Mix Design and Analysis Track
State Feedback

Mixtures that are consistently long-lasting, constructible, and cost efficient
Track 1. Mix Design Analysis

Goal: Mixtures that are sustainable and consistently long-lasting, constructible, and cost-efficient

Subtrack: Tests

- Acceptance
- Uniformity

Materials

- Aggregates
  - ASR
  - Dust
  - Grading
  - CTE
  - D-Cracking
  - Moisture content

- Cement
  - Chemistry
  - LOI
  - Function
  - Side effects

- SCM
  - Chemistry
  - Proportion

- Admixture
  - Function
  - Side effects

Fresh

- Rheology (Workability)
- Stiffening
- Setting
- Proportions

Hardened

- Strength gain
- Permeability
- Shrinkage
- Proportions
- ASR
- CTE

Subtrack: Models

- Effects of Mix Proportioning
- Effects of Materials Interactions

Parameters

- Aggregates
  - Grading
  - Shape
  - Texture
  - Proportion

- Cements
  - Chemistry
  - Proportion

- SCM
  - Chemistry
  - Proportion

- Water
  - Proportion

- Admixtures
  - Proportion

Fresh properties

- Rheology
- Stiffening

Hardened properties

- Strength gain
- Permeability
- Shrinkage
- ASR

Incompatibility

Subtrack: Specifications

- Guide Sheets (Instructions for specific people)
- Guide Specifications (Guidelines on balancing priorities)

- Structural designer
- Specifier
- Mix proportion lab
- Plant operator
- Test lab
- Contractor

- Risk and reward
- Cost and quality
- Project scope and testing costs
- Innovation and Comfort

- Demonstrate tests
- Demonstrate models
- Validate models
- Demonstrate specs

Subtrack: Communication

- Field Trials
- Tech Transfer

- Tests
- Models
- Specifications
- Training
- Workshops

PCC Mix Design Laboratory Testing & Equipment

PCC Mix Design Modeling

PCC Mix Design System Development & Integration

PCC Mix Design Evaluation & Implementation
Which tasks do we want first?

The States have voted…

Nine of them anyway
1. What are the things you wish you could measure in a concrete mixture?

- Properties to predict durability (5)
- Water content and w/cm (3)
- Rheology (3)
- Air entrainment at the paver (2)
- Curing (2)
- Its emotional state of being (2)
- In-place strength test method
- Real time evaporation rates
- Incompatibility
2. What are the causes of materials / mix related failures that you experience?

- Durability related to air void system (5)
- Incompatibilities (2)
- Freeze-thaw
- D-Cracking
- Late ettringite formation
- Excessive aggregate absorption
- Excessive deicers/anti-icers
- Excessive alkali
- ASR
2. What are the causes of materials / mix related failures that you experience?

- Gap graded aggregates (2)
- Improper/inadequate curing (2)
- Cracking (2)
- Unapproved materials
- High cement contents
- Poor construction practices
- Aggregate and concrete handling
- Poor finishing
- Hot weather/cold weather construction
- Low strength
3. Would you use a guide specification if one were prepared?

- Yes (3)
- Yes, if ... (3)
- Maybe (3)
- Probably not
4. What should be the two greatest priorities for the mix track?

- Tests and models to predict long-term performance based upon construction data (3)
- Tests for acceptance and uniformity (3)
- Permeability (2)
- Minimum cementitious materials content? (2)
- Fast and reliable test for freeze-thaw durability
- Correlation of laboratory testing with field performance
- ASR
- How much air is really necessary?
4. What should be the two greatest priorities for the mix track?

- Quick delivery & thorough coverage
- Drop use strength for acceptance of “good” concrete
- Guidelines for different classes of concrete mixtures relative the application
- Define what we expect in terms of durability
- Work should be balanced between concrete structures and concrete pavements
- Standard mix design procedure
- Acceptable variability
5. What immediate tasks or actions should we do to address those priorities?

- Testing equipment and methods (2)
- Good tests and models
- Education and outreach
- Understand the current state of the industry in terms of production versus quality
- Understand sustainability parameters
- Equipment user groups
- Procedures
Review of Current Work (RIP)

- Quality 9
- Models 8
- Air void system 6
- Durability 4
- Mix proportions 4
- Cracking 2
- Corrosion 1
- Sustainability 1
- Rheology 1
Summary

• Good tests and models
  • Predict potential durability (air void system)
  • Confirm mix proportions
  • Workability
• Correlate tests with performance
• Guide Specification
  • Necessary parameters and limits
  • Decision tools
• Now!
• Not just pavements