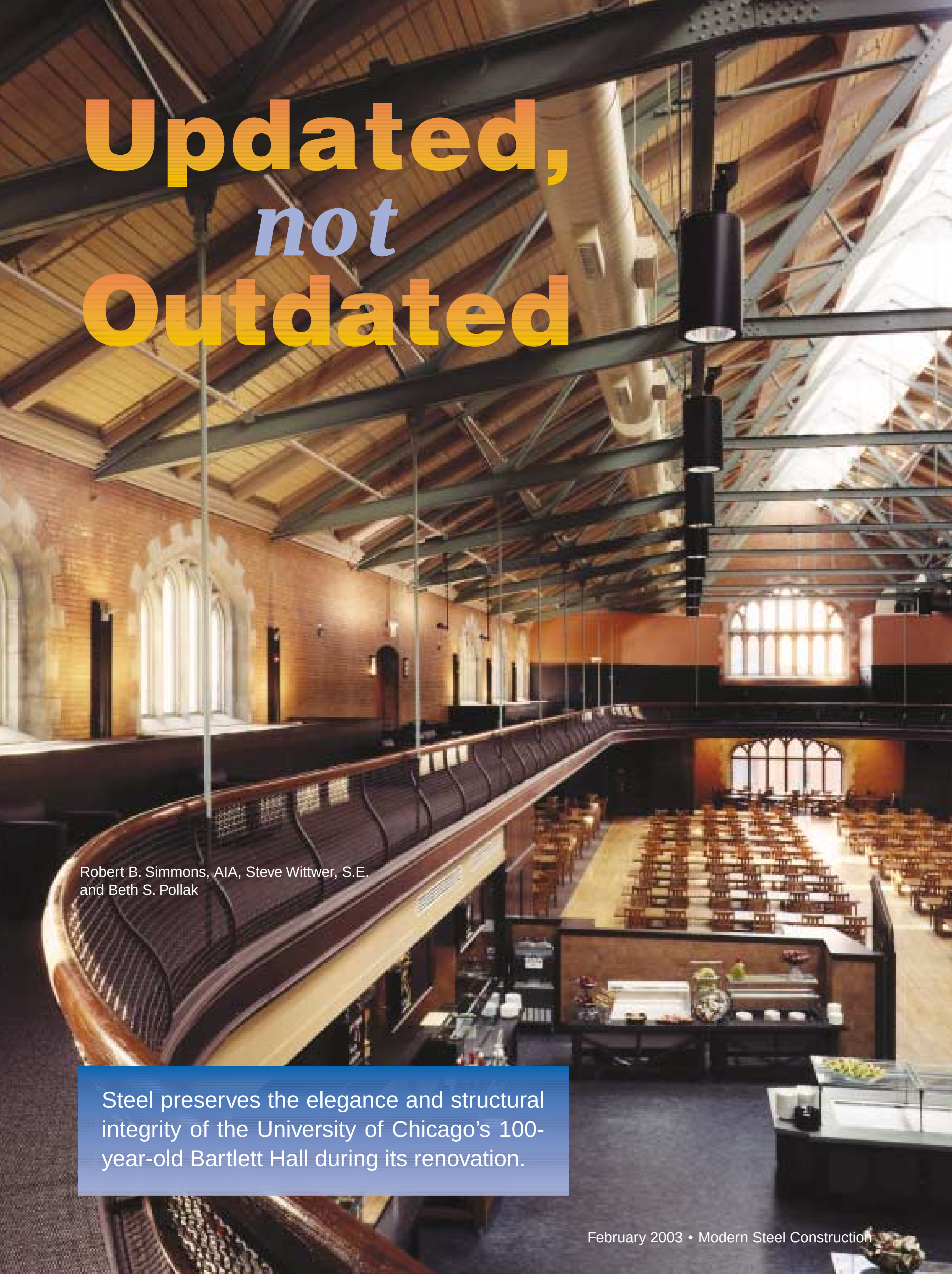


Updated, *not* Outdated

Robert B. Simmons, AIA, Steve Wittwer, S.E.
and Beth S. Pollak

Steel preserves the elegance and structural integrity of the University of Chicago's 100-year-old Bartlett Hall during its renovation.

Renovations and additions transformed Bartlett Hall, a 100-year-old neo-gothic gymnasium at the University of Chicago, into a multi-function student commons building with a dining hall, two performance spaces, and various student activities spaces. The building originally had been designed as the men's U.S. Olympic training center in 1901, but functioned as a university athletic facility for most of its existence.

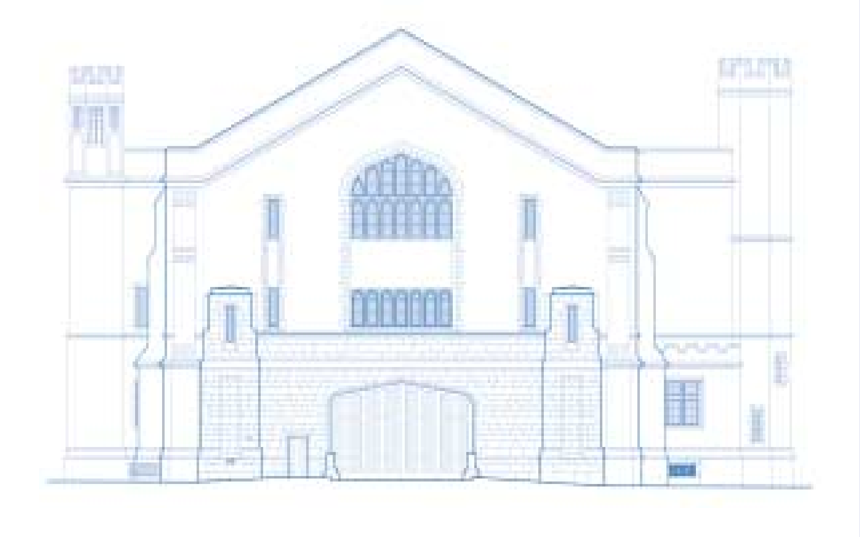
"It was a gothic stone cathedral-like building that blended in with the rest of the limestone buildings on campus," said project architect Robert B. Simmons, AIA of Bruner / Cott & Associates in Cambridge, MA. "It was an old-fashioned facility—so the idea was to create new uses for the building. It was located near a proposed new quadrangle and dormitories, so it made sense to have a new common space with a dining facility."

OWNER'S REQUIREMENTS

The University of Chicago sought a renovation that created 64,000 sq. ft of total space. The renovation was to include a 550-seat dining hall, kitchen facilities, a two-bay loading-dock addition, and plan for a future dining terrace located on the roof of the addition. The renovated hall also would integrate a campus market, two theatre and dance rehearsal / performance spaces, a 6,000-sq.-ft student lounge, six student activities offices, and a large conference room / student lounge. All new systems (HVAC, electrical, plumbing, fire protection) would be installed.

Steel frame was chosen to match the building's existing 100-year-old system. "I'm not surprised that the steel was in good shape," said project engineer Steve Wittwer, S.E. of C. E. Anderson and Associates, Inc. in Chicago, IL. "This wasn't the high-quality steel being produced today, but steel is steel: it lasts a long time and the loads don't change."

Steel was also the most economical system. The addition required steel beams and girders with concrete and steel decking to meet the new roof terrace loads. "Steel was the only choice to be able to give us the spans that we needed for a wide-open space," said general contractor Craig Tolan, of Pepper Construction.



Above: Steel framing was used for the loading-dock addition to provide open space for the loading dock while supporting rooftop loads for a future dining terrace.

Below: Although clad with limestone veneer rather than solid limestone masonry, the loading-dock addition blends seamlessly with the existing building because of careful detailing.

Steel was also considered the best solution because of its ability to frame a 24'-wide, gothic-arched dock-door opening from which architectural "lintels" could be hung. Load-bearing masonry would have been more costly for an authentic gothic-arched opening.

Another bonus of steel was that it could be erected during cold-weather months. "We could have done the addition out of load-bearing masonry," Simmons said. "But the lead time of limestone—and the expense of erecting masonry in the winter made steel a better choice. Limestone would need a heated tent structure to keep it above 55 degrees Fahrenheit so that it would cure properly. In contrast, steel could be fabricated, delivered and erected quickly and with minimal expense."

Above: Interior view of the original gymnasium.

Below: Exterior view of Bartlett Hall, shortly after its original construction in 1901.

TRACK RECORD

The existing steel- and wood-framed running track was converted to a student lounge area and observation deck, with mechanical rooms and stairs inserted into the four corners. Original studies of the building by a previous engineer indicated the running track would not support modern live loads. The engineers recommended demolishing the cast-iron edged track, with its elegantly curved, iron mesh and oak railings. Additionally, the track was found inadequate to support the new heavy water-filled mechanical units. However, because the track structure, suspended from the original trusses with 1½" steel rods, was such an important architectural element to the building, Bruner/Cott sought to save it from the wrecking ball.

"We hated to see it go," Simmons said. "It was a beautiful structure, and it also gave structural stability to the building's exterior walls. So we came back and analyzed it more carefully."

Engineer C. E. Anderson and Associates analyzed the affected trusses using the STAAD-III analysis program with sizes taken from the original turn-of-the-century drawings. The original trusses were found to have the required capacity to support the weight of the mechanical units if they were suspended from the truss bottom-chord panel points above the unit's final location. By running 36"-high, non-inhabitable horizontal duct enclosures along the perimeter of the track, the architects were able to decrease the live-load area to a point where the total loads could be supported.

"It would have cost more money to demolish the track and put in a new one," said Wittwer. "Also, the track structurally braced the building's walls. If we had removed it, we would have still had to somehow brace the walls from the second floor to the roof."

FLOOR SPACE

The original building's structural system consisted of load-bearing exterior walls and steel floor and roof framing, with 12"-deep, clay-tile flat-arch infill between the floor beams. The existing building floor framing consisted of a grid of steel beams in a 6'×18' bay configuration, with flat-arch structural clay tiles spanning the 6' dimension. Many new floor openings for shafts and stairs had to be created within this very fragile and inflexible system. C.E. Anderson developed details allowing the fragile clay tile floors to be saw-cut and re-supported on the cut edges. New C12s were framed to the existing beams, and supported the newly saw-cut tile-arch edges.

Also, during the demolition process, several areas of the existing tile-arch floor system were found to be in disrepair. "There were not a lot of details on the existing building drawings," Wittwer said. "We had to guess what we would find—and one of the oddest things was when we took off the topping slab and found the damaged clay tiles.

The tile was is in bad shape, but it didn't set us back."

The damaged areas of tile-arch were removed, C12s were added as required, and the area was infilled with a new metal deck / concrete slab, flush with the top of the surrounding undamaged tile-arch floor. The area was framed with W12×40s, typically spaced 4' on center, with a metal deck / concrete slab. At the second floor and track levels, new openings were cut in the existing floor system and re-framed using new steel wide-flange shapes, typically W12×22s.

A floor also needed to be created where a pool had been located on the existing first floor. "It had 4'-thick concrete walls, so the cost of removing it would have been astronomical," Simmons said. We had to infill it with tons of gravel and put a slab right on top of it."

Several large horizontal mechanical duct openings for fresh air needed to be cut into the existing masonry foundation wall at new area-well locations around the perimeter of the building. Some of the ducts were as large as 20' wide by 8' long. The existing masonry wall was approximately 3' thick, necessitating two or three side-by-side wide-flange lintel beams. The beam sizes ranged from W8×40s up to W24×84s, with a continuous 3'-wide bottom plate. These lintels required great care in design for field logistical issues, including shoring, steel handling within the tight existing building, and the extreme depth of the walls. The openings in the existing wall were overcut so that new reinforced concrete pilasters, supporting the ends of the lintel, could be poured.

"What was challenging was getting the steel into those 3'- and 4'-thick exterior walls," Tolan said. "The structural steel went up pretty easily, but placing all of the miscellaneous steel and coordinating with the other trades was harder."

STAIRS

Another challenge of renovating the existing building was that it only had a single exit staircase. Modern building codes required at least two additional stairwells for fire safety purposes. The existing grand staircase that had been open to the gym and lobby was enclosed in a two-hour fire-rated transparent glass. The $2^1/_2$"-thick glass walls are composed of two sheets of glass that sandwich a clear, fireproof gel. The gel acts as a fire barrier and stays intact during a fire.

"On the first floor, the stairs were enclosed with fire doors and fire walls," Simmons said. "On the second floor, where there was a 30'-wide opening, we created an oak and glass storefront, the top portion being fire-rated glass and the lower portion being fire-rated wood paneling, with wood columns every 4'. The fire-rated glass is a relatively new product. It's rarely used, because it's expensive, but it is great when you require transparency."

In addition to the existing stairwell, the renovation called for two new exit stairwells, one to be located at the building's northwest corner, and the second in the southeast corner. Extensive new steel framing was required for the stairwell at the northwest corner. "The stairwell cantilevers off of the new openings that we created, so it sort of floats in the space," Simmons said. "We used primarily W12×40s for the framing, and the stairs were made of C12 channels."

Further, a new ornamental steel spiral staircase was added at an existing octagonal turret. The staircase was required to access new mechanical equipment on the roof. Because the existing tile-arch slab could not support the new point load, a steel W12×40 was installed below the existing floor to carry the new spiral staircase center-post, independent of the existing slab.

ELEVATORS

Two new freight elevators, located within the existing floor system, were required to service the new kitchen and serving areas. The freight elevators, which extended from the basement to the second floor, required two large openings to be cut through the existing first- and second-floor clay tile arch floor system. The elevator openings were situated such that no existing steel, which supported the tile arches, needed to be removed. However, the spacing of the existing steel necessitated adding new steel members, W16×40s and W12s, to complete the framed openings. In addition, because of the large floor-to-floor height, additional steel HSS4×4s were required to support the elevator guide rails between floors.

A third elevator on the building's west side was added for handicapped access to all of the floors. "We had to plow through the floor levels to create new openings for the elevator," Simmons said. "On the lobby level, we had to remove the floor completely and rebuild it 4' lower."

Workers also had to remove some of the building's granite "wedding cake" foundation to create the elevator pit. "The foundation was constructed of slabs of granite stacked on top of each other without mortar," Simmons said. "We had to support those from underneath, underpin the granite, and cut half of the footing off in order to get the elevator pit constructed."

DOCK ADDITION

In order for the hall's new dining hall to function effectively, a two-story loading dock addition was required. The addition was designed using limestone cladding to match the university's other buildings. A large HSS18×8 lintel was used at the 24'-wide loading-dock doors, which allowed the limestone surround to look like a load-bearing gothic arch even though the limestone was just a 4"-veneer system. Deep 18" limestone returns at the opening give the effect that the wall is as thick as its historic load-bearing masonry counterparts on the original building.

"A real load-bearing gothic arch would create forces that would push outward and downward on the stone surrounding it," Simmons said. "You don't want to add that [force] to a modern veneer limestone."

ROOF DETAILS

The existing roof system consisted of custom steel trusses spanning 75', composed of double channels and double angles, and a system of solid wood timber beams and purlins, with 2×6 decking spans between the trusses. The steel trusses were spaced 18' on center and were 25' deep at mid span. The wood beam and purlins were connected with formed steel saddles. Evidence of deterioration in the wood beams and purlins—checks, cracks, and general deterioration—due to years of water penetration through the existing clerestory necessitated an extensive investigation of each wood beam and its steel saddle supports. The wood beams were repaired and / or replaced as required, but the 100-year-old steel support saddles showed no signs of deterioration.

The roof of the addition was framed using a beam and girder system with metal decking and an 8” concrete slab to accommodate the future roof terrace. Wide-flange beams were spaced 4’ on center and ranged in size from W18×35s up to W24×104s at the widest bay of the truck area.

After the necessary repairs, the roof deck, beams and purlins, and steel saddles were painted decoratively as part of a three-color paint system. Due to the building’s height and construction, fireproofing the steel was not required. The original riveted steel trusses of the gymnasium were exposed and highlighted with paint as a major architectural feature.

PROJECT MANAGEMENT

The project utilized the construction services on Citadon (then Bidcom) Internet project management systems, which had been implemented by the University of Chicago for several recent projects.

“RFIs, memos, shop drawings and submittals were all logged and transmitted through the system,” Simmons said. “RFIs were passed from sub to contractor to architect to engineer and back again, and progress could be tracked and pushed with scheduling deadlines. It forced well-written, legible questions and responses from all parties. And being a Boston architect, with the rest of the team out of state, meant that the computer helped. It took some training for subcontractors to become more Internet-friendly, but once they were familiar with the system, it went well.”

The renovation was completed in January 2002. The project cost $14.5 million to complete and it used 30 tons of structural steel. It was awarded the Boston Society of Architects 2002 Honor Award Citation and Midwest Construction magazine’s 2002 Renovation Project of the Year. ★

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