Houston-Area Community College Building Designed to Fight Texas Summer Heat

By Barb McDonough

Photo by Jacques Bourgeois, San Jacinto College.

Sustainable design is serious business in the city of Houston, due to the high summer heat and humid subtropical Gulf Coast climate. According to the National Climatic Data Center, more than 75 days per year in the Houston area have temperatures above 90°F. In addition, the substantial humidity levels of the region create heat indices higher than the actual temperature. The sweltering summer heat often leads to heavy air-conditioning use throughout the city—and the high-energy consumption that accompanies it. This considered, local and state building and energy codes now require certain sustainable design strategies that help counteract the heat of the sun's rays.

These climate-influenced design strategies were certainly a high priority in the construction of the new Allied Health and Science Building on the South Campus of San Jacinto College, a community college with three campuses in the Houston area. In addition to the importance of hitting a LEED® Silver target for the 155,000-sq.-ft., three-story building, the school wanted an energy-efficient, up-to-date facility with a comfortable interior for students and faculty.

"There are some extreme climate issues here that you just don't see in many other

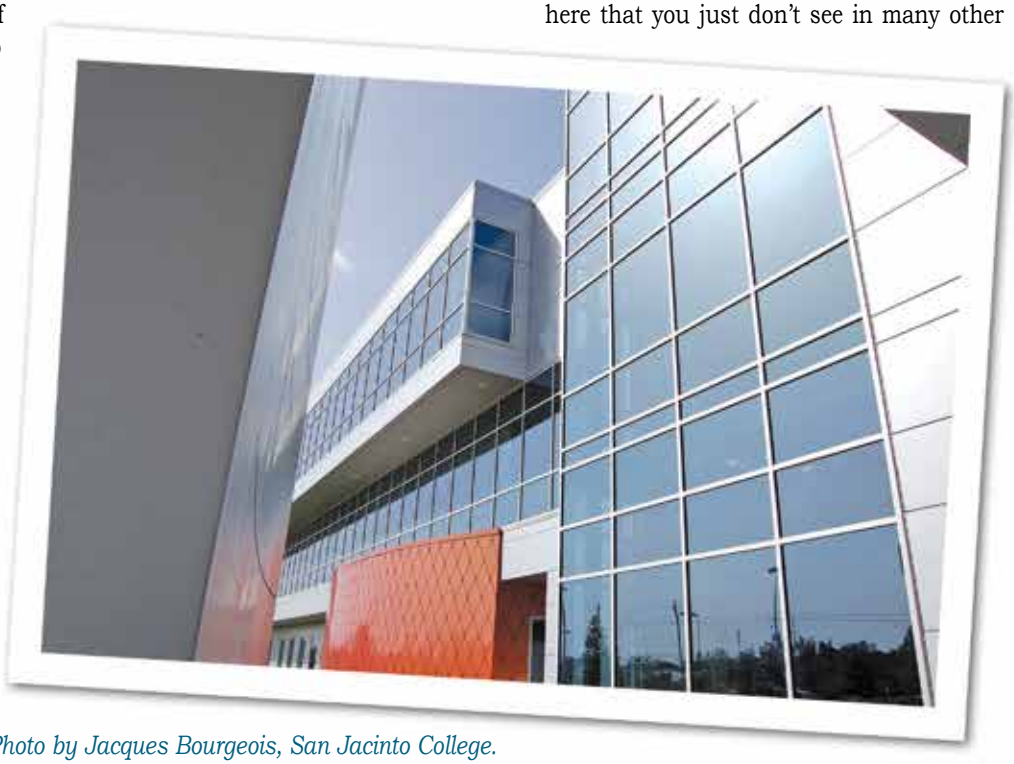

Photo by Jacques Bourgeois, San Jacinto College.

Photo courtesy of Bay-IBI Group Architects and Slyworks Photography.

parts of the country; we frequently see those 100-degree temperatures during the summer months, and they often hold throughout the day," says Bill Dowell, director of project services with facilities and construction at San Jacinto College. "Temperatures this high can have a significant impact on energy efficiency and occupant comfort if buildings are not designed properly. We want our buildings to be as energy-efficient as possible, with healthy, comfortable interiors that an ideal environment for learning and social interaction."

Working with building envelope consultant Building Exterior Solutions, LLC of Houston, the project's architectural firm, Bay-IBI Group Architects, of Houston, devised several exterior and interior design strategies for accomplishing these goals. One of the most important heat-reducing features of the building is its solar-reflective asphalt roof. Solar-reflective roof systems, commonly known as "cool roofs," typically feature a white surface, which reflects the sun's rays to maintain a cooler roof surface temperature. They therefore decrease the need for air conditioning, often resulting in energy savings of 10 to 30 percent, according to the Cool Roof Rating Council. Given these benefits, solar-reflective, white roof surfaces are now a building code requirement in the Houston area.

"We only specify white surfaces for low-slope roofs these days; black surfaces absorb too much solar radiation in our climate and shorten the life of the membrane, so we do not use them any longer," says Robert Trabanino, AIA, associate principal of Bay-IBI

Site visit. Photo courtesy of Building Solutions, LLC.

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Group Architects. "And since we're close to the coast, the roofs have to be smooth-surfaced, as gravel coating can become projectiles in the event of a hurricane."

The architect's design also satisfied the building code's requirement for a minimal 115-mile-per-hour basic wind speed and a 22-gauge galvanized steel roof deck. In addition, several internal and overflow drains and crickets were incorporated into the design to eliminate standing water and to prevent roof collapse from an overstressed structure.

The project's construction manager at-risk, JE Dunn Construction Company, contracted with Chamberlin Roofing & Waterproofing of Houston to install the roof. In preparation, 8 in. of expanded polystyrene Holey board insulation was fastened to the metal base decking. Lightweight concrete was then poured over the insulation board to form a lightweight insulated concrete deck. Chamberlin Roofing & Waterproofing began work in February 2013, installing the roof one section at a time.

"This was a big new construction job, so we had to work around several other contractors," says Randy Brashier, project manager for Chamberlin Roofing & Waterproofing. "As soon as the contractors ahead of us got things ready, we'd jump in and roof another section."

The roofing crew installed a five-ply modified-bitumen roofing system from CertainTeed with a torch-applied, highly reflective cap sheet (93.0 SRI, per ASTM E1980). The base sheet was mechanically fastened, while mid plies were adhered with hot asphalt. All told, approximately 600 squares of roofing were installed with an average thermal resistance of R-36. The crew also installed several stainless-steel wall, base, and edge flashings and was finished by July 2013.

"There was a lot of detail on this roof, due to the project's emphasis on green building; we usually had two to three roofing consultants on site to help," Brashier says. "Everything went down smoothly, the job turned out really nice, and we received great feedback."

Moving down from the roof, the exterior walls display a variety of green design touches.

The basic exterior wall cladding is a metal composite skin and rainscreen system isolated from the backup material. Under this is 1½-in. rigid foam board insulation; 5/8-in. fiberglass mat gypsum exterior sheathing; light-gauge metal stud framing; 1 in. of open-cell, water-blown, semi-rigid spray foam insulation; and 5/8-in. moisture-resistant gypsum board. Altogether, the wall assembly has a thermal resistance of R-28.

Bay-IBI Group Architects also designed an atrium in the center of the building with a large skylight and a high-performance glass curtain wall. This was the perfect answer to the college's request for open spaces with ample daylighting to encourage better social interaction and collaboration among students and staff members. Bringing in an abundance of daylight can also easily raise the interior temperatures, however, if it's not filtered properly. With this in mind, the architect specified high-performance, low-emissivity glass with a slight reflectance for the curtain wall. The overhead skylight at the atrium is fabricated with translucent fiberglass-reinforced polymer sheets, totaling 3 inches in thickness, with a low solar heat gain coefficient, allowing diffused natural daylight to enter the space without the associated heat gain.

Sustainable design does not stop with the building's exterior; the inside of the building features several green touches, as well. In addition to energy-efficient lighting and mechanical systems, there are also occupancy sensors in every room that will shut off lights and adjust thermostats whenever rooms are not occupied for a set period of time. For water conservation, the building has low-flow plumbing fixtures and is designed to capture rainwater and HVAC system condensate for landscape irrigation. And, to help ensure high indoor air quality, the project teams used zero-VOC paints and finishes throughout the building.

The South Campus Allied Health & Science Building is the last and largest of four health and science department buildings built by San Jacinto College—two on the Central Campus and one each on the North and South Campuses—over the past five years.

Photo courtesy of Building Solutions, LLC.

The project finished just in time for the fall 2013 semester, and the building has since received glowing reviews from the college and its faculty.

"It's a beautiful building and is very well designed and constructed," Dowell says. "We're very pleased and are looking forward to seeing how well it performs in the heat of our next summer season."

Barb McDonough

Barb McDonough joined CertainTeed in 1999 as a research engineer working in its research and development facility in Blue Bell, PA. She has held several successive engineering positions, including extensive work in the low-slope roofing area. In 2006, she moved into the marketing area as product manager for commercial roofing. In 2011, Barb also took on the role of marketing manager for solar roofing. Barb holds a BS degree in chemical engineering from Lafayette College and an MBA from St. Joseph's University.