

# Breeding Grounds

How three of America's top architecture schools are challenging students to shape the future of home building and design

BY SEAN GROOM

**T**he houses we live in. The offices we work in. The neighborhoods we travel through. Their character shapes our daily lives. Once architects of these structures and spaces were heroes such as Frank Lloyd Wright, Ludwig Mies van der Rohe, and Louis Kahn—twentieth-century giants whose influence on the built environment spread far beyond the projects they had a hand in.

Today, architects' influence on the nation's cultural stage has shrunk. In some ways, architects—particularly residential architects—are in a struggle to remain relevant. How are 21st-century residential architects going to make paying clients notice and embrace their work? The achievements of design/build programs at three highly regarded architecture schools might tell us.

The programs—Rural Studio at Auburn University, ecoMOD at the University of Virginia, and Studio 804 at the University of Kansas—have wrestled with issues that might make good residential design more relevant to Americans: the need to address the cost of housing and the environmental impact of housing. Based on the experience of these programs, architects may need to



**Building with impact.** Founded as a design/build class with the purpose of improving the lives of the rural poor, Rural Studio is celebrating its 20th year with eight student-designed and student-built two-bedroom "20K Houses." Working in a county with a 30% poverty rate, students learn the construction process and the environmental and social implications of their craft.

# 1. Rural Studio

Auburn University  
Founded by Samuel Mockbee



In western Alabama's Hale County, an area that has no architects or engineers, Rural Studio's 150 residential and community projects have filled a gaping hole over the last 20 years. "In the early years, we did a lot of interesting, idiosyncratic, and fun single-family homes," says Rural Studio director Andrew Freear. "In 2005, I thought, 'There's a missed opportunity here. There are lots of people who need somewhere to live; we are able to build a house every single year. What have we learned from these houses? How can we design a house that could help more people?'"

In Hale County, the poor living in substandard housing might own their own land, but they have no savings or equity. Their cheapest housing option is to purchase a used mobile home (\$15,000 to \$17,000 in Hale County) and, if they can get a loan, pay high rates on a 30-year mortgage. Before the loan is retired, the mobile home is worthless. Rural Studio's 20K House project creates an alternative to mobile homes and offers a housing option to people who don't qualify for commercial credit. The project takes its name from the highest realistic mortgage that someone receiving the median Social Security check can afford: \$20,000.

There are 12 completed versions of the 20K House, and with bank assessments higher than the buyer's price, owners have instant equity. All are single-bedroom homes around 550 sq. ft. and have large porches intended to serve as additional living space. Unlike other projects by Rural Studio, this is an iterative process, where students carefully review

previous versions and make improvements on existing designs.

Freear is particularly proud of the last five houses. "I think the houses from version 8 onward are very good. Non-architects like them, they're really tight, they're affordable, they're starting to be beautiful, and we're able to do these for \$20,000 to \$30,000."

To expand the impact of the 20K House beyond western Alabama, Rural Studio is commercializing three versions. The amount of time needed to create well-designed housing at affordable prices for people struggling below the poverty line is enormous. Freear estimates that roughly 29,000 hours have gone into the 20K Houses. Professional firms can't justify the hours to develop a product with so little profit in it. The fact that architectural schools are engaged in education removes profit (or even pay) from the equation, and it creates the opportunity for some really interesting research and thinking.

If professional design firms can't afford to design such cheap housing, and builders aren't willing to risk exploring whether a market exists for such low-cost homes, school programs must create the market. Unfortunately, Freear believes that most architectural schools don't find \$20,000 houses sexy and don't address these types of modest projects. "But our kids love it," he says. "And we're talking dumb stuff like the width of cabinets or where to put a standard refrigerator—the stuff that really matters and that you just don't talk about at architecture school."



look at new ways of practicing if they are going to provide popular solutions to the problems of cost and environmental impact.

### **Can we build better for less?**

Affordable housing comes in two forms—providing shelter to the poor and providing pleasing, sustainable design to the middle class at prices that don't strip away the ability to save for college and retirement. In both cases, it's a matter of wringing cost out of the design, materials, and construction process. There's nothing like building the lines you drew on a computer to learn the cost and labor implications of curves and flourishes.

While the construction of a house by Rural Studio, ecoMOD, or Studio 804 may be constrained by a hard dollar amount, these programs don't have to assign project cost codes to their time. Tens of thousands of hours to figure out an affordable way to detail a \$20,000 house just aren't available in the real world. But energetic, bright students free to explore and revise can create a well-designed, efficient house that changes lives.

### **More efficient, more durable**

The purchase cost of a home is one measure of affordability. Energy and maintenance costs are another. There's no mystery to minimizing these costs: We know how to build superefficient houses, and we know that details such as vented rainscreens reduce maintenance. But we need creative thinking to make these strategies affordable. Building small houses on budgets between \$40 and \$100 per sq. ft. forces creativity. Doing it repeatedly improves the process so it can be done in a production setting.

While there is variety in the types and locations of the houses built by these three design/build programs, they all favor passive-design principles and build smaller homes that are resource efficient, make frequent use of recycled materials, and put a premium on energy performance. Studio 804 and ecoMOD build infill housing that increases density and often helps revitalize neighborhoods. Although smaller houses, accessory dwellings, infill developments, and modern designs might not represent a large part of the housing market, given their popularity with younger buyers, the market is likely to move in that direction.

### **Interdisciplinary firms**

One challenge facing the architectural profession is the demotion of the role of design



# 2. ecoMOD

University of Virginia  
Founded by Paxton Marshall and John Quale

When UVA engineering professor Paxton Marshall received a solicitation from the Department of Energy to participate in the inaugural Solar Decathlon, he reached out to the university's architecture school for a partner. John Quale volunteered. The two-year process of raising money, organizing students, and designing and building a house was a transformative experience for Quale: "I saw a lot of opportunities for students to get beyond the vague platitudes about what you believe about design and what it can do and really get down to the brass tacks of how you are going to do it. What materials are you going to put together to make a design happen?" It also ignited an interest in modular building.

After the 2002 competition, however, he couldn't see himself devoting another two years to a Solar Decathlon project shaped by the contest's rules. "It doesn't emphasize passive design," he says. "It really just emphasizes energy efficiency and technology when it comes to reducing energy use and thinking about sustainability."

Instead, Quale and Marshall continued their design/build collaboration with the goal of building sustainable, affordable houses in local communities. Their program—ecoMOD—builds modular houses and remodels houses for nonprofit organizations like Habitat for Humanity and Piedmont Housing Alliance. The program is intent not just

on strong design, but on incorporating sustainable features within the budgets of an affordable-housing organization, typically around \$150,000 per house. These include tight envelopes, advanced mechanical systems, alternative-energy components, potable rain-water collection, and green roofs.

The combination of students from architecture and engineering programs, often with a few liberal-arts and business-school representatives mixed in, reflects the practices of leading-edge firms. When designing sustainable modular houses that rely on passive and mechanical designs that work as a system, it's important to include all of the involved disciplines at the earliest stages. Students from the architecture program and the engineering program begin collaborating on the projects with the initial discussion of goals and aesthetics. Quale says, "Inevitably, when we are able to get engineering students involved at the initial stage, the most interesting and compelling drawing is from an engineering student."

In 2010, the studio program completed a near-net-zero house for the Charlottesville, Va., chapter of Habitat for Humanity that is expected to achieve LEED Gold status. The 1158-sq.-ft. house, named ecoMOD4, has an R-60 roof and R-30 walls and was built in modules by the students. The geothermal heating and cooling system is equipped with a desuperheater that uses the waste heat in the summer to preheat the hot-water sup-

ply. The electrical demands are partially offset by a 4kw PV array. Excluding site work and the foundation, the house was built for \$123 per sq. ft.

After finishing ecoMOD4, Quale, Marshall, and a handful of recent graduates set out to refine the design for commercial productions with local modular manufacturer Cardinal Homes. Christened ecoMOD South, the improved design can be configured as a two-, three-, or four-bedroom home up to 1839 sq. ft. in both single-family and multifamily styles. Part of the challenge was reducing construction costs and improving the construction efficiency of the house. Quale says, "There's a lot of complex thinking that needs to happen to come to a design that's both flexible and affordable and that's easy to build and easy to transport." On top of that, they wanted to meet the Passive House standard. "One of the big issues for Passive House is the integrity of the building envelope," Quale explains. "When your house is arriving in big chunks, they have to be sealed up properly. When we got into that part of the project, we had long meetings to talk about how we were going to solve each problem. We needed to do it in a way that was affordable and that maintained the integrity of the design and the integrity of the Passive House envelope."

A number of highly vaunted modular startup companies have promised great design, energy efficiency, and low building costs. If you follow these companies beyond their initial press releases, they typically struggle. In contrast, ecoMOD South may be an instance of a design/build studio's ability to push the market toward more sustainable solutions. Cardinal Homes has built two certified Passive House versions of ecoMOD South. A third house built to code as a baseline comparison came in at \$71 per sq. ft.

**Buy this house.** The ecoMOD South project is a commercially available version of the program's work. Affordable and efficient, these two Passive House-certified homes were built by Cardinal Homes for only \$105 per sq. ft.



**Kansas's first Passive House.** Dan Rockhill's job is teaching students the skills to be successful architects, including navigating green-building programs. His goal is to spread those skills, imbued with passion, throughout the profession. "I don't think we can argue anymore over climate change," says Rockhill. "Something is going on, the ice caps are melting, and buildings account for 40% to 50% of our energy consumption."

in the construction industry. Partnering with engineers and builders will be essential for 21st-century architects to be successful. The interdisciplinary approach can be seen in the Department of Energy's Solar Decathlon. Teams include students pursuing degrees in architecture, landscape architecture, structural engineering, electrical engineering, civil engineering, literature, and business.

Small architectural firms such as Zero-Energy Design in Boston, Mass., show where the profession is headed. Zero-Energy Design was formed by a core group of Cornell University's 2005 Solar Decathlon team with backgrounds in architecture, engi-

neering, and finance. The result is robustly engineered, beautifully designed homes in both modern and traditional styles guided by building science and a rigorous cost-benefit analysis of system choices.

Zero-Energy Design and other new-generation firms are interdisciplinary and entrepreneurial, and their projects reflect that. These practices are more likely to take on parts of a project, such as engineering HVAC or alternative-energy systems, for a development. They may also offer development, construction, urban-design, and landscape-architecture services in addition to building design. Employees are likely to

have degrees in more than one area related to the built environment. Combining different disciplines, specialties, and interests in a single firm is an exciting development.

"The problems we're facing in income disparity and social equity and climate change are really complex problems," says John Quale of ecoMOD. "There is no way that any individual professional firm, no matter what the discipline, can address those problems in a sophisticated way without dealing with other professionals who care about the same issues." □

Sean Groom is a contributing editor.

# 3. Studio 804

## University of Kansas Founded by Dan Rockhill



In the universe of design/build studios, Studio 804 is known for the craftsmanship of its buildings. When you're talking with its founder, Dan Rockhill, you quickly get the sense that he doesn't like to waste time. And he's got a reputation for demanding a lot of his students. Rockhill says, "Just understanding AutoCad and Revit keeps plans square, plumb, and true, but, boy, in the field that's awful hard to do. And we get it straight. I'm a hard ass. I walk a fine line between being the angry father and the nice-guy teacher." His students have turned out a remarkable collection of buildings noted for their design and their focus on craftsmanship.

In the mid-1990s, Rockhill was teaching an upper-level graduate course and felt there was something missing from the experience—both for him and the students. When an opportunity came up to put a roof over the remains of a historic school, Rockhill enlisted his studio class. "I went out to the site with the students, and it was like they were drunk on the experience. I couldn't get them to leave the site! They'd pull their cars up and work all night with the headlights shining on the site. There was something here that these kids were hungry for."

As a former gearhead and the principal of a design/build firm, Rockhill believes in the value of making things, and he embraced the design/build teaching model. The following year, the class—listed in the curriculum as Studio 804—tackled its first residential structure. Rockhill soon created a nonprofit corporation for the studio's activities. While it provides education to the students, it's run as a business. Current projects are financed by the sale of earlier projects or by loans from the community-development groups for which they're building. This approach is critical to Rockhill. In his private practice, the first thing his colleagues ask when he gets off the phone with a prospective client is "What's the budget?" Paper architecture without the constraints of a budget, he says, is too removed from the actual practice of building.

His students are getting a crash course in hands-on construction, acting as developers, learning to deal with building departments and state development authorities, managing suppliers, and financing projects. The last seven projects have earned LEED Platinum status, the students have built several Passive House-certified homes, and they've won Residential Architect

awards—twice. Their accomplishments rival any professional firm in the world, despite a complete personnel turnover every year.

Early on, Studio 804 worked with nonprofit organizations that help the poor to buy homes. Initially, Studio 804 produced stick-built houses on infill lots in Lawrence near the university. When they focused on the housing crisis in Kansas City, Kan., they turned to modular construction because of the distance from the university. All of these houses were built on incredibly tight schedules. The first design meetings were on January 3, and the houses had to be completed by the third weekend in May—graduation day.

Since 2011, Studio 804 has built large institutional projects for a town, a community college, and several buildings for the University of Kansas. The design and construction schedule has been lengthened to the entire academic year. Granted, this isn't a typical class—for example, participants cannot take other classes. And if they're KU basketball fans? Rockhill tells them to read about the games on their own time. There's just not time for typical campus activities; the work day starts at 6:30 a.m. and runs until dark. Sunday is the only day off.

### Why commercial matters



The switch to public buildings stems from Rockhill's interest in sustainable building. The houses Studio 804 built embraced a range of forward-thinking green-building design: They use recycled and recyclable materials throughout, are designed with universal-design principles and/or to be ADA-compliant, and have enviable energy efficiency. But when it comes to promoting the benefits of sustainable design, the downside to private residences, in

Rockhill's mind, is that they are not open to show to the public. "I respect people's privacy. They buy a house, you toss them the keys, and they close the door. I'm not knocking on their door to give tours or anything like that." Rockhill likes public buildings because they can be used to show what's possible. "We can really address sustainability and make the buildings beautiful. I think that's how you bring about change."