

# Pervious Concrete

When it  
rains . . .  
. . . It  
***drains !***



# Pervious Concrete

A concrete mixer truck is shown at a construction site, with its drum rotating. The background shows a dirt road and some trees. The image is overlaid with a semi-transparent dark green filter.

- Legislation – Clean Water Act
- Stormwater Management
- Available land suitable for development
- Applications
- Design Considerations
- Municipalities, DOT's, and other public entities are demanding pervious concrete like nothing else ever!
- Pervious Construction Systems
- Freeze Thaw Durability

# Legislation

The EPA, “Clean Water Act”, Phase 1 and 2, orders States, Counties and Municipalities to adopt procedures that address stormwater runoff issues.

Parking lots are considered to be primary point sources of pollution. When rain falls on a conventional, impervious, parking lots it usually runs off carrying a load of pollutants with it. Polluted stormwater runoff eventually finds its way into our streams, rivers and lakes. Pervious concrete is recognized by the EPA as a Best Management Practice (BMP) to help Engineers design procedures for addressing stormwater issues. Pervious concrete is also recognized as a Low Impact Development (LID) tool for stormwater management.



## Stormwater Management

The EPA Stormwater Phase II Final Rule requires operators of Municipal Separate Storm Sewer Systems (MS4s) whose population exceeds 50,000, to obtain National Pollutant Discharge Elimination System (NPDES) permit coverage because their stormwater discharges are considered “point sources” of pollution. All point source discharges are required under the Clean Water Act to be covered by federally enforceable NPDES permits. Each MS4 must submit, in their individual permit application, a list of Best Management Practices (BMP) that show how they intend to manage their own stormwater discharge issues.

Pervious concrete is recognized by the EPA as a BMP. It is fast becoming a material of choice for the construction of parking area pavements in compliance with this ruling.

## Low Impact Development

Low Impact Development (LID) is an approach to environmentally friendly land use planning. It includes a suite of landscaping and design techniques that attempt to maintain the natural, pre-developed ability of a site to manage rainfall. LID techniques capture water on site, and let it soak into the ground where it is filtered and allowed to recharge the local water table rather than being lost as surface runoff.

LID can be applied to new development, and redevelopment at many scales. On a small scale, LID techniques can be used to better handle rainfall for a single-family lot through the use of pervious concrete driveways and grass swales. On a larger scale, proper site design in combination with pervious concrete pavements and infiltration techniques improve rainfall runoff management.

A background image of a concrete mixer truck, partially obscured by a dark green overlay. The truck is white with a large rotating drum. It is parked on a light-colored surface, possibly a road or construction site, with some trees and a hill in the background.

## Pervious Concrete Composition

– Pervious concrete is a mixture of hydraulic *cement*, *coarse aggregates* (stone), water and admixtures. Pervious Concrete contains little or no sand, and is sometimes referred to as a “*no-fines*” concrete. The cement and water forms a paste that binds the coarse aggregates together. Only enough paste is added to the mix to glue the aggregate together where they touch each other, but not enough to fill all the space between the aggregates.

A typical pervious concrete mixture will contain about 17-25% void space within the concrete. Many of the void spaces within the pervious concrete will be interconnected, forming channels that allow water and air to pass freely through the pavement structure.



# Pervious Concrete

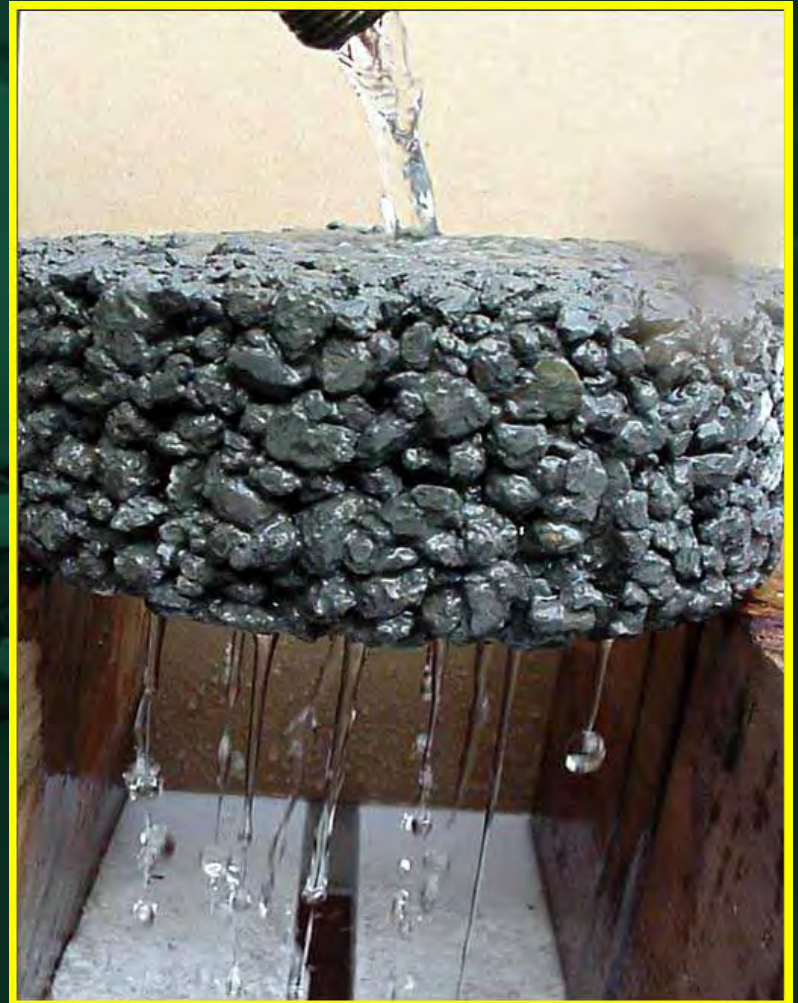
## Basic Benefits:

- **Environmental**

- ✓ More environmentally friendly  
vs. conventional pavements  
in many applications

- **Reduces Costs**

- ✓ Over-all Project Costs  
(usually)
- ✓ Can reduce Op. Costs &  
Liability



# Pervious Concrete Environmental Benefits

- Mitigates First Flush Pollutants
- Prevents Thermal Pollution
- Reduces the heat island effect
- Keeps Stormwater on Site
  - ✓ Replenishing groundwater
  - ✓ Reducing soil erosion
- Tree Friendly



# Pervious Concrete Environmental Benefits

Because water is allowed to percolate into ground, nearby vegetation is watered & reduces irrigation needs, groundwater is recharged & stormwater run-off that remains is improved yet reduced.





# Pervious Concrete Apps.

- ◆ Parking Areas
- ◆ Driveways
- ◆ Sidewalks
- ◆ Roadways/Alleys
- ◆ Swales & Ditches
- ◆ Erosion Control
- ◆ Slope Protection
- ◆ Load-bearing Walls
- ◆ Etc.









# Pervious Concrete Pavement as a Stormwater Mgt. System

## Permeability/Infiltration Rates & Depth

- Open-graded crushed stone, gravel, or sand
- Geotextile Fabric as required

## Aggregate Recharge Bed

- Open Graded aggregate #57 stone is most common
- Contain 35% to 40% voids
- 1 foot of stone will hold approximately 5" rain





# Design Considerations

The background of the slide is a dark, green-tinted photograph of a construction site. In the foreground, a large concrete mixer truck is visible, its drum partially obscured by the text. In the background, other construction vehicles and equipment are scattered across a dirt area, with some trees visible in the distance under a hazy sky.

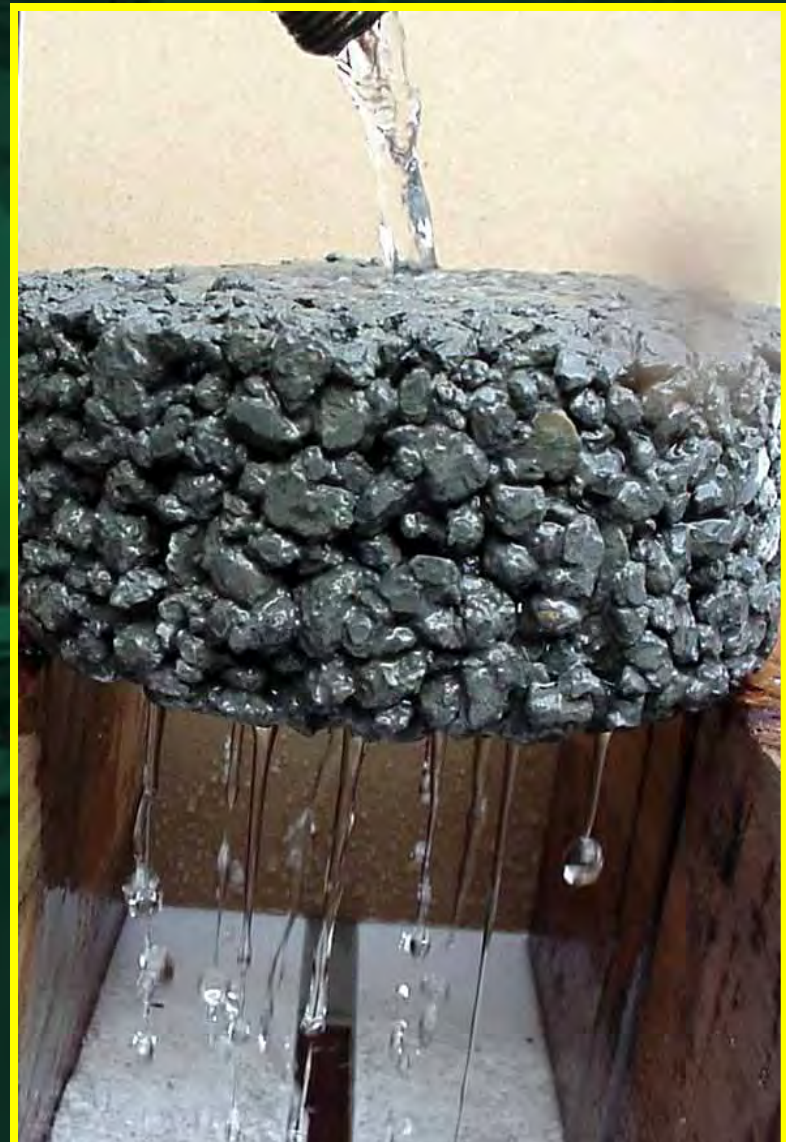
- High Quality Geotechnical Evaluation
- Subbase Porosity & Rainfall Factors
- Geotextile Fabric – Most Apps.
- Slab Thickness – Usually thicker than conventional concrete pavement
- Usually FLAT grade



# Pervious Concrete Mix Design

## General Description:

- Structural pavement - 2000-3500 psi
- Components:
  - Coarse aggregate
  - Portland cement
  - Pozzolans
  - Water
  - Admixtures
- Void content range of 17-25%



# Mix Design Recommendations

1. **Cement:** Portland Cement Type I/ II conforming to ASTM C 150. Fly Ash Type C or F 20% maximum or Slag 30% maximum replacement for Portland Cement.
2. **Aggregate:** Use coarse aggregate ( 3/8 to No. 4) per ASTM D 448, subject to Engineer's approval. If other gradation of aggregate is to be used, submit data on proposed material to owner or engineer for approval.
3. **Admixtures:** Mid or Low range water reducer, Delvo-Hydration Stabilizer, Viscosity Modifier.
4. **Water:** Potable shall be used.



# Typical Placing Procedures (varies by market)





# Pervious Concrete - Zero-Low Slump



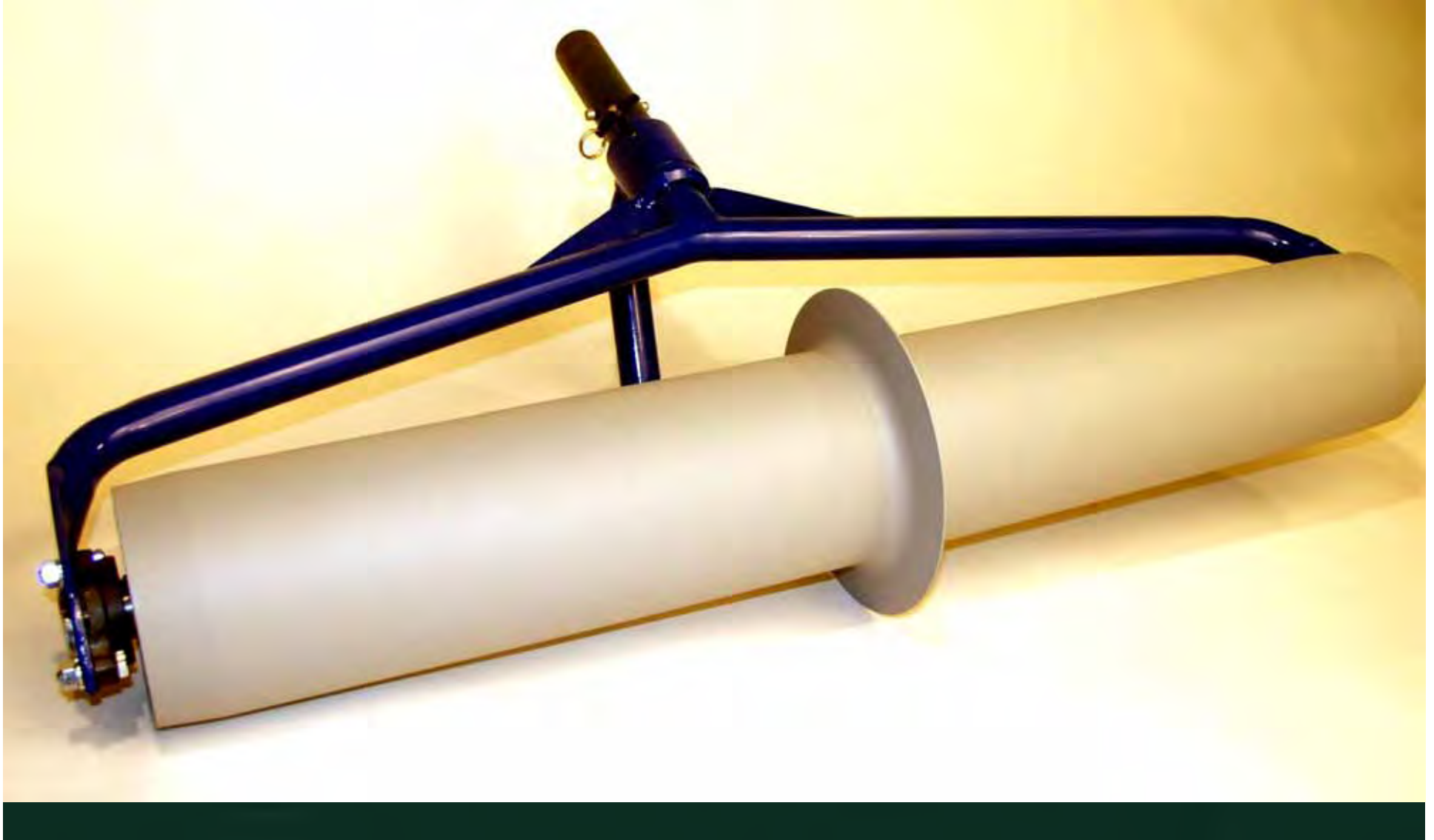


# Jointing – Various Methods

Jointing –20' X 20'  
“Pizza Cutter”  
style jointing tool  
should have a  
radius or fillet  
between the  
“wheel” and the  
roller.



# Jointing Roller













# Cross Roller



# CURING



Curing pervious concrete is Critical due to the open structure and low w/c ratio. Curing should begin within 20 minutes of final finish or early if conditions warrant it. The best curing compound for pervious concrete is the THE BEAN.



# What about Freeze-Thaw Durability ?



# NRMCA – May, 2004



## **Freeze-Thaw Resistance of Pervious Concrete**



NRMCA • 900 Spring Street, Silver Spring, MD 20910 • [www.nrmca.org](http://www.nrmca.org) • (888) 84-NRMCA

May 2004



# Freeze / Thaw Issue

- Importance of Aggregate Base
- CTRE Research – 300+ cycles
- <http://www.ctre.iastate.edu/>"[www.ctre.iastate.edu](http://www.ctre.iastate.edu/)
- Water in Bottle Analogy
- Recent Projects

# Additional Information

- [www.nrmca.org](http://www.nrmca.org)
- [www.cement.org](http://www.cement.org)
- [www.aci-int.org](http://www.aci-int.org)





# Certification Program

The background of the slide is a photograph of a construction site. In the foreground, a large concrete mixer truck is parked, its drum partially visible. In the background, another truck and some construction equipment are visible on a dirt road. The entire image is overlaid with a dark green tint.

- National Ready-Mixed Concrete Association
- Previous Concrete Contractor Certification
- Train- test and certify contractors in the placement of pervious
- Nebraska Concrete & Aggregates Assoc. Producer Training..
- To achieve a quality and consistent product
- To ensure the contractor, producer, engineer and owner work to together.

















Thank you and the finally the Q&A Time

