Innovations in Chemical Admixture Technology as Related to Sustainability, Part 2

ACI Spring 2012 Convention
March 18 – 21, Dallas, TX

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Presentation Overview

- Concrete Industry Challenges
- Hydration-Controlling Admixture Technology
- Why HCA is a Sustainable Technology
- HCA Applications, Financial and Environmental Impact Examples
- Innovative HCA Value Calculator, Economic and Sustainability Reports
- Take Away Messages

Concrete Industry Challenges

Returned Plastic Concrete

- Estimated 2% to 10% of all concrete produced is returned to the plant
- 2011 concrete production = 263M yd³ (201M m³)
- 5% return rate = 13.1M yd³ (10.1M m³)

Financial Impact

- R&M plant with annual production of 38K yd³ (29K m³)
- 5% return rate = 1,900 yd³ (1,453 m³)
- Materials cost of $53 per yd³
- Annual materials cost of $100,700
- Concrete waste recycle opportunity

Concrete Washwater

- Typically at the end of each work day, 225 gallons (850 L) of water are used to clean out each truck drum
- Example:
  - Plant with 10 concrete trucks
  - 240 working days per year
  - Disposal of 540K gallons (2.0M L) of washwater
  - Disposal of 720 tons (655 mt) of residue waste

Financial Impact

- Solid waste residue is equivalent to batching 380 yd³ (275 m³) of fresh concrete
- Materials cost of $53 per yd³
- Annual materials cost of $19,080
- Concrete wastewater and solid waste residue recycle opportunity
Innovative HCA Technology (Addressing Concrete Industry Challenges)

Hydration-Controlling Admixture
- Technology originally developed in 1986
- Ready-mixed concrete producer idea
- Chemistry controls (stops) cement hydration
- Seven current HCA applications:
  - Same day stabilization of returned plastic concrete
  - Overnight stabilization of washwater
  - Long-haul stabilization of fresh concrete
- Extended set time control of conventional concrete, preserving
- Ready-mixed concrete producer idea
- Technology originally developed in 1986

Why HCA is a Sustainable Technology

HCA Technology Reduces:
- Returned concrete waste
- Water needed to clean truck drums
- Concrete washwater waste
- HCA Value Calculator:
  - Determines the value of using HCA technology in one or more applications as a sustainable concrete practice
  - Creates economic and sustainability reports
  - Calculates environmental impact savings using Eco-Efficiency Analysis

Environmental Impact Categories

- Consumption of Energy
- Emissions
- Toxicity Potential
- Risk Potential
- Consumption of Raw Materials
- Land Use

Seven current HCA applications:
- Chemistry controls (stops) cement hydration
- Ready-mixed concrete producer idea
- Technology originally developed in 1986

How do you Measure Ecological Benefits?

Eco-Efficiency Analysis
Strategic life cycle method used to compare the relative ecological and economic efficiencies of alternative
- products (like concrete)
- processes
- technologies
ISO 14040 (ecological part)
  - Cradle-to-gate
  - Cradle-to-grave
  - Cradle-to-cradle

Eco-Efficiency Analysis for Concrete

Same Day Concrete Stabilization
- With HCA technology, stabilizes returned plastic concrete in a truck drum for a short time period (30 minutes to 4 hours)
- Use the combination of recycled and fresh concrete in non-critical project applications
- Concrete Producer Value:
  - Reduced concrete waste and disposal costs
Example: Concrete Stabilization

**Financial Impact:**
- Reduces returned concrete waste, disposal costs and batching of fresh concrete
  - 2011 production = 38K yd³ (29K m³)
  - 5% return rate = 1,900 yd³ (1,453 m³)
  - Materials cost of $53 per yd³
  - Annual materials cost = $103,700
- Typical HCA dosage = 7 fl oz/cwt (455 mL/100kg)
- Net annual material savings = $93,668

**Environmental Impact:**
- 5% return rate = 1,900 yd³ (1,453 m³)
- Equivalent concrete waste = 3,800 tons (3,455 mt)
- Same day concrete stabilization application recycles waste
- Annual Savings:
  - 1,255,356 kWh (4,511,001 MJ) of energy
  - Power for 108 U.S. homes
  - 1,159,363 lb (526,983 kg) CO₂
  - 61,019 gal (230,957 L) of gasoline
  - 165,426 lb (75,194 kg) solid waste
  - Waste equivalent to 33,085 people

**Example: Washwater Stabilization**

**Financial Impact:**
- Reduces water to clean truck drums, concrete washwater waste and disposal costs
  - 10 trucks using 225 gallons (850 L)
  - 360 yd³ (275 m³) concrete residue
  - Materials cost of $53 per yard³
  - Annual materials cost of $19,080
- Typical HCA overnight and weekend dosage = 32 fl oz (0.95 L) and 64 fl oz (1.9 L) per truck
- Net annual cost savings = $10,440

**Environmental Impact:**
- Overnight washwater stabilization application recycles residual waste
- 10 trucks = 540K gal (2.0M L) of water
  - Equivalent to:
    - Washing out 1,867 truck drums
    - 37,793 showers
    - 3.6M 1/2 L bottles of drinking water

**HCA Application**

**Concrete Washwater Stabilization**
- With HCA technology, stabilize concrete washwater in a truck drum for a long time period (overnight or over a weekend)
- Use recycled washwater as part of the mix water in freshly batched concrete

**Concrete Producer Value:**
- Reduced washer waste and disposal costs

**Long-Haul Concrete Stabilization**
- With HCA technology, stabilize fresh plastic concrete in a truck drum for a specific time period (generally 3 to 10 hours)

**Concrete Producer Value:**
- Increased revenues from having an expanded ready-mixed concrete delivery zone
- Reduced labor and material costs for constructing a portable concrete batch plant

**Extended Set Time Control**
- With HCA technology, extend concrete set time for a few minutes or hours as needed on a given project
  - Conventional concrete subjected to higher ambient temperatures
  - Truck breakdowns and job delays
  - Previous concrete
  - High early strength concrete (400 psi flex in 4 hours)

**Innovative HCA Value Calculator**

Concrete Producers Can Use To:
- Determine the value of using HCA technology in one or more applications as an economical and sustainable concrete practice

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**HCA Application**

**Concrete Stabilization**
- With HCA technology, stabilize concrete and other materials for a long time period (overnight or over a weekend)
- Use recycled washwater as part of the mix water in freshly batched concrete

**Environmental Impact:**
- Same day concrete stabilization application recycles waste
- Annual Savings:
  - 1,255,356 kWh (4,511,001 MJ) of energy
  - Power for 108 U.S. homes
  - 1,159,363 lb (526,983 kg) CO₂
  - 61,019 gal (230,957 L) of gasoline
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**Concrete Producer Value:**
- Reduced washer waste and disposal costs
Economic and Sustainability Report

Take Away Messages

Hydration Controlling-Admixture Technology

- HCA chemistry controls cement hydration
- Seven applications for concrete producers
- Twenty-five years of industry experience

HCA Value Calculator:
- Creates economic and sustainability reports
- Calculates environmental impact savings

HCA technology helps concrete producers:
- Manage concrete and washwater waste streams
- Increase plant operational efficiency