NRMCA™

Pervious Concrete Design

Presented By:

National **R**eady **M**ixed **C**oncrete **A**ssociation

PAVE AHEAD

DURABLE. SUSTAINABLE. CONCRETE.

National Ready Mixed Concrete Association

- National Trade Association – Established in 1930
- HQ in Alexandria, VA
- 1,400+ Member Companies
- NRMCA Represents ~75% of North American Ready Mixed Production
- Mission - Serve Industry and Partners Through:
  - Compliance and Operations
  - Engineering
  - Government Affairs
  - *Local Paving: Pave Ahead™ Initiative*
  - *Structures and Sustainability: Build With Strength™ Initiative*

Interested in becoming a member?
Visit: www.nrmca.org/membership/

NRMCA

PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

Thank you to the NRMCA 2020 Super Sponsors

PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

NRMCA Disclaimer

- This presentation has been prepared solely for information purposes. It is intended solely for the use of professional personnel, competent to evaluate the significance and limitations of its content, and who will accept full responsibility for the application of the material it contains. The National Ready Mixed Concrete Association and any other organizations cooperating in the preparation of this presentation strive for accuracy but disclaim any and all responsibility for application of the stated principles or for the accuracy of the content or sources and shall not be liable for any loss or damage arising from reliance on or use of any content or principles contained in this presentation.
- Unless otherwise indicated, all materials in this presentation are copyrighted to the National Ready Mixed Concrete Association. All rights reserved. Therefore reproduction, modification or retransmission in any form is strictly prohibited without the prior written permission of the National Ready Mixed Concrete Association.
-

PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

Instructions

- Webinar is being recorded and posted at paveahead.com/education/.
- Everyone is muted.
- Type questions in the question box.
- Download the handouts in the GoToWebinar control panel.
- Credit for course:
  - Based on attendance.
  - Survey (Quiz) – In follow-up e-mail, not required, but encouraged.
  - Attendance Certificate – In follow-up e-mail 1 hour after webinar.
  - AIA members – Attendance registered with AIA-CES if AIA number provided.

PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

About the Course

Learning Units (LU) or Professional Development Hours (PDH)

- AIA-CES CSP101: 1.0 LU|Elective (1.0 Hour) | 1.0 PDH for Engineers
- **Learning Objectives:**
  - What is pervious concrete and how is it used?
  - How does pervious concrete contribute to sustainable construction?
  - How do you design a pervious concrete system?
  - How does pervious concrete perform in the winter?
  - How do you maintain pervious concrete?
  - How much does it cost?

PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

Today's Presenter

- Ken Justice, P.E.
  - –NRMCA Local Paving, Midwest Region
  - –31 Years in Practice
  - –Civil Design & Pavement
- NRMCA Certified Pervious Concrete Craftsman

More information at paveahead.com/experts/

PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

Agenda

- Welcome, introductions
- What You Need to Know About Pervious Concrete
  - Basic Definitions
  - Uses
  - Regulations
  - Environmental
- Pervious Concrete Mixtures & Production
  - Mix Basics
- General Design Principles
  - Pavement Types/Uses
  - Pavement Thickness
  - Base Thickness
  - Computer Programs
- The three questions
  - What happens in the winter?
  - How do you maintain pervious concrete?
  - How much does it cost?
- Questions & Answers

What You Need to Know About Pervious Concrete

Pervious Concrete Design

PAVE AHEAD

DURABLE. SUSTAINABLE. CONCRETE.

Rethink . . .

Remove the word "Concrete" from Pervious Concrete

What is Portland Cement Pervious Concrete?

- A No-Fines Concrete Mix
  - Coarse Aggregate
  - Portland Cement
  - Water
- Intended for use as an open-graded drainage material

PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

Texture Comparison

PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

Parking Lots

Moorestown, NJ
Oct 2006

Newark, NJ
July 2009

PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

Driveways

Long Branch, NJ
Aug 2011

Philadelphia, PA
June 2009

PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

Sidewalks

Sussex Co. YMCA, NJ
June 2008

Hopewell Township, NJ
June 2007

Rt. 73, Berlin, NJ
June 2011

PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

Streets, Alleys, Cul-de-sac's

Lambertville, NJ
Oct 2009

Cape May, NJ
June 2007

PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

Heavy-Duty

Loading Dock

Forsgate Industrial Park, Cranbury, NJ

April 2009

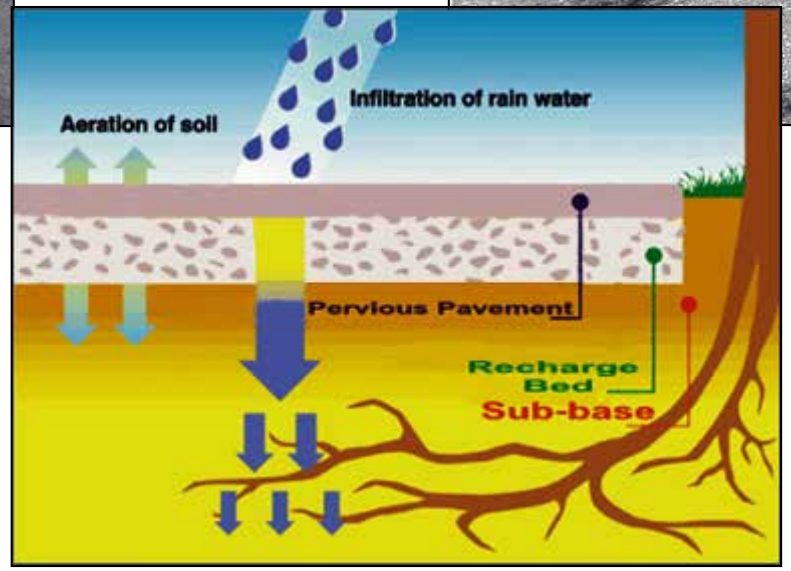
PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

Patios

MY HOUSE!

PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

Protects Trees



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

PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

Nature Paths/Parks

Herschfield Park, Pompton Lakes, NJ Sep 2009

Hogan Park Northvale, NJ 2008

Mantalooking Pier Brick, NJ – Sep 2011

The pavement can drain the equivalent of

275” – 1500” of rain per hour!

Note: The 100 year storm in NJ is roughly 8.75 inches per hour

Hershfield Park, Pompton Lakes, NJ
Placed September 2009

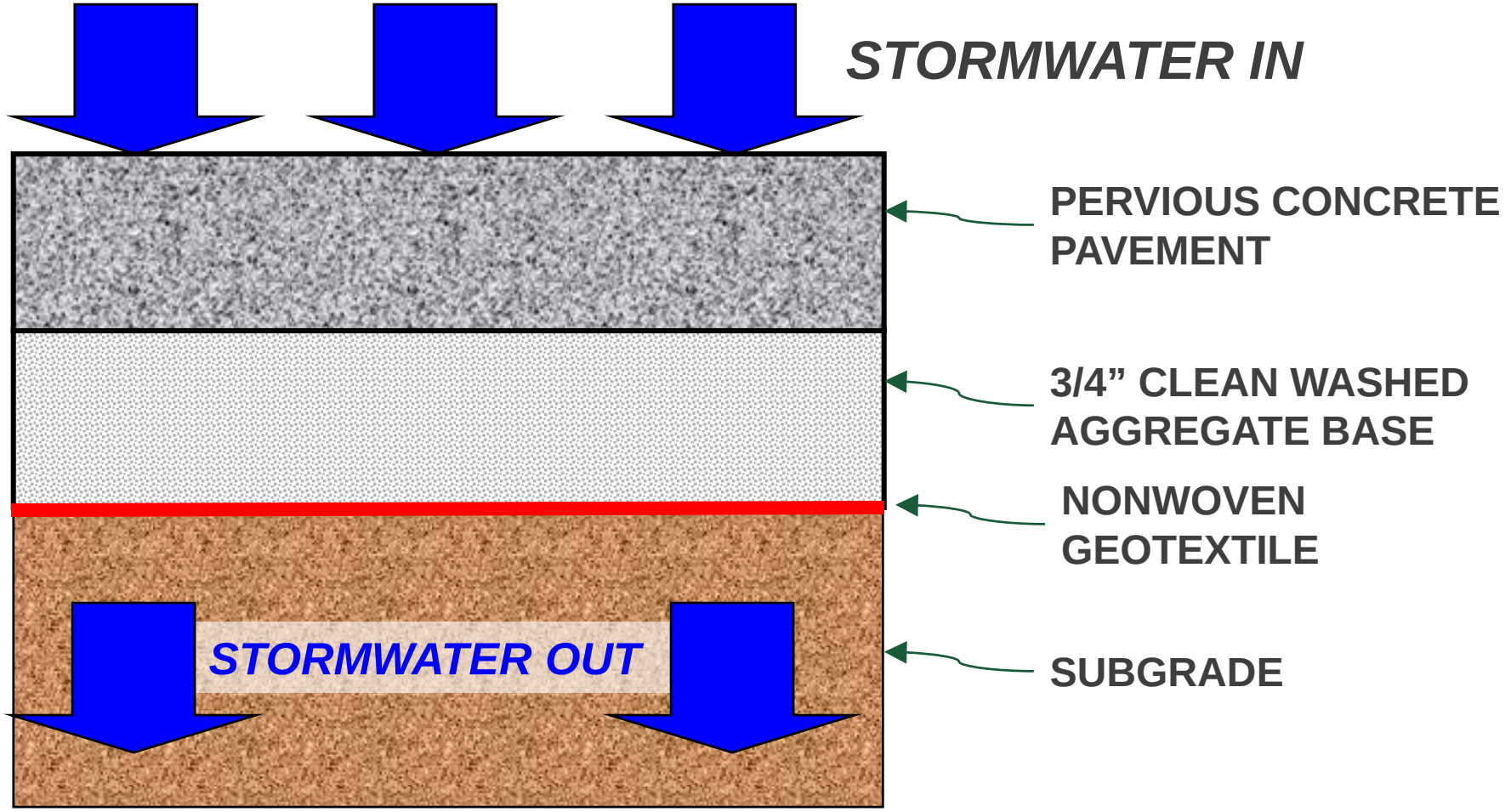
PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

Benefits of Pervious Concrete

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

PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

Solution to Stormwater Management



PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

Parking Lots & Pavements: Environmental Disasters

- Almost Total Runoff, No Percolation
- Valuable Water Resources are Wasted
- Public Water Needed for Vegetation
- Runoff Has Chemical Pollutants, Requiring Treatment
- Runoff is Hotter, Damaging Ecosystems
- Rapid, High Volume Runoff Requires Larger Public Drainage Facilities
- Hot Parking Lots Add to Urban Heat Island Effects

PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

Parking Lots & Pavements: Stormwater Runoff

- Impervious pavement minimized ground water recharge
- Stormwater flows into storm drains and away from immediate area

Pervious Concrete Pavement Environmental Advantages

- Percolation Recharges Groundwater
- Water Resources are Conserved
- Less Need for Irrigation
- Adjacent Trees and Vegetation are Allowed More Rainwater
- Runoff to Streams and Lakes is Reduced, Cooler and Cleaner
- Cooler Surface Has Less Impact on Air Temperature
- Minimizes Urban Heat-Island Effect

PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

The pavement can drain the equivalent of

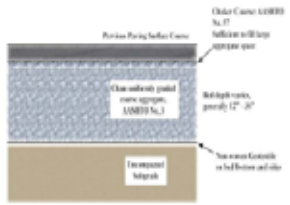
275” – 1500” of rain per hour!

2007 - Duraport Corporate parking lot, Bayonne, NJ

PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

EPA and statewide acceptance as a Best Management Practice

BMP 6.4.1: Pervious Pavement with Infiltration Bed



Pervious pavement consists of a permeable surface course underlain by a uniformly-graded stone bed which provides temporary storage for peak rate control and promotes infiltration. The surface course may consist of porous asphalt, porous concrete, or various porous structural pavers laid on uncompacted soil.

Key Design Elements

* Almost entirely for peak rate control
* Water quality and quantity are not addressed
* Short duration storage; rapid restoration of primary uses
* Minimize safety risks, potential property damage, and user inconvenience
* Emergency overflows
* Maximum ponding depths
* Flow control structures
* Adequate surface slope to outlet

Potential Applications

Residential: Limited
Commercial: Yes
Ultra Urban: Yes
Industrial: Yes
Retrofit: Yes
Highway/Road: Limited

Stormwater Functions

Volume Reduction: Medium
Recharge: Medium
Peak Rate Control: Medium
Water Quality: Medium

Water Quality Functions

TSS: 85%
TP: 65%
NO3: 30%

Other Considerations

- Protocol 1. Site Evaluation and Soil Infiltration Testing and Protocol 2. Infiltration Systems Guidelines should be followed, see Appendix C

New Jersey Stormwater Best Management Practices Manual

February 2004

CHAPTER 9.7

Standard for Pervious Paving Systems

Definition

Pervious paving systems are paved areas that produce less stormwater runoff than areas paved with conventional paving. This reduction is achieved primarily through the infiltration of a greater portion of the rain falling on the area than would occur with conventional paving. This increased infiltration occurs either through the paving material itself or through void spaces between individual paving blocks known as pavers.

Pervious paving systems are divided into three general types. Each type depends primarily upon the nature of the pervious paving surface course and the presence or absence of a runoff storage bed beneath the surface course. These three types are summarized in Table 9.7-1 and discussed below. Porous paving and permeable paver with storage bed systems treat the stormwater quality design storm runoff through storage and infiltration. Therefore, these systems have adopted TSS removal rates similar to infiltration structures. The adopted TSS removal rate for each type of pervious paving system is presented in Table 9.7-1.

Table 9.7-1: Types of Pervious Paving Systems

Type of Paving System	General Description of Paving System	Adopted TSS Removal Rate
Porous paving	Porous asphalt or concrete paving constructed over runoff storage bed of uniformly graded broken stone	80%
Permeable pavers with storage bed	Impervious concrete pavers with surface voids constructed over runoff storage bed of uniformly graded broken stone	80%
Permeable pavers without storage bed	Impervious concrete pavers with surface voids constructed over structural bed of sand and crushed stone	Volume reduction only

PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

First Flush

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

PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

Soil chemistry and biology will naturally treat water

- Pervious pavement does function in the removal of pollutants.
- Removal is accomplished through absorption, filtration and microbiological conversion.
- Long term studies show removal efficiencies of:
  - 82-95% of sediments
  - 65% total Phosphorous
  - 80-85% total Nitrogen
  - high removal rates are also reported for Zinc, Lead and Chemical Oxygen Demand (COD)

Pervious Concrete Mix

Pervious Concrete Design

PAVE AHEAD

DURABLE. SUSTAINABLE. CONCRETE.

Properties of Portland Cement Pervious Concrete

- 15% to 25% air void content
- 100 to 130 lbs/ft^3 unit weight
- 500 to 3,000 psi strength
  - Introduction of small amount of fine aggregate (sand) can increase strength to 4,500 psi (+/-) or greater
  - **BUT** compressive strength typically NOT USED as acceptance criteria.
  - Air void structure and unit weight are used for acceptance instead.
- Unit weights 125-135 lbs/ft^3

PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

Typical Portland Cement Pervious Concrete Mix

- 500 lbs. Portland Cement per CY
  - 50 lbs of slag or flyash could replace some cement
- 2,700 lbs Coarse Aggregate per CY
  - 3/8” aggregate most common
- 18-21 gal +/- water per CY
  - Sufficient water to display a wet, metallic sheen on the aggregate
  - *Compared to 32-35 gal water for regular concrete*
- 0.29 – 0.35 W/C Ratio

Uniformity: Water to Cement Ratio

Lb. Water

Lb. Cement = W/C Ratio

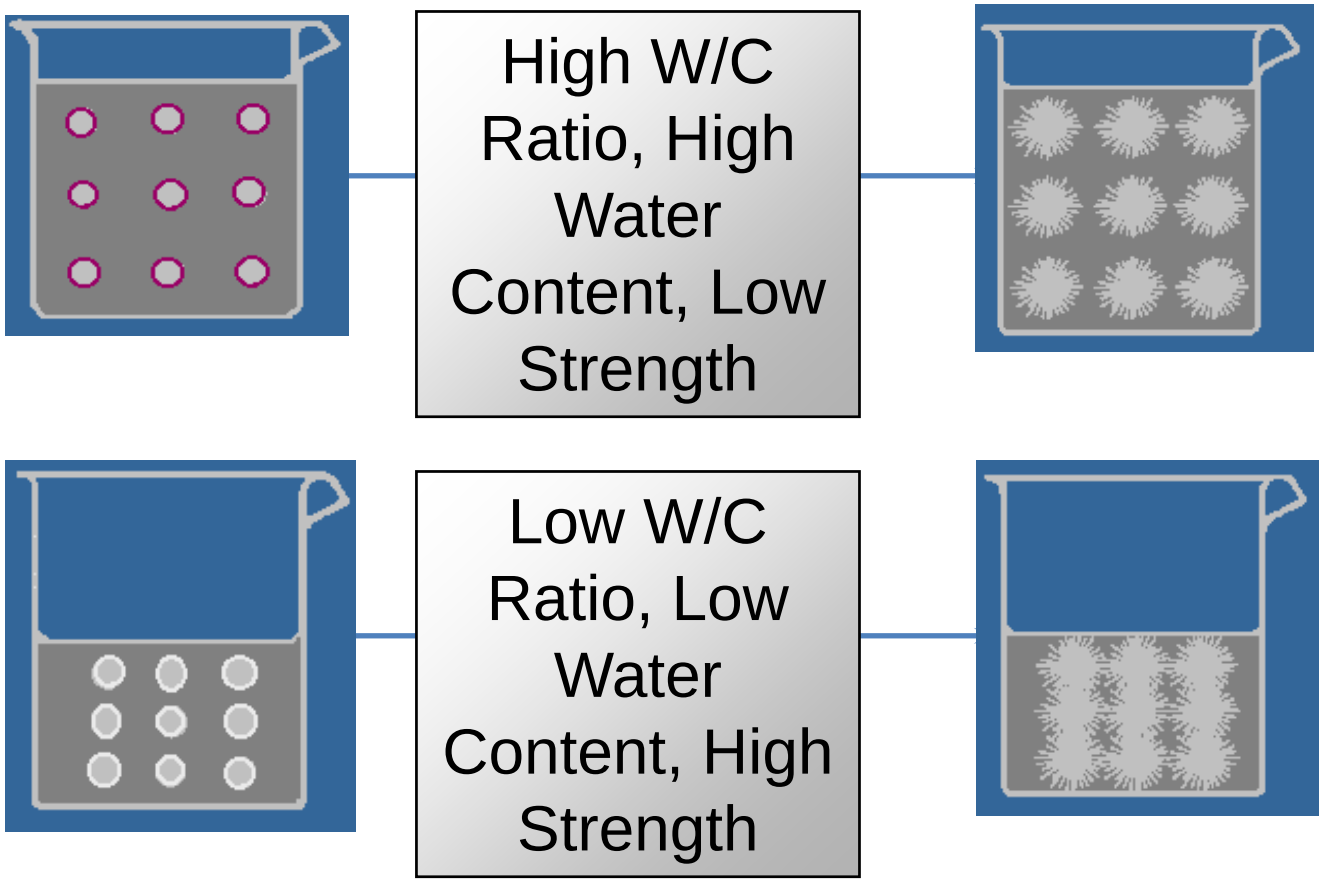
5# Water

10# Cement = 0.50 W/C Ratio

3.0# Water

10# Cement = 0.30 W/C Ratio

Water/Cement Ratios



PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

w/c of Pervious Concrete

Lb. Water

Lb. Cement = W/C Ratio

160# Water (No Fines) = 0.33 W/C Ratio

500# Cement

283# Water (Normal) = 0.50 W/C Ratio

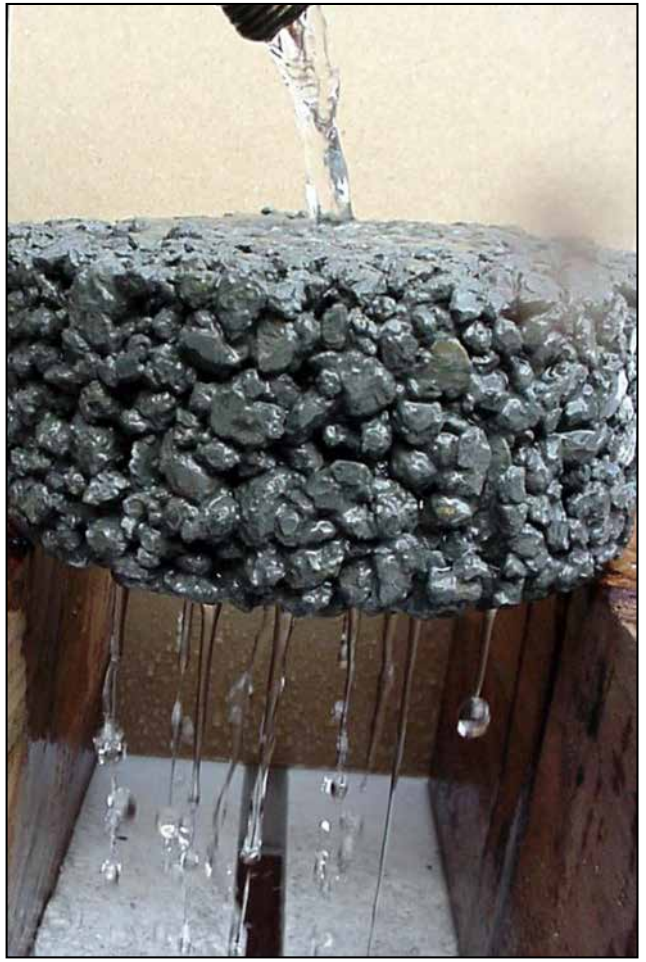
564# Cement

Typical Portland Cement Pervious Concrete Mix Design

- ADMIXTURES
  - Hydration Stabilizer
    - 10 to 16 ounces per 100 weight
    - Ounces depend on temperature – add more on hotter days
  - Viscosity Modifier
    - Ounces depend on % passing the 30 & 50 sieve
    - 2 to 6 ounces per 100 wt – add VMA for more fines

Permeability and Porosity

- Permeability – rate at which water can flow
- Function of interconnected voids
- Porosity – the amount of voids
- Increase in porosity increases permeability
- Some voids are entrapped during the placement and compaction process



PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

Aggregate

- Texture and Porosity Affected by:
  - –Aggregate Size
  - –Aggregate Grading
  - –Aggregate Angularity
  - –Paving Equipment

Pervious Concrete Design

Pervious Concrete Design

PAVE AHEAD

DURABLE. SUSTAINABLE. CONCRETE.

Pavement Thickness

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

Strength

- Add sand into mix
  - 5% up to 25%
  - Adds up to 1,000 psi
  - Sacrifice porosity for strength
- Synthetic Fibers
- Larger Aggregate Size
  - For areas where high heels & wheelchairs are not a concern
- Thicker sections

PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

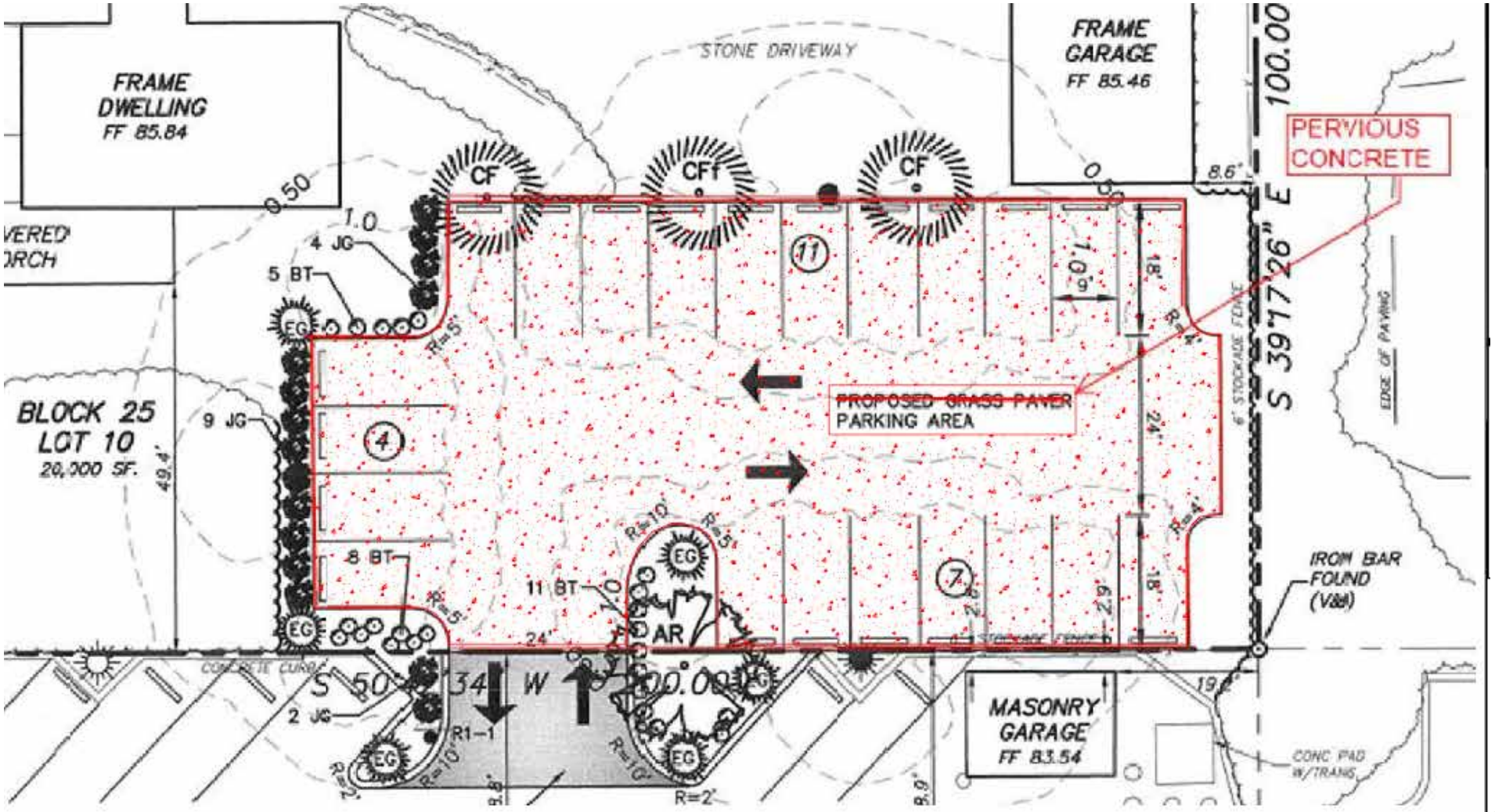
Design Example

Pervious Concrete Design

PAVE AHEAD

DURABLE. SUSTAINABLE. CONCRETE.

Example Site Plan

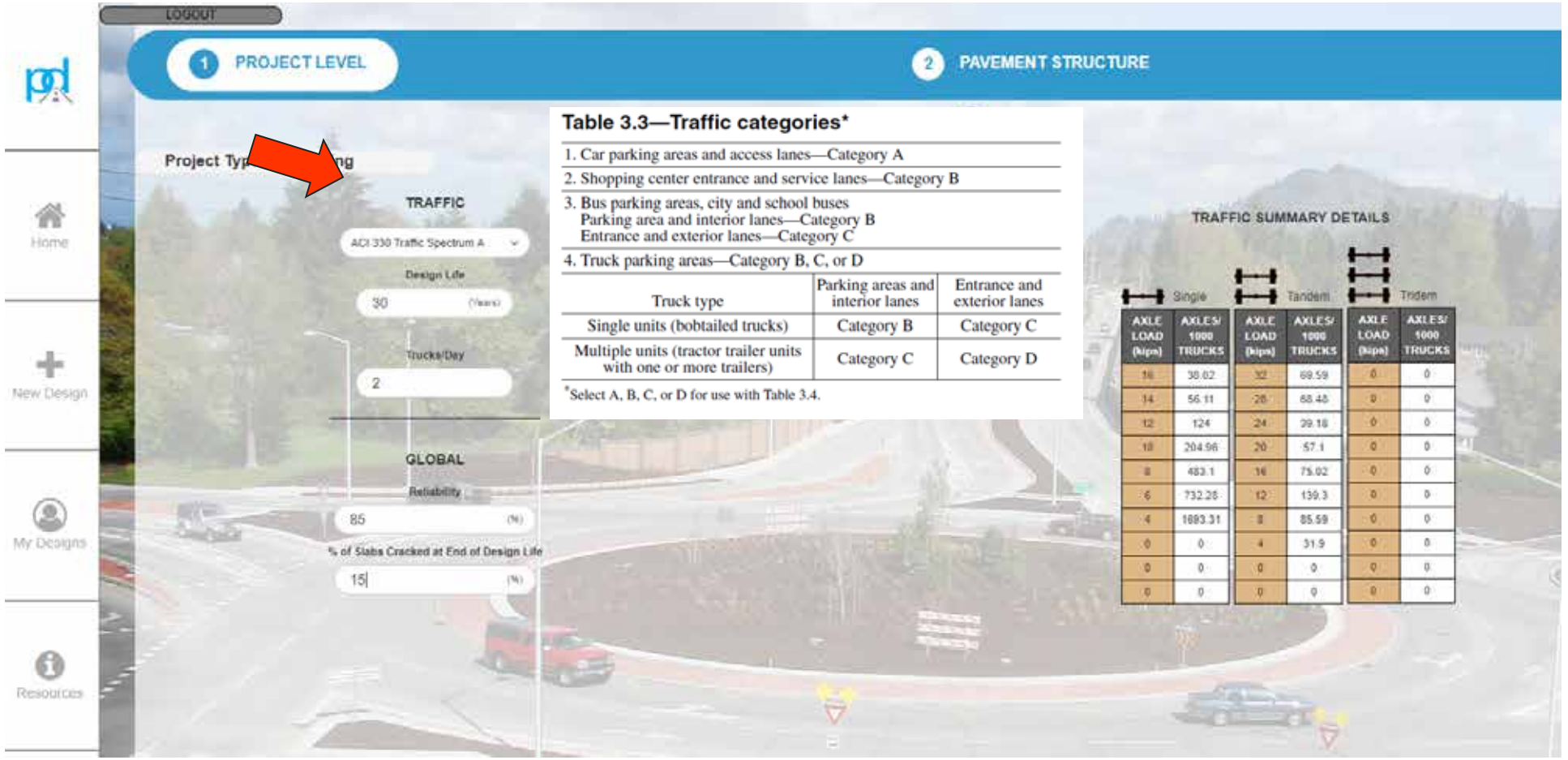


Pavement Thickness Design

https://www.pavementdesigner.org/

PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

Pavement Thickness Design



https://www.pavementdesigner.org/

Pavement Thickness Design

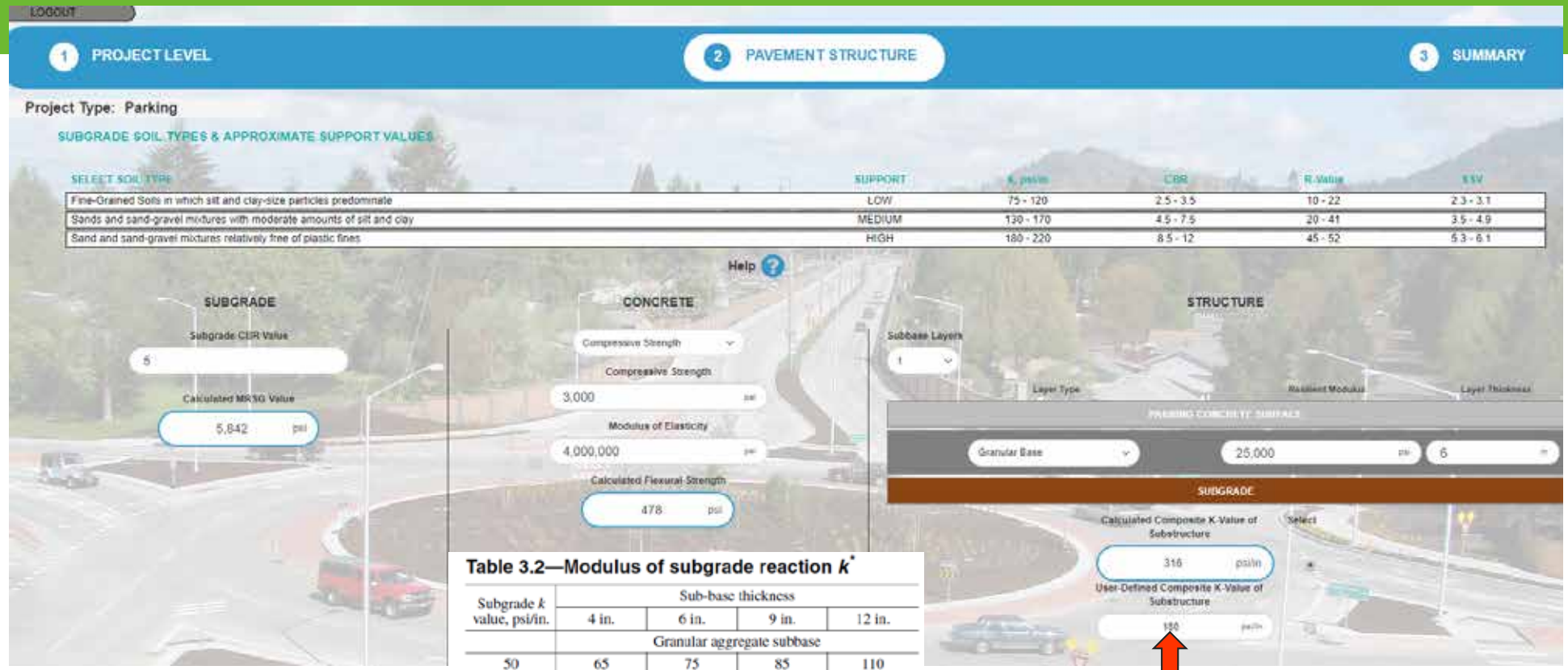


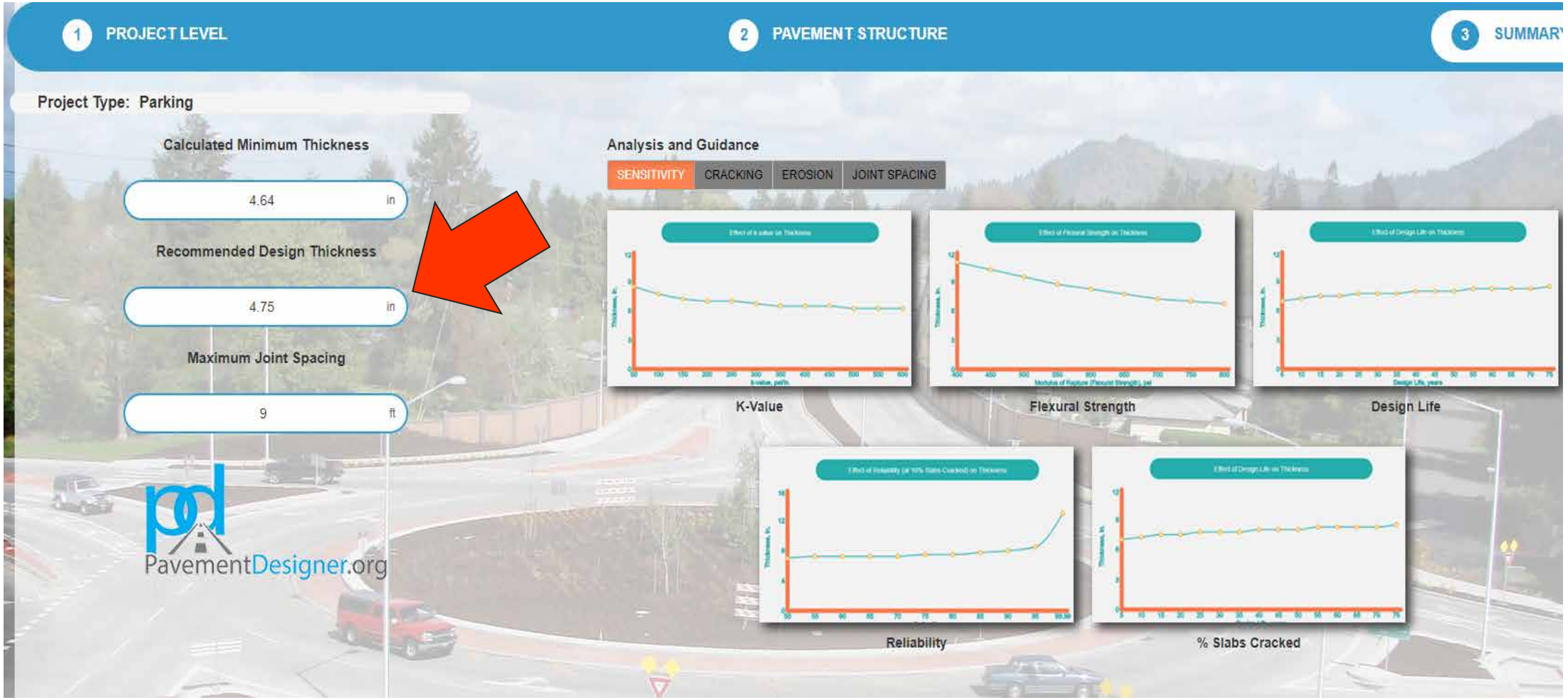
Table 3.2—Modulus of subgrade reaction *k*[*]

Subgrade *k* value, psi/in.	Sub-base thickness			
	4 in.	6 in.	9 in.	12 in.
	Granular aggregate subbase			
50	65	75	85	110
100	130	140		
200	220	230	270	320
300	320	330	370	430
	Cement-treated subbase			
50	170	230	310	390
100	280	400	520	640
200	470	640	830	—
	Other treated subbase			
50	85	115	170	215
100	175	210	270	325
200	280	315	360	400
300	350	385	420	490

[*]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.

PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

Pavement Thickness Design



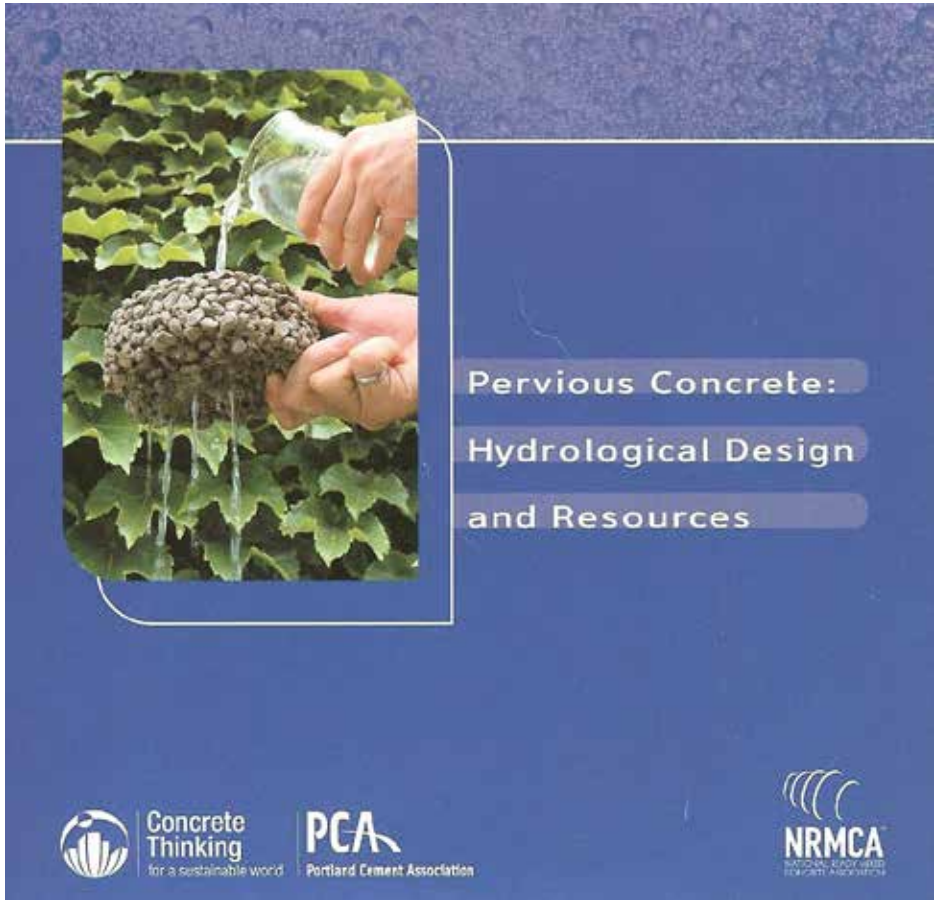
4.75” rounded to 5” PERVIOUS CONCRETE

PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

Drainage Design Assistance

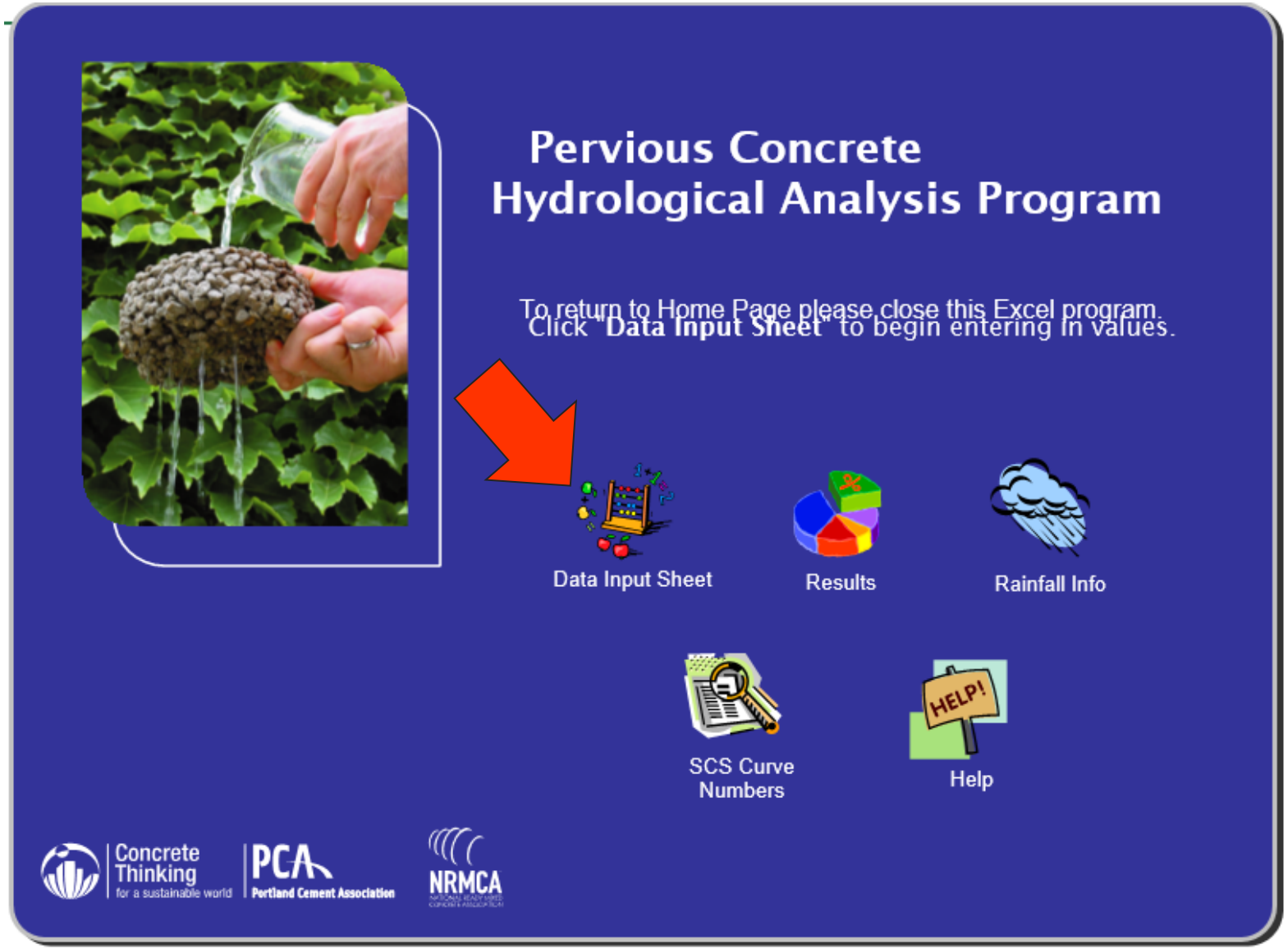
- PCA/NRMCA Design CD
  - Available on the PCA website for $35

http://www.cement.org/bookstore



PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

Storage Base Design



Analysis Start

Data Input Sheet

Results

Rainfall Info

SCS Curve Numbers

Help

Data Input Sheet

Instructions: Press Tab to move from Cell to Cell

Project Details

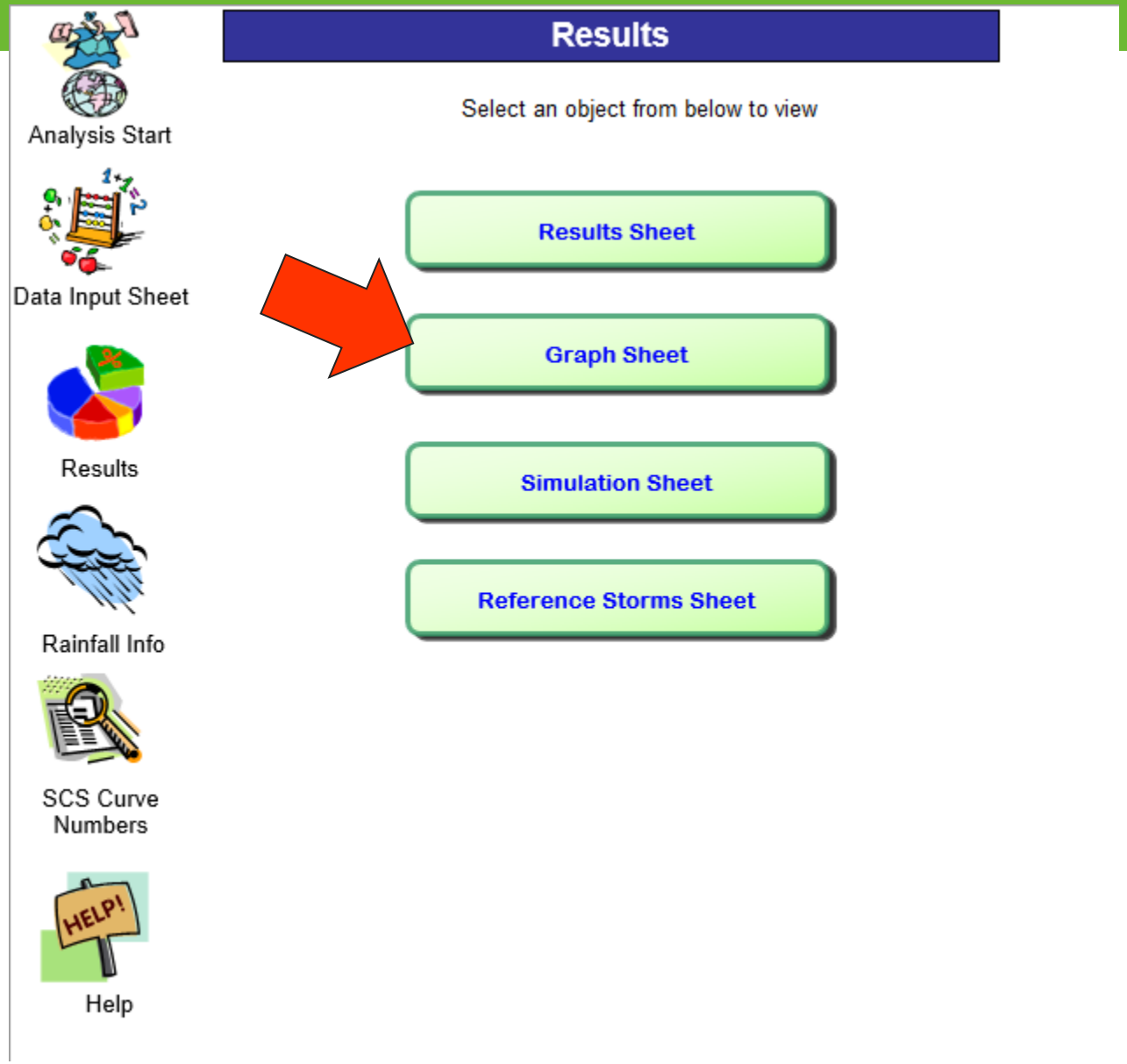
Project:	**Stanfill Towers**
Designer:	**KMJ**
Date Run:	**4/1/19**

Pervious concrete		
Thickness	5	in
Surface area	7,020	sq ft
Porosity	20	%
Gravel base		
Thickness	6	in
Porosity	40	%
Ponding limit	4	in
Exfiltration rate	2.500	in/hr
Impervious surface		
Surface area	0	sq ft
Off-site drainage		
Area	2,000	sq ft
CN	61	

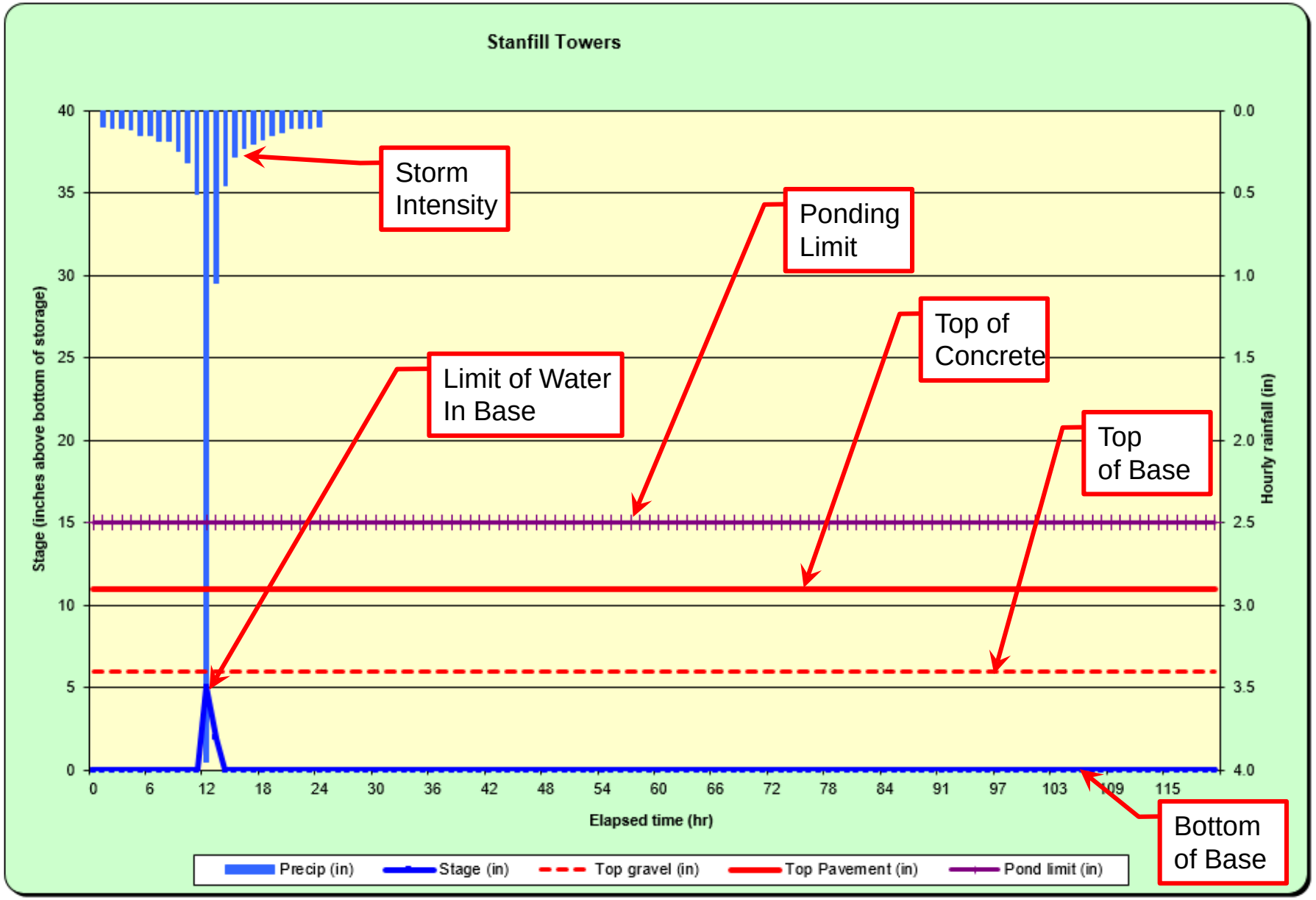
24-hr Precipitation	9.25	in
Location	Boca Raton, FL	
Return period	100	yr

Storage Base Design

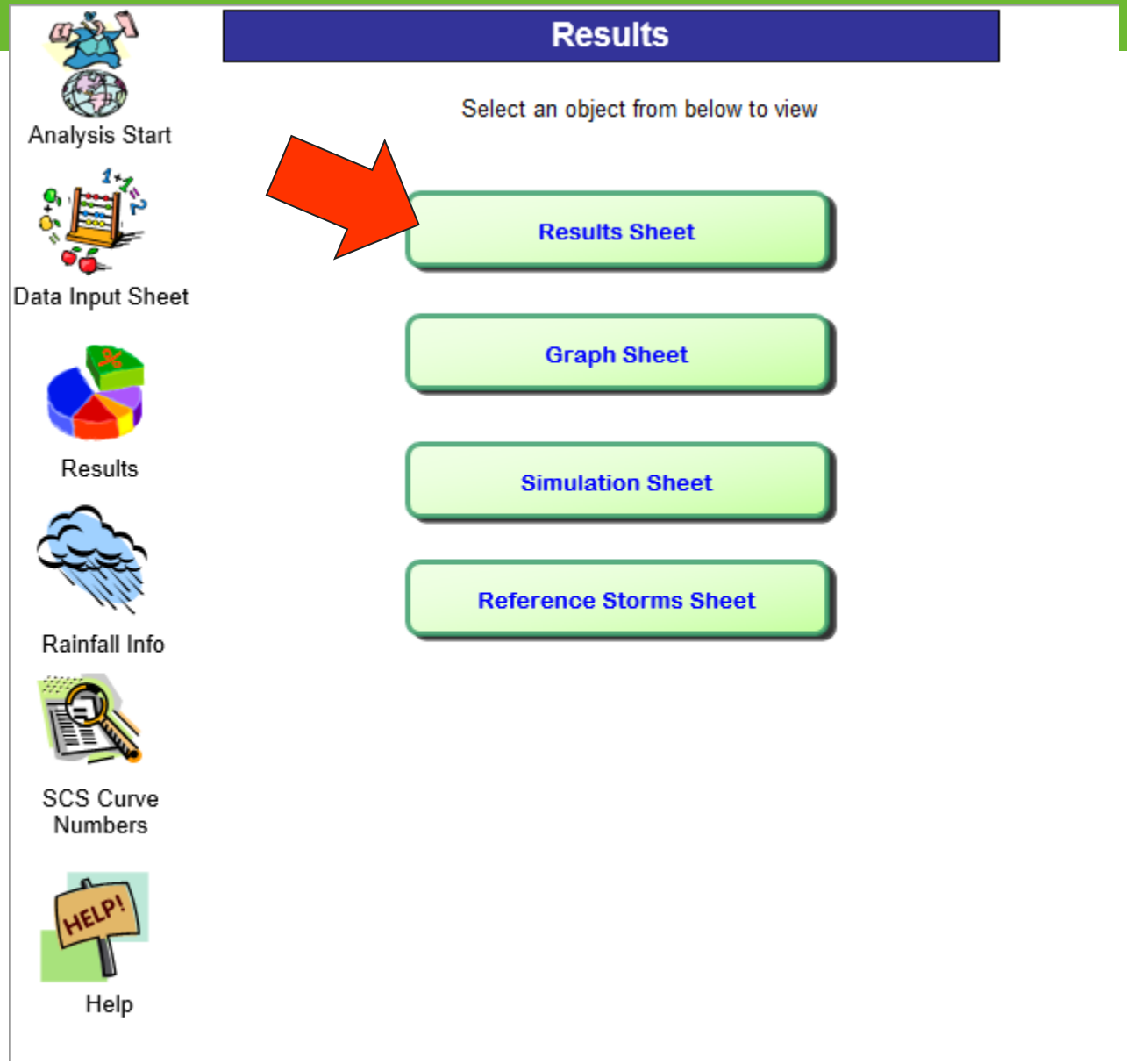
Storage Base Design



Graphic Results



Storage Base Design



Storage Base Design Report

< Back

Results Sheet

Project:	Stanfill Towers
Designer:	KMJ

Click Here for
Metric Conversion

Values shown in blue are user inputs.
Values shown in red are computed results.
See caution note below.

Run date	04/01/19

Configuration

Pervious concrete		
Thickness	5	in
Surface area	7,020	sq ft
Porosity	20	%
Gravel base		
Thickness	6	in
Porosity	40	%
Ponding limit	4	in
Exfiltration rate	2.500	in/hr
Impervious surface		
Surface area	0	sq ft
Off-site drainage		
Area	2,000	sq ft
CN	61	

24-hr Precipitation	9.3	in
Location	Boca Raton, FL	
Return period	100	yr

Design aim

Target CN	65	
Allowable runoff	4.93	in

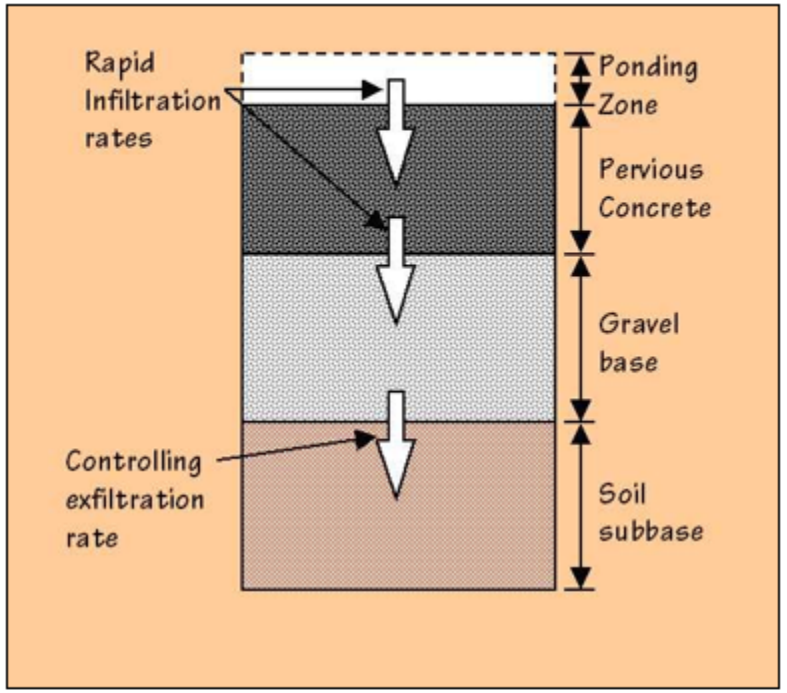
Storage Base Design

Summary of results

Effective CN	18	
Estimated runoff (5 days)		n
Available storage used		%
Number of hours of ponding	0	
Max ponding depth	-6.0	in
Available storage after 24 hr	100	%
Available storage after 5 days	100	%
Stage after 5 days	0.0	in
Additional time to drain completely	0	hr

Intermediate results

Total drained surface area	9,020	sqft
Storage capacity, pervious concrete	585	cuft
Storage capacity, gravel base	1,404	cuft
Storage capacity, ponding	2,340	cuft
Total stormwater storage	4,329	cuft
Total precip volume	6,148	cuft
5-day exfiltration volume	6,148	cuft
Total runoff (overflow)	0	cuft
Water stored after 5-days	0	cuft
Water balance error	0.0	cuft



Caution: This spreadsheet is intended for study purposes to illustrate expected hydrologic behavior of pervious concrete. Designers must verify results for specific sites by independent means.

AHEAD
STAINABLE. CONCRETE.

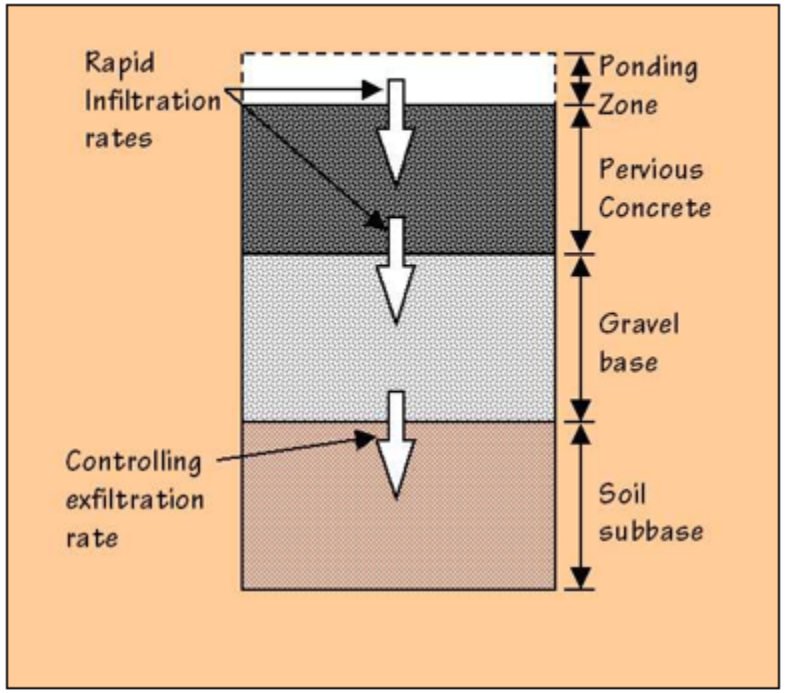
Storage Base Design

Summary of results

Effective CN	18
Estimated runoff (5 days)	0.00 in
Available storage used	27 %
Number of hours of ponding	0
Max ponding depth	-6.0 in
Available storage after 24 hr	100 %
Available storage after 5 days	100 %
Stage after 5 days	0.0 in
Additional time to drain completely	0 hr

Intermediate results

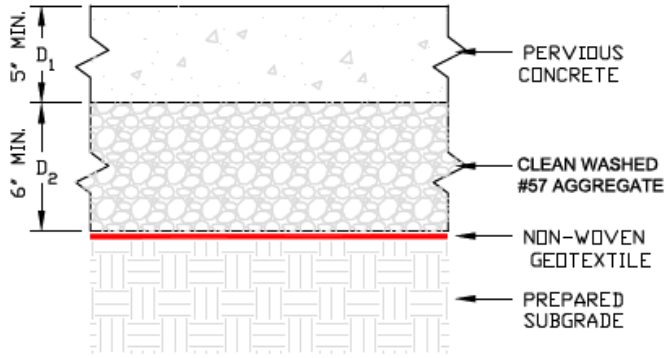
Total drained surface area	9,020 sqft
Storage capacity, pervious concrete	585 cuft
Storage capacity, gravel base	1,404 cuft
Storage capacity, ponding	2,340 cuft
Total stormwater storage	4,329 cuft
Total precip volume	6,148 cuft
5-day exfiltration volume	6,148 cuft
Total runoff (overflow)	0 cuft
Water stored after 5-days	0 cuft
Water balance error	0.0 cuft



Caution: This spreadsheet is intended for study purposes to illustrate expected hydrologic behavior of pervious concrete. Designers must verify results for specific sites by independent means.

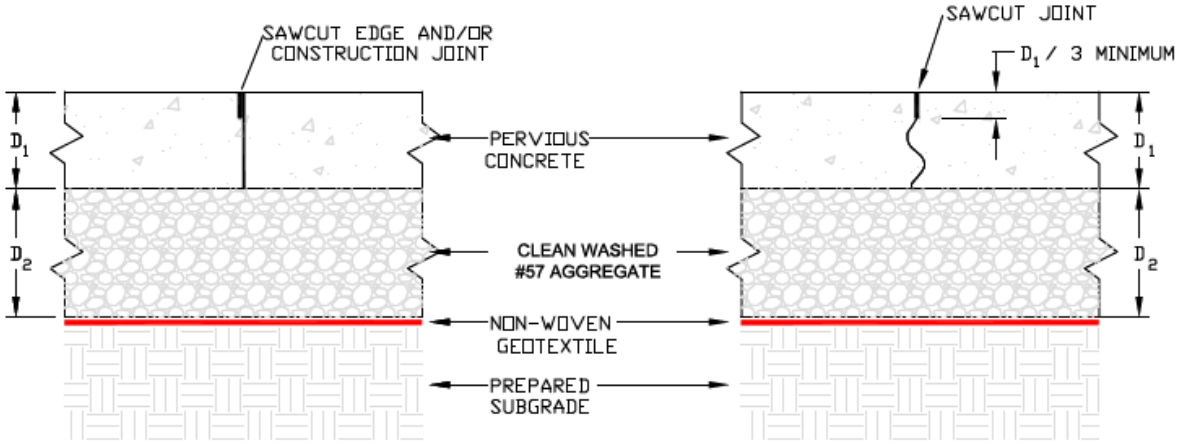
AHEAD
STAINABLE. CONCRETE.

Typical Details



PERVIOUS TYPICAL SECTION

NOT TO SCALE



PERVIOUS CONSTRUCTION JOINT

NOT TO SCALE

PERVIOUS CONTRACTION JOINT

NOT TO SCALE

PLACEMENT

CURING

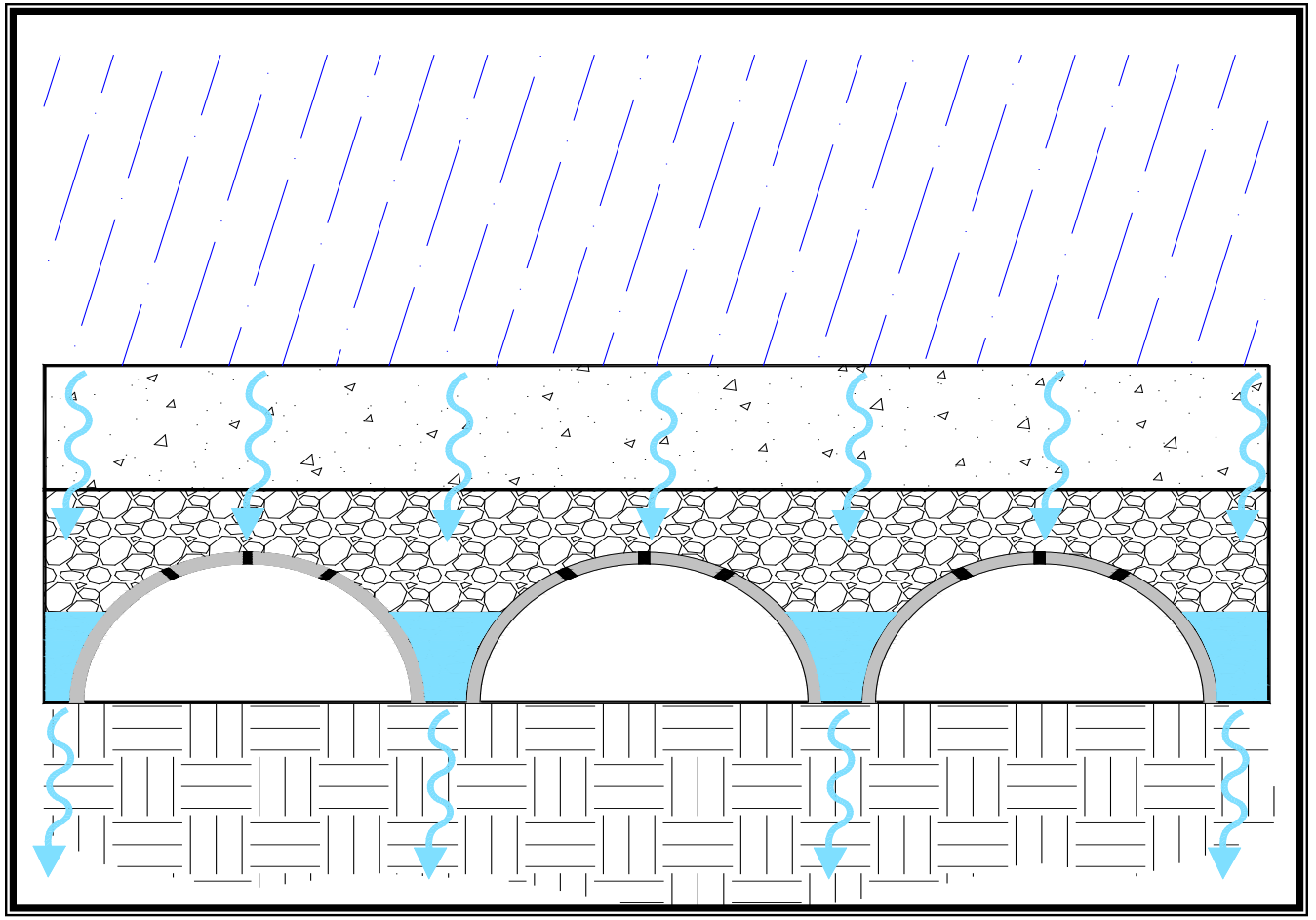
NOTES:

1. PERVIOUS CONCRETE MUST BE SUPPLIED AND INSTALLED BY NRMCA CERTIFIED PRODUCERS AND CONTRACTORS.
2. JOINTS, IF SPECIFIED, TO BE SAWCUT 48 TO 60 HOURS AFTER PLACEMENT OF CONCRETE.
3. PERVIOUS CONCRETE MUST BE COVERED WITH 6 MIL PLASTIC, SECURELY FASTENED ON THE EDGES AND ACROSS THE TOP, FOR A MINIMUM OF SEVEN (7) DAYS.
4. D1 AND D2 AS PER THE PLANS AND SPECIFICATIONS.
5. D1 HAS A 5" MINIMUM THICKNESS
6. D2 HAS A 6" MINIMUM THICKNESS

PAVE AHEAD

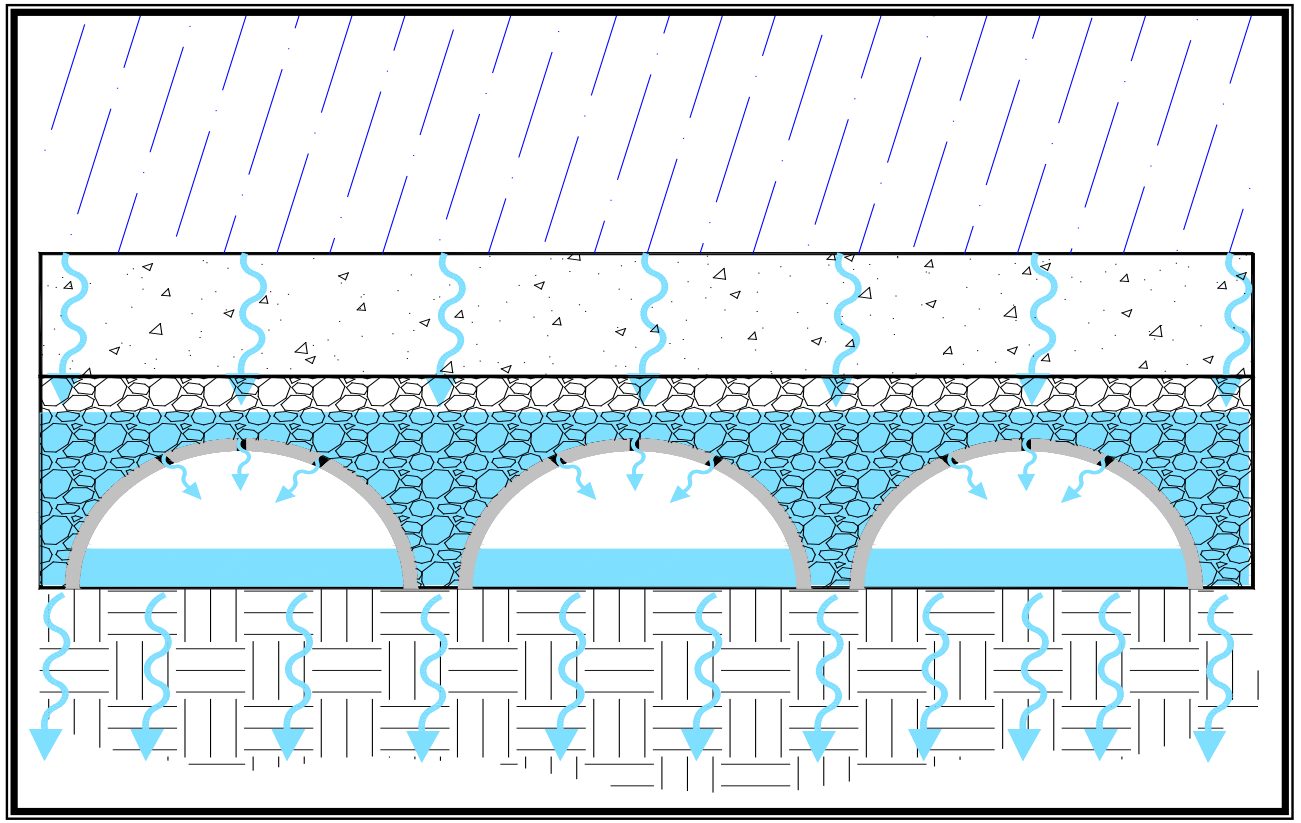
DURABLE. SUSTAINABLE. CONCRETE.

Stormwater Storage Design Example: 30” diameter perforated “half pipe” over aggregate



PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

Open area within pipe sections allow for greater storage until water can percolate into subgrade



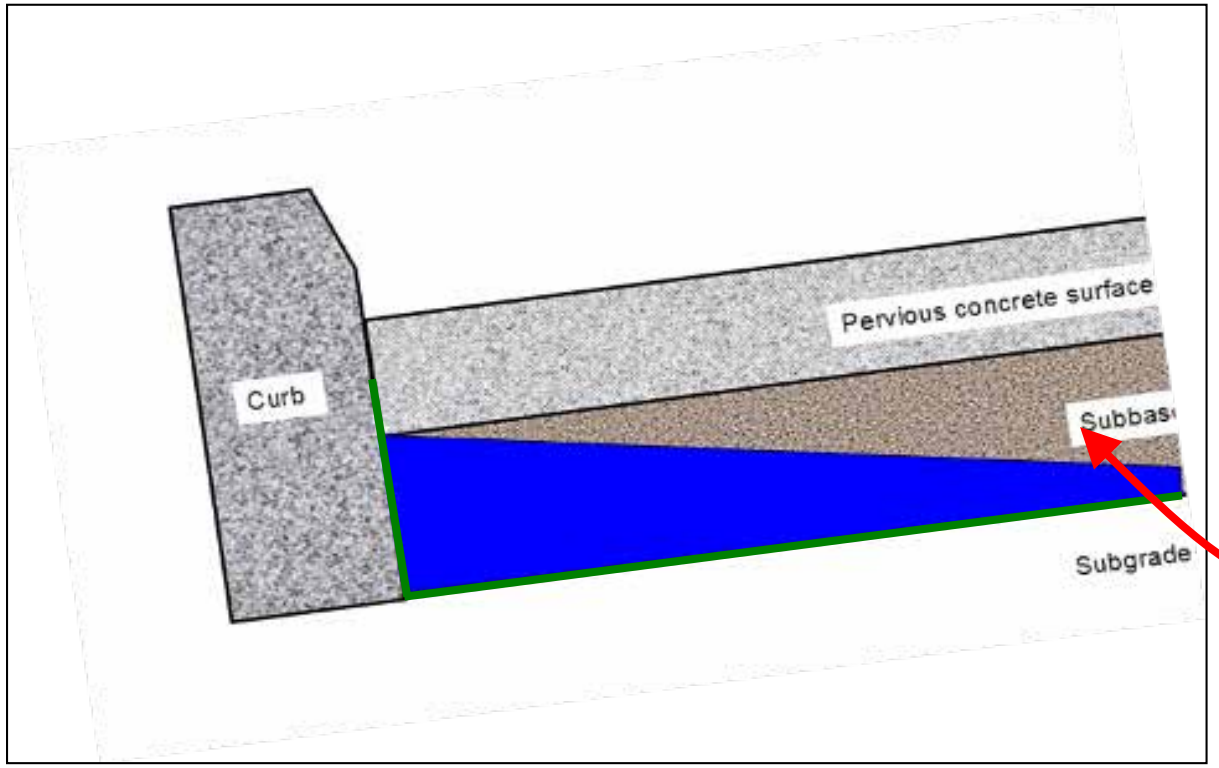
East Atlanta Library Example

Watch for . . .

- Stormwater storage capacity is **maximized** when concrete grade is **flat**

- **Can be placed on a slope** by utilizing special techniques

Pavement Grades

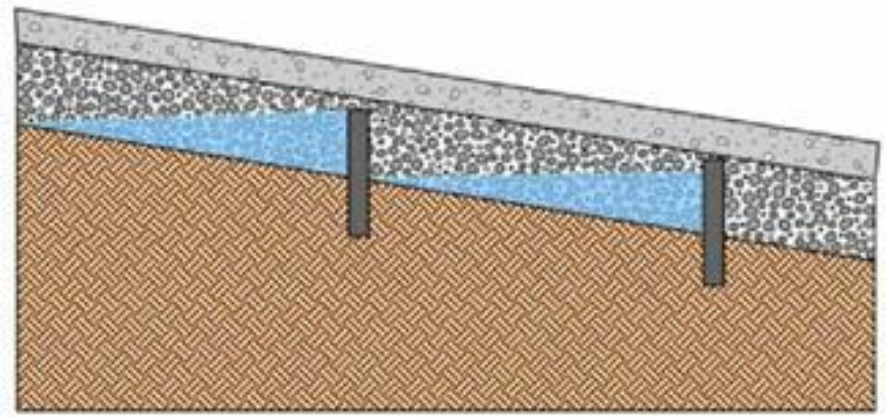


Storage capacity in recharge bed is "wasted" on a slope

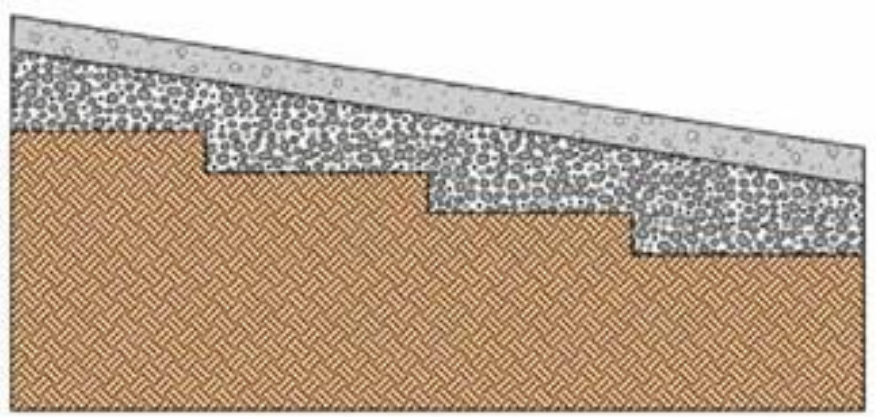
0% slope is best for detention

PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

Alternate Designs on Slope



Dams



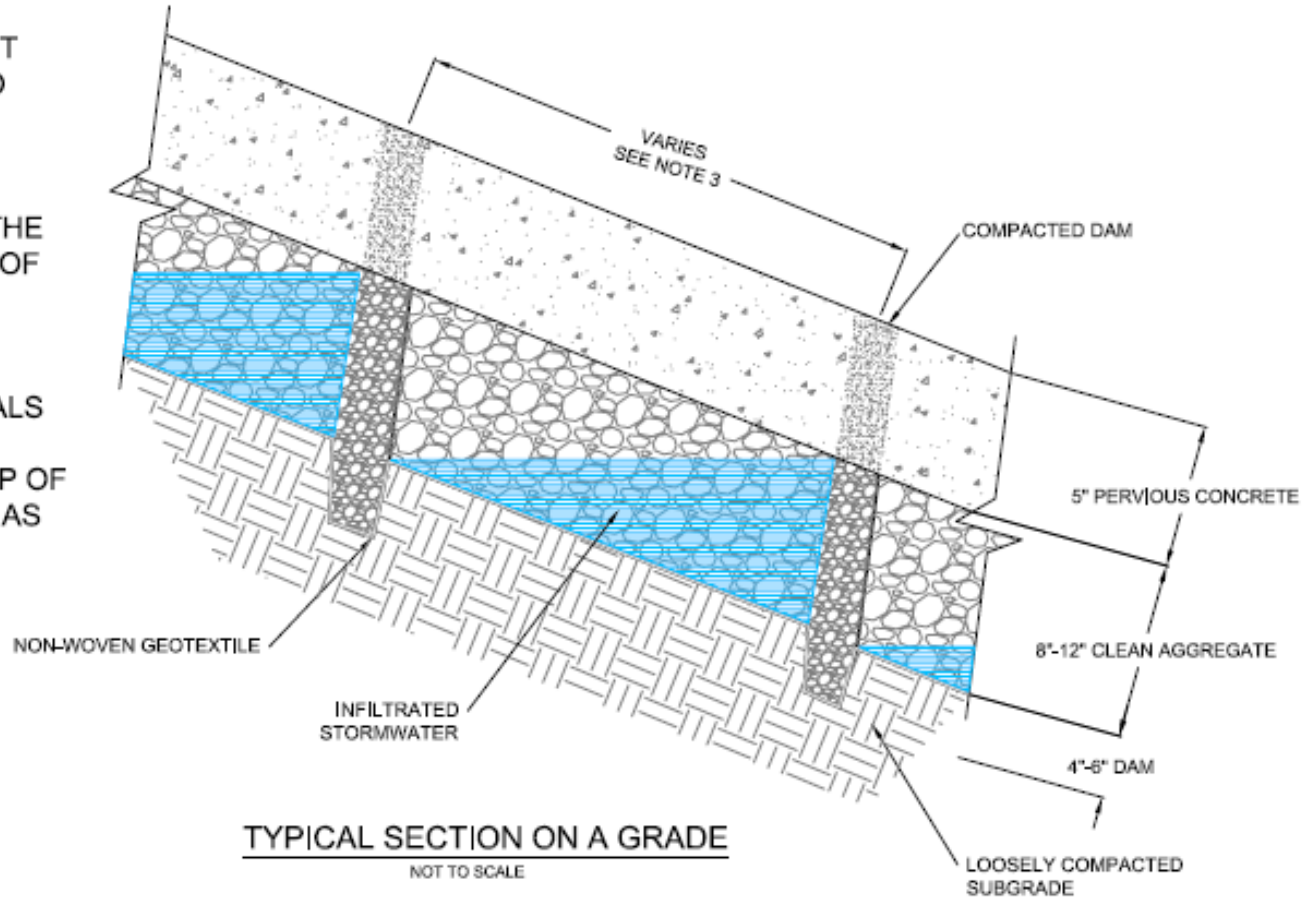
Tiered Base

NOTES:

1. ADD FINES TO DAMS TO PREVENT MIGRATION OF STORMWATER TO OTHER CELLS.

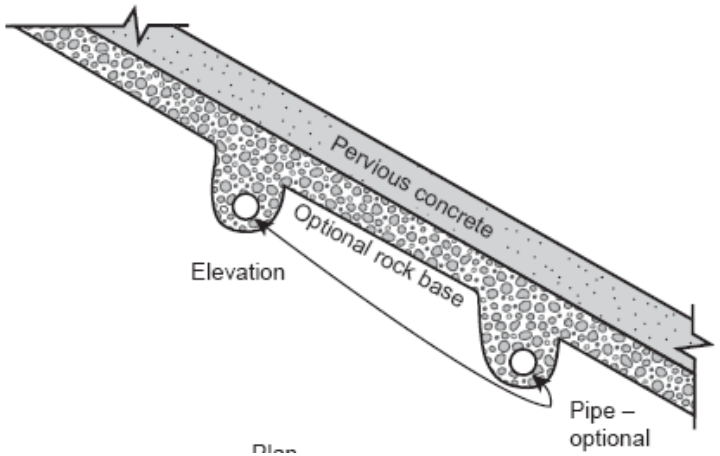
2. A 6" PERFORATED PIPE MAY BE INSTALLED PERPINDICULAR TO THE SIDEWALK, ON THE LOWER DAM OF EACH CELL, TO AID IN WATER DISPERSION.

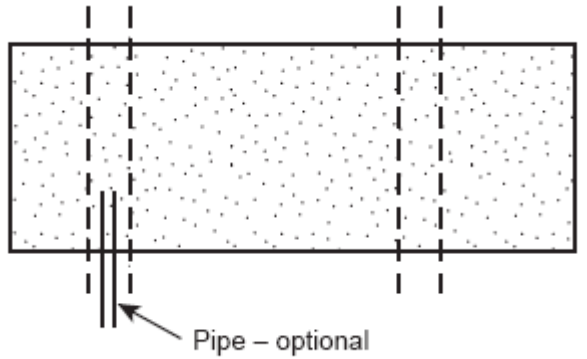
3. DISTANCE BETWEEN DAMS EQUALS DISTANCE INFILTRATED WATER TRAVELS BEFORE REACHING TOP OF AGGRGATE BASE IN EACH CELL, AS SHOWN ON DETAIL.



TYPICAL SECTION ON A GRADE

NOT TO SCALE





Slopes > 1%

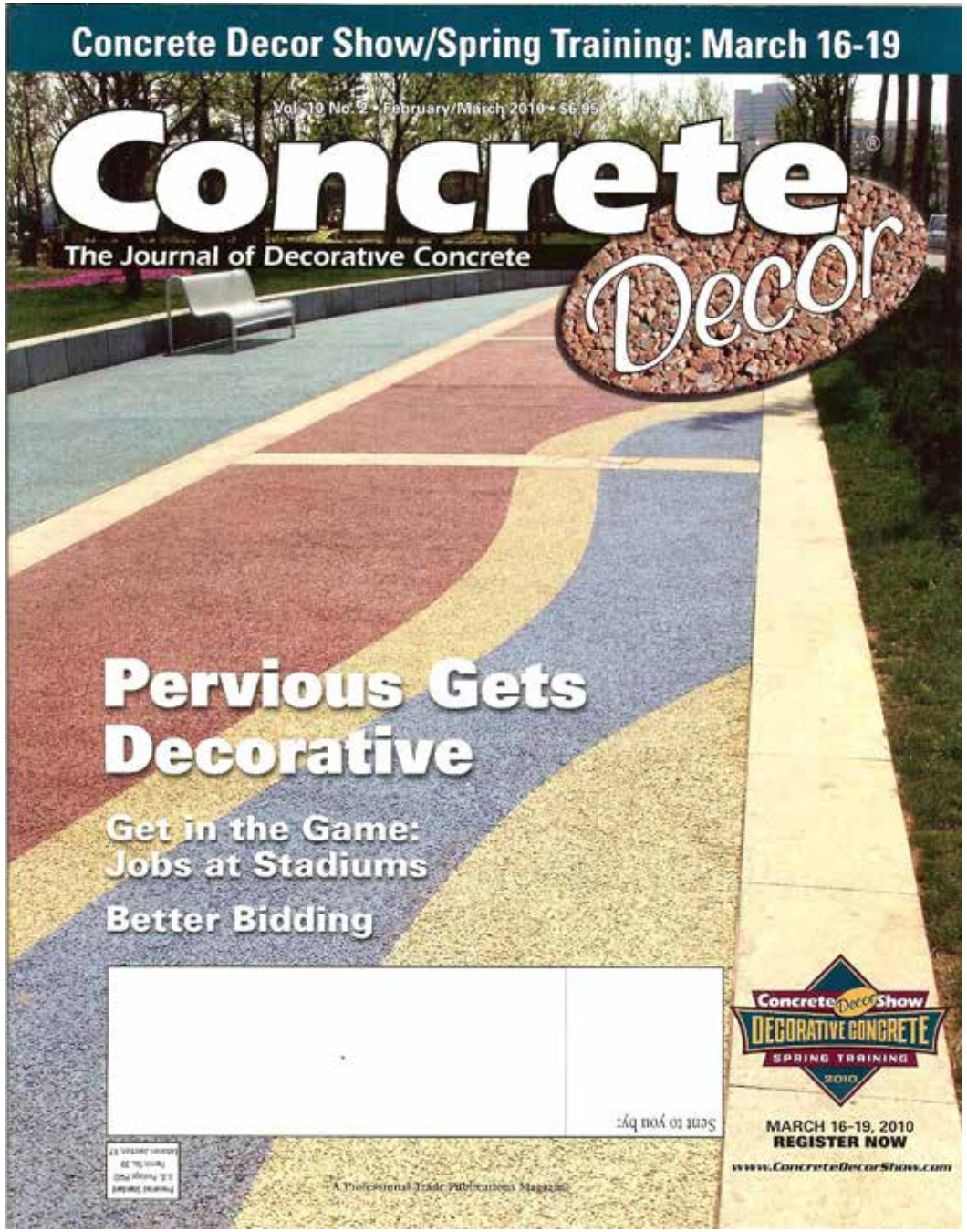
Stone dams in base

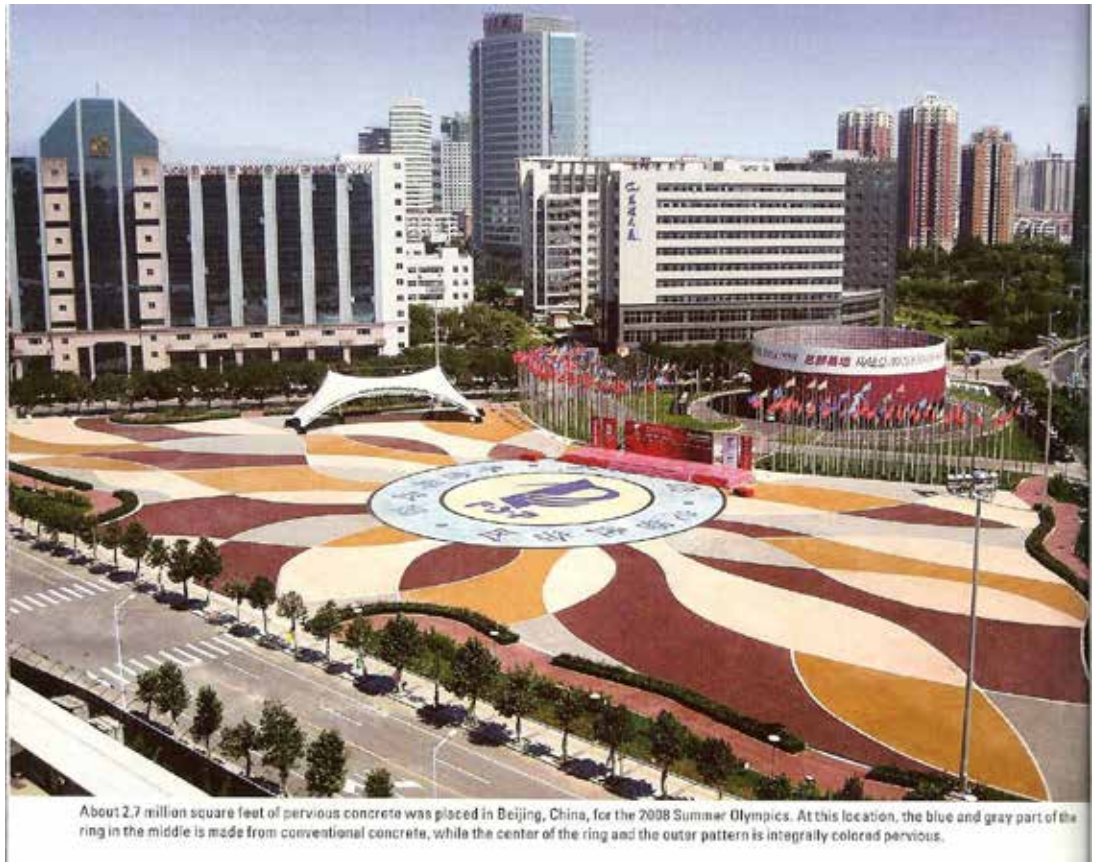
Header curb

Traffic markings are no problem with Pervious Concrete

PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

Pervious Concrete can be colored and stamped too!





About 2.7 million square feet of pervious concrete was placed in Beijing, China, for the 2008 Summer Olympics. At this location, the blue and gray part of the ring in the middle is made from conventional concrete, while the center of the ring and the outer pattern is integrally colored pervious.

PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

3 Questions

1. Freeze/Thaw
2. Maintenance
3. Cost

Freeze/Thaw

Pervious Concrete Design

PAVE AHEAD

DURABLE. SUSTAINABLE. CONCRETE.

Can Pervious Concrete Withstand Freeze-Thaw?

- 15-25% void structure and high infiltration rate means little moisture trapped in matrix
- Expansion of moisture due to freezing does not exert undue pressures on matrix
- Can withstand over 300 freeze/thaw cycles *fully saturated* without damage
- SEALCOAT RECOMMENDED TO PROTECT FROM SALT / DEICING DAMAGE

Freeze Thaw Comparison

Melting snow on impervious pavements can become

BLACK ICE

Freeze Thaw Comparison

- Melting snow on a pervious concrete parking lot does not leave a “trail” of water that could freeze
- Melting snow goes through the pavement

PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

Maintenance

Pervious Concrete Design

PAVE AHEAD

DURABLE. SUSTAINABLE. CONCRETE.

Before Cleaning

After Cleaning

PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

Broom and/or garden hose

- Power Blower

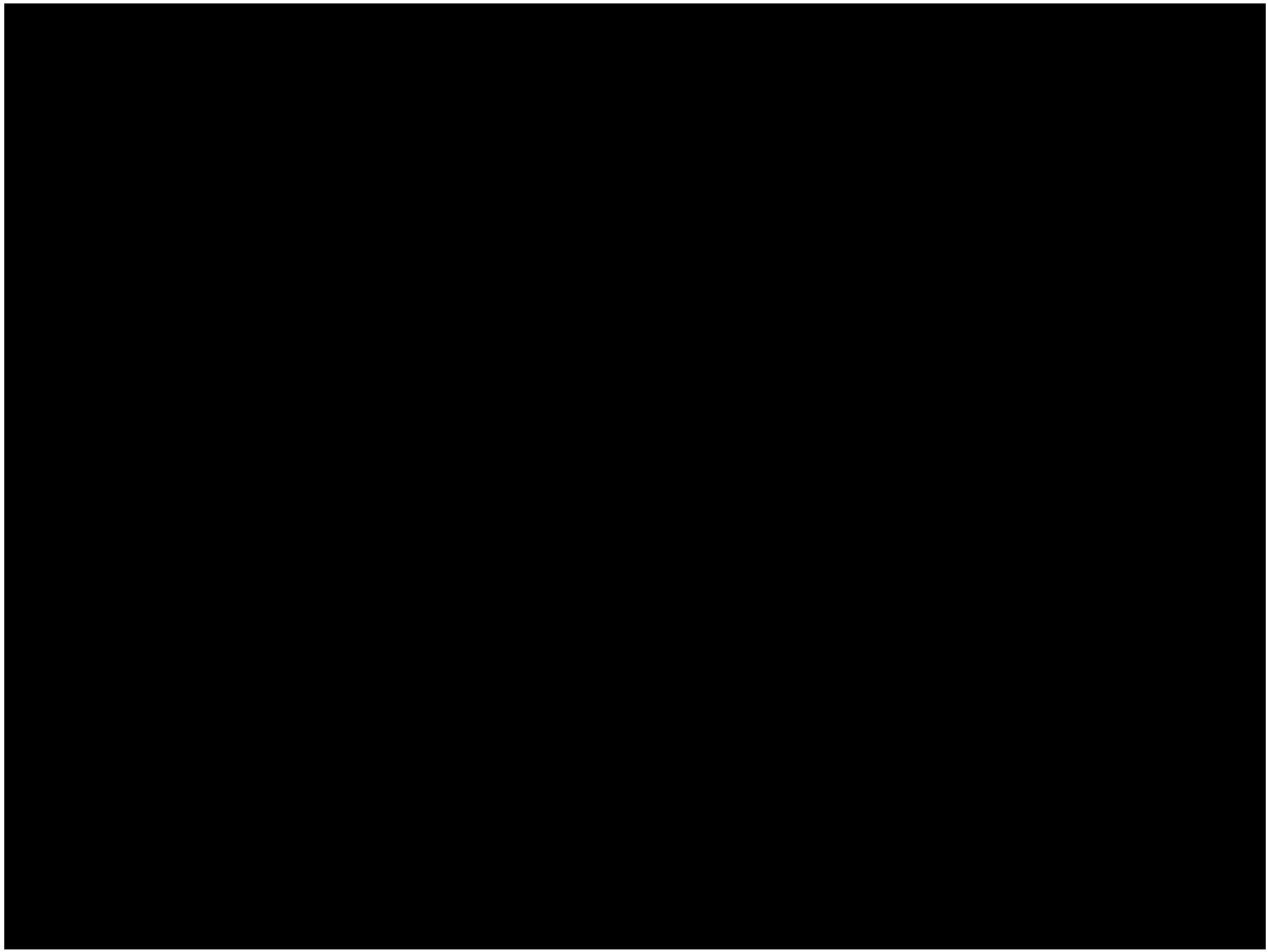
PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

Power Washing

Power Washing / Vacuum

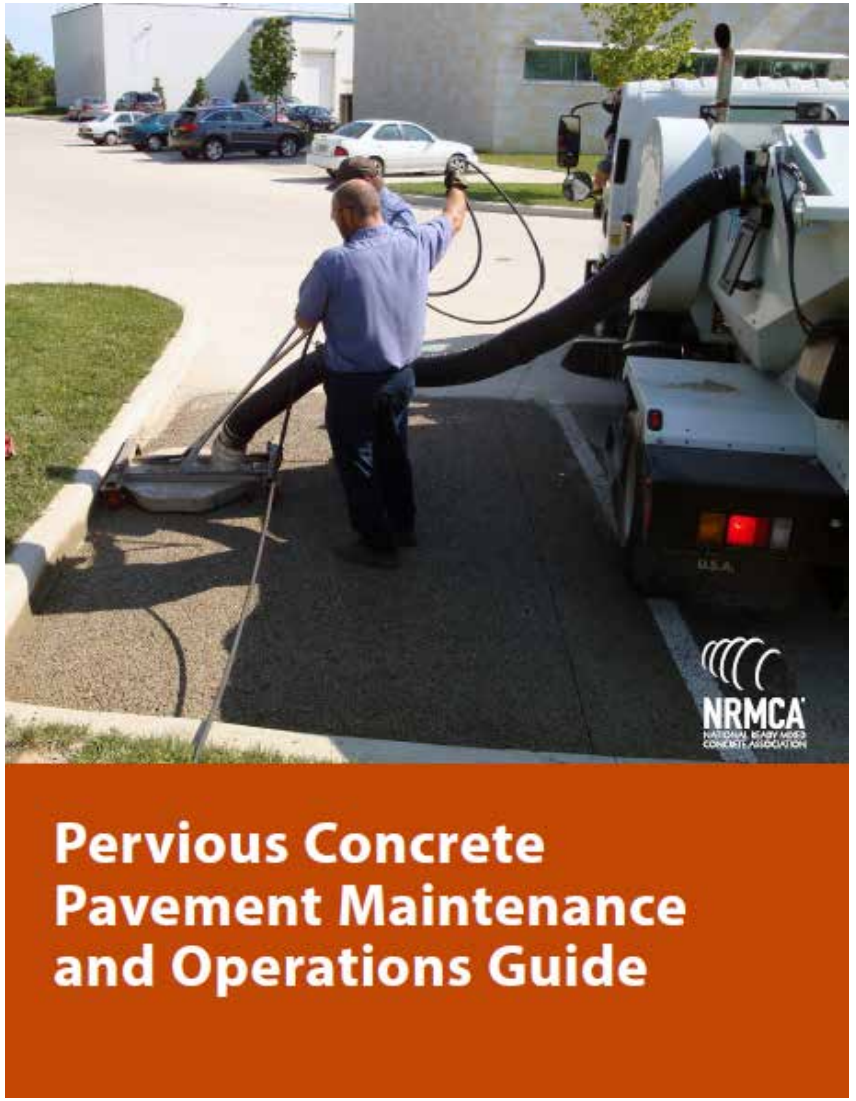
Vacuuming

PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.



Vacuum Sweeper

The Bible for Maintaining Pervious Concrete



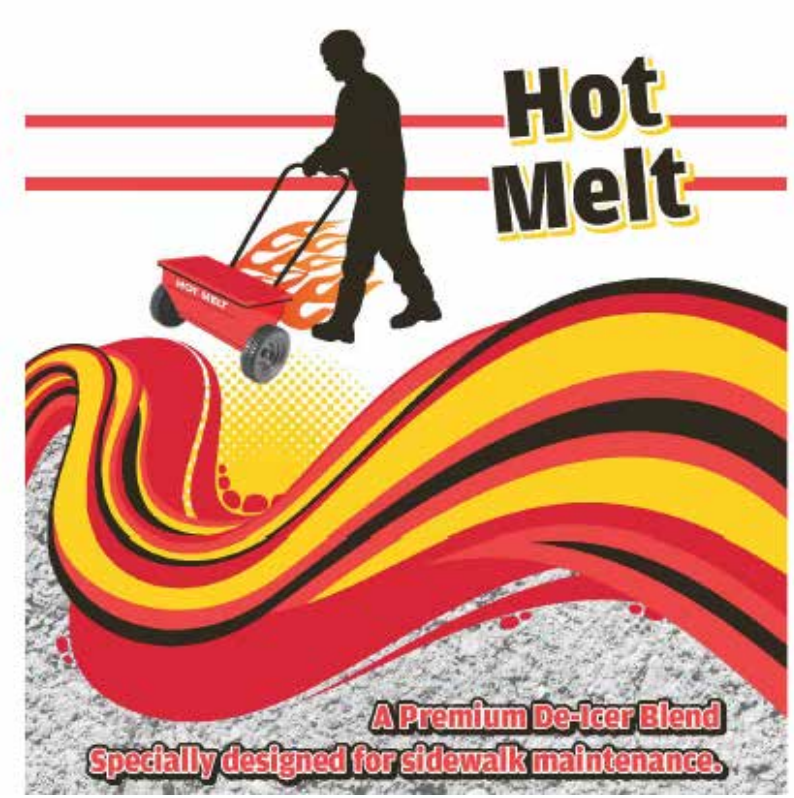
PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

Deicing – Winter Maintenance

•The following recommendations should be followed:

- Anti-icing pre-treatments should never be used on pervious concrete pavements. If these products are used on adjacent pavements, care should be taken to prevent the adjacent runoff from infiltrating the pervious concrete.
- Deicers containing magnesium chloride, calcium magnesium acetate or potassium acetate should ***never be*** used on pervious concrete pavement.
- Deicing agents that contain fertilizer ingredients such as Ammonium Sulfate and Ammonium Nitrate cause chemical deterioration to any Portland cement-based concrete pavement and should ***never be used.***
- **Coarse sand (minimum 1/8”), or small crushed aggregate (1/4 – 10, or similar gradation) can be used as an anti-skid material with the understanding that vacuum cleaning will be performed after the winter season**.

Deicing – Winter Maintenance



PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

Deicing – Winter Maintenance

Notice

Do not use on concrete that is less than two (2) years old or that was not properly mixed, finished or cured. Flaking or spalling may occur when using any ice melting product on concrete surfaces, especially those that are poorly constructed, contain porous concrete or mortar joints, bricks and flagstone. May be harmful when used excessively or repeatedly applied.

Contents

Contains sodium chloride and magnesium chloride. Avoid prolonged contact with skin. If swallowed give 1 or 2 glasses of water and call physician immediately. Do not induce vomiting unless directed to do so by medical personnel. Hot Melt contains a unique blend of high performance ice melting chemicals that, when combined, produce a superior ice melting product.

Keep Out Of Reach Of Children.

AHEAD
STAINABLE. CONCRETE.

Deicing – Winter Maintenance

- Sealers are highly recommended
- Silane or silane/siloxane blends
- Applied in two to three coats
- Reapplied every 3-5 years depending on traffic/use
- OR
- Use coarse sand for skid resistance
- Vacuum all sand in spring

Cost

Pervious Concrete Design

PAVE AHEAD

DURABLE. SUSTAINABLE. CONCRETE.

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

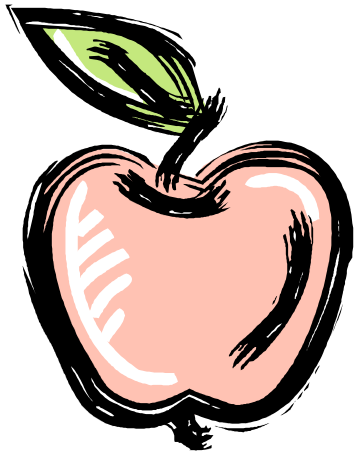
- Pervious concrete is approximately 4%-15% higher than regular concrete PER YARD,

BUT . . .

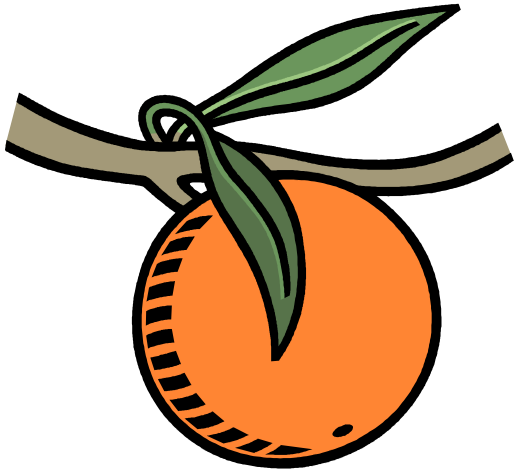
- Higher installation costs can be off-set by elimination of the need for curbs, gutters, storm drains and large retention ponds.

How much does it cost????

Given: 100,000 SF parking lot

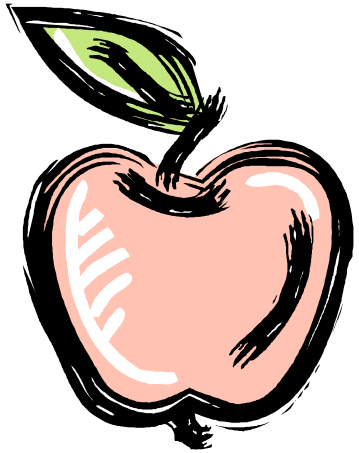


6” pervious concrete + 12” aggregate recharge bed, installed = $355,000

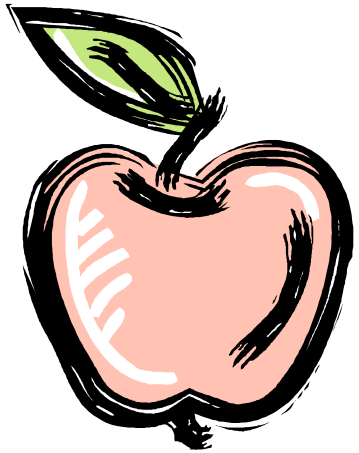


4” asphalt + 8” aggregate base = $285,000

PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.



6” pervious concrete + 12” aggregate recharge bed, installed = $355,000



4” asphalt + 8” aggregate base = $285,000

+

Inlets = $25,000

18” Pipe = $85,000

1 acre detention pond with land cost = $135,000

= $530,000

Let's Take a Look at Some Projects

PAVE AHEAD

DURABLE. SUSTAINABLE. CONCRETE.

•PROJECT: Hershfield Park

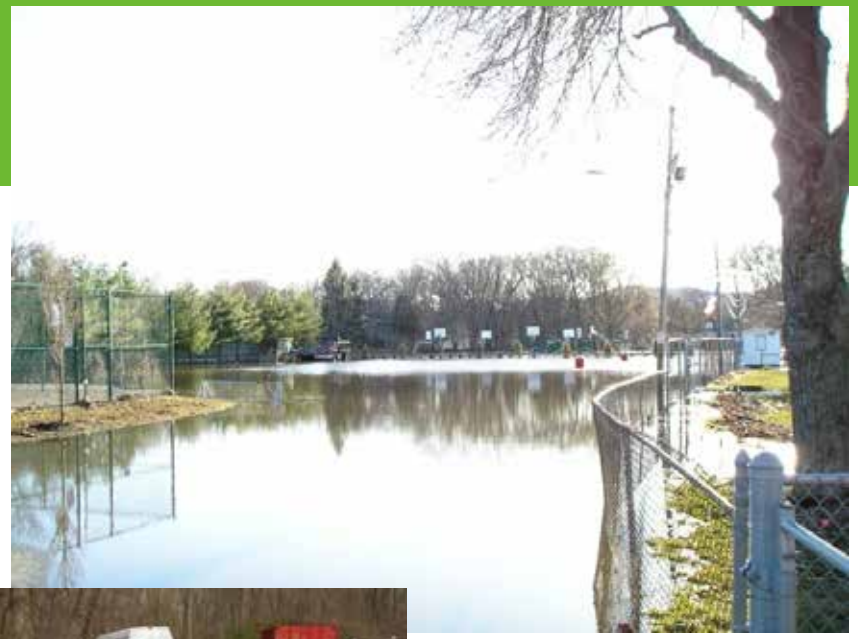
Pompton Lakes, NJ

Constructed August 2009

PAVE AHEAD

DURABLE. SUSTAINABLE. CONCRETE.

THE FLOOD



500 year storm – March 2010

PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

Super Storm Sandy 2012

Fishing Pier

Mantoloking, NJ

Pervious concrete survives Hurricane Sandy at the New Jersey shore

AND STILL FUNCTIONS!

AHEAD

TAINABLE. CONCRETE.

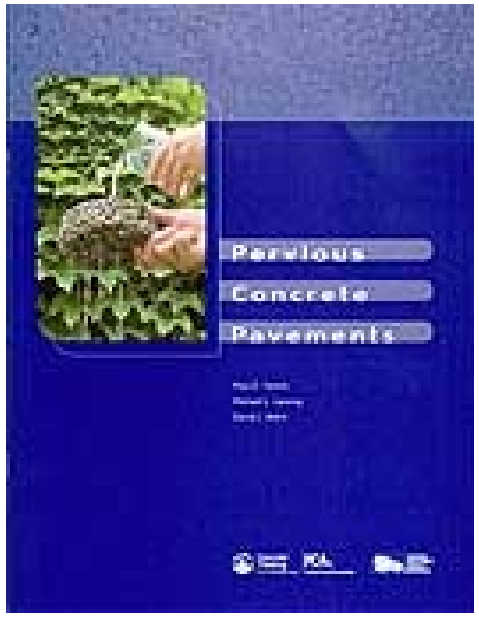
Promenade @ 7 World Trade

Pervious Concrete Contractor Training & NRMCA Certification

Over 400 contractors and 120 RMC producers in data base

Must Read:

PCA/NRMCA – Pervious Concrete Pavements
(PCA Publication - EB302)
(NRMCA Publication - #2PCP)



NRMCA – Pervious Concrete Contractor Certification
(NRMCA Publication - #2PPCRT)

PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

NRMCA Resources

How Can We Assist You for Free?

PAVE AHEAD

DURABLE. SUSTAINABLE. CONCRETE.


PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.
Paving Projects
Meet the Experts
Resources
Education
Videos
Design Center
www.paveahead.com
THERE'S A BETTER WAY TO PAVE.
IT'S CALLED CONCRETE.
FREE PROJECT ASSISTANCE ›

•

PAVE AHEAD

DURABLE. SUSTAINABLE. CONCRETE.

Paving Projects | Meet the Experts | Resources | Videos | Design Center

- Concrete Overlays
- Concrete Parking
- Concrete Streets
- Pervious Concrete
- Roller Compacted Concrete

AHEAD

JSTAINABLE. CONCRETE.

PAVE AHEAD

DURABLE. SUSTAINABLE. CONCRETE.

Paving Projects | Meet the Experts | Resources | Videos | Design Center

- Concrete Overlays
- Concrete Parking
- Concrete Streets
- Pervious Concrete
- Roller Compacted Concrete

AHEAD

JSTAINABLE. CONCRETE.



Pave Ahead™
Concrete Pavement Design Center

paveahead.com/register/


paveahead.com/register/

Pave Ahead™ Design Center

- Design and Jointing recommendations and reviews for FREE
- Cost comparisons including life cycle costs
- Specification review
- Ready mixed products:
  - Conventional concrete (full depth and overlays)
  - Pervious concrete
  - Roller compacted concrete
  - Cement slurry for full depth reclamation (FDR)

PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

Local Paving Division: State and Regional Assignments

TEAM LEAD

Brian Killingsworth, P.E
Executive Vice President, Local Paving

bkillingsworth@nrmca.org | 830-438-2690

Kenneth M. Justice, P.E., LEED AP

Senior Director, Midwest

kjustice@nrmca.org
267-716-8675

Luke McHugh, P.E.

Senior Director, Northeast

lmchugh@nrmca.org
267-212-4700

Phil Kresge

Senior Vice President, East Central

pkresge@nrmca.org
215-779-7375

AHEAD
AINABLE. CONCRETE.

Local Paving Division: State and Regional Assignments

Jon Hansen

Senior Vice President, Southwest

jhansen@nrmca.org
515-779-0456

Amanda Hult, P.E.

Senior Director, Southeast

ahult@nrmca.org
720-648-0323

Don Clem, P.E.

Vice President, Northwest

dclem@nrmca.org
303-881-5009

PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

www.paveahead.com/education

- More NRMCA **Concrete Pavement** professional development:
  - Each Thursday beginning at 2:00 pm EDT
  - May 28 Designing Pervious Concrete
  - June 4 Specifying Pervious Concrete
  - June 11 Installing Pervious Concrete
  - June 18 Maintenance Guidelines for Pervious Concrete

Pervious Concrete Webinar Series!

- **Portland Cement Association** Webinar Series: www.cement.org/events/pca-infrastructure-webinar-series
  - Full-Depth Reclamation with Cement
  - Lightweight Cellular Concrete for Geotechnical Applications
  - Roller-Compacted Concrete Pavements
  - Cement Stabilized Subgrade Soils
  - Cement-Based Water Resource Applications

Recordings available for previous webinars!

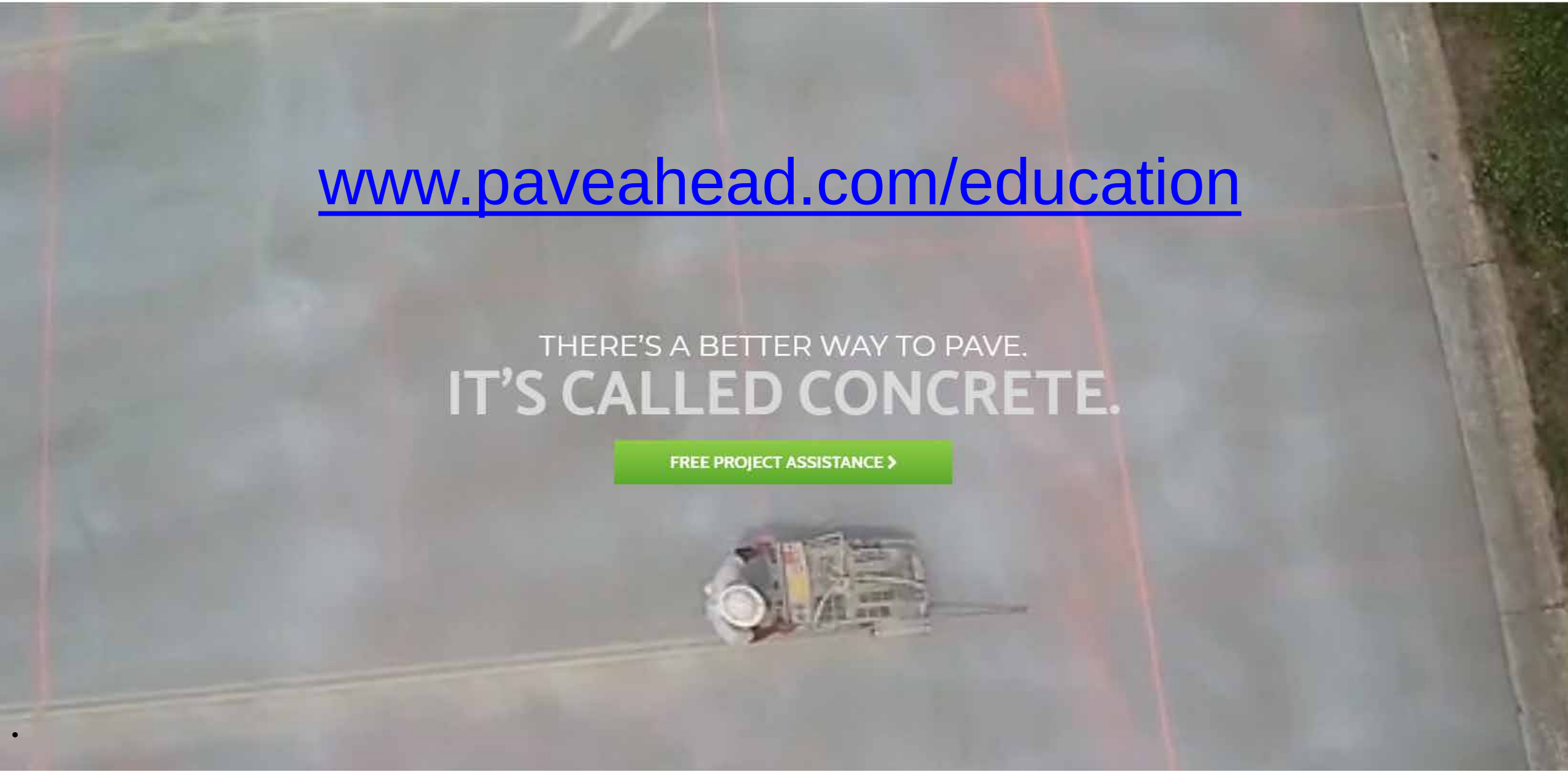
PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.

www.paveahead.com/education

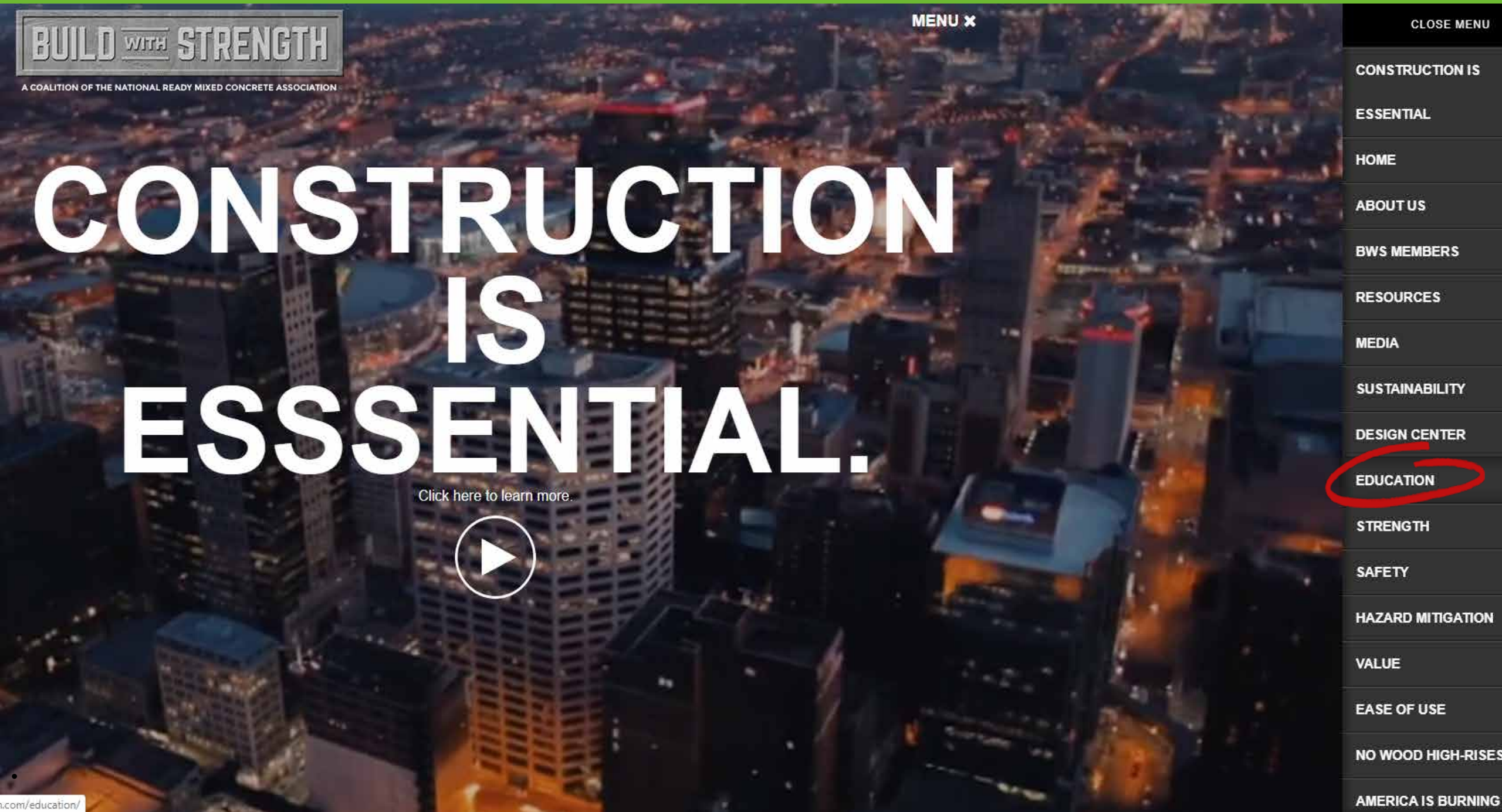
- More NRMCA **Concrete Pavement** professional development:
  - Designing Concrete Parking Lots and Streets
  - Designing Concrete Industrial Pavements
  - Soils 101: What to Know for a Successful Paving Project
  - Concrete Pavement Jointing and Details
  - Materials and Construction Specifications for Concrete Pavement Projects
  - Concrete Street and Parking Lot Maintenance and Repair
  - Concrete Overlays of Existing Asphalt Surfaced Streets and Parking Lots
  - Concrete Trail Design
- NRMCA **Concrete Buildings** Webinar Series: buildwithstrength.com/education/

Recordings available for these previous webinars!

PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.


PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.
Paving Projects
Meet the Experts
Education
Design Center
www.paveahead.com/education
THERE'S A BETTER WAY TO PAVE.
IT'S CALLED CONCRETE.
FREE PROJECT ASSISTANCE ›

•


BUILD WITH STRENGTH
A COALITION OF THE NATIONAL READY MIXED CONCRETE ASSOCIATION
MENU ✖
CONSTRUCTION IS ESSSENTIAL.
Click here to learn more.
CLOSE MENU
CONSTRUCTION IS ESSENTIAL
HOME
ABOUT US
BWS MEMBERS
RESOURCES
MEDIA
SUSTAINABILITY
DESIGN CENTER
EDUCATION
STRENGTH
SAFETY
HAZARD MITIGATION
VALUE
EASE OF USE
NO WOOD HIGH-RISES
AMERICA IS BURNING

Questions??

Concrete home survives Hurricane Ike in Gilchrist, Texas

September 2008

PAVE AHEAD
DURABLE. SUSTAINABLE. CONCRETE.