

# High Volume Fly Ash in the Madera Project

Located on a fully wooded 44-acre site in Gainesville, Florida, directly adjacent to the University of Florida campus, Madera consists of 80 lots being developed by Green Trust, LLC, and built by three builders. In the spring of 2002, selected builders were invited to participate in a presentation and meeting with the Florida Energy Extension Service (FEES) which spearheaded the project for the University and the development partnership. Following that meeting, the participating builders were selected. The homes were designed to be both green and profitable. The first eight homes were to be intended to be used as educational and sales tools for prospective buyers and as a vehicle for education and outreach, and to entice other developers and builders to apply these lessons to other projects. The project was also expected to increase homeowners' awareness and utilization of energy-saving and recycling practices. High volume fly ash (HVFA) concrete is one of the technologies used in the project to promote resource-efficient construction.

Rinker Materials supplied Carter Construction of Gainesville with two 3000 psi HVFA mix designs utilizing ASTM C-618 Class F fly ash, supplied by Headwaters Resources, and ASTM C-150 Type II cement. Both mix designs maintained typical residential water to cement ratios and did not require special admixtures to increase workability or decrease initial setting time. Material costs for both mix designs were low enough to be competitively used in most ready mix markets.

The first building to be constructed at Madera Community was the model center. The design for the foundation of Madera's model center is monolithic, meaning the footing and the slab were poured at the same time without isolation joints or cold joints. A 40% Class F fly ash concrete mix was used in the foundation and patio slabs. Placement of the foundation commenced at 7:00 a.m., and Rinker Material's trucks pulled



off the job at 10:00 a.m. Carter Construction's three finishers started floating and troweling the slab surface at 11:00 a.m., and the finishers had their tools packed by 3:00 p.m. Approximately 80 cubic yards of HVFA concrete was placed in the foundation with a 28 meter boom pump.

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*Using fly ash in residential and commercial development increases concrete density, reduces permeability, ultimately produces higher compressive strengths, and inhibits sulfate attack, alkali silica reactivity, and chloride attack, as compared to concrete without fly ash.*

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The exterior walls of the model center were formed with insulating concrete forms (ICFs), a building system that uses concrete as the main structural member. ICFs are hollow building blocks made of expanded or extruded polystyrene. The blocks stack on top of each other and the interior and exteriors are braced with plastic or metal web ties. The ICFs used in the model center had a 4-inch inside dimension. A 60% Class F fly ash concrete mix was used in the exterior walls. Concrete slumps greater than six inches were needed so the concrete could flow through the ICFs. This need was met by using the 60% fly ash concrete mix. Approximately 33 yards of HVFA concrete were placed in the exterior walls using a 2-inch line hydraulic pump. Wall compressive strengths averaged 3650 psi at 28 days.

Both mix designs performed exceptionally well on the job site, having compressive strengths which exceeded 3000 psi at 28 days and did not increase Carter Construction's labor or material expenses. The concrete finishers were pleased with the concrete's workability, set time performance and finished appearance.

Approximately 18 tons of fly ash were used to replace cement in Madera's model center, which reduced CO<sub>2</sub> emissions into the atmosphere by approximately 18 tons.

The production of cement emits approximately one ton of CO<sub>2</sub> per ton of cement produced into the atmosphere. Over 500 cubic feet of landfill space were saved by using fly ash as a cement replacement in the model center. Fly ash not used beneficially, such as for cement replacement, consumes precious landfill space throughout the country.

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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