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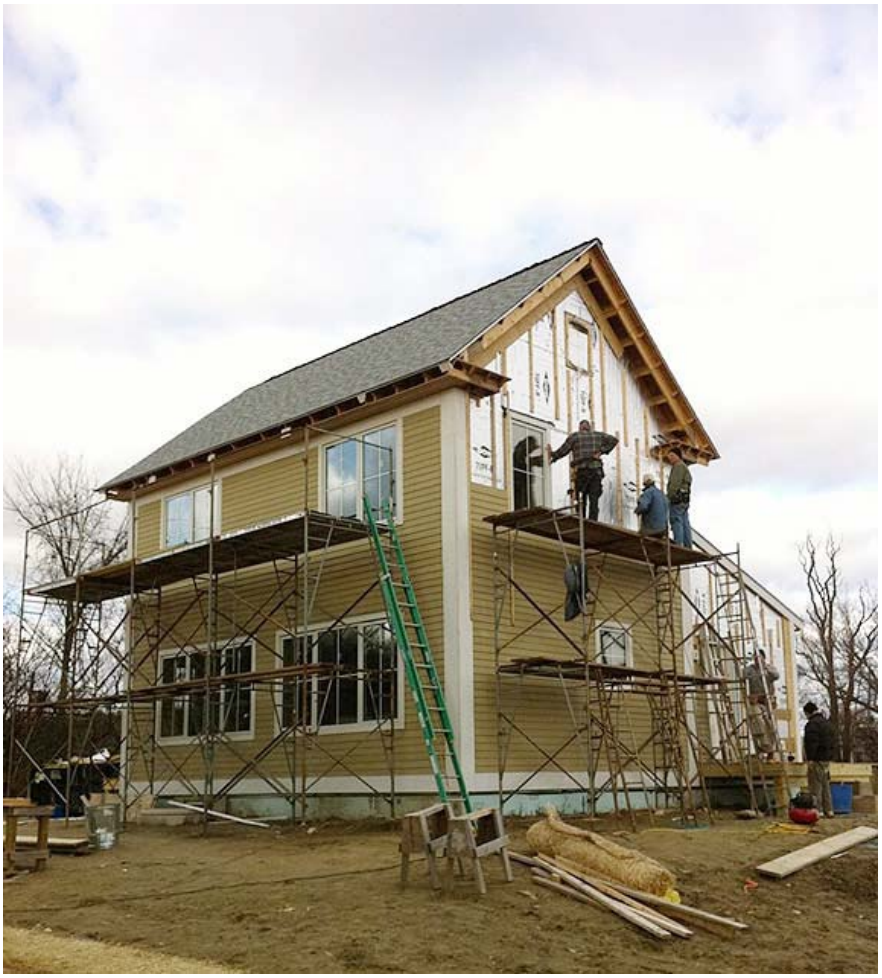

The Green Mountain Habitat for Humanity Passive House, in Charlotte, Vermont, combines classic New England style with game-changing energy efficiency. Photo: J.B. Clancy/ Albert, Righter & Tittmann Architects, Inc.

Build Boston 2010

by Evan H. Shu, FAIA

The venerable Build Boston conference often provides an excellent way to take the temperature of the architecture and construction industry. This year was no different, as the conference, now in its 26th year, took on a leaner, less glitzy feel, with a smaller trade show area and fewer celebratory ballroom events. But it was clear that attendees were serious about preparing for the future: the nearly 200 workshops and seminars were extremely well attended by thousands of industry professionals.

Among the diverse range of topics covered at the conference, held November 17 to 19, 2010, three major themes emerged at the most popular sessions: energy, technology, and codes.

Energy Conservation: Passive House

Six of the seminars were grouped as a symposium on the topic of "Passive House" buildings, which are airtight, super-insulated houses and other structures

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that rely on passive (non-mechanical) energy gain, augmented by renewable resources.

Proponents like to say such buildings "can be heated with a hair dryer"; no less impressive, the buildings are typically warmed sufficiently by the heat from occupants and appliances. The key elements of this approach are codified into a set of measurable standards that can result in a building being certified by the Passive House Institute US (PHIUS) or by corresponding European organizations.

In the talk "Passive House: Carbon Neutrality in Europe and North America," Katrin Klingenberg of PHIUS and Günter Lang of Lang Consulting in Vienna described some of the history of this rapidly growing movement, which traces its roots to the late 1980s and the work of Bo Adamson of Sweden and Wolfgang Feist of Germany.

With over 25,000 buildings now certified, the Passive House (Passivhaus) standard has become quite well entrenched, especially in Europe and particularly in Germany and Austria. The 2012 Winter Youth Olympic Village under construction in Innsbruck, Austria, will have its 444 residential units constructed to this standard. >>>

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In the United States, however, the Passive House movement is only in its infancy, with just a dozen or so certified buildings. But Klingenberg made the point that some Passive House principles can even be seen in early New England saltbox houses, so the reintroduction of this mode of building should seem all the more natural to architects in the northeastern United States. That Passive House design can work quite nicely with the LEED program and other green-design principles may also help speed broader implementation.

So, what standards does a house or other building have to meet to be Passive House-certified? The structure must have an airtight building shell, with no more than 0.6 ACH (air changes per hour), which might be some 20 times less than a typical house. The building must use less than 160 kilowatt-hours per square foot per year (15 kilowatt-hours per square meter per year) of energy for heating, and the total primary energy use must be under 1,290 kWh/ft^2/year (120 kWh/m^2/year) — around 10 percent of what a conventional home might consume.

 These elevated standards might require an average-sized U.S. house (at 2,500 square feet, or 230 square meters) to have 12 inches (30 centimeters) or more of wall insulation and 20 inches (50 centimeters) or more of roof insulation. The designer must also give attention to other special construction concerns and be careful to match minimum ventilation needs with these lowered heating loads. But the whole point of this type of construction, says Klingenberg, is that you can get rid of the furnace.

Proponents estimate it increases costs by about 10 percent to build a Passive House building compared to a conventional new code-compliant light wood-frame home, but payback from energy savings can come in as little as seven to ten years. And obviously, if energy costs keep going up, those numbers will look better all the time.

Biomimicry

In the seminar "Building in Nature's Image," Pam Campbell of Cook + Fox Architects and Jeff Licht of Botanicals Nursery and the University of Massachusetts Boston showed how examples from nature, or biomimicry, can be used to harness and conserve energy within buildings. In Cook + Fox's prototype Live Work Home in Syracuse, New York, the architects used perforated screens to bounce and maximize daylight into the house, mimicking the dappled patterns of filtered light through trees. Sliding screens and a fold-down garage-type front door create a combination front porch and loading dock, forming a place of "prospect and refuge" — an idea from biophilic design.

Jeff Licht showed how to break away from the formulaic rooftop layer of sod that many designers opt for as a "green" roof, and how to instead create a "roofscape truly inspired by nature." In his practice, Licht looks carefully at an area's local ecosystem to find examples of biological features — such as osprey nests, drumlins, rock outcrops, pine barrens,

SUBSCRIPTION SAMPLE

The Passive House-certified Stanton House in Urbana, Illinois, was designed by Katrin Klingenberg.
Photo: Courtesy Katrin Klingenberg/ Darcy Bean Custom Construction

SUBSCRIPTION SAMPLE

Cook + Fox Architects used perforated screens around the exterior of the Live Work Home in Syracuse, New York, to simulate the effects of light filtering through trees.
Photo: © Cook + Fox Architects LLP Extra Large Image

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POPQUIZ

Inside the Live Work Home, sliding metal panels also produce dappled light. Photo: © Cook + Fox Architects LLP Extra Large Image

Cambridge Seven Associates designed the Current Science and Technology Center at the Museum of Science in Boston, Massachusetts. Photo: Courtesy Cambridge Seven Associates Extra Large Image

or subalpine meadows — to inspire alternatives to the more-common ingredients of planted roof installations, such as metal gratings, plastics, and trucked-in soils. In his roofscapes, you might find corn, wood pellets, and biochar substituting for imported soil and minerals, with natural plant species to better mimic local ecosystems, and mini-hills and swales that provide natural drainage patterns. These natural-looking garden roofscapes have proven hardy even in tough locales where previous green-roof installations have failed.

The Green of Modular

Another form of sustainable design comes straight from the factory. In the talk "Green Modular Manufacturing Delivery," Chuck Savage of Kullman Buildings Corp. and retired architect Peter Papesch, the session's moderator, showed how modular building has come a long way from the trailer-home boxes that most of us still associate with this technology. The greatest limitations on each module's size are the limits of what can be transported on our highways — the U.S. Department of Transportation sets the maximum dimensions at 14 feet wide by 60 feet long by 13.6 feet high (about 4.3 by 18.3 by 4.1 meters), with specific variations on those dimensions in some states.

In addition, "manufactured" homes need not even be truly modular or repetitive at all. Savage showed images of factory construction of the Jane H. Booker Learning Center (designed by Saphire + Albarran Architecture) in Neptune City, New Jersey — a project that was not even originally intended for modular construction. Kullman was hired on in response to its proposal for factory construction. The building was cut up into appropriate parts, and 90 percent to 95 percent of it was constructed offsite. Kullman's use of Revit BIM modeling for manufacturing shop

Three flatscreen monitors are integrated into a simulated classroom in the "Five Friends from Japan" exhibit designed by Cambridge Seven Associates for the Boston Children's Museum and Capital Children's Museum. Photo: Courtesy Cambridge Seven Associates Extra Large Image

drawings allowed direct-to-machinery tolerances of one-sixteenth-inch (1.6-millimeter) accuracy between parts. The project came in at $360 per square foot, compared to the $400 per square foot from a conventional construction bid (per square meter: $3,875 versus $4,300).

Modular construction and its building-systems approach can significantly help with LEED certification, according to Savage, and can earn as many as 12 automatic points. The Booker Learning Center's LEED certification pending, with a Silver rating targeted.

Savage said that Modular Building can also cut the construction schedule in half and provide the client with cost certainty. Savage also kept emphasizing to the incredulous architects in attendance that manufactured structures can now be built to the architect's design and not be limited in shape, size, or even height — reaching up to 35 stories with a steel frame.

Another computer monitor masquerades as a children's dressing mirror in the "Five Friends from Japan" exhibit.
Photo: Chris Johnson
Extra Large Image

The Efficiency of "Lean"

The movement of some architectural construction into the factory is not the only industrial influence being felt by the construction profession. There has also been a strong movement toward "lean design" by many design and building firms. This approach is more of a philosophical and company-culture shift than about technological innovations. The "lean" movement comes out of the Toyota automobile company, which also spawned what is commonly known as TQC, or Total Quality Control. These principles are intended to create a culture where everyone strives for *kaizen*, or "continuous improvement."

The exhibit also includes a display that digitally mimics shadow profiles of a person doing aikido.
Photo: Chris Johnson
Extra Large Image

A key event in the application of the lean approach to construction practices was the founding in 1997 of the Lean Construction Institute, a nonprofit research organization, by Glenn Ballard, a professor in construction management at the University of California, Berkeley, and Greg Howell, who left a professorship at the University of New Mexico to co-found LCI.

According to architect Cliff Moser of CADFORCE, studies have shown that some 58 percent of time logged in a typical construction project is nonproductive time. That "waste" can largely be eliminated using "lean" tools, such as value-stream mapping and set-based design. Moser likened the typical construction process to a mini-golf birthday party in which each group of four is sent off on its own and there is a lot of waiting time between holes, since each foursome must wait for the previous group to finish. Principles of queuing theory would have each golfer start and finish each hole on his or her own, resulting in a much shorter total time for the group as a whole. Of course, Moser added, his kids hated it when he actually ran a family birthday party that way — but then, running a construction project like a birthday party would be no more effective at achieving the stated goals.

The "Our Common Wealth" exhibit, designed by Cambridge Seven Associates for Boston's Commonwealth Museum and Massachusetts Archives, includes a digital touchscreen table that allows children to interact with digital copies of historic documents.
Photo: Kwesi Arthur/ Cambridge Seven Associates Extra Large Image

Technology in Museum Exhibits

Back in 2003, Bill Gates predicted that by 2010, we would be surrounded by computers "but we won't know it." That prophesy is becoming truer every day, and modern museum design is one area in which such a reality is closer than ever.

In the seminar "Museums in the Digital Age," architect Peter Kuttner of Cambridge Seven Associates asserted that the ubiquitous (and often defective) computer kiosks that populate many aging museum exhibits no longer interest visitors. "People want to see the real thing" — or at least feel as if they are — he said. Contemporary museum designers are now often asked to design exhibits in which the technology is hidden, assists the overall exhibit presentation, and does not interrupt the bigger experience.

Click on thumbnail

Kuttner showed an array of examples in which a computer display was

camouflaged to appear like other everyday objects. In the Boston Children's Museum exhibit "Five Friends from Japan," large computer flatscreens look like mirrors, bulletin boards, or even shoji screens — anything but monitors. And at the Hall at Patriot Place in Foxborough, Massachusetts — a museum and hall of fame for the New England Patriots football team — what appear to be two-story-high billboard banners of star players are really made up of large-scale digital wall tiles created by the Israeli company Magink. >>>

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