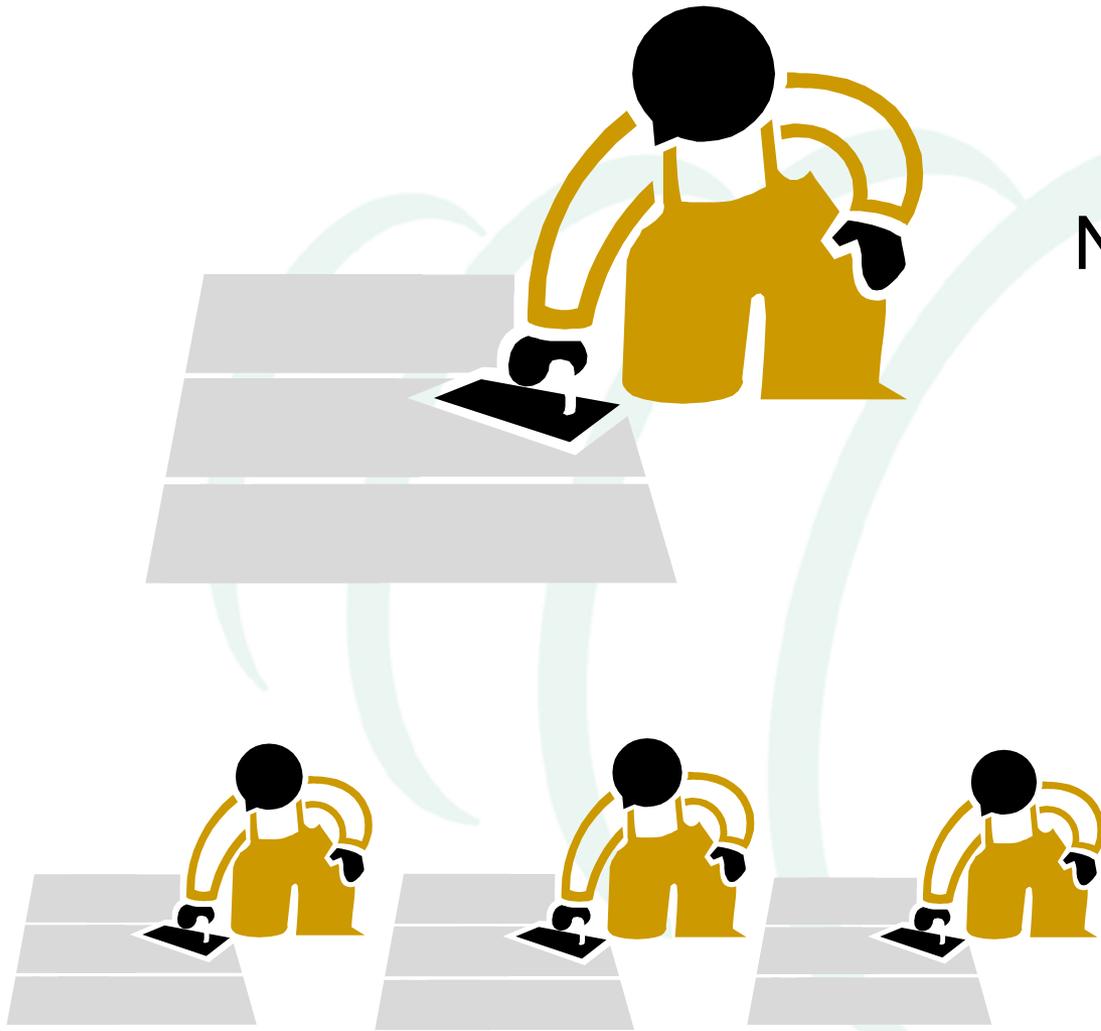
- Fresh density of pervious concrete shall be within 5 lbs. (+/-) of the fresh density of the specified fresh density (approved mix design)
-

# Section 1.6: Quality Assurance

## 1.6.1.1 *Contractor Qualification*

NRMCA Pervious  
Concrete Contractor  
Certification Program





NRMCA Certified  
Craftsman

NRMCA Certified  
Installers

# Section 1.5; Submittals

## 1.5.3.2 *Pre-Placement Conference*

Attendance is Mandatory

- Architect/Engineer
- General Contractor
- Concrete Contractor
- Concrete Supplier
- Site Contractor
- Field Testing Agency

***“Checklists for Pervious Concrete Contractors and Suppliers” available through NRMCA***

---

# Pervious Concrete Acceptance Testing

---

---

# Acceptance Testing

Considered zero-slump

Compressive strength *should not* be used as acceptance criteria.

Air void structure and density are used instead.

---

# ASTM Test Procedures

## Fresh Concrete Density and Voids Content

ASTM C1688-12: Standard Test Method for Density and Void Content of Freshly Mixed Pervious Concrete

## Field Permeability (Infiltration Rate)

ASTM C1701-09: Standard Test Method for Infiltration Rate of In-Place Pervious Concrete

## Hardened Concrete Density and Porosity

ASTM C1754-12: Density and Void Content of Hardened Pervious Concrete

## Other Concrete Sites

- [Concrete Parking.org](#)
- [Green Concrete.info](#)
- [Concrete Buildings.org](#)
- [Flowable Fill.org](#)
- [Green Roof Tops.org](#)
- [Concrete Streets.org](#)
- [Self Consolidating Concrete.org](#)
- [Decorative Architectural Concrete](#)

## Help for Commercial Projects

- [Concrete Answers Hub Site](#)
- [Project Assistance](#)

## Links

- [Indu](#)
- [Publi](#)
- [Link](#)

# Pervious Concrete Pavement

## An Overview

Pervious concrete pavement is a unique and effective means to address important environmental issues and support green, sustainable growth. By capturing stormwater and allowing it to seep into the ground, porous concrete is instrumental in recharging groundwater, reducing stormwater runoff, and meeting U.S. Environmental Protection Agency (EPA) stormwater regulations. In fact, the use of pervious concrete is among the Best Management Practices (BMPs) recommended by the EPA—and by other agencies and geotechnical engineers across the country—for the management of stormwater runoff on a regional and local basis. This pavement technology creates more efficient land use by eliminating the need for retention ponds, swales, and other stormwater management devices. In doing so, pervious concrete has the ability to lower overall project costs on a first-cost basis.



### ► NRMCA Pervious Concrete Contractor Certification Program

The program is designed to be administered locally by local sponsoring groups in conjunction with planned training sessions or demonstrations of pervious concrete placement. NRMCA provides certification exams and

local

# www.PerviousPavement.org

[...more](#)

or no sand, creating a substantial void content. Using sufficient paste to coat and bind the aggregate particles together creates a system of

### ► NRMCA Specifier Webinars

The image features a collection of construction-related items. In the foreground, there are two rolled-up white blueprints with technical drawings. A yellow hard hat is positioned on the right, with the NRMCA logo (a stylized wave icon above the letters 'NRMCA') printed on its side. Below the hard hat, a yellow pencil and a yellow ruler are visible, resting on a flat blueprint. The background is slightly blurred, showing a laptop keyboard. The overall scene is brightly lit, suggesting a professional or educational setting.

# **NRMCA Design Assistance Program**



**Philip Kresge**

Sr. Director – National Resources

*pkresge@nrmca.org*

*610-966-7220*