Workshop on Coal Combustion Products: UWM-CBU

The Use of Fly Ash in Ready-Mixed Concrete – The WRMCA Perspective

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Fly Ash Usage by Ready Mix Producers

• Class F and Class C usage started in the early 1970’s
• Why used: Permeability, Strength, Economy, Pumpability

Mix Design Adjustments
Quality of Concrete Mixes
Quality of final in-situ concrete
Placement & Finishing
Permeability

- Reduction vs. standard concrete
- Water repellency characteristics
- Workability
- Reaction with admixtures
  - Air Entrainment, Accelerators, Retarders
  - Water Reducers, High Range Water Reducers
Strength and…..

- Compressive
- Flexural
- Set times
- Storage / Batching
- Hot Weather / Cold Weather
Pumping & Conveying

- Particle size assists movement
- Reduction in pump pressure
- Concrete heat build up is reduced
- Flow with reduced cement contents is improved
- Mix Consistency is improved
Mix Adjustments

- Water adjustment
- Other Admixture adjustments
- Delivery considerations
Quality of Mixes

• Improvement noted at all stages of strength development.
• Improvement noted at all stages of durability development.
• Long-term results of fly ash concrete is superior to straight cement mixes (strength development, permeability reduction, workability, durability.)
Mix Usage - Versatility

- Structural Concrete
- Lightweight Concrete
- Waste Water Treatment Plants
- Water Treatment Plants
- Highway / Municipal projects
- Residential projects
- Specialty projects
Structural Concrete

- Long-term strengths (gain is continual)
- Permeability reduction
- Placing and workability
- Consolidation and finishing
Lightweight Concrete

- Strength development
- Pumpability and workability
- Placing and finishing
- Quality improvement
- Dead load vs. live load considerations
Wastewater & Water Treatment Plants

- Permeability reduction
- Economy of mixes
- Pumpability and workability
- Long-term durability
Highway & Municipal

• Quality and Placement
• Economy of Mixes
• Durability and Performance
• Availability and storage
• Permeability
Residential

• Multitude of uses:
  - Footings and foundations
  - Driveways, patios, sidewalks, pools
  - Retaining walls
  - Decorative (stamped, colored)
  - Ornamental
Specialty

- Insulated Concrete Forms
- Pervious Concrete
  - storm water solution
  - reduction of impervious to meet DNR shore land regulations
LEED Requirements

- Sustainability and use of by-products
- Fly Ash adds extra points for project
- Specifics of USGBC
  - heat island
  - lighting efficiency
  - energy performance
  - waste minimization
Meets ASTM Standards

ASTM C 618
Pervious Concrete

When it rains . . .

. . . It *drains*
Pervious Concrete Benefits

- Reduces stormwater runoff
- Eliminates the need for detention ponds and other costly stormwater management practices
- Replenishes water tables and aquifers
Pervious Concrete Benefits

• Allows for more efficient land development
• Minimizes flash flooding and standing water
• Prevents warm and polluted water from entering our streams
• Mitigates surface pollutants
• Excellent Traction
Pervious Concrete Applications

- Parking areas
- Driveways
- Sidewalks
- Residential roads and alleys
- Swales & ditches
- Erosion control
- Slope protection
- Etc.
Pervious Concrete Driveway
Pervious Concrete Parking Lot
Pervious Concrete Mix Design

General Description

- Structural Pavement - 2000-3500 psi
- Strength of pavement derived from point to point contact of the aggregate
- Components
  - Coarse aggregate
  - Portland cement + SCMM
  - Water
  - Admixtures
- Void content range of 15-25 %
Striking Off
Cross Rolling
Jointing
Curing

- Curing pervious concrete is **critical** due to the open structure and low w/c ratio. Curing should begin within 20 minutes of final finish or earlier if conditions warrant it.
Questions ?