



Open Houses

by Tim O'Sullivan

Tedd Benson doesn't just want to create innovative buildings. He wants to revolutionize the building process.

"The homebuilding industry in general hasn't moved very far in terms of adapting to available technology, and therefore hasn't changed the quality and the efficiency of the product and the process," says Benson, owner of Bensonwood Homes, based in Walpole, N.H. "And we believe really strongly that the time has come for some radical changes in the building industry."

Benson also strongly believes that those radical changes can be delivered by the concept of Open Building, a

theory of adaptability Bensonwood uses in its custom-built timberframe homes.

Disentangled Buildings

Under the Open Building concept, a building is viewed as a series of systems — from the mainframe exterior structure to the walls that divide kitchen from living room to the plumbing and electrical systems to the dresser in your bedroom. Once these systems are separated — or "disentangled," in Open Building jargon — they can be organized and renovated, replaced or repaired.

Not only are systems disentangled in Open Building, so is the process, which calls for open communication between

the architect, the builder, all the subcontractors and, most importantly, the owner.

The process is further disentangled by prefabricating as many of the building's components as possible in a controlled environment (in this case, the Bensonwood shop) and not at the work site. This allows for more precise techniques, easily reused or recycled waste, and increased predictability of both time and cost. Think of it this way: Ford doesn't come to your driveway to build your car — why build the house on the lot?

Benson believes so strongly in the concept's capabilities that he has trademarked his own version of Open Building, called the Open-Built system. He uses the system when building Bensonwood's timberframe homes, and last summer he also used it for a project called the Open_1 Prototype, the first of four buildings that will constitute the Open Prototype

An innovative concept called Open Building results in homes that are "disentangled"



Photos courtesy Bensonwood Homes



ABOVE: The Open_1 Prototype at Crotched Mountain is green, efficient and flexible.

explains Kent Larson, director of House_n, an MIT research group that explores innovative homebuilding technologies, materials and strategies. "We hope to point the way towards making excellent residential architecture widely available in an industry that is decades behind others in deploying innovation."

The Roots of Open Building

It is interesting that Benson is working on this Open Prototype Initiative with MIT, where the roots of Open Building took hold in America. Going back to the roots in order to move forward is something of a specialty for Benson.

When he moved to Boston in the early 1970s, Benson started renovating and repairing old timberframe buildings. He became enamored with the structures and since then has been revitalizing the once-dead art of timberframing.

Initiative, a collaborative effort between Bensonwood and the Department of Architecture at the Massachusetts Institute of Technology (MIT) in Cambridge, Mass.

The Open_1 Prototype is a three-story transitional residence for brain injury patients at Crotched Mountain, a Greenfield, N.H.-based charitable organization that serves individuals with disabilities and their families. The Open Building concept will enable the residence to adapt as patients heal and their needs change, a stellar demonstration of Open Building's possibilities.

But don't be misled. The proponents of Open Building don't want to see it used only for facilities with multi-million-dollar budgets or in high-end homes.

"The goal of the Open Prototype Initiative is to revolutionize the way homes are built, making today's extraordinary into tomorrow's ordinary,"

The seeds of Benson's relationship with Open Building were planted in the late 1970s, when he started to use stress skin panels (normally found in walk-in coolers and refrigerated warehouses) to insulate timber structures. "That started the whole idea of disentangling for us," Benson says.

After that, the company started to tackle the problem of how to run pipes and wires through solid insulation. Then it was on to developing "a complete building system for our homes that solves foundation issues and hold-down issues, and how do buildings get plumbed and wired and insulated and heated, and how do we achieve the kind of energy efficiency we want."

The result of that learning process is the Open-Built system, which Bensonwood started using in 2000. The standard Bensonwood home is between 2,500 and 4,000 square feet in size and costs between \$300,000

ABOVE: By prefabricating as many of the building's components as possible in the controlled environment of a shop, and not at the work site, costs and quality can be more easily managed, and the home goes up faster on site, often in a matter of weeks.



Courtesy, Bensonwood Homes

Growing the Craft of Timber Framing

Bensonwood began as a woodworking and cabinetmaking enterprise in 1974. Today, the company has 50 team members, including three registered architects, a timber engineer with a Ph.D., three CAD specialists, two structural engineers and several master timberframers, as well as visiting artisans from foreign countries, such as temple carpenters from Japan and French *compagnons*, or timbercrafters.

The first foreign worker to travel to Bensonwood was Masahiko Ishikawa, who visited for a year in 1984. "All of a sudden we had [access to] 2,000 years of craft evolution, because it had never died in Japan," says Bensonwood's founder, Tedd Benson. "The skills and some of the standards [used in Japan] were nearly exactly the same [as

ours]. He brought the wisdom and the confidence of the ages."

Since Ishikawa's visit, Bensonwood has had an ongoing "foreign exchange" program that has included German engineers as well as French and Japanese craftsmen.

Not only has Benson looked outside of America for influences, he's also looked outside of the residential building industry. Airports and hospitals have provided him with inspiration for Open Building concepts. Hospitals have some of the most complex mechanical systems of any buildings, which have to be disentangled and highly accessible. Airports often have exposed systems, many of which actually add to the beauty of the building.

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and \$450,000. The company also builds some multi-million-dollar homes, but it is looking to "bring down our cost by designing smaller, better, smarter homes," says Benson.

Six Layers

The crux of the Open-Built system is the separation of the building into six layers: site, structure, skin, space plan (division of space), services (plumbing, wiring, heating/cooling) and "stuff" (cabinets, furniture, etc.).

These layers are built with materials that are appropriate for their lifespans. The structure is expected to last between 100 and 300 years, so hardy, salvaged old-growth timbers are an excellent material. Parts of the services — the branches of the plumbing system, for example — may need to be replaced in a few years, so cheaper plastic pipes can be used. But the backbone of the plumbing system should last longer, so cast-iron is an option.

Because the layers are clearly identified, they can be disentangled. But in order for that to happen, there has to be open communication between everyone involved in building the house. This inclusive planning starts with the owner and branches out from there.

A key part of the planning is building virtually, so mistakes can be identified and corrected on a computer screen before they ever reach the construction

site, again creating a greater efficiency. Once the virtual building has been reviewed and modified, the actual building can be organized down to the finest details.

For example, rather than installing wires, pipes and flooring on a first-come, first-install basis, the subcontractors work together and coordinate their schedules. And because they already know where everything is supposed to go, they spend less time cutting, shaping and retrofitting on site, which speeds build time and reduces waste.

The other key element in Bensonwood's Open-Built system is prefabricating in a shop, which greatly increases efficiency. Workdays and workers aren't subject to the weather. Quality is controlled by using computerized numerically controlled machinery. Waste can be easily disposed or recycled. Bensonwood's shop, for example, is heated with wood waste.

The Adaptable Home

Because the building's elements are disentangled, they can be easily altered or repaired. It's relatively simple to move anything, from an outlet to a bathtub, because the wires and pipes aren't in a jumble and are easily accessed behind removable wall panels.

The disentanglement also helps in emergencies. "In one case there was a horrendous plumbing leak that could have

been a complete disaster," Benson relates when asked about feedback from some Bensonwood homeowners. "But because of our removable ceiling system, they were able to fix the problem quickly. They didn't have to replace any sheetrock, because there wasn't any. They just got in there and fixed the leak, cleaned up the water, refinished two ceiling panels and they were done."

The adaptability works on a larger scale, too. Say you want to turn two bedrooms into a single suite. Rather than knocking down walls, re-plumbing and re-wiring, Open Building enables you to easily move walls and reconfigure the mechanical systems. Timberframing works especially well with this concept, since none of the interior walls in timberframed homes are load bearing.

The Open_1 Prototype

All of these concepts were tested to an extreme measure in the Open_1 Prototype at Crotched Mountain. "We ended up prototyping a lot more stuff than we had originally anticipated," says Andrew Dey, Bensonwood's project steward for the Open_1 building. That was possible because Bensonwood, led by architect Eli Gould, had open lines of communication with its clients. Whatever the brain injury therapists wanted, they got.

For instance, the building's heating and cooling units (a series of valance convector systems) will allow for fine-tuned adjustments in each room and are silent to accommodate the patients' sensitivities to both temperature and sound. Triple-glazed windows provide further sound protection as well as insulation. A heat recovery ventilation system will ensure excellent indoor air quality.

Cabinets and wardrobes are equipped with mechanisms that allow wheelchair access. Sink heights are easily adjusted according to the patients' changing needs. There's an elevator that was not in the original design, and the building is even equipped with two lifts — one that helps patients get into and out of a therapeutic tub and another that will move them from a bedroom to a bathroom.

Bensonwood was able to smoothly incorporate these special accessories because the planners and the process were adaptable. It's also important to note that the structure, while it does employ timbers, is more like a classic stud-frame house than a timberframed building.

Open Building concepts were pushed to new limits during the construction of the Open_1 residence. Several examples of this are provided by the building's mechanical core wall.

Originally, the core wall, which houses the backbone of the plumbing, electrical and HVAC systems, was to be prefabricated in one piece. But after looking at the virtual model, it became clear it would need to be separated. Then, during one of the regular meetings between the architect and the three primary subcontractors (the plumber, electrician and HVAC installer), it became clear where each system would fit into the wall.

While the client made the extra challenges and prototyping in Open_1 inevitable, Benson is hoping to simplify things for his next prototype project, Open_2, which is in the planning stages.

"My idea is to do a single-family detached home that is heavily focused on energy efficiency and sustainability as its primary issues," Benson says. That type of project, he believes, will help in his quest to revolutionize the building process for the masses.

"Our efforts to make a difference in the building industry as a whole, as well as for our clients, are extremely important us," he notes. "And changes are inevitable — because the process right now is unsustainable."

Tim O'Sullivan wrote about healthy home plans in the July/August 2006 issue. He's based in Concord, N.H.

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