



U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

New Concrete Panel Technology in Yonkers **A Habitat for Humanity of Westchester Project in Yonkers, NY**

TECHNOLOGY HIGHLIGHTS

Structural Concrete Insulated Panels—Wall, Floor & Roof

ENERGY STAR® Homes

Low-Impact Development

Air Admittance Vents

Low-E Insulated Windows

ENERGY STAR® Appliances

Compact Fluorescent Lighting

Habitat for Humanity of Westchester (HfHW) recently constructed three two-story duplexes in inner city Yonkers, New York using a new insulated concrete wall and roof panel technology that incorporates carbon grid reinforcement. The U.S. Department of Housing and Urban Development's Partnership for Advancing Technology in Housing (PATH) program provided assistance in bringing the new technology to the project. Both organizations are committed to affordability, durability, and energy efficiency in housing. By teaming up with PATH, HfHW is able to build high performance homes that maximize the nonprofit builder's resources and offer homeowners additional long term energy savings.



The Altus Group, a partnership of precasters and reinforcement specialists, has created a new Carbon-Cast technology that incorporates a carbon grid reinforcement with precast concrete components. The Altus Group funded the design and manufacturing costs of the insulated CarbonCast panels used for the walls and roof of the HfHW demonstration homes. Six new housing units will be located on two different sites in Yonkers, with one duplex at Willow Place and two more duplexes located at Purcer Place. The sites were previously occupied by older homes that were razed due to age, poor condition, and nearby infrastructure work. The Willow Place site was selected to be the site of the first units built from the carbon-reinforced concrete panels. HfHW volunteers are working for an expected completion date of September 11, 2005.

Project goals include affordability, rapid construction, energy efficiency, and durability. Because HfHW depends on volunteer labor, the builder examines each new technology for "volunteer friendliness" to see whether individuals with no prior construction experience can work with the new product. To facilitate easy learning, HfHW also strives to make its projects highly replicable, serving as models for future affordable housing projects. Panelization and the other PATH technologies incorporated at the Yonkers duplexes support these goals.

Advanced Technologies

It is the goal of the U.S. Department of Housing and Urban Development's PATH program to accelerate the development and use of technologies that radically improve the quality, durability, energy efficiency, environmental performance, and affordability of America's housing market. The Habitat for Humanity of Westchester demonstration homes in Yonkers, New York feature several of these technologies, including three of PATH's featured top ten technologies. Each new product or technique is carefully planned and implemented to yield performance and cost benefits to both the builder and the homeowner. Any new technologies must meet criteria specific to HfHW for affordability, simplicity, replicability, and volunteer-friendliness.



1

ENERGY STAR® Homes

All of the homes in the Yonkers project were designed to meet ENERGY STAR® Home standards. Engineers providing PATH technical advising performed energy modeling to predict and optimize home efficiency. Homeowners will benefit from long-term energy savings offered by a tight building envelope. Home performance tests will be conducted to verify that the design goals for efficiency are being met.



2

Concrete Insulated Panels

Concrete Insulated Panels (CIPs) developed by the Altus Group are used for foundation walls, floors, roofs, exterior walls, and party walls at the Willow Place and Purcer Place duplex homes. Foundation walls rest on a gravel pad (1) and support the walls of upper stories. The floor and roof decking panels are end-bearing only, so the interior partitions are non-load bearing and can be rearranged at will in the future. The shell is rapidly erected using cranes (2). Panels arrive fully manufactured with framed openings and are pre-insulated with expanded polystyrene foam (EPS) for faster construction and superior energy performance.



3

CarbonCast technology uses a reinforcing grid made of carbon fibers called C-GRID™ to achieve superior strength in thinner concrete members. The panels are lightweight and the carbon grid reinforcing is designed to eliminate the "cold bridge" issue normally found in masonry and concrete structures that use metal reinforcing. The panels resist fire, mold, insects, wind, and projectiles. Standard wall panels deliver insulation values of R-15 (R-25 is also available) while the roof deck panel provides R-37. The combination of concrete and insulation in walls and decks also provides an excellent acoustic barrier, a critical aspect of comfort for a two-family building.

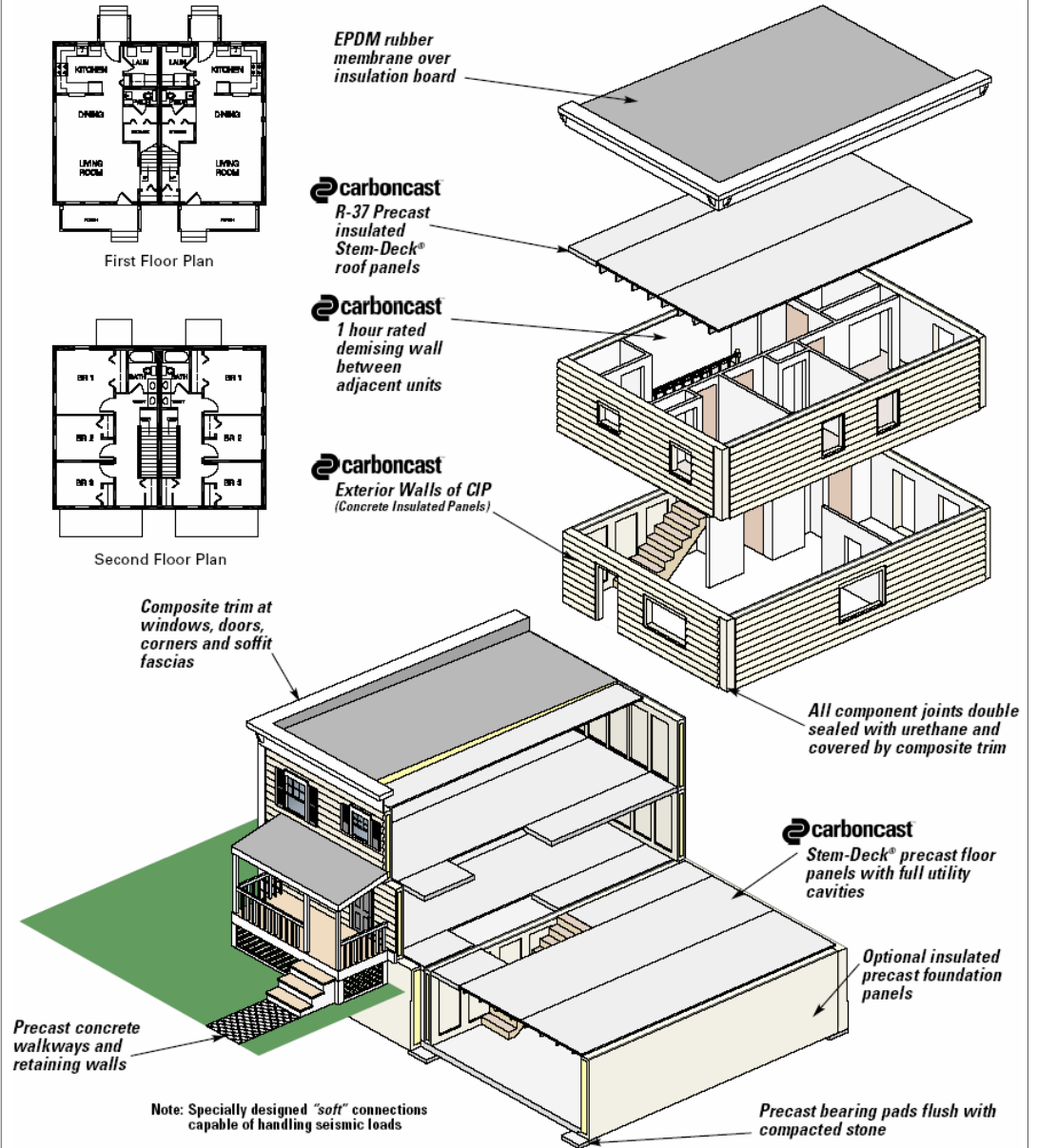


4

While panels were installed by experienced erection crews (3), HfHW relied on volunteer labor for much of the construction process. Any new technology therefore had to meet the organization's need for volunteer-friendly building systems. The precast panels are designed to be easily assembled with "fastener friendly™" connection points. Panels can be directly painted or stained for durable, low-cost, low-material finishing. Exterior wall panels are cast with an architectural finish so there is no need for additional siding other than corners and trim (4).

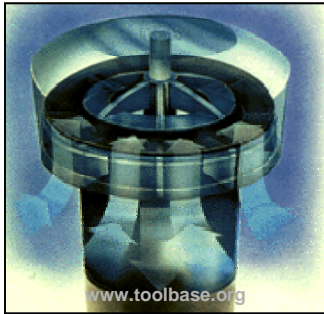
Although the installation of panels went as planned, the project team initially faced challenges when dealing with code officials and subcontractors. As with any new technology, CIPs may require builders to educate building inspectors along with plumbers, electricians, and other trades to modify conventional practices. The PATH demonstration home presents a valuable opportunity for builders, suppliers, and advisors to experiment with training processes to overcome these barriers.

The Altus Group developed the following structural schematic of the Yonkers prototypes:



Low-Impact Development

As building developments cover more and more land, stormwater runoff from impermeable surfaces (roofs, parking lots, streets) has increased dramatically. Municipalities have required developers to control runoff through storm sewers and other structures, but this approach does nothing to address concerns about decreasing levels of naturally filtered groundwater found in aquifers, or pollutants carried to streams and rivers via storm runoff. Low-Impact Development manages stormwater runoff by maximizing natural infiltration of rainwater as close as possible to the original area of rainfall. One way the Yonkers demonstration homes employ Low-Impact Development concepts is by reusing sites that were previously covered by impermeable structures. HfHW also committed to eliminating stormwater runoff by installing underground catchbasins or French drains to hold rainwater until it infiltrates into the ground.

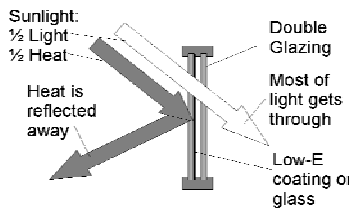


5

Air Admittance Valves

Air admittance valves (AAVs) are pressure-activated one-way mechanical vents for plumbing systems (5). They admit air for proper drainage when wastewater is being discharged, but the valves remain closed during other times to prevent sewer gases from escaping into the living environment. Air admittance valves replace the conventional venting technique of pipes running from fixtures out through the roof. While one conventional vent per building is common practice, using AAVs at other locations throughout the building saves material, labor, and long-term maintenance problems associated with roof penetrations.

Designers also have more flexibility with room layout when vent piping is eliminated. When dealing with concrete panels, designers try to limit piping penetrations through walls and floors because of the labor associated with boring precast concrete. At the Yonkers project, the original plumbing contractor worked closely with the project team leaders to streamline the plumbing system to work well with panelization. However, by construction time the plumbing contractor had changed to crews who had different expectations. The education and re-education processes associated with new technologies present ongoing challenges in all facets of construction.



6

Low-E Double-Glazed Windows

Generous windows let in daylight and reduce lighting loads, but poor quality windows result in heat and cooling losses. Low-e coating and argon-gas-filled double glazing minimize energy losses while maximizing daylighting (6). Building systems consultants have found that a low-e coating with insulated glass is one of the most effective energy upgrades homebuilders can make, and the additional cost of high-performance windows is offset not only by energy savings in the long run, but also by allowing smaller mechanical equipment to be specified up front.

ENERGY STAR® Appliances and Fixtures

ENERGY STAR® appliances and light fixtures are being installed in the Willow Place and Purcer Place duplexes in compliance with the New York Energy \$mart™ Program. Fluorescent and compact fluorescent lamps use one-quarter to one-third of the energy of conventional incandescent light bulbs, saving homeowners money on their energy bills. They also last up to seven times longer than incandescent lamps, thus reducing maintenance and replacement costs. Both ENERGY STAR® appliances and compact fluorescent lights generate less waste heat than conventional appliances and fixtures, thereby reducing summertime cooling loads.



Conclusion

The Habitat for Humanity of Westchester demonstration project at Willow Place and Purcer Place in Yonkers, New York has faced its share of difficulties, including the lack of planned lots and problems with zoning regulations preventing duplex housing in Yonkers. The key innovation in the three duplex structures is the use of carbon-reinforced, insulated concrete panels for the foundation, walls, floors, and roof. Throughout the project the builder, PATH technical advisors, and panel manufacturers have found opportunities to better understand the cost, installation, and training issues associated with this new technology. When completed, the demonstration homes will provide quiet, durable, energy-efficient alternatives.