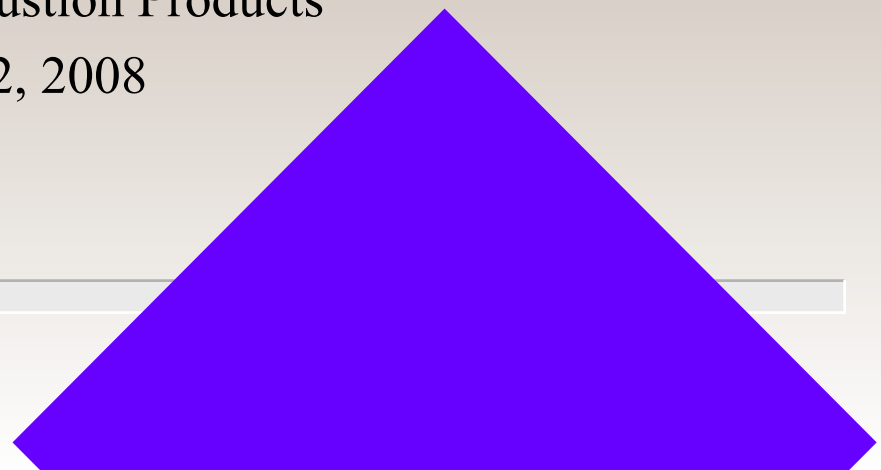
UWM - CBU Concrete Materials Technology Series No.71

UWM - CBU Workshop on Green Construction Materials
Using Coal-Combustion Products

May 1 & 2, 2008



Use of Fly Ash and Other Coal Combustion Products in Concrete and Construction Materials

Use of Fly Ash in Concrete and Flowable Slurry – A Ready Mixed Concrete Manufacturer's Perspective

- Steve Pozza
  - New Berlin Redi-Mix, Inc.
  - Batchman 1993 – 1995
  - Sales 1994-1999
  - Sales Manager 1999 to Present
  - Prior experience in Sales, Business Administration, and Finance

New Berlin Redi-Mix, Inc.

- Family Owned and Operated since 1958
- Use of Fly Ash to Enhance Concrete since the early ‘60s
- Active participants in the Ready Mixed Concrete Industry and Many Other Construction Related Associations

Flyash use to meet Contractors needs

- Low Strength Material
- Footings
- Walls
- Mechanically Placed and Finished Flatwork
- Hand Finished & Decorative Flatwork
- Pervious Concrete

Practical Fly Ash Use For CONCRETE

- High: 55% reduction
- Low: 10% reduction
- Average: 15% reduction
- Driveways, Sidewalks, Patios, Stoops, Garages, Basement Floors, Industrial Floors, Curb & Gutter, Block Fill, Walls, Insulated Concrete Forms
- Limited by Severe Freeze - Thaw Conditions in our market

Fly Ash Use Pros and Cons

- Facilitates Placement
- Produces a denser mix
- Increased strengths
- Provides an apparent higher slump
- Improved “Pumpability”
- Lengthens set time
- Lower Heat of Hydration

- Sensitive to ambient temperature
- Not wind friendly
- Influences color
- Confounds the Finisher
- Requires frequent A/E testing
- Lengthens set time

Controlled Low Strength Material (CLSM)

- DEFINITION* - Flowable Fill is a self compacting, cementitious material used primarily as a backfill material in lieu of compacted-soil backfill.
- Not considered concrete
- Also called lean-mix
- *Defined in ACI 229R-94.

Flowable Fill is Not Concrete

- Similarity ends with delivery vehicle
- Low cementitious
- Does not hydrate
- Settles, dewaters
- The wetter the better
  - Less water does not equate to faster hardening
  - Too little water will not allow proper settlement

Properties of Flowable Fill

- High Slump
  - (8” +) Self-Leveling
- Low Strength
  - Commonly 100 PSI
  - (0.7 Mpa) in 28 days
- Density in Place

  115 to 145lb./cu.ft.

  (Higher than most compacted soils/aggregate)

Why use Flowable CLSM?

- Economical Alternative
- Backfill
- Structural Fill
- Other Uses (Abandoned Underground Tanks and Utility Vaults, Wells, Voids under Pavement, Sewers / Manholes
- Contend with Muddy Conditions

FLOWABLE CLSM

- **Flowable fill was used to fill an abandoned tunnel that crossed under the Menomonee River in Milwaukee. (Right) The flowable fill mixture was designed to flow over 200 feet.**

WE Energies Flow-Pak

Formula Number	Mix Description	Cementitious Bag Equivalent	#1 Stone	Torpedo Sand	Water Gallons	A/E	Cement Pounds	Fly Ash	Total Cementitious	% Flyash	W/C Ratio	UNIT WEIGHT	A/E
FFMIX1	FLO-PAC1	6.91		2100	48	19.5	50	600	650	92.3%	0.62	116.683	3.000
FFMIX2	FLO-PAC2	10.59		1175	94	10	70	925	995	93.0%	0.79	109.415	1.005
FFMIX5	FLO-PAC5	9.57	1500	750	57		200	700	900	77.8%	0.53	134.279	0.000
FFMIX6	FLO-PAC6	1.06		3100	60		50	50	100	50.0%	5.00	137.057	0.000

Subsidence and Settlement

- **Subsidence is the reduction in the initial in-place volume caused by the displacement of water and release of entrapped air as a result of consolidation. Typically, 1/8in per foot of depth is experienced.**
- **Settlement does not occur to flowable fill mixtures once they have hardened.**

NBRM CLSM

Mix Description	Cementitious Bag Equivalent	#1 Stone	Torpedo Sand	Pea Gravel	Water Gallons	A/E OZ	Cement Pounds	Fly Ash	Total Cementitious	% Flyash	W/C Ratio	UNIT WEIGHT	A/E
1500psi	3.72	778	1668	1167	24	1.1	105	245	350	70.0%	0.57	154.193	0.314
1000psi	2.93	988	1165	1305	24.5	6.3	50	225	275	81.8%	0.74	145.829	2.291

- Cementitious Material is great for constructability more than it is for early strength achievement.
- Minimum bag content of cement needed for meeting 28 day strength requirements.

TESTING FLOWABLE CLSM

- Sample & Remix
- Slump not Recommended
- Air content by Pressure Meter
- Compressive Strength
- Unit Weight (ASTM C138)
- Penetration Resistance
- Density Test not required (becomes rigid after hardening)

Thank you!