The Advantages of Pervious Concrete Pavement in Florida

> FACERS Fall Meeting November 2019 Roger C. Schmitt, P.E., M. ASCE

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What are We Going to Talk About Today

Description of Pervious Concrete Pavement	Pervious Concrete Mixtures and Production	General Design Principles	Design Example
Examples Where it Has Been Used	Innovative Pervious Concrete Bike Lane: Olympia, Washington	How Does Pervious Concrete Pavement Help the Environment	How Much Does Pervious Concrete Pavement Cost

Design Assistance Program What is Pervious Concrete?

- 15-25% Void Space
- Also Called No-fines
 Concrete



The pavement can drain 275" – 1,800" of rain per hour!



Duraport Headquarters

Bayonne, NJ Placed October 2007



Texture Comparison

Fresh Concrete Surface



Hardened Concrete Surface



Pervious Concrete Mixtures and Production

Specifications for Pervious Concrete

- ACI 522.1-13
- <u>www.concrete.org</u>
- Florida Concrete and Products Association Specification can be Downloaded from the Link Below.
- <u>https://studylib.net/doc/9011209/p</u> <u>ervious-specification---florida-</u> <u>concrete-and-product-assoc...</u>



Basic Ingredients

- Hydraulic cement
- Coarse aggregate
- Water
- Little or no sand
- Admixtures



"Start" Mix

- 400-500 Lbs. Cement
- 2,700 Lbs. Aggregate (3/8" typical, 1/4" or 3/4" also common)
- 19-22 Gal Water
- Admixtures PER OUTSIDE TEMPERATURE and cleanliness of aggregate



NEVER, EVER, use hot water in the mix – it binds in the truck and WILL NOT COME OUT

Supplementary Cementitious Materials

- Fly Ash (up to 25%)
- Slag (up to 50%)
- Will increase set time
- Increase curing time
- Color variations



Admixtures

- Water Reducing/Set Controlling
 - Retarders
 - Hydration Stabilizers
- Air Entraining
- Viscosity Modifying Admixtures (VMA)
- Dry shake color not recommended



Color

- Liquid integral color is preferred
- Powder integral color has also been used
- Dry-shake color not recommended
- Acid stains not recommended



Fibers

- Improve ability of mixture to hold together
- Increase permeability
- Comply with ASTM C 1116



Surface Texture Comparison



3/8" rock or gravel is most common size due to smoothness and appearance

You and Your Staff Can Learn More December 4th

General Design Principles

Layout/Grade/Slope

- Part of System
 - Supports traffic
 - Allows water to pass
- Water should flow vertically
- Minimize horizontal flow
- Storage in gravel base
- Can use pavement and ponding zone
- Flat system offers the maximum storage



Pervious Pavement Profile



Permeable subgrade compacted to 92% max Subgrade permeability should be at least 0.5 inches per hour

Storage Capacity

The stormwater storage capacity of a pervious concrete layer is equal to <u>total void content</u> multiplied by the <u>pavement thickness</u>.



Pavement Thickness

• Minimums

- 5" Sidewalks
- 5"-6" Parking lots & Residential Driveways
- 8¹¹ Streets & Commercial Driveways
- Consider Conventional Concrete Pavement
 - Heavy industrial traffic
 - High volume traffic
 - Poor soils





Design Example

Example Site Plan



Pavement Design



https://www.pavementdesigner.org/

Pavement Design Parking Lot: Category A



https://www.pavementdesigner.org/

Pavement Design: Modulus of Subgrade Reaction k

1 PROJECT LEVEL			0	PAVEMENT	STRUCTURE				3 SUMMARY
Project Type: Parking				100					
SUBGRADE SOIL TYPES & APPROXIMATE SUPPORT VALUES									
							and the second s		
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Sands and sand-gravel mixtures with moderate amounts of silt and clay					MEDIUM	130 - 170	4.5 - 7.5	20 - 41	3.5 - 4.9
Sand and sand-gravel mixtures relatively free of plastic fines					HIGH	180 - 220	8.5 - 12	45 - 52	5.3 - 6.1
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	178 nei								
	4/0 psi Calculated Composite K-Value of Select							Select	
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	value, psi/in.	4 in.	6 in.	9 in.	12 in.	115	180 psi/in		
		Granular aggregate subbase							
	50	65	75	85	110	-			
	100	130	140			- 			
	200	220	230	270	320				
	300	320	330	370	430	-			
		520	Cement-tres	ated subbase	150	-			
	50	170	230	310	390	-			
	100	280	400	520	640	-			
	200	470	640	830	070	-			
	200	4/0	Others (see	0.00	_	-			
	Other treated subbase			215	-				
	50	85	115	170	215	-			
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	300	350	385	420	490	_			
	*For subbase apr	aliad over differ	ant subpredes and	(in (Dostland Cos	nant Association	-			

For subbase applied over different subgrades, psi/in. (Portland Cement Association 1984a,b; Federal Aviation Administration 1978). Note: 1 in. = 25.4 mm, and 1 psi/in. = 0.27 MPa/m.

Pavement Design: 5" Thick



4.75" rounded to 5" PERVIOUS CONCRETE

Drainage Design Assistance

- PCA/NRMCA Design CD
- Available on the PCA website for \$35



http://www.cement.org/bookstore/

Storage Base Design



Pervious Concrete Hydrological Analysis Program

To return to Home Page please close this Excel program. lick Data Input Sheet to begin entering in values.







Data Input Sheet

Results

Rainfall Info



Numbers



Help







You and Your Staff Can Learn More on December 4th

Examples Where Pervious Concrete is Being Used

Applications for Pervious Concrete

YES

• Parking Lots

- Driveways
- Residential Streets
- Roadway Base

- Airports
- Basketball Courts
- Truck Areas
- Industrial Facilities
- Gas Stations
- Areas with high water table

NO

 Areas needing frequent maintenance

Parking Lots



Newark, NJ



Moorestown, NJ

Publix Store Zephyrhills, Florida Pervious Concrete Parking Lot



Pervious Parking: Lexus of Melbourne, Florida


Parking Lot Pervious Concrete Pour Palm Beach County



Pervious Concrete: Around Palm Trees at Debary SunRail Station



Driveways & Patios



Philadelphia, PA



Sidewalks



Sussex County YMCA, NJ

Hopewell Township, NJ



A Florida Community



Roadway and Driveway



Roadway and Nature Trail



Florida Parking Lot



Nature Paths/Parks



Herschfield Park, Pompton Lakes, NJ



Hogan Park, Northvale, NJ

Parking Lots



Oviedo Public Works

Photos from Magruder Concrete Solutions





Innovative Pervious Bike Lane Project: Olympia, Washington





Construction

Sequence

Sidewalk First and Outside Curb



Excavate and Check Dams



Line with Geotextile



Place Drain Rock



Pour Inside Curb



Backfill Drain Rock and Compact



Place First Lift of Pervious Concrete



Place Second Lift of Pervious Concrete



Screed, Roll, Compact and Cover



Stripe Bike Lane



Bike Lane Adjacent to Sidewalk



Bike Lane and Planter Strip



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How Does Pervious Concrete Pavement Help the Environment





Benefits of Pervious Concrete

•Elimination or reduction of expensive detention/retention ponds or underground storage systems, making more land available for development

Protects Trees



- Can pave within the drip line
- Water and air filters to roots



Solution to Stormwater Management





First Flush

- First 1" of rain
 - \odot Contains contaminants
 - EPA requires collection and treatment prior to release
- Pervious pavement reduces runoff
 - \odot captures first flush
- Approved by EPA as part of Stormwater Discharge Best Management Practice (BMP)

Maintenance

INDUSTRY-WIDE STANDARD!



Pervious Concrete Pavement Maintenance and Operations Guide



Before Cleaning

After Cleaning

PowerPowerWashingVacuum











Vacuuming

Vacuum Sweeper



Cost
Cost of laying pervious pavement exceeds that of traditional pavement, historically:

 Pervious concrete is approximately 4%-15% higher than regular concrete PER YARD,

BUT . . .



• Higher installation costs can be off-set by elimination of the need for curbs, gutters, storm drains and large retention ponds.

NRMCA Design Assistance Program: No Cost

Parking Lots: Pervious and Conventional

Multi-Model Facilities

Streets and Local Roads

Full Depth Reclamation

Roundabouts

What is the Design Assistance Program

 NRMCA in conjunction with Florida Concrete and Products Association will provide Design Suggestions that will include enough guidance to the project designer, contractor, or owner to allow them to design, specify, and/or build an economical and well designed project.



What will be included with the Design Suggestions?

- Scale CAD drawing with jointing plan
- Design details
- Alternatives for pervious pavement sections (when applicable)
- Disclaimer stating that the Design Suggestions are not every known fact about concrete pavement but complies with current industry standards. The final design is the responsibility of the engineer of record for the project.



What will be included in the Design Suggestions?

- A detailed transmittal letter which can include some of the following
 - Potential sources of project specifications
 - Base Materials
 - Potential LEED points
 - Subgrade and drainage, for pavements with and without detention (when applicable)
 - Hydrological illustration for pervious concrete projects (when applicable)

Who Do You Contact?

FDOT District Counties: Two, Three, Five, Seven and Northern District One

Roger C. Schmitt: <u>rschmitt@fcpa.org</u>

FDOT District Counties: Southern District One, Four and 6

Amy Wedel: <u>awedel@fcpa.org</u>

Woodland Blvd. Deland Constructed 1939: 80 years old

