the proof is in the panels

By K. Schipper

Client:
The University of Chicago, Chicago

Designer:
Goody Clancy, Boston

Construction Manager:
Gilbane Building Co., Providence, R.I.

Façade Manufacturer/Installer:
ASI Limited, Whitestown, Ind.

Anchor and Bracket Supplier:
Probe Construction Products Inc., Wayne, N.J.

Limestone Supplier:
Indiana Limestone Co., Bedford, Ind.

The Indiana limestone gleaming in the Midwestern sun helps tie the new residence structure – officially, the South Campus Residence Hall – to the rest of the University of Chicago campus, but the design of the building is strictly 21st century. (Photo courtesy Goody Clancy)

CHICAGO – The University of Chicago is a story in contrasts: an institution with an Ivy League reputation, but located in the broad-shouldered metropolis of the Midwest.

It's probably not surprising that when university officials began the process of building a new residence hall they were looking for up-to-date technology – while still incorporating a classic look offered campus-wide with Indiana limestone.

They got it, too, although not without plenty of effort to find a fabrication method that would allow the stone to be used while staying within budget.

In the end, everyone agrees what put the job over was an ingredient natural to any good college campus: plenty of teamwork by all involved.

COMBINATION OF NEEDS

Because of the investment involved, no university casually enters into building student housing. The University of Chicago is no exception; its last on-campus dorm effort was completed in the mid-1990s.

Adding more residential space became a priority a decade later, however, with some interest in growing the university's enrollment – and the prospect of losing an iconic staple of its off-campus housing stock.

"They (the university) had been leasing a former hotel (built in 1926) off-campus about a mile away," says Roger Goldstein, principal with the Boston-based Goody Clancy, who designed the new project. "They'd been leasing it for around 20 years, but the building had been sold, and they had a date by which they had to be out."

Goody Clancy, which lists academic, civic and institutional projects as its specialties, was chosen to design the new building based on its expertise, says Goldstein, and started working on the project in late 2004.

Goldstein adds that school officials saw the project as an opportunity not only to bring students back to campus, but also to enhance its residential-house system, which puts a group of undergraduate students together for dining, studying and socializing under the supervision of a resident head and assistant resident head.

The first unitized panels go up on the building. It's also readily apparent that not all the stones – and panels – are the same size. (Photo courtesy ASI Limited)

"That's the real social unit at the university; while they had a version of it at the old hotel (and in their other residence halls), they wanted this complex to build on it and carry it forward," says Goldstein. "Because it's at

A wide-angle shot displays the sheer size of the new hall, which currently holds more than 800 residents. Set on the edge of the campus, the nearness to the adjoining neighborhood is evidenced by the home in the background at far right. (Photo courtesy Goody Clancy)

the south side of the campus and right up against a neighborhood, they were very concerned not only about how the building was going to be designed, but also how it was going to be perceived by the neighbors."

While making the nine-story structure attractive to and a comfortable fit with the neighborhood was addressed via a number of different elements, including a street-side café open to the public, fitting it into the rest of the

ASI had to install new equipment and learn new processes to get the University of Chicago job. The panels had their own assembly area within the company's Whitestown, Ind., plant. (Photo courtesy ASI Limited)

campus wasn't difficult – given the use of approximately 175,000 ft² of exterior limestone

"We reviewed several different materials when developing the design for the exterior envelope," says Ted George, the Goody Clancy associate responsible for the design of the building's façade. "We investigated some different limestones based on their color and strength, but Indiana limestone is the traditional limestone on the campus and its continued use was deemed an important way to unify it with the campus."

TESTING, TESTING

While the selection of the limestone is traditional, George says how it was to be applied is definitely 21st century.

"Part of our approach was to provide a building that expanded on or demonstrated some of the latest ideas about the use of technology," he says. "We looked at the idea of a curtain wall or exterior insulation over an air-and-vapor barrier on the outside face of the wall."

To do that, George envisioned a rain-screen system in which the edges and the depth of the material keep the water from migrating to the inside face, while the open joints provide ventilation without the use of sealants that would require future maintenance.

Goody Clancy has experience with using rain-screen systems in several different situations, and was confident it would work with Chicago's climate of rain and wind.

George based his design proposal on the German-based Fischer Advanced Curtainwall Technology (ACT) System.

Represented in this country by Probe Construction Products, Inc., of Wayne, N.J., the Fischer system incorporates undercut anchors suspended from an aluminum subframe utilizing specially designed wall holders to hang 3cm stone. Because of the size of the project, an important goal in utilizing the ACT System was to reduce the thickness of the stone, making the support system, anchors and everything else more cost effective.

However, Probe had concerns regarding the selection of Indiana limestone as the project stone.

"Our stress-free undercut anchors

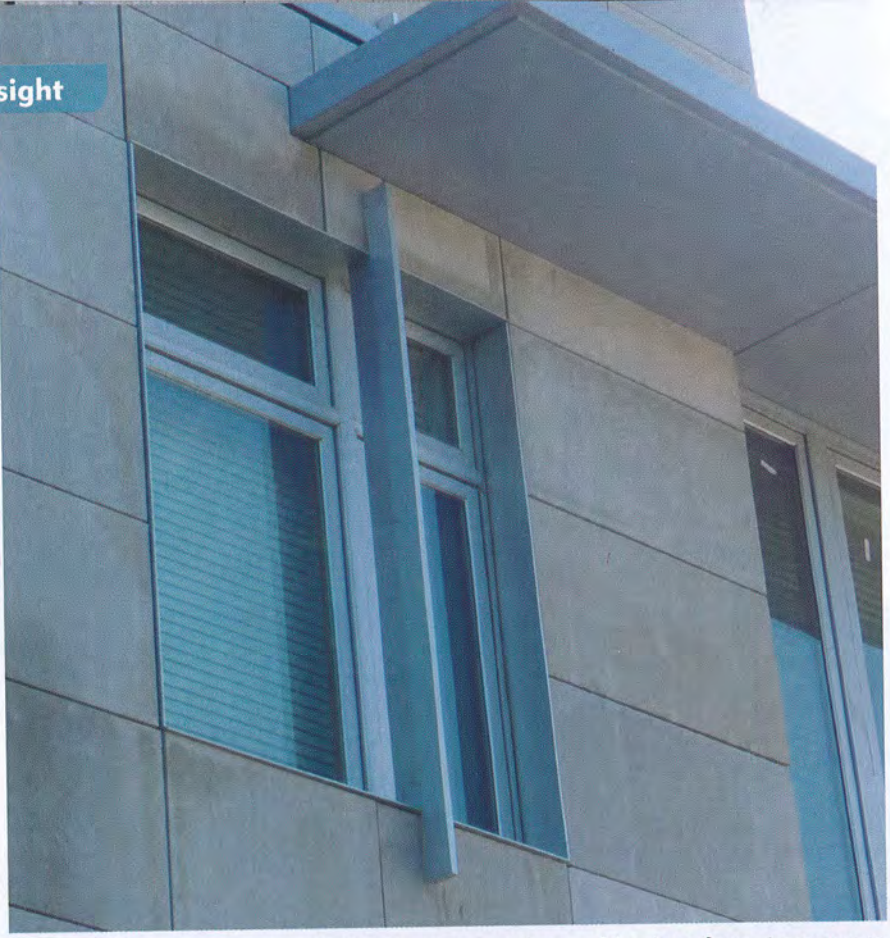
(Left) To set the anchors in the back of the stone panels, ASI installed a Fischer drilling machine and trained employees to use it. (Above) Once the panels were completed, they were shipped by truck to Chicago. (Photos courtesy ASI Limited)

have been used very successfully with thinner, subframe limestone," says Louisa Tett, Probe's owner. "However, since Indiana limestone is so soft, we had two issues that were of concern to us. The anchor had to produce a high-pull-out resistance in a very soft stone, and it had to produce this value fairly close to the edge of the stone due to the design of the façade."

The anchor location was important because the curtain-wall contractor was using custom edge brackets for the panels and reveal angle brackets for the returns. (Fischer/Probe supplied both bracket types.)

At Fischer's testing labs in Germany, however, the first sample stone with the standard undercut anchor didn't produce the desired values. The results led Fischer to produce a custom undercut anchor with a larger expansion element and deeper embedment; the new anchor solved the issues and produced outstanding pullout values, allowing for the use of 2" Indiana limestone panels.

However, another part of the proposed design – having two men mount each 2' X 4' piece of stone to the tracks used to hang a rain-screen system – raised other concerns, according to architect George.



The variety of stone sizes used in the project is apparent at the top of the photo. Some pieces were so small that installing four anchors became a problem. (Photo courtesy Goody Clancy)

One involved the time involved handling each piece individually. Another was the time and expense of scaffolding the project to hang the stone. That translated into a concept that – despite the thinner stone panels – put the project over budget.

A BIG CHALLENGE

At that point, solving the problem involved finding the right contractor to fabricate and install the façade.

Gilbane Building Co., the Providence, R.I.-based firm that served as project manager for the job, procured all the subs. Senior project manager Michael Houston says that, in this case, the company went outside the contractor parameters set by the university.

"We have to adhere to the client's budget, but they also had other requirements for minority contractors, women-owned businesses and local residents," he says. "However, this was such a unique scope of work that we were allowed to find firms on a national scale that would meet the specifications."

Gilbane also specializes in education projects at all levels, and Houston

Continued on page 34

recently completed a project involving a rain-screen system at the University of Michigan. While he contacted that contractor for a proposal, Goody Clancy suggested ASI Limited.

Building enclosure specialist ASI, based in Whitestown, Ind., was doing some design work with Goody Clancy on another project at the time, according to ASI president Ken Smith.

"They reached out and said they had a project in Chicago that was having some budget issues," says Smith. "We had really never done a rain screen before, but we sat down with the design team to see if we could help them out."

Part of the ASI business model is adapting the company's capabilities to what each client needs, whether the façade is being built of metal, glass or stone. In this case, the first thing ASI proposed was taking the project from being stick-built to one utilizing unitized panels assembled at ASI's shop.

A big challenge for ASI was getting the panel sizes correct. Smith says that even at a thickness of 2", the stone did put constraints on the size of the units that could easily be constructed.

"The gravity-loaded anchors are drilled from the backside and the distribution of the weight, and the wind-loading is done by our location of the curtain wall units behind the panels, which were at quarter points to allow the stone-panel thickness to be thinner," Smith explains. "However, due to the thickness of those panels, about the maximum size we could go on the limestone was 5' X 3'.

"So, we designed the system based on how many pieces of stone we could put on a unit. In most cases, it was five-to-seven pieces of stone, so that our units were 10'-14' tall."

Smith adds that it took several months to work through potential problems. However, by taking the stone application out of the hands of masons on-site and turning it over to people in his shop, the end result represented an approximately 30-percent savings to bring that part of the job back under budget.

"Ted George really mentored us through the process," he says. "He got with our engineers and said, 'How can we make it work with Gilbane on the budget?' He helped us figure the kind of value engineering we needed to get the thing done."

"There were a couple minor layout changes that would allow for the panelization," says Goody Clancy's George. "There were some variations to a few of the joint layouts and there were certain stone panel dimensions that were enlarged just for the stability of the stone. We tried to get four anchors in per piece of stone to ensure stability and some of the small pieces were getting difficult to install."

STUTTER STEPS

Even as work was going on resolving the façade issues, the concrete framework of the building was going up, and Gilbane's Houston says that was one of his biggest challenges.

"Especially with a rain-screen system, there are always issues inherent to trying to enclose the building," he says. "We had to make sure the concrete structure was built into a tolerance that could accommodate the rain screen, and it's hard to do because the tolerance for concrete is very wide."

Nor was Houston the only one concerned with tight tolerances. Both Smith and Duffe Elkins, chief operating officer of Bedford, Ind.-based Indiana Limestone Co., say there was little room for inaccuracy with the

limestone pieces being shipped to ASI.

Elkins, whose company supplied limestone to other projects on the University of Chicago campus, says he was naturally interested in this particular job.

"It's the type of work we do," he says. "It was a good fit for us because it's a large project and close to home."

Nor was he concerned about his company's ability to produce pieces at a 2" thickness.

"The 2" material is becoming more and more common, although it's still not as common as a 4" veneer," he says.

What was out-of-the-ordinary was the number of different pieces the job required: Smith estimates some 22,000 pieces of stone were required in more than 7,000 different configurations.

"The challenge to this job was the accuracy that needed to be kept because of the open joint system," says Elkins. "Certainly we have systems to track the stone, but because it wasn't all the same piece size and there were a lot of pieces it was a challenge to get all the pieces through the plant."

"Due to the reverse anchor details, the workmanship was critical," agrees ASI's Smith. "They had to be cut to plus-or-minus $^{1}/_{16}$". The architect only wanted a $^{3}/_{8}$" separation, so to be off $^{1}/_{16}$" each way would mean $^{1}/_{8}$" total."

Further complicating the work for the stone supplier and the assembler were some 150 cutouts for access to utilities such as plumbing and lighting.

"They were all on our drawings and the panels came out with the holes in place," says Smith. "They went right over whatever utility work was there."

In fact, if there was one thing Smith says he and Goody Clancy's George learned from the project is that future jobs might benefit from more standardization.

"We ended up having so many different units it overwhelmed everything from engineering to manufacturing to installation," says Smith. "They say a lot of the panels looked the same, but when you got into the details you found there wasn't much the same."

MAKING IT WORK

And, that doesn't even take into consideration the rest of the work ASI went through before manufacturing the unitized panels began.

"We bought a Fischer drilling machine from Germany and the special bits needed to put these anchors in," says Smith. "And, so our people didn't have to lift the stone, we had vacuum pumps put in so that we had ways to move the stone panels around without having to pick it up. We really had to put in a complete unitizing line."

And, as he notes, the stone was only one component of the system. All the stone was hung on aluminum frames.

"We had to make sure there was always a space or an isolating material between any aluminum and the limestone because there's a carbonic reaction when you combine water, limestone and mill-finished aluminum," says Goody Clancy's George. "We had a couple areas where we had corner brackets to support the tiny limestone pieces and we had to use a neoprene material to make sure there was no contact."

Once the infrastructure was in place for building the panels, Smith says Indiana Limestone began shipping the cut limestone to the ASI shop on pallets. The pieces were then drilled and assembled and shipped out at the rate of 25-30 units per day.

Use of a rain-screen system not only saved money on construction, but reduces future maintenance because the joints aren't sealed. (Photo courtesy Goody Clancy)

The use of the stone panels provides visual interest and a counterpoint to the 21st-century glass-and-steel theme of the residence hall. (Photo courtesy Goody Clancy)

"We tried to keep about two weeks ahead of the demand," he says. "We developed a box system for the framed units that could be lifted off the truck and set at the jobsite. The stone units could then be lifted from the boxes and straight up on the building."

Another critical component of the job was the work done onsite by ASI's Chicago-based crew.

"We had to put curtain wall anchors on every floor, and they had to be leveled and plumb and all done accurately," Smith says. "We hang the units from clips and in them we've developed ways to adjust the frames left and right and up and down, so if there are tolerance issues we can go in and try to align everything."

The ASI president says the company had 50-60 people involved in the project for its duration, with 25-30 devoted to the stone part of the job, which also included responsibility for the roof parapets and granite base – although work on the base was subbed out.

"We did the entire skin of the building, including the complete building enclosure, the metal studs, the DensGlass™ insulation, air and water barrier and the curtain wall," he says.

Students were scheduled to begin moving into the new building last September.

Smith says the approximately 22 months ASI was involved in the project were hectic, but rewarding, and he's looking forward to working with Goody Clancy in the future.

"We felt we got an opportunity to shine as a design-and-installation-type company," he says. "We all learned a lot with the dimensions and issues and constraints, but at the end of the day it's the largest limestone rain screen in the United States, and it's a beautiful building."

Others involved in the project say much the same thing. For instance, Probe's Tett says this particular method seems to offer limestone as a good alternative to granite for building facades. "We think we have a good solution to using limestone and we're excited about that"

Gilbane's Houston says from a client perspective, it was definitely worth the extra effort to find a construction method that worked with the look the university wanted.

"The client loves the look of the building and it fits in well with the surrounding campus," Houston says. "It took longer than I think everyone anticipated. However, at one point there was an option to go with metal panels to save money, and they're pretty happy they decided not to do that."

Goody Clancy's George agrees.

"It was very important for us to be rigorous in getting the details properly worked out early in the project," he says. "This is a new concept for the campus and a new concept to have a limestone rain screen of this scale. I think a lot of people who are very knowledgeable about energy codes and the concept of ventilated facades were interested to see how it would be developed, and now they're very pleased with how it turned out." ■