

WHAT HAVE WE LEARNED,
Getting to good outcomes from Construction through
Acceptance

WSU Permeable Pavement Workshop
Puyallup Sept. 2014



WASHINGTON AGGREGATES
& CONCRETE ASSOCIATION



ACI 522R-13 www.concrete.org

- National Pervious specification
- Revision to require
- ~~5 Technicians OR;~~
- 3+ Installers OR;
- 1 Craftsman

In specs; *require copy of
wallet cards or certificate
upon submittal to validate
current & valid crew certification*



TRAINING & CERTIFICATION

NRMCA PERVIOUS CONCRETE CERTIFICATION:

- IS FOR CONTRACTORS, RM PRODUCERS, TESTING LABS
- PUBLIC AGENCY, LID, SPECIFIERS, ENGINEERS
- WELCOME TO AUDIT

• **BENEFIT:**

EVERYONE GETS THE SAME MESSAGES
GOOD PERVIOUS / BAD PERVIOUS
ESTABLISH EXPECTATIONS TO GET
GOOD OUTCOMES IN THE FIELD



NRMCA PERVIOUS CERTIFICATION

- ACI 522-13 Revisions
- ~~TECHNICIAN~~
- Pass written exam with 75% or greater score
- No experience necessary
- Revise specs to Remove Technician
- **ENTRY LEVEL**



NRMCA CERTIFICATION

- **Installer:** Pass written
- Requires completion of 10,000 sq. ft of pervious concrete work over 3 projects
- We require a performance evaluation at this level
- **Revise specs to require 4 or more on crew**



NRMCA CRAFTSMAN- Highest Level

- Pass written test
- Requires completion of 10,000 sq. ft over 3 projects of pervious concrete work (**Installer**)
- Possess a **ACI Concrete Finisher Technician or Craftsman** at time of application
- **Work experience required: Option A:**
- Complete a performance evaluation and document pervious work over 1500 hours
- **Option B: (no performance evaluation)**
- Provide documentation of pervious concrete work exceeding 3,000 hours

NRMCA CRAFTSMAN *cont...*

- Work experience is documented in square footage and hours using NRMCA work experience spreadsheet
- Documentation includes project detail info
- Craftsman application reviewed by Certification committee
- Craftsman interviewed by local Certification committee on project experience
- Full details at: www.nrmca.org
- **Super Spec requires a Craftsman** **BEST**

SPECIFIERS ROLE

- WORK WITH INDUSTRY RESOURCES **BEFORE** YOU START PLANNING
- BECOME KNOWLEDGABLE ON WHAT GOOD PERVIOUS IS; **ESTABLISH EXPECTATIONS**
- ON SITE: KNOW WHAT GOOD PERVIOUS LOOKS LIKE
- KNOW WHEN A MIX DESIGN LOOKS OFF
- KNOW WHEN CONTRACTOR IS NOT FOLLOWING PROCEDURES- **NO short cuts**



SPECIFICATIONS: *Keep it simple*

- Do NOT Google “pervious specifications”
- Do NOT “Cut and Paste” or copy someone else’s specifications!
- Pervious is a regional product, what works in Peoria may not work here !
- DO NOT over specify mix design; cement content, aggregates, non standard testing methods, voids, proprietary products...
- If you over specify..... you may own the outcome !!!
- Do NOT arbitrarily limit void content range IE: 15 +/- 3%
- Do NOT specify Strength, Slump, Air content
- DO use established ASTM tests for acceptance

Specification- Key basics

- **Require Installer level** w/ documented certifications
- **Cement-** Do not specify specific content (Producer)
Range 450 – 540 lbs. **SCM** - Yes
- **Aggregates-** ASTM C-33 Size and range- locally readily available aggregates- (controls cement content)
- **Subgrade Prep / Forms / Mixing** / some construction method direction (Jointing) **ACI 522-10**
- **Curing:** coverage / 7 days / opening / protection
- **Final surface texture:** smooth and uniform- **Reference Slab**
- **Field Quality Control-** require lab to be experienced

SPECIFICATIONS

- Do reference **ACI 522-13:** “Specification for Pervious Concrete”
- Do reference **ACI 522-10-** Overview of construction practices
- Do use local Industry Resources: RM producers / **WACA** can assist / **NRMCA** Certified Contractors...
- **ACI 330R-10:** good for practical depth design or use PCA Design Pave software
- Do NOT specify “new” or proprietary products that promise a bazillion things but only increase or double material costs
- Do NOT use proprietary specs as supplied by others

SPECIFICATIONS

- **Do** require a **PRECON** of all parties supplying, placing, testing or accepting previous-
- **Do** make sure spec has been read and understood
- **Do** use a **REFERENCE SLAB**: (not a mock up)
- *Make sure reference slab is just not everyone's best effort- **Use the slab as the standard for expectations and acceptance.** Referee*
- **Do** require certified crew members, require verification of certification at time of bid
- **Do** specify **Installer** level of above; Minimum of 4
- **Do** consider or specify minimum square footage / project portfolio experience

Mix design development

Less paste & lower cement
= better aggregate coverage
= better point to point content
= better bonding
= greater bond strength

Too much cement =
< incomplete hydration
< aggregate bridging
< poor bonding,
= RAVELLING



Can you identify the difference ?



Supplemental Materials

- Increased use to improve workability, paste durability, freeze thaw resistance
- **Fly Ash**
- **Slag**
- **Silica fume**
- *Balanced & Modern mixes*



What's new in testing ?

No ASTM standards for Cylinders, Slump, Air Content -
Strength a function of the depth of the mass

ASTM C-09.49 Committee has or is developing:

✓ **ASTM C-1688**- Test Method for Density and Void Content of Freshly Mixed Pervious Concrete

✓ **ASTM C-1701** Test Method for Infiltration Rate of Pervious Concrete- *not a acceptance test*

✓ **NEW: ASTM C-1754**- Density and Void Content for hardened pervious concrete

In development or under consideration:

Abrasion Resistance, Fresh Concrete Density, Compressive & Flexural Strength, Surface Durability
ACI 522- 2014 planning a Maintenance Committee



New placing equipment ++

- [Bunyan Springs](#)

Committed
Pervious
Contractors are
Pushing standards
Higher



Next: Color, Stamped, Decorative



Surface Uniformity



maintenance



- Efforts underway to establish a simple, effective methods to clean pervious
- Equipment is specialty & deep cleaning, washes & vacuums
- Anticipated to be available to public works or maintenance contractors

Establish Expectations- The key to acceptance... is before & during placement



Its not new anymore ! Thank you !


