

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

WSU Permeable Pavement Workshop
Puyallup Sept. 2014

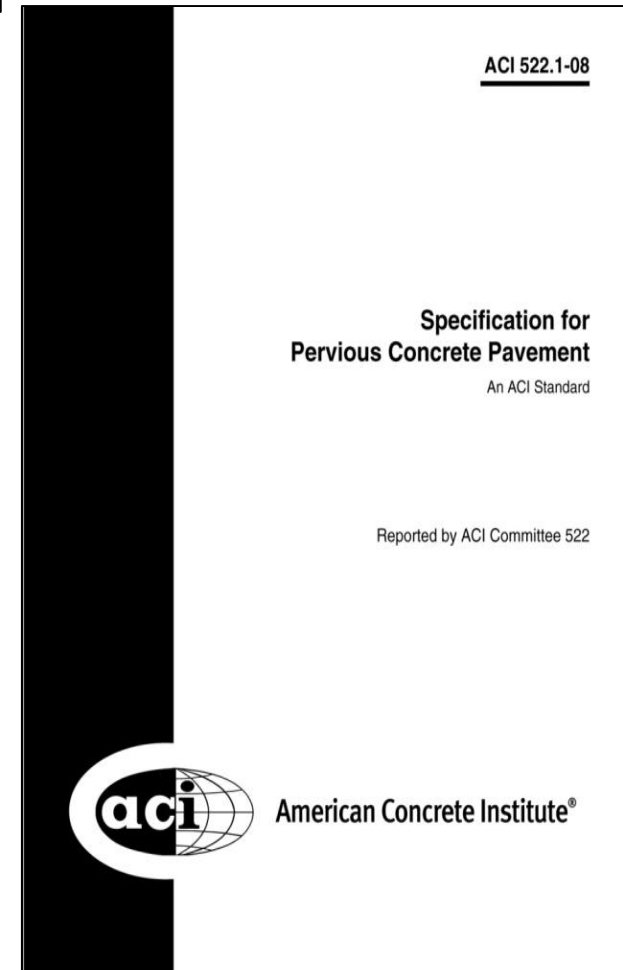




ACI 522R-13 www.concrete.org

- 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 “previous 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 pervious-
- **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
contact

= 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

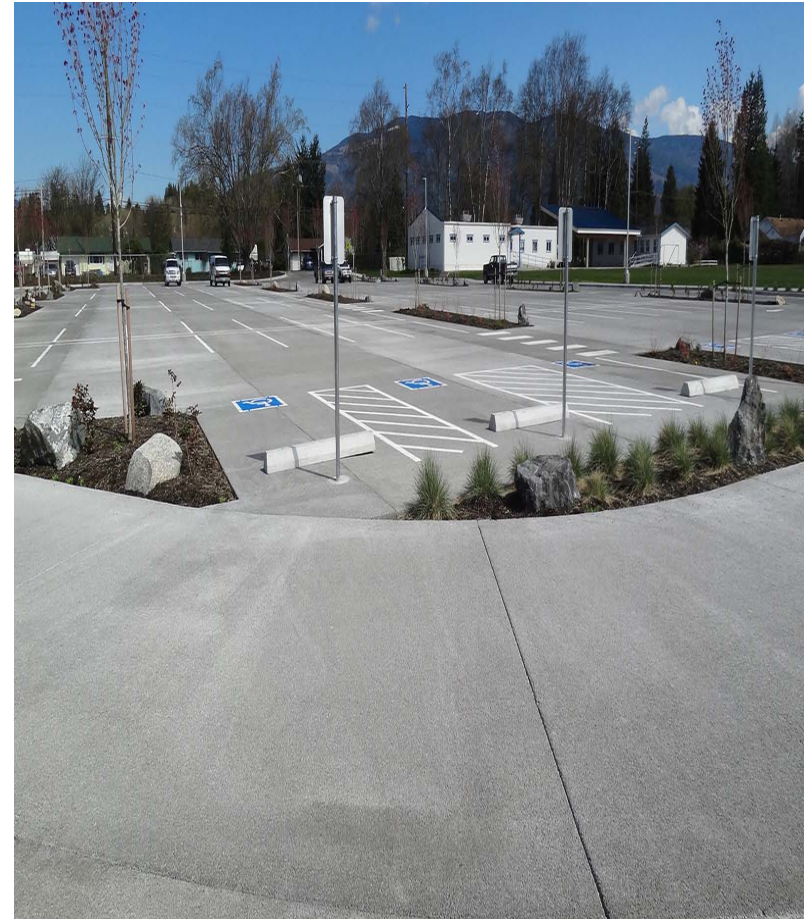
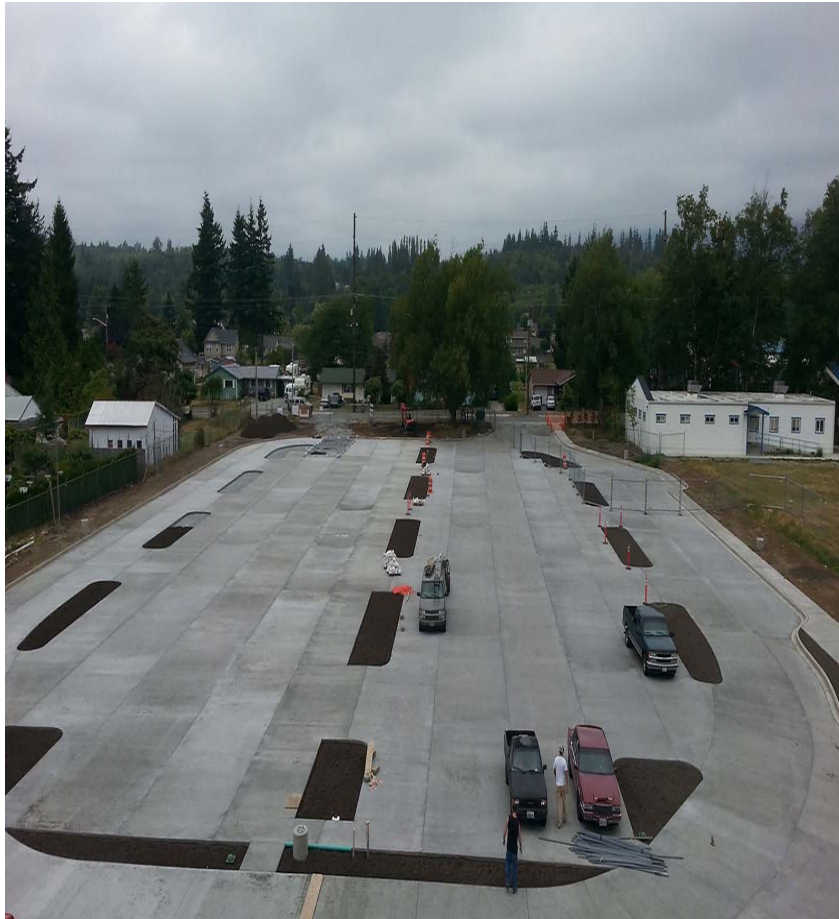




maintenance

- 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 !

