Technical Bulletin 27

Fly Ash for Insulating Concrete Form Construction

INSULATING CONCRETE FORMS (ICFS), which became popular in residential construction in the 1990s, are steadily gaining acceptance in the commercial market, as well. ICFs combine framing, insulation, sheeting and shear wall strength into one superior building system that uses concrete as the main structural member from foundation to roof top.

ICFs are hollow, Lego®-like building blocks made of expanded or extruded polystyrene capable of withstanding lateral pressures from plastic concrete. The blocks stack on top of each other, and plastic or metal web ties brace the interior and exterior foam walls to form a hollow cavity. Openings in the walls for doors, windows and services are provided as the block layers are erected. Bracing and plugs for the hollow blocks are fitted to make a tight forming system for the concrete structure. Once the blocks are installed with reinforcing bars, the window and door penetrations are properly framed out with wood or vinyl buck, and the walls are braced, the blocks are filled with concrete. The concrete provides structural integrity to resist hurricane force winds, floods, and fire while providing energy conservation, sound proofing, pest control, and mold and mildew deterrent.

Building with ICFs offers many advantages over standard wood frame construction. ICF construction is a superior earthquake, flood, fire, and hurricane-resistant building system. Using fly ash in the concrete mix that fills the forms can further increase the strength and durability of this construction.

ICF construction offers many advantages, including:

- Lower utility bills
- Reduced insurance premiums
- Improved resale value
- Solid state of the art construction
- Low maintenance

Fly Ash Can Improve ICF Construction.

1. **Environmental Benefits.** Fly ash is a byproduct of coal combustion, and is a 100% post-industrial recovered product. Fly ash used in concrete is diverted from landfills. As a component of concrete, fly ash also reduces greenhouse gas emissions attributed to the production of portland cement.
2. **Strength.** Increased usage of fly ash can reduce the early strength (7-28 days) of concrete; however, it would still meet or exceed strength requirements of conventional cement block walls. Long-term strength (+56 days) is typically higher than straight cement mixes. Fly ash is an ideal addition because ICFs retain the heat from hydration of cement, which accelerates strength gain. Thus, higher percentages of fly ash can be used, yielding early strength typical of lower volume fly ash mixes.
3. **Reduced Water Requirements.** The inclusion of fly ash in concrete mixes reduces water requirements, which in turn results in a stronger finished concrete.
4. **Minimal Cracking and Shrinkage.** Fly ash in concrete helps reduce cracking. The two thick layers of insulating foam provide an ideal curing environment for concrete. Fly ash concrete cured within the confines of an ICF wall will achieve higher ultimate strength with a minimum of cracks and shrinkage. Reduced water needs also aid in reducing drying shrinkage and cracking.
5. **Improved Workability.** Despite the reduction in water content, fly ash concrete maintains its integrity better, keeping aggregates, cement, fly ash, water and other materials in optimum suspension. The spherical shape of fly ash particles fills spaces between angular cement particles. Fly ash concrete is more cohesive, which results in reduced segregation and more homogeneous concrete. Fly ash concrete mixtures move more easily through pump lines, which creates stronger walls without pockets of aggregate.

How Much Fly Ash?

Many ready mixed concrete producers use fly ash at levels between 15% and 20% of total cementitious materials in ICF mixes. Some innovative producers, however, have reported success with 30% to 50% fly ash mixes. In fact, a 50% percent fly ash mix used within a U.S. Green Building Council LEED™ structure may count as an innovative practice toward LEED certification.

A worker installs the insulated concrete forms and reinforcement for the foundation walls of a water tank in Angoon, Alaska.

Photo courtesy of ECO-Block, LLC

For more information or answers to questions about the use of fly ash in specific applications, contact your nearest Headwaters Resources Technical Sales Representative or call 1-888-236-6236.

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