Investing in the Future: *Pulte's Switch to Panelization*

Builder's Experience

EASE OF INSTALLATION
DIFFICULT — EASY

SPEED OF CONSTRUCTION
SLOWER — FASTER

COST EFFECTIVENESS
POOR — EXCELLENT

RETURN ON INVESTMENT
IMMEDIATE — DEFERRED

COMPETITIVE EDGE
NONE — SIGNIFICANT

HOMEOWNER INTEREST
LOW — HIGH

Challenges: Marketing and educating code officials, installation crews, and homeowners

Would he do it again? Yes

PATH Attributes:

- Energy Efficiency
- Quality and Durability
- Safety and Disaster Mitigation

Builder Tips: Educate code officials early in the process, and install insulation on the outside of the foundation wall to move the condensation point to the outside edge.

Builder:
Stephen Runnels & Chuck Chippero
Pulte Homes
Manassas, Virginia

Builder Type:
Large Production Builder

The Technology:
Panelized Systems

The Project:
Pulte's panelized system is primarily installed in mid- to high-end developments with homes up to 6,000 square feet in Northern Virginia. A dozen of Pulte's large developments in the area are using unique panelized components manufactured in Pulte's Manassas, Virginia plant.

"On average, it takes us 19 days from the day we start to dig the foundation to the day we turn the house over to the mechanical contractor."

– Stephen Runnels

A typical Northern Virginia single-family home built with Pulte high performance panelization.

PULTE'S STORY

Faced with increasing shortages of skilled labor and the desire to create a market niche through high-performance homes, Pulte Homes made a long-term business decision to invest in innovation. This decision was based on years of internal research and a corporate mission to embrace innovative solutions.

A giant in the industry, Pulte invested significantly in manufacturing capacity to supply its new division, Pulte Home Sciences. From its panel factory, Pulte manufactures concrete foundations, open-web floor joists, structural insulated panel (SIP) external walls, and steel-framed interior walls to create energy-efficient, durable homes. Not every builder can replicate this investment, but any builder can apply Pulte's lessons learned.

FACTORY-BUILT COMPONENTS

Pulte manufactures and supplies factory-built components similar to those that are available from other manufacturers, but Pulte standardized the products by designing and building its own.

Chuck Chippero has been General Manager of Pulte Home Sciences for the past 5 years. He has over 20 years experience in automotive component manufacturing and engineering.

Stephen Runnels is a journeyman in five trades with over 30 years in the manufacturing and installation of construction components, and extensive study in Construction and Business Sciences. For the last six years, he has worked with Pulte Home Sciences developing the Premier PHS-Systems.

Why Pulte builds with panelized systems:

"The primary objective was to build a higher-performing house faster. We also saw that the number of skilled carpenters is declining, and we wanted to be ahead of the curve so that we can limit our exposure to labor shortages."

Open metal web floor trusses are precisely positioned by the floor deck assembly machine.

"The design and selection of the individual subsystems of our homes were carefully chosen to support our dedication to whole-house performance," says Chuck Chippero, General Manager of Pulte Home Sciences. "We developed individual subsystems that complemented each other from a structural, thermal, moisture management, and—very importantly—assembly standpoint. We deployed them all independently at first, and over time worked them into a full shell system. Our goal was to reduce the ultimate operating cost to the homeowner by providing them with a high-efficiency home."

MOISTURE-RESISTANT FOUNDATIONS

Pulte sees many advantages of precast foundations and has developed some valuable installation procedures.

"We build our foundation in the factory out of a very dense, very high-yield strength concrete," says Stephen Runnels, director of Field Operations for Pulte Home Sciences in Virginia. "We use 5,000+ psi concrete, rather than the industry average of 3,000 psi, for on-site curing. This high density occurs because we pour it at a very long slump, so it's a very liquid pour that self-compacts. The high density in the concrete makes the foundation more water resilient, which is a benefit to the homeowner."

After shipping and installing the concrete panels, site workers apply a moisture curing urethane at the seams of the foundation.

"Because the inside of the urethane coating remains pliable, it functions like a gasket seal," says Runnels. "If ground movement occurs, the walls may move and in extreme cases may tear the skin of the urethane. When this happens, the urethane sealant skins over the seam again to maintain the seal. So you get a good gasket seal even if there is movement in the foundation. We're talking minimum movement, but in conventional pour-in-place concrete foundations, it can lead to long-term problems like cracking, leaks, and bridging."

"We install 1" of rigid foam insulation on the exterior of our concrete foundation for optimal insulation performance and to manage condensation potential. If we do not insulate the exterior of the foundation, water may condense on the interior surface. By insulating the exterior, we move the condensate line to the outside of the foundation wall so it can drain properly, rather than allowing any moisture inside the basement."

"Over the top of the foam, we do a shotcrete finish for added durability. This is done in the field, which gives it a continuous seamless appearance. When you look at our foundation, you cannot see a difference between a poured-in-place wall and the product we deliver because of the shotcrete finish. So it has the same curb appeal."

A STRONG FLOOR SYSTEM

Once the foundation walls are installed, a pre-fabricated open-web floor truss is laid.

HOW IT WORKS

Panelized components are wall, floor, and roof sections that are constructed in a factory, and then shipped and quickly installed on site. The panels form a structural envelope that eliminates the need for conventional framing, provides integral insulation, and can be assembled swiftly by less skilled laborers. Many panels are lightweight, and can be designed to resist earthquakes, high winds, debris impact, moisture, and insect infestation. Insulated panels also provide better overall air tightness and thermal performance than conventional wood framing. Panels can be produced in an automated factory environment using computer-controlled equipment that transfers panel-cutting instructions directly from digital CAD drawings. Once the panels are shipped to the jobsite, they can be quickly assembled, speeding the onsite construction schedule and allowing homes to be placed under roof more quickly.

READ THREE PATH FIELD EVALUATIONS:

- Home Front, Inc.: Port Charlotte, FL
- Howard Building Company: Rougemont, NC
- Hughes Construction: Lexington, NC

LEARN MORE:

- PATH's Residential Panels Benchmark Requirements
- PATH's Factory Built Housing Roadmap
- ToolBase Tech Spec

"Because they are built in the factory, we end up with a very low deflection: 3/16" maximum over 10 to 12 feet," Runnels says. "In addition, we get a very high deflection ratio in our floor system. Minimum code requirement is L/360. Our average is L/720. By raising the deflection ratio in the floor, we dramatically reduce the shake that occurs when someone walks up stairs."

"We provide a 7/8" decking on the floor system. With this decking, we can increase our floor truss spacing to 32" if we have to, but we keep our truss spacing to a maximum of 24". The thicker decking also adds stiffness to our subfloor to prevent tile cracking."

SIP WALLS

"We manufacture a SIP exterior wall, which we also use in walkout areas for the foundation," says Runnels. "The SIP consists of 7/16" Oriented Strand Board (OSB) that sandwiches a one-pound-density extended polystyrene (EPS) core. The layers are adhered together by a moisture-cured urethane adhesive. We use SIPs instead of a normal stud-framed wall because the 9'1"x 24' long SIP gives us more consistent wall insulation. At the same time, the wall has tremendous strength compared to stud framing. So we get the benefit of using the high sheer strength from the OSB, and we get energy-efficiency benefits from the foam."

INTERIOR STEEL WALL

"We also provide an interior steel wall," Runnels says. "Steel interior walls were chosen because they are light; they provide a straighter clean finish; and with the use of mechanical fasteners like self-tapping screws in steel, nail pops are virtually eliminated."

"We manufacture two walls at this time: 20-gauge (033-mill) for bearing walls and 22-gauge (027-mill) interior non-bearing for our usual 9'1" first-floor wall system and 8'1" second-floor wall system. Both have a high yield strength of 33,000 psi and a G-60 galvanized coating."

"The G-60 coating is a standard for us because we know the longevity is greater. There have been issues with lower galvanized coatings that may have come in contact with masonry, in the basement for instance. G-60 is recommended by the American Iron and Steel Institute and the Steel Framing Alliance to minimize corrosion."

WHOLE-HOUSE THINKING

"We look at the house as a system: we want to make everything work together—to simplify and speed up construction, and for better living," says Runnels.

"For example, we design the floor system to be able to handle our lateral pressure loads so we can backfill the foundation a lot quicker. There have been many cases in the Mid-Atlantic area where lateral pressure caused foundation walls to cave in. So code officials are requiring a lot of additional things to be done to the foundation walls before they can get backfilled. And framers don't like building over open digs anyway. But with our system, our decks are in panels, so they can be rolled out quickly. Within an hour or two, you can have the first floor deck on. In a couple more hours, you can have the bolting done, and therefore the shear diaphragm in the floor can handle the lateral pressure to the walls from the backfilled dirt."

INSTALLATION: QUICK AND EASY

"We manufacture and ship wall panels that are up to 36 feet long and deck panels that are up to 45 feet long," Runnels says. "With long panels, the installer installs fewer pieces in the field, so he has fewer connections and alignment problems to deal with."

"For small houses, we can install the pre-cast concrete foundation, install our floor

LESSONS LEARNED

- Early contractor trade education and integration is critical to success.
- Educate code officials early for easiest acceptance.
- Use whole-house thinking to maximize benefits.
- Insulate the foundation with rigid foam on the exterior for optimal performance and to prevent condensation.
- Use galvanized G-60 coating on steel.

system to support it, and backfill in a 10-hour day. Larger homes [5,000 to 6,000 square feet] will take us about a day to lay the foundation walls, and another day to clean up and install the deck."

"For the entire process, we leave a 23-day window from the day we start to stake-out and dig to the day we turn the house over to the mechanical contractors. We generally take an average of 19 days, based on the last six months of homes built. That's getting it all under the roof. The speed minimizes weather-related problems because building components are less exposed, which in turn gives us a better finished product."

INSTALLATION CREW: LEAN AND SPEEDY

Installation costs are much lower because a smaller, less-skilled crew assembles the house more quickly.

"We no longer need a large crew of carpenters," says Runnels. "We've done time studies that compared crew size, from four-man crews to eight-man crews, and we've narrowed it down so that the best size crew is five people. Before, you had a massive group of carpenters; now, you only need one carpenter and four installers. The carpenter is there only to manage the crew for any building that needs to take place inside the house."

"We do a lot of training of the crews so they are able to adapt to this particular system. It does take them some time to learn how to install it. We usually allow framers five to six houses to be able to get up to par."

HOMEOWNER BENEFITS

"Our customers tell us that they are seeing substantial energy savings per month," Runnels says. "Some of our homeowners have compared utility bills with friends and neighbors who live in conventional houses of similar size and style and are very satisfied with the savings they are realizing."

"As far as the structure, we have case studies that show Pulte SIPs are 1.5 to 4 times stronger than conventional walls in different types of loadings. After the recent storms and flooding in the past

A quality operator performs a visual check and stages trusses immediately after automated assembly.

TECHNOLOGY HIGHLIGHTS

This project included the following PATH-profiled technologies:

- Panelized Systems
- Precast Concrete Foundation and Wall Panels
- Steel Framing
- Structural Insulated Panels

month in Virginia, we've seen that the precast concrete foundations have had hands down fewer problems than conventional basements."

EDUCATING CODE OFFICIALS

"It's taken a while to educate the inspectors since the technology is so new to them," Runnels says. "Often, they're just so pressed for time they don't have time to learn about a new technology. We've also had to educate the officials that do plan reviews. What we've learned is that it's a dollar well spent to educate inspectors up front."

"Educating the inspectors from the beginning has helped with getting permits approved and getting inspections without any problems," says Chippero. "Now we see no resistance from code officials and inspectors who have been educated, and permits and inspections go quickly."

CONSUMER ACCEPTANCE

The biggest hurdle in consumer acceptance is understanding how much potential homeowners value the benefits. Simply stated, what price premium would a customer be willing to pay?

"We rely on the operations side of our division to do the marketing and sales for the local market," Chippero says. "There are brochures, videos, and samples that we put in our sales office, so when a potential buyer comes in, our people are equipped to explain how this system works and how it benefits the homeowner."

"Our homeowners are very pleased with getting a house that performs very well. In fact, when we first started building houses in Virginia with this system, we approached homeowners on a one-on-one basis to explain what they'd be getting. Their first reaction was 'What's the catch? You're offering this home with all these benefits, why aren't you charging me more?' This was a question that we were asked very frequently, and of course our answer was, we're just getting started, and we don't think we're in a position just yet to offer this at a premium, so that's why we offer this as a normal house. So many homeowners left feeling that they were getting a good value, which they were."

"It's all about education," Runnels says. "Most homeowners don't perceive the value of a high-quality, high-durability, energy-efficient home. We have only just begun to look at marketing this package as a premium house—and it truly is a premium product. For a given price, how do we get the customer to choose a much better, higher-performing house that uses premium materials and technology over a conventional house with upgraded cabinets and countertops? We haven't figured it all out yet, but we're working on it."

PATH will follow this story closely and report on Pulte's progress in the future.

The Partnership for Advancing Technology in Housing (PATH) brings together builders, manufacturers, researchers, government agencies, and other members of the housing industry. PATH partners work to improve the quality and affordability of new and existing homes. The program is administered by the U.S. Department of Housing and Urban Development's Office of Policy Development and Research.

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