

Autoclaved Aerated Concrete: *Better Building Blocks Make Better Homes*

Builder's Experience



Challenges: Getting subcontractors comfortable with cutting the block.

Would he do it again? Yes

PATH Attributes:

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

Builder Tips: "Make sure you have enough thin-set mortar during construction because you can't drive to a typical home improvement store to get it."

Builder:

Doug Edwards and Kevin Edwards
Edwards Design Group
Scottsdale, Arizona

Builder Type:

Small Custom Homebuilder

The Technology:

Autoclaved Aerated Concrete

The Project:

A 3,500-square-foot, single-story home with an observation deck built in northern Scottsdale for the Foster family. With exterior walls of autoclaved aerated concrete (AAC) block, the Santa Fe style home is built to withstand desert extremes and provide an effective building envelope for homeowners who want to reduce their energy costs.

"It has so many construction advantages and easily meets hurricane and building codes. I don't know if it can get any better."

– Doug Edwards

THE EDWARDS' STORY

Edwards Design Group became the first builder in Arizona to use autoclaved aerated concrete in 1999.

"It's strong, light, insulating, fireproof, mold-resistant, and has excellent design flexibility," says Doug Edwards. "I just feel lucky that we learned about AAC and are able to use it on our projects. It has so many construction advantages and easily meets hurricane and building codes, I don't know if it can get any better."

TRYING SOMETHING NEW

"Many contractors are hesitant to change their routine because they are used to making a certain amount of profit on a job and aren't usually willing to risk trying something new," says Edwards.



The design flexibility and material characteristics of AAC block creates a multitude of building advantages.

"The combination of financial and time constraints in the construction industry makes trying a new product a somewhat risky venture."

"We'd been looking for alternative building products, but we usually ended up shunning them because we found a lot of problems with them. There are other alternative block products on the market, but nothing really struck us until AAC came around. The AAC material had so many positive attributes, it just made sense to us. After doing some research, we found that AAC had been around in Europe for over 80 years. It has great insulating, termite-resistant, and fire-resistant properties. Even when exposed to fire, it releases no toxins or gases. And it's nearly soundproof."



Doug Edwards is the head designer and partner for Edwards Design Group, a design/build firm formed in 1985 that specializes in using AACs to build custom homes in and around the Phoenix area. With his brother Kevin, who heads up construction management, Doug Edwards builds between 5 and 10 ten homes a year ranging in price from \$650,000 to \$750,000.

Why Edwards builds with AAC:

"Thanks to versatile materials like AAC, it's easy to construct environmentally friendly homes that are comfortable, affordably priced, and aesthetically appealing."



Steel rebar reinforces AAC block to create durable walls that easily meet load requirements.

AUTOCLAVED AERATED CONCRETE

AAC is an economical precast, manufactured building block made of all-natural raw materials. AAC is available in a variety of forms, ranging from wall and roof panels to blocks and lintels. It is fire- and termite-resistant, and is lighter and easier to cut than conventional CMU block. AAC also has superior thermal and sound insulating properties. AAC can be sawed, drilled, nailed and milled, making it highly adaptable to a variety of architectural styles.

“Our first AAC project took more effort and was a bit more expensive because it was a new approach to building, but it was well worth our time to learn how to use it. AAC will not rot, warp, corrode, or otherwise decompose, providing a very durable material that will last for many years. In order to make AAC more affordable for our clients, we started our own AAC masonry crew. Now we are able to offer AAC homes to our clients at the same cost as a wood-framed home, and we feel really good as far as our conscience is concerned.”

“When compared to conventional home construction, AAC construction can sometimes be a bit slower, but as our crew gets more experienced, this may not always be the case. In the meantime, we pride ourselves on delivering an AAC home for the same price as a stick-built home. Our in-house crew allows for better control over quality of craftsmanship, scheduling, and cost. We feel that our clients get a product that is superior when compared to wood-framed construction. The fire resistance and insulating qualities alone make our homes much safer and more energy efficient. We usually have to educate homeowners about the benefits of AAC, but once installed, the qualities speak for themselves.”

MATERIALS

“We use three different types of AAC block on our jobs. The first is our standard building block, which is 8” tall, 24” long, and either 8”, 10”, or 12” thick. We typically use 10” thick block on our projects for its combination of insulating value, structural strength, and average unit cost. Then there is a same-sized block with a 4” bore in it for corners and door and window openings, which requires vertical rebar and gets filled with concrete. The third type of block is a bond beam block (U-block), which is for the top course and has a v-channel cut out for the horizontal and vertical rebar attachments.”

AAC is highly adaptable to a variety of architectural designs and can easily be engineered to meet structural load requirements. It can also reduce jobsite waste if components are pre-made and tailored to building-specific features.

“On the Foster’s residence, we used 10” AAC block to create an exterior wall with a performance R-27 value and we used cellulose insulation to create a ceiling with an R-40 value. The performance R-value of an AAC block wall depends on the kind of block used and its geographic area.”

For the impact of geographic and block type variables on the performance R-value of an AAC wall, visit TruStone America at www.e-crete.com: Chapter 3, page 8 of the technical design manual under “Engineering.”

“AAC block provides for walls that are very straight and consistent from an insulating and smoothness perspective. There is less thermal bridging than with wood framing, and you don’t have to deal with batt insulation on the walls. When you put your hand on the exterior wall, there is hardly a difference in temperature from the interior wall. All of our customers speak of the unbelievable difference in comfort and energy savings associated with AAC.”



Walls built with AAC block are consistently straight, but can also be sculpted to meet a variety of architectural designs.

According to Oak Ridge National Laboratory, energy demands of a home with AAC walls are about 18 percent less than wood-frame walls, 36 percent less than two-core CMU, and 23 percent less than steel stud walls.

INSTALLATION AND TRAINING

“Originally, we were hoping our regular masonry crews would be interested in building with AAC, but their unfamiliarity with the product drove the price up more than we expected. Being hands-on contractors who design and build, we invested in our own AAC crew.”

“At first, we had to work closely with the crew to get them used to the different processes, but it’s not that different. Masonry crews have to adjust to using a special polymer-modified thin set mortar system, which creates less margin for error. Our masons use a special notched trowel to apply the thin set mortar and create texture for subsequent pieces of block.”

“AAC blocks can either be installed directly on a foundation system or on an elevated floor for multi-level construction. As with typical masonry projects, the initial bed joint is critical because the base mortar joint must be level and true to avoid continual adjustments. Initial bed joints are usually between $\frac{3}{8}$ " and $\frac{1}{2}$ " thick. Using a waterproof mortar on the floor slab under

the first course of block protects the building from water in the soil. A horizontal moisture barrier in the first mortar joint is another way to protect against water intrusion.”

“Depending on the architectural style, we build the exterior walls with the AAC block and attach the trusses using a top plate, anchor, or ledgers consistent with typical construction methods. Ledgers are attached to J-bolts that are installed to the bond beam block with 4" concrete around the anchor bolt filled to the face of the wall.”

“AAC blocks can be cut with a handsaw and sculpted with a rasp, creating endless design possibilities. At first, we purchased a big band saw thinking we would have one table to do all the cutting, but it turned out that the laborer working next to the mason can actually handsaw cut the pieces right on the spot rather than having to travel all the way over to the sawcutter and bring the piece back. With handsaws, we were able to cut the blocks right on the scaffolding and put them in place twice as fast as having a central sawcutter. The handsaws are not typical handsaws though. They are 3 feet long, $\frac{1}{4}$ " carbide-tipped handsaws. Other masonry tools we use include sanding floats, rubber mallets, and levels. The AAC waste created on-site can be recycled or disposed of in a regular waste bin.”

“As with many buildings products, exterior surfaces of AAC must be protected from moisture. We use an impermeable synthetic stucco system that helps avoid moisture issues. The exterior stucco finish depends on what the client wants, but we usually use a sand or steel trowel finish. Regular 3-coat stucco is permeable, which is why we use synthetic stucco. For interior wall finishes, we apply a scratch/brown stucco coat topped with regular drywall mud, and usually a smooth Santa Fe finish. Other wall options include painted or veneered plaster left unpainted. Our interior partition walls are wood-framed and receive a $\frac{5}{8}$ " gypsum board finish to match adjacent walls.”

TECHNOLOGY HIGHLIGHTS

This project included the following PATH-profiled technologies:

- Autoclaved Aerated Concrete
- Concrete Floor Finishes
- High Performance Glazing
- HVAC Equipment and Ducts in Conditioned Space
- Low-VOC Paints
- Solar Water Heating
- Xeriscaping

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.

To learn more about PATH, visit www.pathnet.org.
To learn more about PATH-profiled technologies, visit www.toolbase.org/techinv.



The opinions expressed in this document represent those of the builder and do not necessarily reflect the views of PATH.

WORKING WITH THE MANUFACTURER, THE TRADES, AND BUILDING CODE OFFICIALS

"When we built our first home with AAC, TruStone America representatives were out there on the first day of our job showing us how to use it, helping lay the first blocks to get our crew comfortable with the product. Now, TruStone simply provides detailed shop drawings and then our structural engineer provides any custom construction details that may be required."

"The electrician is the subcontractor most affected by the use of AAC block. It's a whole new way of pulling wire and installing J-boxes, switches, and outlets. They have to use a skill saw to cut out 1 1/2" deep x 1 1/2" wide channels to accommodate romex and j-boxes. A circular skill saw cuts through AAC like butter, but protective eye equipment and respiratory masks are a must because of the dust. Regular screws, clips, and metal shields are used to fasten the romex or conduit in place. We then use channel metal and a special patching material from the AAC manufacturer to cover all the channels made for the electrical chases. We like to keep the plumbing out of the walls, so we fur out the plumbing walls using hat channels to create a cavity for

pipng and then penetrate the wall rather than the roof to accommodate plumbing vents. Dust is the main reason subs may not like working with AAC, so sometimes we end up doing the cuts ourselves."

"Building code officials were naturally curious about AAC when we first submitted plans to their building department, but once they reviewed the testing results, code compliance standards and structural engineering calculations, they were willing to approve its use. The city of Scottsdale is actually a pioneer when it comes to advanced and sustainable development technologies and has been extremely supportive."

SCHEDULING AND SUPPLIES

"There is about a 2-3 week lead time from our AAC block supplier, but given that there are only a few suppliers in the U.S., we are just plain lucky that a manufacturing plant is located so close by. Otherwise, transportation costs could be prohibitive until more plants are built."

TruStone America currently has two manufacturing plants, one each in Arizona and New Jersey, and is working to open another in Louisiana or the Midwest. Aercon Florida and Texas Contec are the other two domestic AAC suppliers.



"Since most of the homes we build are in the Senora desert, with a lush and beautiful terrain, we try to minimize the impact of our projects on the land," says Edwards. "We make every attempt to be as environmentally respectful as possible."