Superabsorbent Polymers in Concrete

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Internal Curing

• Theory
  • Provide curing water
    • Uniformly
    • When needed
Internal Curing

- Benefits
  - Less cracking
  - Improved durability
Internal Curing

• Benefits
  • Less warping
Internal Curing

• Challenges
  • Stockpiling
  • Moisture control
  • Transport costs
Internal Curing

• Super Absorbent Polymers – the theory
  • Can be batched like an admixture
  • Extra water in mixture is soaked in, to be released later

• But how?
Super Absorbent Polymers

- Lit review
- Lab work
  - SAP Materials Characterization
  - Batching
  - Concrete properties
  - Data Analysis
  - Economic analysis
- Reporting / Implementation
  - Lab report
  - Guide specification
Super Absorbent Polymers

- What defines a good product?
  - Chemistry
  - Absorption
  - Desorption
  - Particle size
  - Stability
Chemistry

- Molecular weight
- Crosslinking density
Absorption

- Amount
- Rate
Absorption

- Amount
- Rate
### Desorption

- **Amount**

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Size

- Smaller is better

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• Mixture:
  • w/cm = 0.42
  • Target air = 5%
  • 25% fly ash
  • Aggregate combinations to fit Tarantula curve
  • Paste content based on V_r = 175%
  • WRA as needed to get 4” slump w/o SAP
• Investigate batching procedures
  • Calculate amount of SAP needed
    • 7% desorbed water by mass of cementitious
  • Determine water absorbed in 30 minutes
  • Add the extra water to the mixture
  • Batch SAP dry

• Monitor workability loss
• Assess w/cm in hardened concrete
Effects on concrete

Variables:
- Binder type and content
- Design w/cm
- SAP type

Properties
- Fresh properties
- Calorimetry
- Microscopy
- Cracking risk
- PEM properties
Goals

- How to choose an SAP
- How to design the mixture
- How to prepare the mixture
  - Includes effects of variability
- Technical benefits
- LCCA
- Impacts on sustainability