Ohio Asphalt Paving Conference

Fawcett Center, The Ohio State University
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Porous Asphalt – An Owner's Perspective

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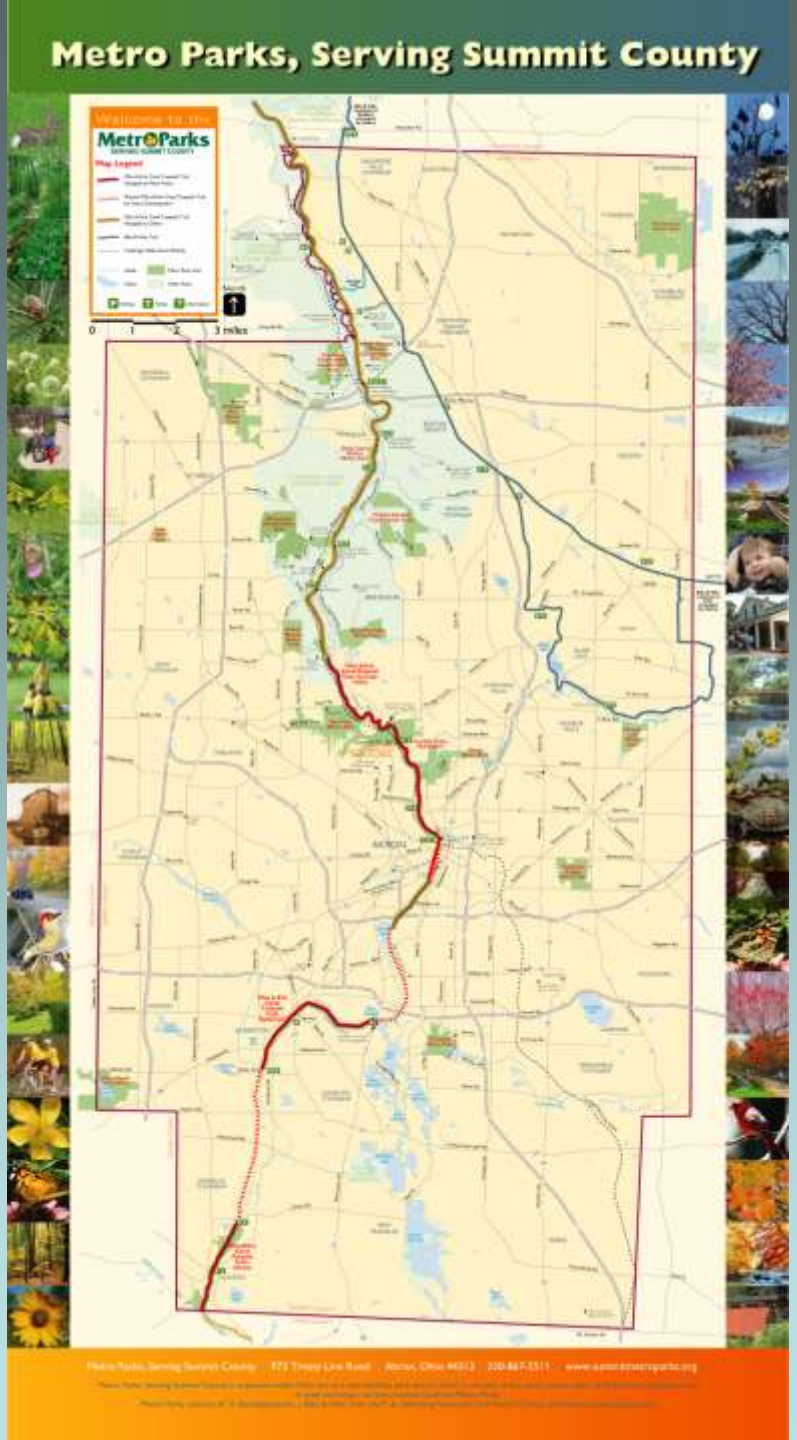

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Metro Parks, Serving Summit County
11,000 acres, 14 developed parks + several conservation areas

Governed by independent, unpaid board

Approx. 5m visits per year

15 lane miles of roads

Parking for 5,000 cars

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33 miles of paved
Bike and Hike Trail

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Why porous pavement where there is so much room?

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Why porous pavement?

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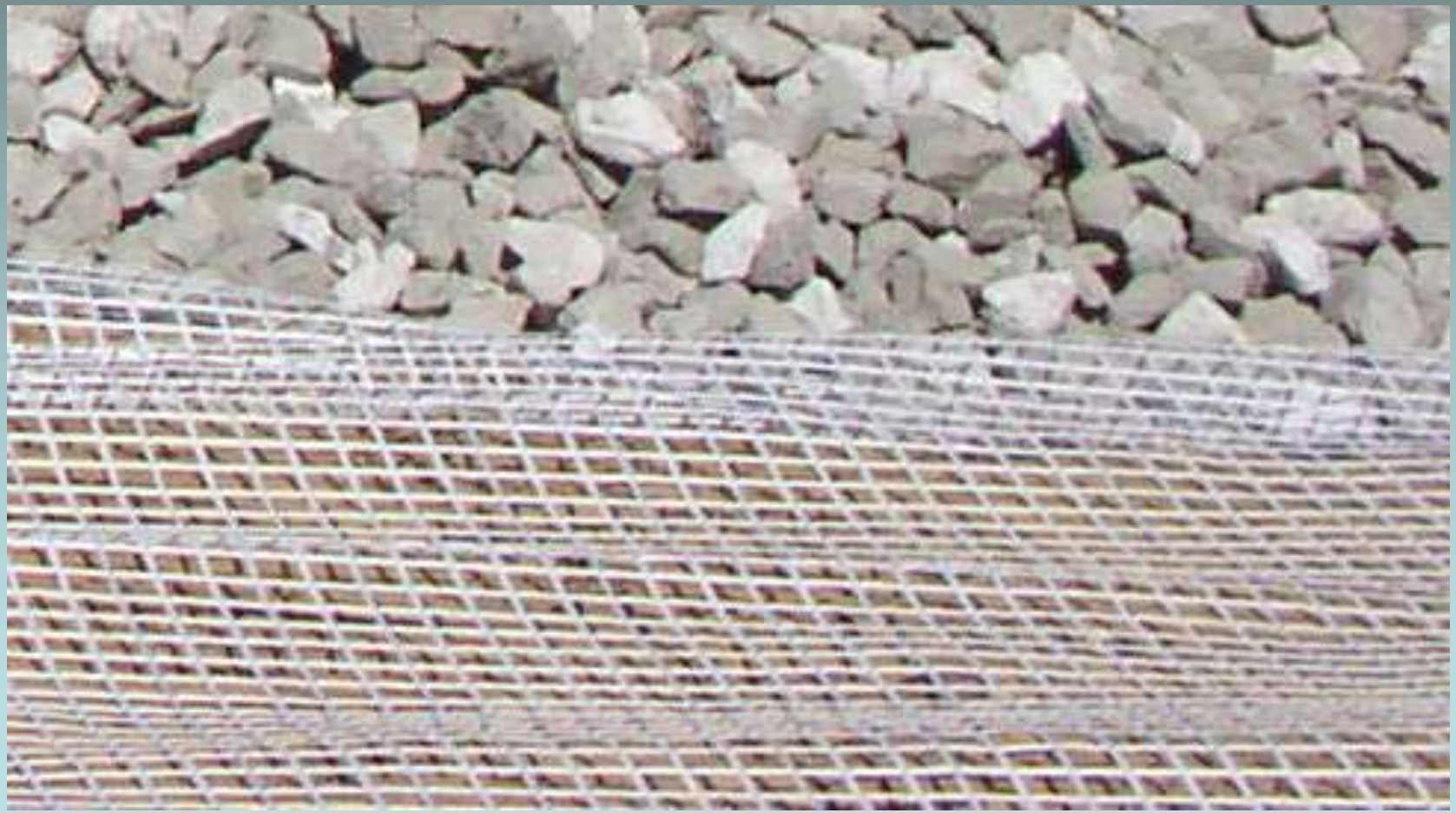
Why porous pavement?



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LIBERTY PARK 2011

TALLMADGE MEADOWS 2010

SAND RUN 2007

SPRINGFIELD BOG 2010

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BRANDYWINE 2011

OWS 2010

S

2010

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WHAT ON EARTH HAVE WE LEARNED FROM THIS??

- If it's a good site for development, it's probably a good site for porous
- If you're designing to meet other standards, you're designing for porous
- Don't go it alone – use FPO specs
- Porous asphalt works, but be smart
- Be prepared for ***different*** maintenance
- Water doesn't hurt porous asphalt

WHAT ON EARTH HAVE WE LEARNED FROM THIS??

- Site selection
- Design
- Construction
- Performance
- Maintenance
- Durability

Site Selection

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- **Resource protection – space, receiving waters, wetlands**

Site Selection

- Traffic volume, loads, turning movements

Site Selection

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- Sources of sediment, dirt – “run-on”, trees

Site Selection

- **Soil – strength and permeability testing**

Springfield Bog:
sand

Tallmadge,
Liberty Park,
Brandywine:
silty clays

Site Selection

- Surface and subgrade slopes

Site Selection

- **Commitment to maintenance**

Design

- Hydrologic design criteria per local regulations
- Regulations refer to “predevelopment” and “postdevelopment” discharge rates and volumes, and water quality practices.
- Need to measure (dye-test) rainfall vs. discharge from porous pavement & underdrain systems.
- Many variables, as with any other drainage design.

Our opinion: areas of porous pavement should be modeled similarly to dense meadow over the same soil when calculating time of concentration and runoff coefficients.

Design redundancies

- **Soil infiltration rate – assume zero infiltration during storm duration**
- **Store design storm volume either in pavement base for infiltration or collect in underdrains and pipe to basin – *OR BOTH***

Design redundancies

- **Soil infiltration rate – assume zero infiltration during storm duration**
- **Store design storm volume either in pavement base for infiltration or collect in underdrains and pipe to basin – *OR BOTH***
- **DRAINAGE, DRAINAGE, DRAINAGE**

Design

- **Design as if it won't be porous someday – institutional decision, lack of maintenance funds, ignorance**

(Brand X)

Design

- **Redundancies in stormwater infrastructure**

WATER QUANTITY

WATER QUALITY

Design

- Base and pavement thickness - water storage volume vs. pavement structure
- Minimum thicknesses recommended for porous provide more than adequate pavement support

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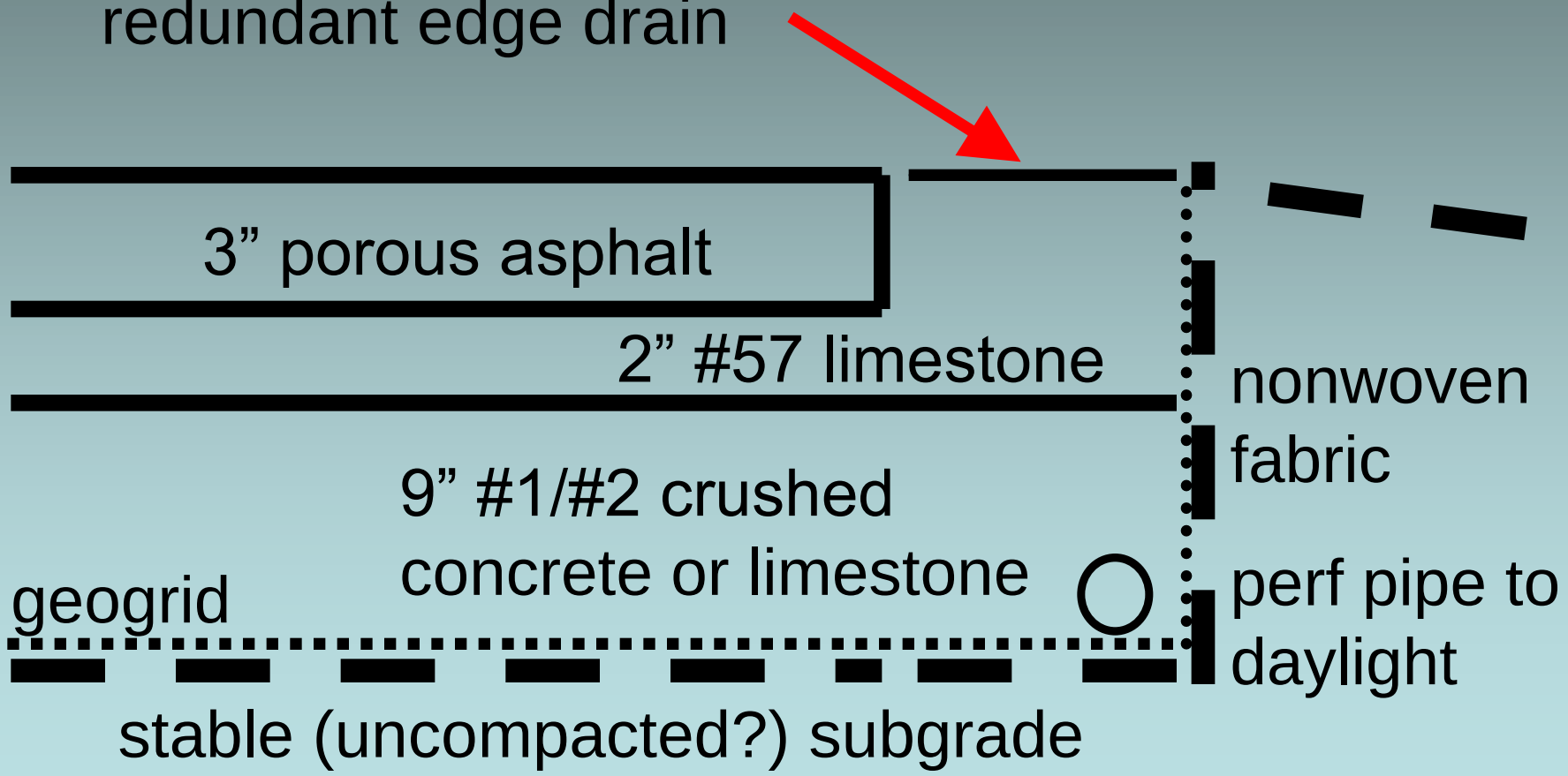
Porous Asphalt Section



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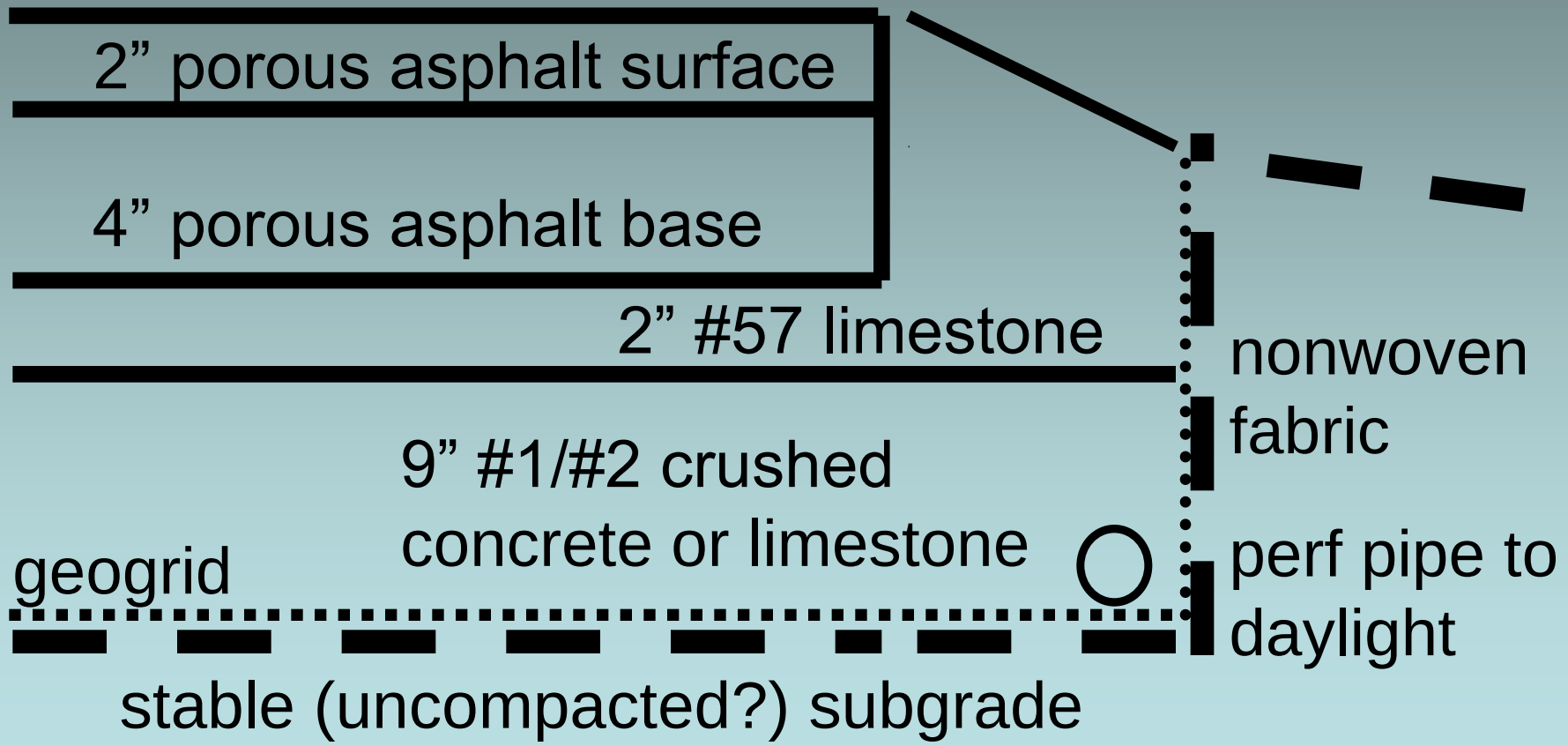
Porous Asphalt Section



Design

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What do we do when we encounter weak or wet subgrade for “regular” asphalt?

What do we do when we need to reduce energy and stop erosion at pipe outlet?

D,D,D

IF YOU ARE DESIGNING TO MEET OTHER STANDARDS, YOU ARE PRACTICALLY DESIGNING FOR POROUS

Design

- **Surface and subgrade slopes and ADA**

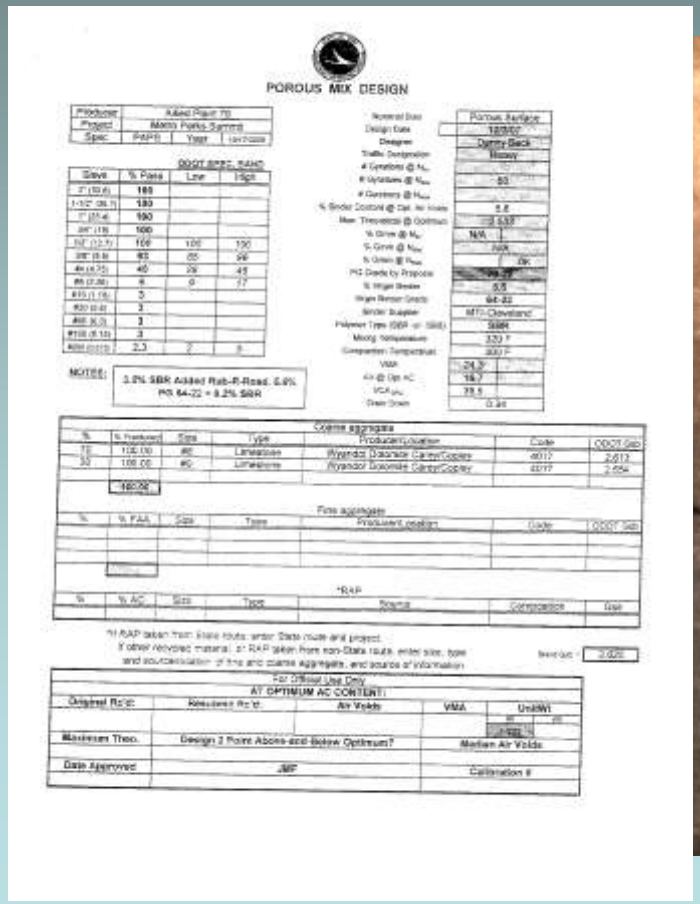
0% to 4% for porous pavement

5% max for ADA
2% max in loading areas

IF YOU ARE DESIGNING TO MEET OTHER STANDARDS, YOU ARE PRACTICALLY DESIGNING FOR POROUS

Design

- Mix design/spec
- Don’t reinvent the wheel!
- We use single 3” lift, considering two lifts.



POROUS MIX DESIGN

Producer	Allied Paving, Inc.
Project	Metro Parks Summit
Spec	PASP1

Sieve	% Pass	Low	High
2" (50.8)	100		
1-1/2" (38.1)	100		
1" (25.4)	100		
3/4" (19)	100		
1/2" (12.7)	100	100	100
3/8" (9.5)	95	85	98
#4 (4.75)	40	28	48
#8 (2.36)	8	0	17
#16 (1.18)	5		
#30 (0.6)	3		
#50 (0.3)	3		
#100 (0.15)	3		
#200 (0.075)	2.3	2	3

NOTES: 3.0% SBR Added Rob-R-Road. 0.6% PG 64-22 + 3.2% SBR

Nominal Size	Porous Surface
Design Date	10/09/07
Designer	Danny Beck
Traffic Designation	Heavy
# Gyrations @ N_{ini}	
# Gyrations @ N_{des}	50
# Gyrations @ N_{max}	
% Binder Content @ Opt. Air Voids	5.6
Max. Theoretical @ Optimum	2.537
% Gmm @ N_{ini}	N/A
% Gmm @ N_{des}	N/A
% Gmm @ N_{max}	OK
PG Grade by Propose	76-22
% Virgin Binder	5.6
Virgin Binder Grade	64-22
Binder Supplier	MFT-Cleveland
Polymer Type (SBR or SBS)	SBR
Mixing Temperature	320 F
Compaction Temperature	300 F
VMA	24.3
Air @ Opt AC	18.7
VCA DRC	19.5
Drain Down	0.04

Coarse aggregate

%	% Fractured	Size	Type	Producer/Location	Code	ODOT Gsb
70	100.00	#8	Limestone	Wyandot Dolomite Carey/Copley	45117	2.617
30	100.00	#9	Limestone	Wyandot Dolomite Carey/Copley	45117	2.664
	100.00					

Fine aggregate

%	% FAA	Size	Type	Producer/Location	Code	ODOT Gsb

*RAP

%	% AC	Size	Type	Source	Composition	Use

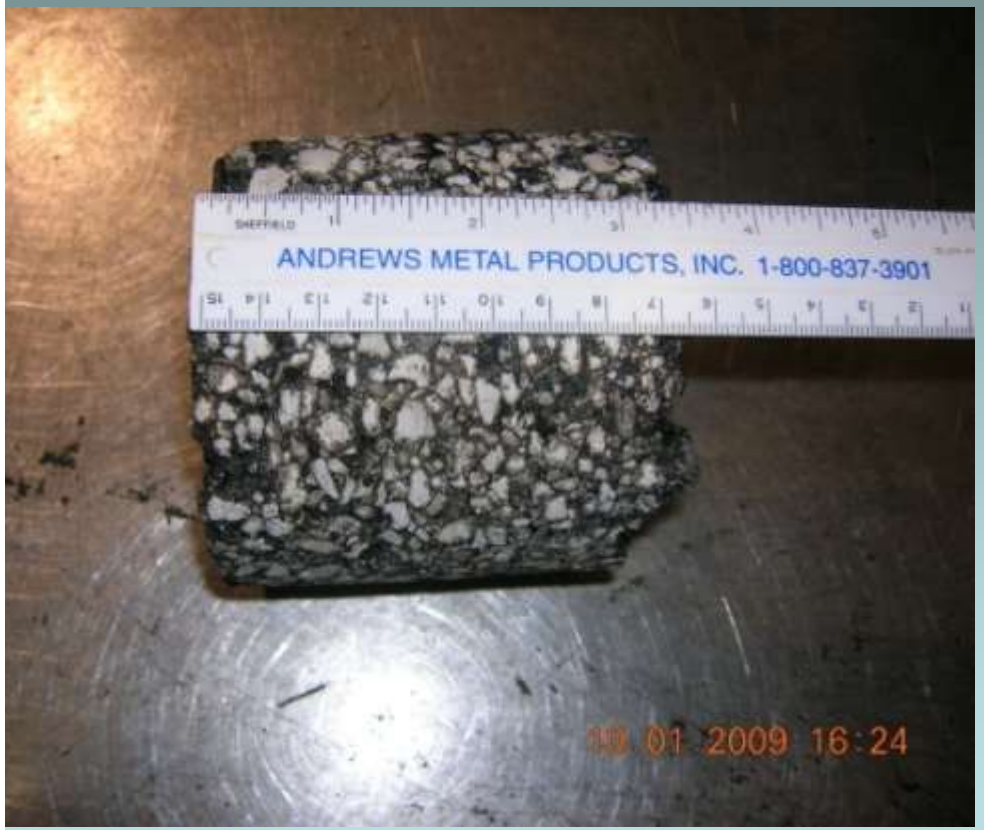
*If RAP taken from state route, enter State route and project. If other recycled material, or RAP taken from non-State route, enter size, type and source/composition of fine and coarse aggregate, and source of information.

Bend Gsb = 2.620

For Official Use Only

AT OPTIMUM AC CONTENT:

Original Rice:	Retained Rice:	Air Voids:	VMA:	Unit Wt:
				pcf
				kg/m³
Maximum Theo.	Design 2 Point Above and Below Optimum?			Median Air Voids:
Date Approved:	JMF			Calibration #:



Construction

- Experience counts!
- Work with FPO and others in the industry
- Communication with contractor and inspector
- Construction sequence
- Observe mix, temperature, compaction timing, compaction effort
- Cold joints
- Costs

Construction Sequence

Prevent wash from adjacent areas

Project sequence to build porous parking last

Construction Sequence

Construction Sequence

Prevent wash from adjacent areas

Project sequence to build porous parking last (not often practical)

Placement & Compaction

Compact the mixture using a minimum of four (4) passes of a static tandem steel wheel roller having a minimum weight of 8 tons. Complete rolling before the mix temperature has dropped below 180 °F. (FPO spec)

Keep trucks off!

Cold joints

Cost

Standard duty asphalt drive
4,316 sy 8 bids
$25.44/sy - $29.50/sy

1.5” 448
4.5” 301
6” 304

Porous asphalt parking
3,346 sy 8 bids
$27.24/sy - $33.50/sy

3” porous asphalt
2” #57
9” #1/#2
geogrid

LIBERTY PARK 2011

Cost

Porous asphalt trail
1,500 sy 6 bids
$26.00/sy - $35.00/sy

2” porous asphalt
8” #57 (6” #4 + 2” #57)
geogrid

Porous asphalt parking
5,175 sy 6 bids
$28.70/sy - $36.48/sy

3” porous asphalt
2” #57
9” #1/#2
geogrid

Cost

Porous asphalt as bid
5,175 sy
$31.00/sy

3” porous asphalt
2” #57
9” #1/#2
geogrid

Improved section
1,553 sy
$50.00/sy

(Not a large quantity, double mobilization, change order)

2” porous asphalt surface
4” porous asphalt base
2”+ #57
9” #1/#2
geogrid

BRANDYWINE 2011

Performance

Performance

Performance

Performance

Performance

Performance

Overflow pipe in heavy rain

Maintenance

Sand Run –
blow pine needles

Nature Realm –
(BRAND X)
pollen is pasty

Springfield Bog –
Tallmadge –
Liberty Park –
Brandywine -
SO FAR SO GOOD!

Strong vacuum sweeper might be in our future

KEEP IT CLEAN!

Maintenance

Careful plowing

Use only salt for de-icing

NO SEAL COAT!

Clogging anyone???

Clogging anyone???

Portland, OR study

100-yr storm:	2.5 in/hr
New porous asphalt:	43 in/hr

Clogging anyone???

(BRAND X)

Durability

SPRINGFIELD BOG 2010

Durability

NO alligatoring (base failure, load)
NO rutting/shoving (mix)
NO pot-holing (base, tack)
NO frost-heaving (soil)
NO cracking at all! (base, load)

Durability

NO alligatoring (base failure, load)
NO rutting/shoving (mix)
NO pot-holing (base, tack)
NO frost-heaving (soil)
NO cracking at all! (base, load)
NO FAILURE BY WATER

LESSONS LEARNED

- Know the site and test soil – know infiltration rate & expectations for project
- If you're designing for stormwater compliance, ADA compliance, pavement structure, and LEED points, you are practically designing for porous
- Plan for overflow from base, even if small: D,D,D
- Consider using porous for drive lanes only
- Consider two-lift porous system

LESSONS LEARNED

- Don’t go it alone
- Good, experienced contractor is critical
- In context of a bigger project, cost difference for porous is small
- Keep it clean

Sand Run – 2007

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Broke all the rules and it still works!

Sand Run – 2007

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Broke all the rules and it still works!

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Thank you!
Questions?