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# Pervious Concrete Paving

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# Outline

- **Stormwater runoff:** causes and concerns
- **Pervious concrete:** pavement and stormwater BMP
- **Why pervious concrete?**
- **Applications** of pervious concrete in VA
- **Future of pervious concrete with VDOT**

# Stormwater Runoff Causes

Rainwater

# Stormwater Runoff Causes

Snowmelt

# Stormwater Runoff Concerns

Water Quality and Water Quantity (EPA)

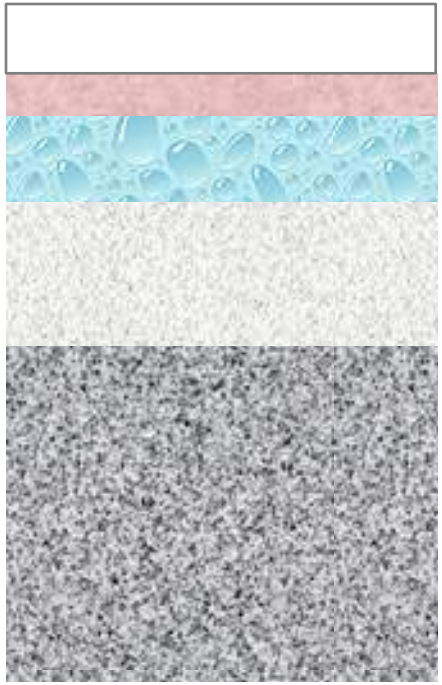
- **Flooding**
- **Combined sewer overflows**
- **Damages to infrastructure**
- **Stream health:** hydraulics, temperature, pollutants
- **Habitat destruction**

# Stormwater Management

- Best Management Practices:
  - Reduction of discharge
  - Reduction of pollutants
- Bioretention (rain gardens, etc.)
- Cisterns/rain barrels
- Green roofs
- Porous pavements (pervious concrete)
- Grass swales (biofiltration devices)

# What is Pervious Concrete (PC)?

“No fines concrete”



Air voids (15 – 25%)

Admixtures

Water

Cementitious material

Coarse aggregate

# VTRC Pervious Concrete Project

- Make and test specimens in the lab
  - Varying void contents: 15 – 25%
  - Investigate clogging and maintenance
- Observe non-VDOT field projects
- Prepare special provision for VDOT applications

# VTRC Lab Work

# Lab Consolidation Techniques

Marshall Hammer

Proctor Hammer

# ASTM

- **C1688:** Density & void content of freshly mixed pervious concrete
- **C1701:** Infiltration rate of in-place pervious concrete
- **C1747:** Determining potential resistance to degradation of pervious concrete by impact and abrasion
- **C1754:** Density & void content of hardened concrete

# Fresh Density

ASTM C1688

# Infiltration Ring

12” specimen

**ASTM C1701**

18” specimen

# Los Angeles Abrasion Test

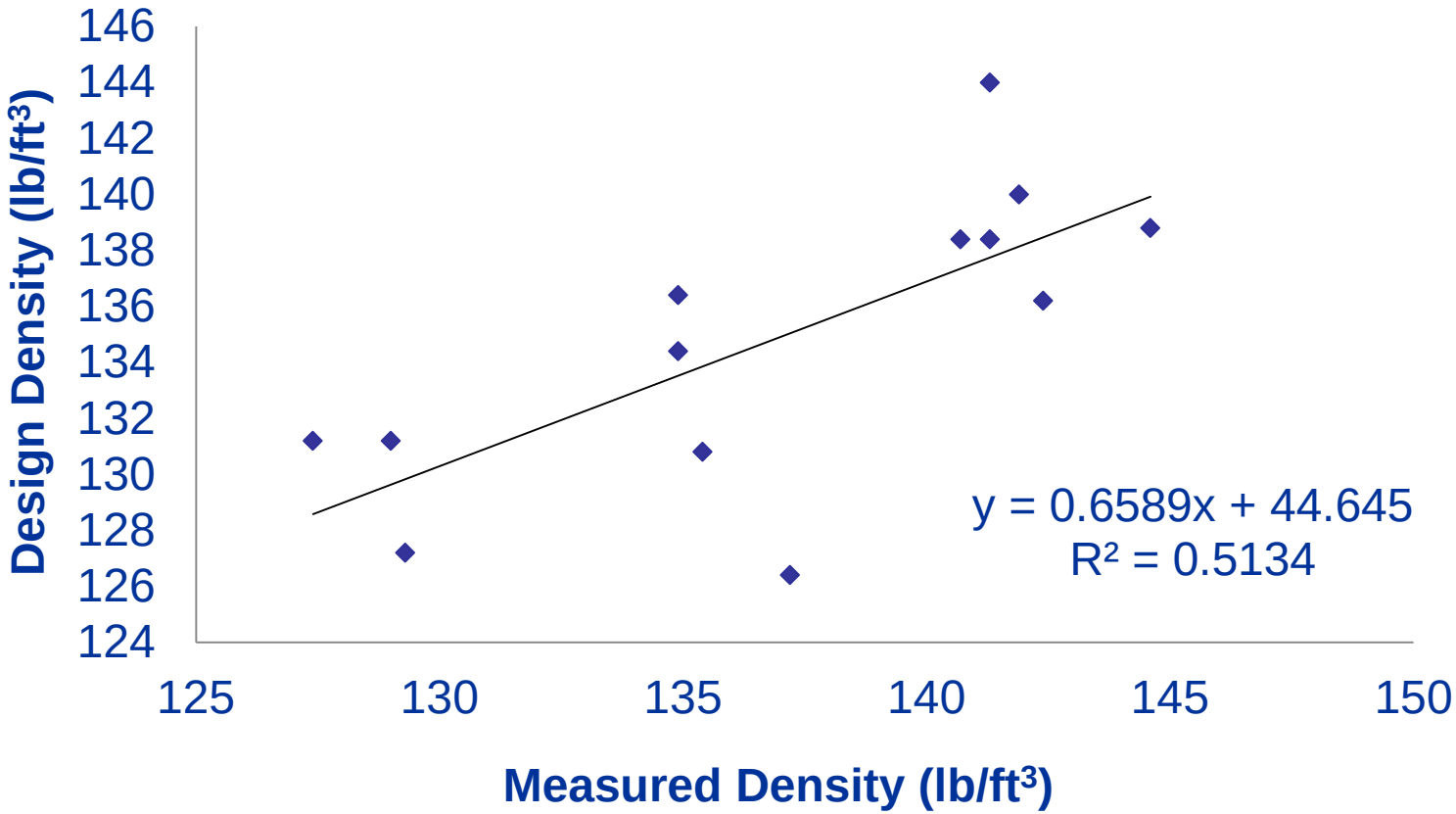
**ASTM C1747**

# Hardened Density

ASTM C1754

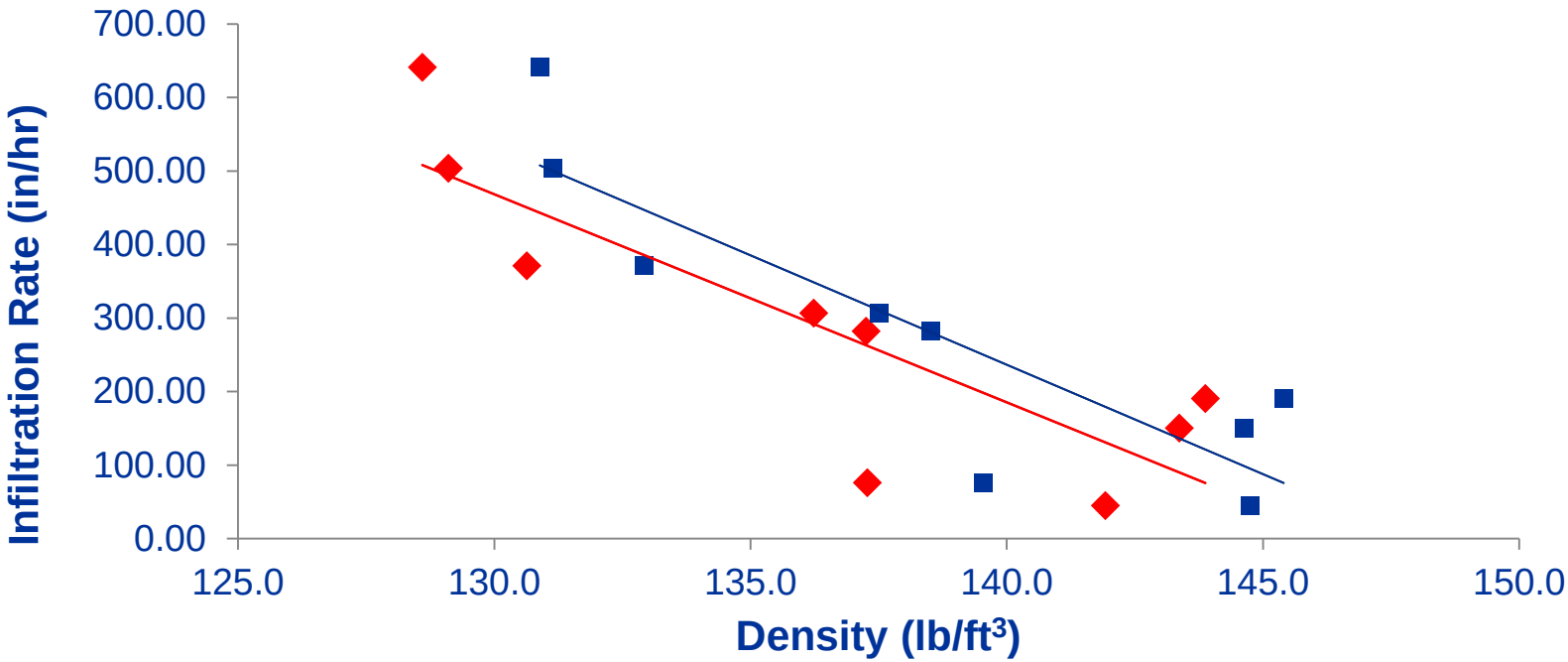
# RC Test Results

## Design density and measured density



# RC Test Results

## Density and infiltration




◆ Hardened Density

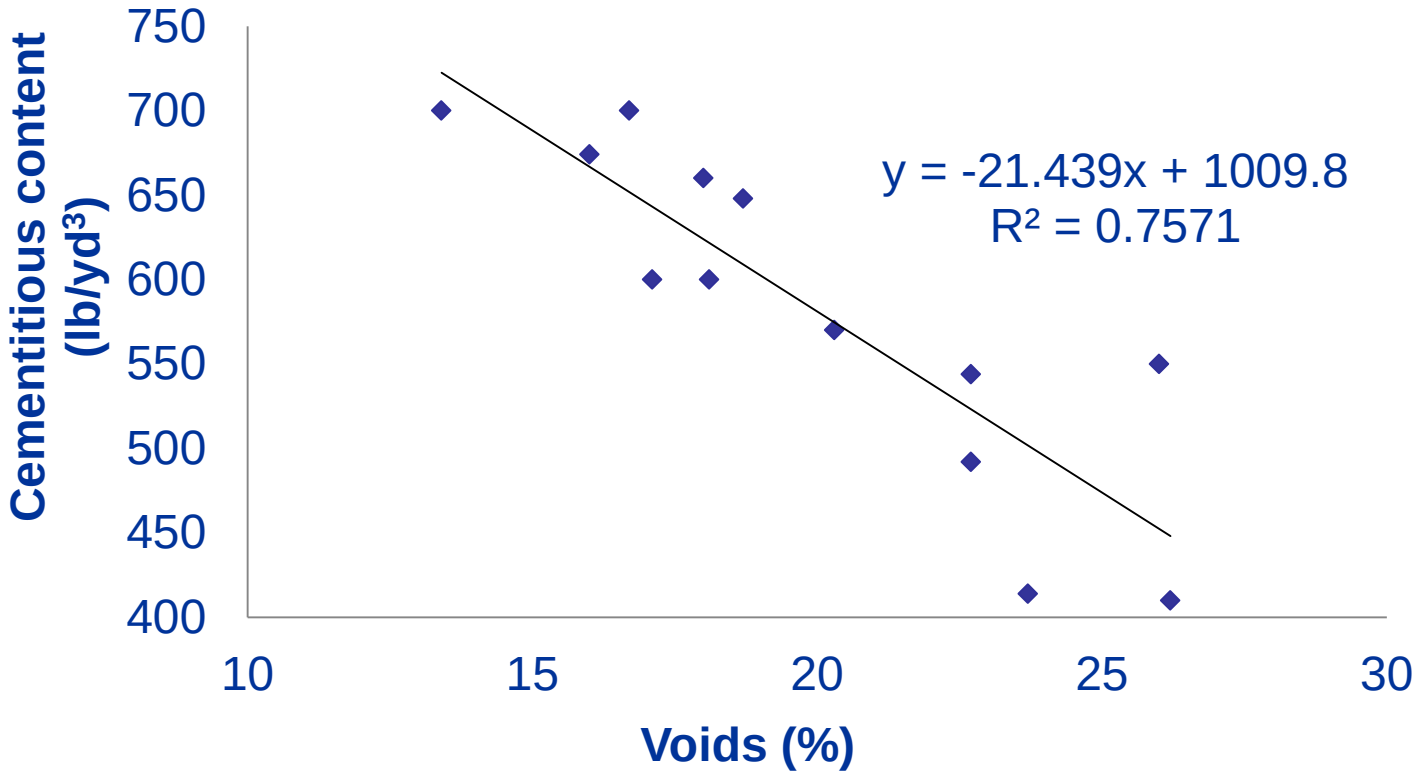
■ Fresh Density

$y = -28.303x + 4147.6$
$R^2 = 0.7312$

$y = -29.755x + 4402.1$
$R^2 = 0.7675$

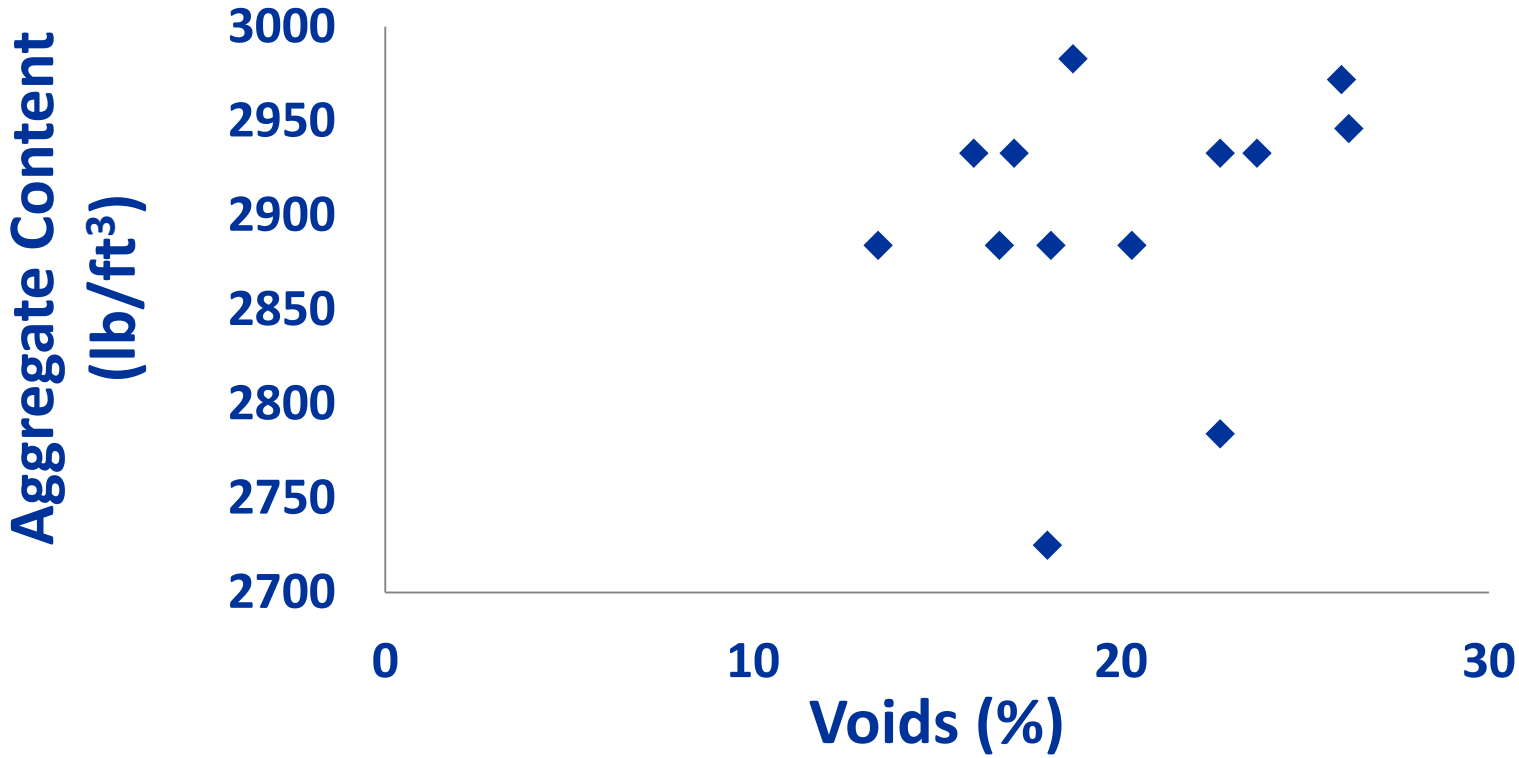
# RC Test Results

## Voids and cementitious content



# RC Test Results

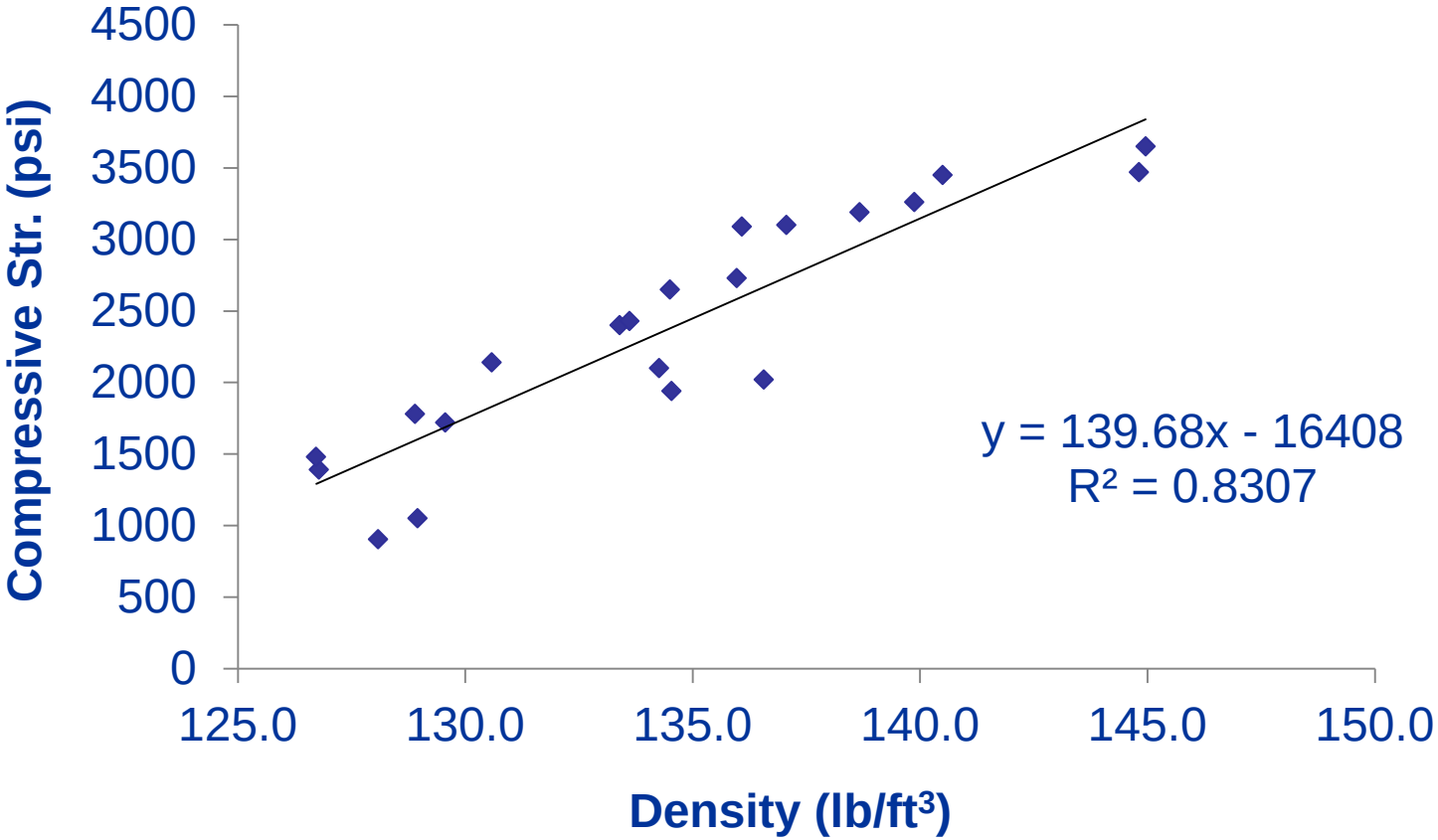
## Voids vs Aggregate Content (lb/ft$^3$)



# Compressive Strength

# RC Test Results

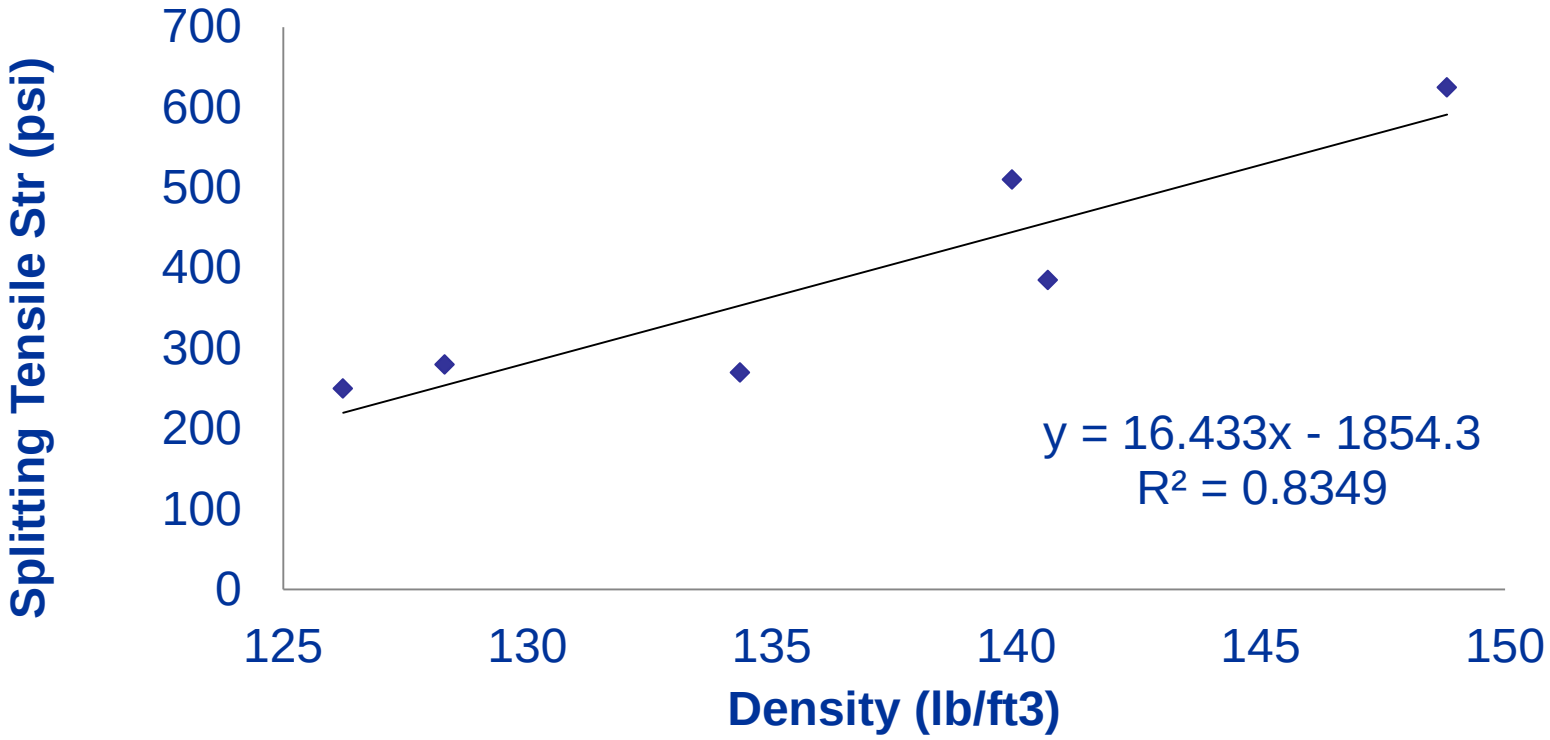
## Fresh density and compressive strength



# Splitting Tensile Test

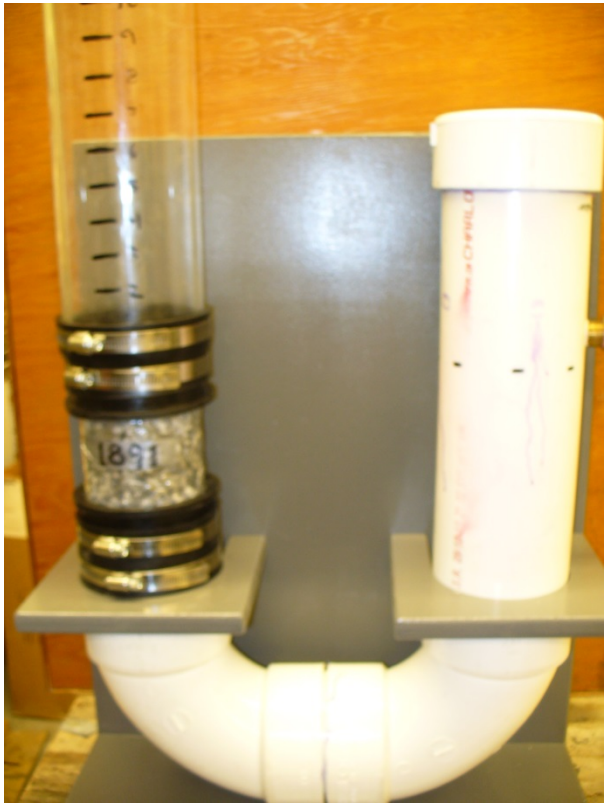
# RC Test Results

## Splitting Tensile Test



# Permeameter

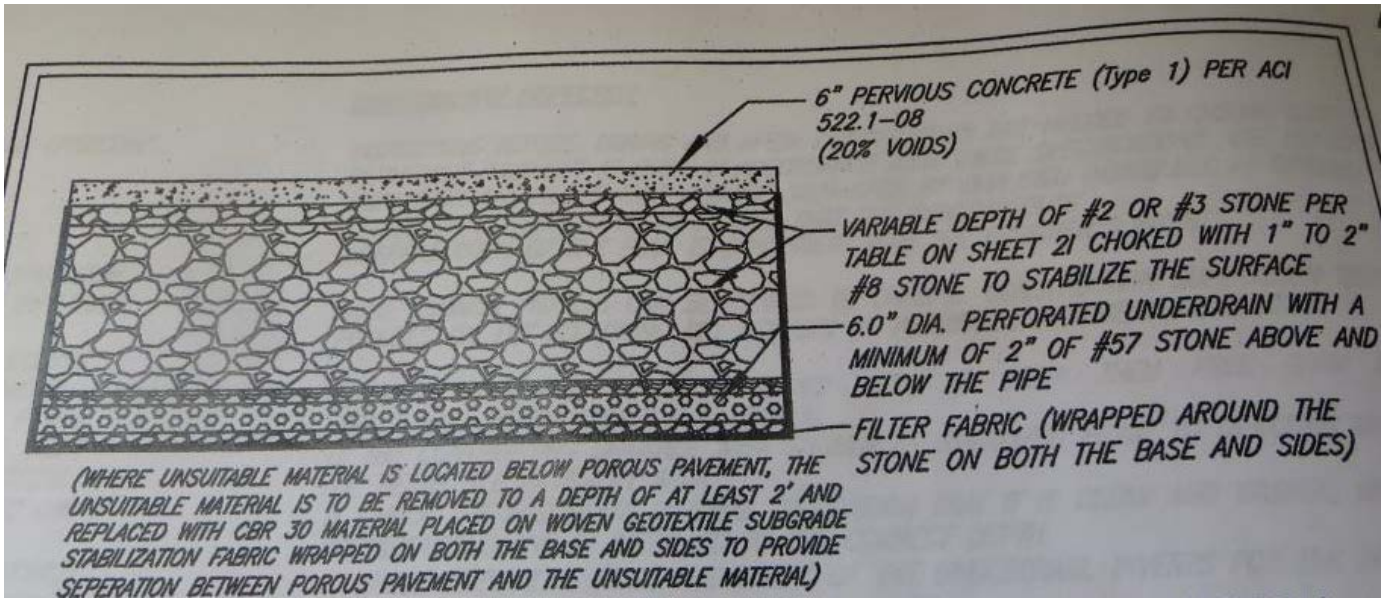
## To investigate infiltration and clogging



# Lessons from RC Lab Tests

- Importance of cementitious material
  - 400 – 700 lb/yd$^3$
- Consolidation efforts
  - Proctor hammer, marshall hammer, vibrating hammer, jigging, rodding
- Infiltration rates and strength depends on density and void content

# Pervious Concrete Pavement Cross-Section




*Plan drawing from Stringfellow Park and Ride*

# Non-VDOT Applications in Virginia

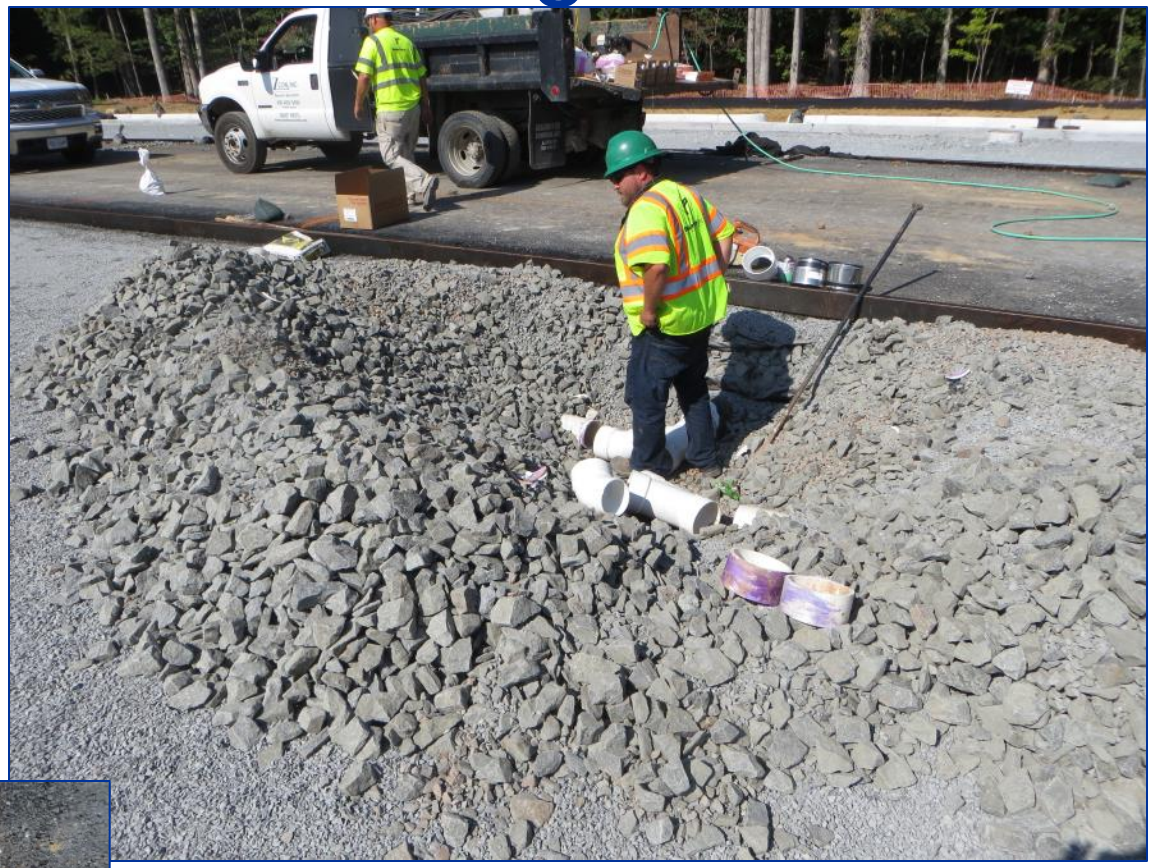
Reston Police Department

Stringfellow Park & Ride (Fairfax)

# Base Preparation
# Stringfellow

Nonwoven filter, underdrain, aggregate

# Base Stringfellow



perforated underdrain pipe.

# Detention Ponds Stringfellow

Wooded area in
the back

# Stringfellow Park& Ride Trial Section

# Concrete deposited using a conveyor belt and drop chute

# Consolidation and Screeding

Vibrating roller and hand roller

# Joints to control cracks

# Specimens at Stringfellow

# Specimens at Reston

# Williamsburg Outlet Mall

# Possible VDOT Applications

- Park and Ride: Salem?
- Soundwalls
- Slope protection
- Low-volume roads
- Pavement edge drains

# New VDOT Special Provision

- Draft is available
- Contents:
  - Materials and proportions
  - Weather restrictions
  - Pre-placement conference
  - Construction
  - Quality control
  - Acceptance criteria
  - Maintenance
  - Payment

# Conclusion

- Pervious concrete is a BMP to control storm water runoff
- Non-VDOT applications are available in Virginia
- VDOT special provision is being developed for VDOT applications

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# Thank you.

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