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ADVEN-TURES IN GREEN BUILD-ING

A STRAW-BALE TRANSPORTATION FACILITY PRESENTS SOME CHALLENGES

BY CHRISTINA KOCH

GREEN BUILDINGS OFTEN are reminiscent of a time when design and construction considered site and took advantage of passive ventilation and natural daylight. The green-building movement encourages design and construction professionals to adopt these often-forgotten design ideas to reduce energy consumption and decrease building operating costs.

With that in mind, the city of Santa Clarita, Calif., decided its new Transit Maintenance Facility should be designed and constructed according to the Washington, D.C.-based U.S. Green Building Council's Leadership in Energy and Environmental Design Rating System (www.usgbc.org).

"The city wanted one of its own municipal projects to set an example for developers, contractors and architects who work in the city to illustrate the benefits of sustainable design," says Charles R. Smith Jr., AIA, LEED AP, vice president of HOK's Los Angeles office. "Santa Clarita also wanted to show that sustainable design doesn't cost much more, is achievable and allows you to have a beautiful building with beautiful materials while helping the environment."

Among those materials are 3,600-square-feet (334-m^2) of copper shingles used on the building's exterior walls. Copper contributes to green buildings because it often is composed of up to 80 percent recycled material and is durable for decades.

"We not only chose copper because it's a sustainable product, it also weathers nicely with time."

SPECIFYING STRAW

Smith and his design team suggested many green-building ideas attributed to a bygone era for the 20,000-square-foot (1858-m²) administration building and 40,000-square-foot (3716-m²) maintenance facility. Natural daylighting and large overhangs easily were accepted by city officials, but more experimental green-design concepts, like straw-bale walls, caused concern.

Straw bales are more often used in residential construction, so designing with them was a first for HOK. Because the firm was new to straw-bale construction, the design team understood the city's concerns. "If you ask anyone their concerns with a straw-bale wall, they'll say pests, rot and burning," Smith notes. "We explained to them that we would use rice straw, which has a waxy coating and is very difficult to burn. We also encased the straw bales in 1 1/2-inch- [38-mm-] thick lime plaster, which is dense but unlike regular plaster allows moisture to seep in and out naturally."

In addition, the design team scheduled several field trips for city officials to visit buildings that were constructed of straw bales. The group visited the Real Good Store in Hoffman, Calif., which used straw-bale construction and has passive mechanical systems. In Halesburg, Calif., a winery made of straw bales also was toured. After the tours, the city agreed to straw-bale construction for the Transit Maintenance Facility's administration building.

Each straw-bale wall is 7 1/2-feet (2.3-m) tall and topped by a 3-foot (0.9-m) clerestory window; the clerestory windows wrap

all the way around the building. Windows also are punched through the straw bales every 10 feet (3 m). "Skylights are utilized for internal spaces that don't have access to natural light," Smith remarks. "Most people within the building have access to natural light, especially because it's a U-shaped building with a narrow floor plate."

The rice straw used in the facility comes from California farmers who, according to the Sacramento-based California Rice Commission, produce 1.2 million tons (998000 metric tons) of rice straw per year. Most farmers till the straw back into the soil and add water to decompose the straw, but this is an inefficient use of water and costs farmers money. Straw-bale construction, ethanol production, erosion control and paper fabrication currently consume 3 to 5 percent of the rice straw produced in the state. By setting an example with its Transit Maintenance Facility, the city of Santa Clarita hopes the constructive reuse of rice straw will increase.

"The city has created a brochure to showcase the sustainable aspects of the design and offers a self-guided tour of the facility," Smith explains. "We also installed a 'truth window' inside one of the conference rooms' straw-bale walls. There's a window frame in the straw-bale wall surface and it shows the straw bale and three layers of plaster."

During construction, the team did encounter a problem with the straw bales and Smith is forthcoming about it because he wants other teams to learn from the mistakes on the Santa Clarita project. Because the straw-bale walls were partial height, the structural engineer designed the walls to cantilever out of the footing. The walls were secured with strapping from the footing that went around the bales, and wood box beams were placed on top. The walls were supported with temporary wood angles.

"Some of the contractors started climbing on the walls and removing the bracing, and by the time anyone realized it, all the bales were out of plumb," Smith recalls. "The contractor had to go back and straighten them out, which took some time."

In addition, a wet winter and an improperly installed overflow roof drain caused rainwater to pour into the straw bales. About 60 percent of the bales had to be removed and replaced because of moisture and mold growth.

COPPER'S CHARM

Although visitors to the facility may not immediately recognize the R-69 straw-bale walls, they will notice the copper shingles on the building's exterior. The shingles appear on the administration building's oval-shaped dispatch area and accent another curved wall. Copper also

acts as trim on the building's 8-foot (2.4-m) roof overhangs, which block unwanted heat and ultraviolet rays from reaching the building's interior in the hot summer months and keep the walls dry during rain storms. The administration building's interior courtyard also features the copper shingles.

"We not only chose copper because it's a sustainable product, it also weathers nicely with time," Smith says. "Because Santa Clarita isn't near the ocean or water, the copper won't turn green as it ages. Now it's a really attractive dark brown with a little patina on it, so it turned out beautifully."

Although the copper today is stunning, there was a mishap with it early in the project that threatened the copper's natural beauty. After the copper was installed on the oval-shaped dispatch area, a subcontractor began cleaning the concrete raised-access floors. Raised-access floors allow a space to easily be reconfigured because all wiring is below the floor. The Santa Clarita Transit Maintenance Facility also features underfloor air, which decreases the energy used by an HVAC system because conditioned air naturally rises in a space rather than being forced down.

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Because the windows had not yet been installed in the building, the solution used to clean the concrete floors was thrown out of the windows and splashed onto the copper shingles. "The solution left red spots and black areas," Smith remembers. "The contractor did some kind of solution wash the copper manufacturer suggested. The contractor went over the whole oval shape

SANTA CLARITA TRANSIT MAINTENANCE FACILITY, CALIF.

Architect: HOK, Los Angeles, www.hok.com

General contractor: Fedcon General Contractors, Santa Clarita, www.intertexcompanies.com

Commissioning agent: CTG, Irvine, Calif., www.ctg-net.com

Copper shingle installer: Smith Electric, Carpentry Division, Santa Maria, Calif., www.smith-electric.com

Copper shingles: 3,600 square feet (334 m²) of ZR-100C from Zappone Manufacturing, Spokane, Wash., www.zappone.com

during a couple days. However, if you don't do it all on the same day [the copper] tends to be different colors because it cures differently, so some shingles looked different from others. The manufacturer assured us in one year it would all blend and look good. And actually it has done that."

LEED GOLD

Smith says the natural synergies between the green features of the building helped the project team qualify for Gold LEED certification though it had initially been seeking Silver. In addition to straw-bale walls, natural daylighting, recycled content in copper shingles and raised-access floors, the project also features a reflective rubber roof, greywater reuse for irrigation and a photovoltaic canopy for bus parking that Smith says is producing enough energy to operate the facility.

Many developers, owners and architects still shy away from green building because they believe it costs much more than traditional construction. However, Smith notes the Santa Clarita Transit Maintenance Facility did not cost more than a traditionally built structure of similar size. "We typically tell clients if you want a LEED-certified building it probably will be 3 percent more in construction costs," he says. "Our design fees don't tend to be any different because HOK naturally designs sustainable projects, so it's built into our thinking. But you have to hire a LEED commissioning agent, which sometimes can run up to $100,000. The agent monitors the construction process and building systems and makes sure all the paperwork is documented to get the LEED certification. Some of the mechanical systems are a little more expensive, so we figure 3 percent is about average. And the cost probably is going to be coming down because many products are becoming sensitive to LEED requirements."

Despite delays in the construction schedule caused by mishaps with the straw bales and copper, Smith believes the project was a rewarding one. "We did get a Gold LEED certification," he says. "It was nice to give the city a project they're proud of, and it's nice to know the employees love working there."