



State Visit- Requested Information

Jim Grove, Center for PCC Pavement Technology

TPF-5(066) Material and Construction Optimization for Prevention of Premature Pavement Distress in PCC Pavements

Purpose of Project: To develop optimal mix design and test methods for monitoring Key performance parameters and conduct demonstration tests in participating states.
<http://www.ctre.iastate.edu/pccpoolfund/>

State Procedures

□ Concrete Mix Design

- Who provides the mix design?
 - State
 - Contractor/Supplier
- What procedure is used to develop the mix design?
 - ACI 211.1
 - A state specific procedure
 - Past experience
 - Another procedure
- What concrete properties are specified (hardened or fresh) in contract documents? For example, is concrete strength, slump, etc. specified?

Mark the properties that are commonly specified:

Specified?		
	Workability / Slump	Fresh Concrete Properties
	Bleeding	
	Segregation	
	Set	
	w/cm (water-to-cementitious materials ratio)	
	Plastic Shrinkage Cracking	Hardened Concrete Properties
	Strength at Opening	
	Strength at 28 days	
	Coefficient of Thermal Expansion (CTE)	
	Drying Shrinkage	
	Permeability	Concrete Durability
	Resistance to freezing and thawing	
	Resistance to sulfate attack	
	Resistance to ASR	
	Abrasion Resistance	
	Corrosion Resistance	
	Other (specify)?	

- In addition to the specified properties, what properties are targeted (desired), but are not specified? Fresh ones are targeted for the best possible placement / construction? Hardened ones for increased concrete durability?

Of the properties that are not specified, rank their importance with 1 the most important:

Rank		
	Workability	Fresh Concrete Properties
	Bleeding	
	Segregation	
	Set	
	Plastic Shrinkage Cracking	
	Strength / Stiffness	Hardened Concrete Properties
	Coefficient of Thermal Expansion (CTE)	
	Drying Shrinkage	
	Permeability	
	Resistance to freezing and thawing	Concrete Durability
	Resistance to sulfate attack	
	Resistance to ASR	
	Abrasion Resistance	
	Corrosion	
	Other (specify)?	

- What are the typical values of the following mix design parameters for paving concrete? Please denote the method of construction, *i.e.* slip-formed (SF), formed paving (FP), or other.

- w/c

Min. _____, Max. _____, Typical _____

- Slump (in)

Min. _____, Max. _____, Typical _____

Method of Construction: _____

Min. _____, Max. _____, Typical _____

Method of Construction: _____

- Air content (%)

___ ± ___% to ___ ± ___% Application: _____

___ ± ___% to ___ ± ___% Application: _____

___ ± ___% to ___ ± ___% Application: _____

___ ± ___% to ___ ± ___% Application: _____

- Water content (lb/cu.yd)

___ to ___ lb/cu.yd Application: _____

___ to ___ lb/cu.yd Application: _____

___ to ___ lb/cu.yd Application: _____

- Cement content (lb/cu.yd)

___ to ___ lb/cu.yd Application: _____

___ to ___ lb/cu.yd Application: _____

___ to ___ lb/cu.yd Application: _____

- Maximum size of coarse aggregate (in)

- | | | |
|------------------------------|--------------------------------|-----------------------------|
| <input type="checkbox"/> 3/8 | <input type="checkbox"/> 1 | <input type="checkbox"/> 3 |
| <input type="checkbox"/> 1/2 | <input type="checkbox"/> 1 1/2 | <input type="checkbox"/> 6 |
| <input type="checkbox"/> 3/4 | <input type="checkbox"/> 2 | <input type="checkbox"/> 6+ |

- Coarse aggregate (lb/cu.yd)

___ to ___ lb/cu.yd Application: _____

___ to ___ lb/cu.yd Application: _____

- Fine aggregate (lb/cu.yd)

___ to ___ lb/cu.yd Application: _____

___ to ___ lb/cu.yd Application: _____

- Which of these SCMs are commonly used in your concrete mix design?
(Check all that apply)

- | | |
|--|--------------------|
| <input type="checkbox"/> Class F Fly Ash | Application: _____ |
| <input type="checkbox"/> Class C Fly Ash | Application: _____ |
| <input type="checkbox"/> GGBFS Slag | Application: _____ |
| <input type="checkbox"/> Silica Fume | Application: _____ |

- Have you experienced compatibility problems between mix components like SCM's and chemical admixtures?

“Symptoms” 1 to 4 such as,

- Less than expected water reduction (1)
- Rapid loss of slump (2)
- Fast set (3)
- Abnormally retarded setting (4)
- Other _____(5)
- Other _____(6)

- What were the *complete* mix designs (lb)/ dosages (floz/cwt)? How was the problem corrected?

	Symptom #__	Symptom #__	Symptom #_
Water	_____	_____	_____
Portland Cement	_____	_____	_____
Fly Ash Class C	_____	_____	_____
Fly Ash Class F	_____	_____	_____
Slag	_____	_____	_____
Silica Fume	_____	_____	_____
WR	_____	_____	_____
MRWR	_____	_____	_____
HRWR	_____	_____	_____
AEA	_____	_____	_____
Acclerator	_____	_____	_____
Retarder	_____	_____	_____
Other _____	_____	_____	_____

Correction for Symptom #__:

Correction for Symptom #__:

Correction for Symptom #__:

○ Do you require a combined aggregate gradation design/analysis procedure? If yes, what one or ones?

○ Do you have an aggregate sources approval system? If yes, explain.

○ Do you require testing of the cementitious materials, beyond normal certification testing? If yes, what tests?

○ What fresh concrete tests are required? Please cite name/number of specification/test procedure.

• Slump Test Method: _____

• Air Content Test Method: _____

• Unit Weight Test Method: _____

• Time of Setting Test Method: _____

• Plastic shrinkage cracking susceptibility Test Method: _____

• Heat of hydration Test Method: _____

○ What hardened concrete tests are required? Please cite name/number of specification/test procedure.

• Resistance to freezing and thawing?
Test Method: _____

• Strength, What is the typical design strength?
Test Method: _____

- Permeability?
Test Method: _____
- Shrinkage – restrained or free?
Test Method: _____
- Creep?
Test Method: _____

- Have you ever used fibers in a paving mix? Yes No
 - If so, which fiber type?
 - Steel
 - Polypropylene
 - Polyester
 - Polyolefin
 - Nylon
 - Carbon
 - Other (describe)

- How was the mix design adjusted for the fibers?

Was there a change in the water content?
 Were chemical admixtures used?
 Some other method?

Comments:

- Please rank the primary concerns about concrete durability in your state?
 (1 – not a concern, 2 – rarely a concern, 3 – sometimes, 4 – often, 5 - always)

	<u>Rank</u>
<input type="checkbox"/> Freeze-thaw resistance / Scaling resistance	_____
<input type="checkbox"/> DEF susceptibility	_____
<input type="checkbox"/> ASR susceptibility	_____
<input type="checkbox"/> Chemical attack	_____
<input type="checkbox"/> Abrasion resistance	_____
<input type="checkbox"/> Fatigue cracking	_____
<input type="checkbox"/> Other (describe)	_____

If possible, please attach some of the typical mix designs used by your state for paving concrete.

	Mix #1	Mix #2	Mix #3
Water	_____	_____	_____
Portland Cement	_____	_____	_____
Fly Ash Class C	_____	_____	_____
Fly Ash Class F	_____	_____	_____
Slag	_____	_____	_____
Silica Fume	_____	_____	_____
WR	_____	_____	_____
MRWR	_____	_____	_____
HRWR	_____	_____	_____
AEA	_____	_____	_____
Acclerator	_____	_____	_____
Retarder	_____	_____	_____
Other _____	_____	_____	_____

Comments:

□ Project testing

- Do you require field trial-batch testing?
 - If yes, what tests are required?

- Do you require tests on field materials prior to paving?
 - If yes, what tests are required?

□ **QC/QA**

○ What concrete tests are required? And what test is performed?

- Air? Yes No
Test Method:

- Slump? Yes No
Test Method:

- Strength? Yes No

- Maturity?

- Beams? Center point or third point?

- Compression?

- Split tensile?

- Other? (describe)

Research

- What research, especially local/in-house research, have you, or others in your state, conducted that relates to the five concrete properties focused on in this study?
 - Workability

 - Strength development

 - Air content

 - Permeability

 - Shrinkage

This should include materials tests, concrete tests, and any other research that would be relevant to this project.

- Please provide reports, write-ups, or data for these research efforts if available.