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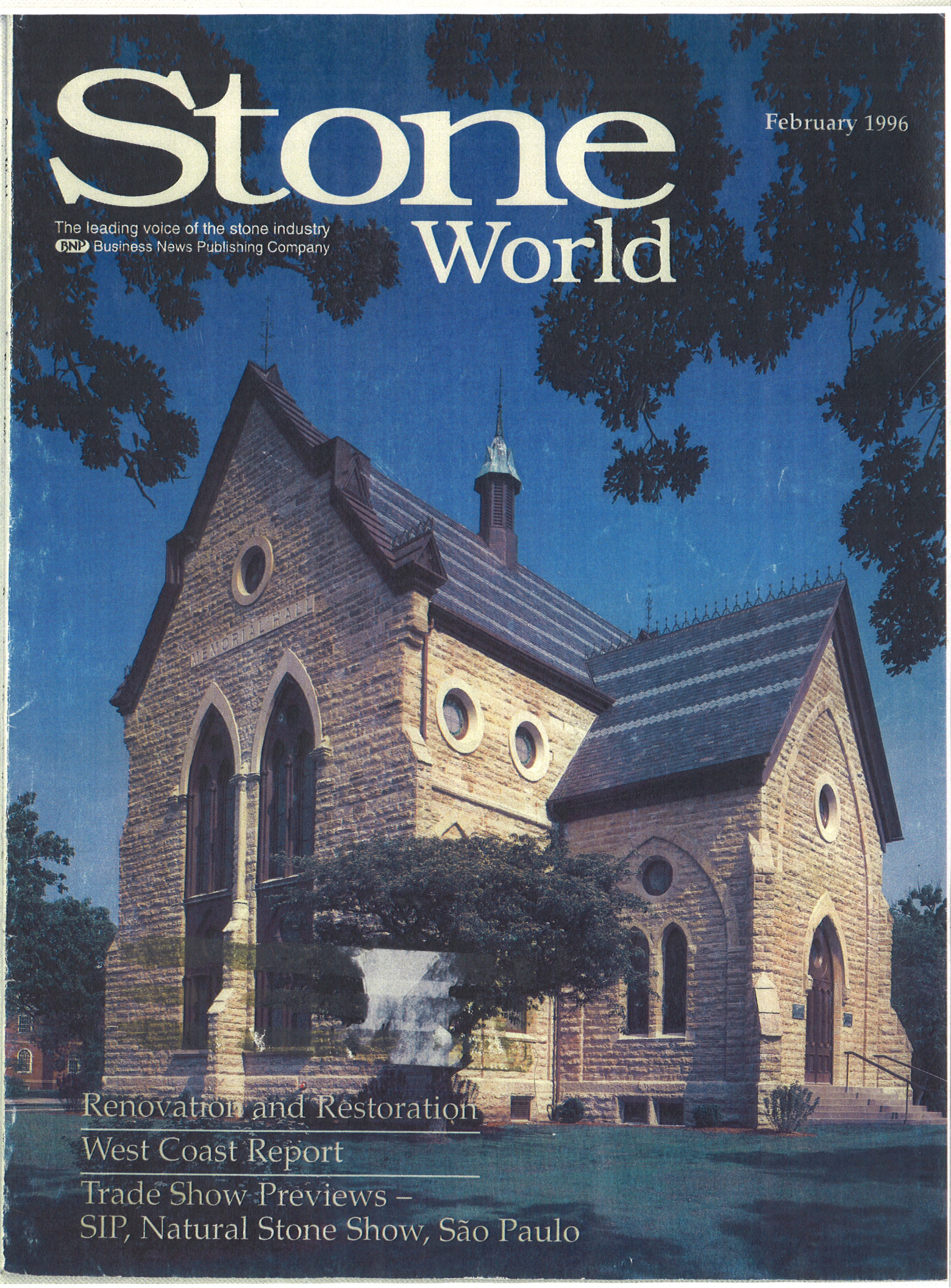


Renovation and Restoration

West Coast Report

Trade Show Previews –
SIP, Natural Stone Show, São Paulo

RESTORATION Renovation

Piece by piece restoration

The restoration of the Beloit College's Logan Museum required intense attention to detail, right down to the individual pieces of stone

by Michael Reis

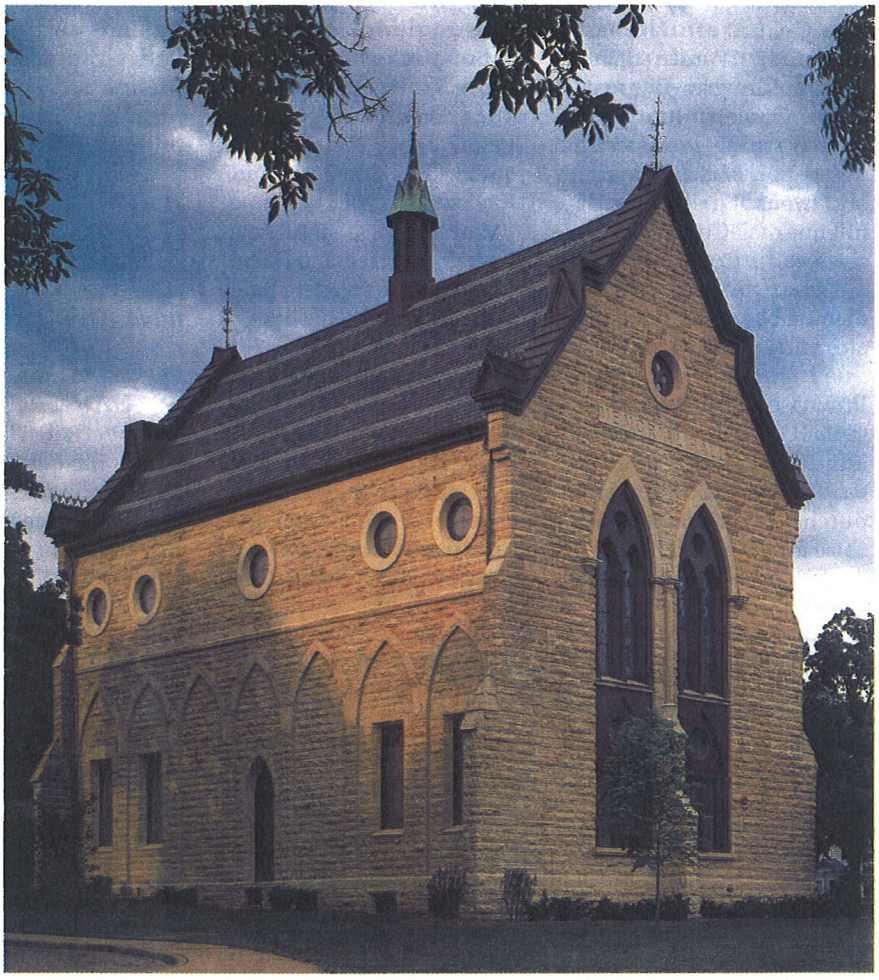


photo by Steve Hall-Hedrich Blessing

The limestone exterior at the Logan Museum was cleaned, and one wall was taken down and re-installed.

When Dagit-Saylor Architects began its restoration work on the Logan Museum at Beloit College in Wisconsin, they encountered a building that was "deteriorating on many fronts," recalled Principal-in-Charge Peter Saylor, FAIA. But an extensive restoration effort on the limestone-clad facility has re-captured the classic charm that was conceived over 125 years ago.

The Logan Museum is actually part of Memorial Hall, which was designed by the Chicago firm of Cochrane & Gornsey as a tribute to the Civil War dead of the community and college of Beloit. The building served as the college library from its opening in 1869 until 1906, when a new library was built and the structure was renamed the Logan Museum of Anthropology. Today it contains a collection of some 225,000 objects, including the most comprehensive French Paleolithic collection outside of France. Because of the building's importance to the college, the administration called for a $4 million restoration and adaptive use effort.

Cochrane & Gornsey designed the building with an exterior facade of limestone, with buttresses at the outer corners of the building. The limestone, which was quarried locally, was also used for the first floor window arches. In addition to the limestone facade and window arches, the facility also featured a steep gabled roof of Vermont slate. This material was arranged in horizontal bands of green, six-sided pieces alternating with rectangular brown variegated pieces.

"In general, the building was deteriorating on many fronts," Saylor explained. "Years of deferred maintenance presented a building

Logan Museum, Beloit College
Beloit, WI

Architect: Dagit-Saylor Architects, Philadelphia, PA
General Contractor: Klobucar Construction Co., Inc., Beloit, WI
Structural Evaluation: Wiss, Janney, Elstner Associates, Chicago, IL
Structural Engineer: Keast & Hood, Philadelphia, PA
Quarrier: Vetter Stone Co., Kasota, MN
Fabricator: Quarra Stone Co., Madison, WI
Installer: Ballou Masonry, Ballou, WI (limestone); S.H. Christiansen Inc. Rockford, IL (slate roofing)

Surveying the limestone at the Logan Museum

Prior to restoration of the Logan Museum, a report on the building's condition was prepared by Deborah Slaton, project architect, and Stephen J. Kelly, project structural engineer, of Wiss, Janney, Elstner Associates, Inc. of Chicago. The following excerpt is a description of the limestone before work began:

The exterior facades are constructed of limestone, with buttresses at the outer corners of the building. Each buttress is stepped, with sloped stone caps. A horizontal trim course extends along each elevation at the watertable and between the first and second floors. All of the first floor windows are surmounted by limestone arches, while the second story windows are surrounded by segmental round arches. On the north elevation, the center of the wall to two-thirds height is incorporated in the link to the new addition.

The stone, which appears to be a dolomitic limestone typically quarried in Wisconsin and Illinois, is buff to yellow-gold in color. Most of the units are set with the bedding planes horizontal and parallel to the ground, while some units in the arches are bedded vertically so that the bedding planes are parallel to the face of the wall. The stone surface is very eroded, especially where the bedding orientation makes it more vulnerable to water-related erosion. The stone on the sloped caps at the buttresses, which is bedded at an angle, is shearing off along the slope. Wherever stone units are bedded vertically, the surface is delaminating and spalling off. Where the stone units are bedded horizontally, the surface is typically eroded but not spalling off. Where the stone has spalled off, newly exposed areas are gray-white. After the stone has been exposed to the air and has oxidized, it turns buff to yellow-gold in color.

Erosion of the stonework is more severe at the base of downspouts and near the top of downspouts, where leakage has occurred from attached gutters. An example can be seen at the southwest corner of the east wing. The overflow from built-in gutters is causing water damage to the stonework at the top of the walls, especially along the main east wall. Water damage has also occurred to the stonework of the main east wall at the southwest corner of the east wing from a leak at the downspout at that location.

Erosion and open joints were also observed in many areas of the belt course between the first and second stories. Projecting units including the belt course, buttresses, and sill are all more vulnerable to water accumulation and erosion. The stone sills are in very poor condition. The second story window sills are severely eroded with much loss of section. At the first floor level, the sills are eroded, and the west sill on the south elevation is cracked through.

The south elevation features an ornamental round window below the peak of the stepped gable. Below the window, carved stone lettering reads "Memorial Hall." The stone units containing letters are deteriorated, and the face of some units has sheared off. Several stone letter units are seriously delaminated. An area of stone at the center of the wall below the round window is bleached or covered with efflorescence. On the west elevation, the stones below the door are eroded and have been patched in the past.

The joints are very narrow, and the mortar is very soft, fine, high in lime content, and similar to the stone in color and texture. The lower portion of the wall generally does not exhibit much repointing, while more significant repointing has been done at the upper portions of the walls on all elevations. Open joints and previous repointing were observed below the gable ends of the main roof and below the gable edge trim, on the north wall of the east wing. At the west end of the north elevation, at the base of the gable, there are also step cracks, open joints, and previous crack repairs. Repointing was typically done with a mortar that is grayer in color and harder than the original mortar. The newer pointing also does not match the tooling of the original joints in some locations.

In localized areas, spalling and delamination of individual stone units are severe. For example, the stone arch unit at the south side above the east entrance door has spalled off, and the stone arch unit at the north side appears ready to fall off. In the east wall of the building, just north of the east wing, the top unit in the round second-story window surround appears displaced because the adjacent units have fallen away. The joints in this area are open. The stone directly above the top of the round arch is eroded, and adjacent joints have been patched but have reopened. On the south elevation, at the east and west arches at the second story level, two stone units are almost broken away. The east capital adjacent to the west window is broken through at the corner. At the east side of the arch, the stone is split through.

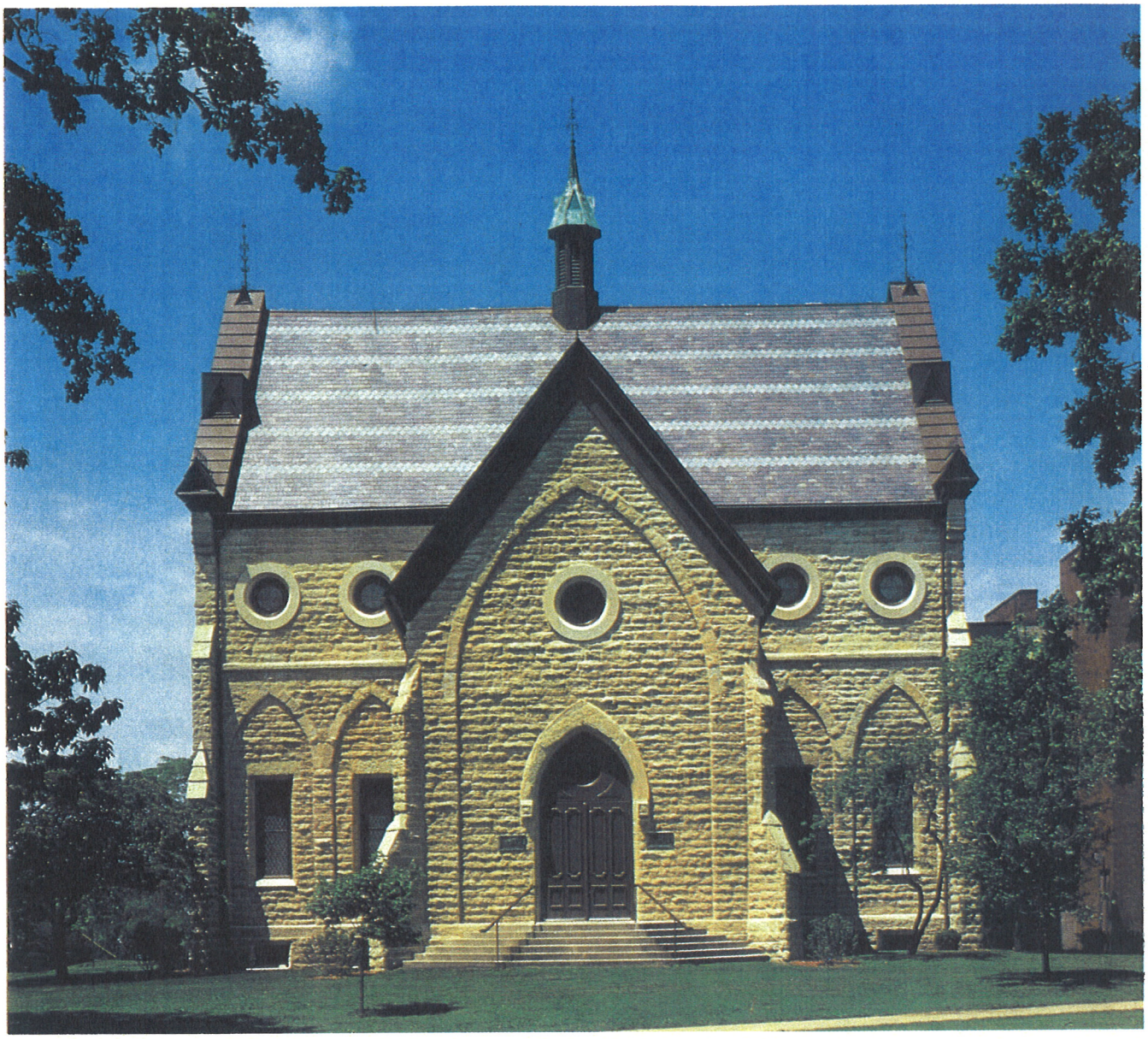
The most severe delamination and spalling was observed on the upper portion of the west elevation. The face of the second-story window surrounds are generally spalled off. At the fourth window from the north end, the north half of the window surround has been replaced with concrete, which is cracked through the face and along the inside edge. Various repointings have been performed at the upper fourth of wall and along the outer edge of each round window surround, indicating ongoing distress. The stone units between the first and second windows from the south end of the wall delaminated. The stonework is cracked below the second round window from the south end. At the northernmost round window in the west wall, the upper and south units in the window surround are badly cracked, and appear ready to spall off. At the two first floor windows at the north end of the west wall, the stone window heads are cracked. Severe fractures were observed in both the first and second-story windows at the north end of the wall. The cracks are parallel to the plane of the arch, and are open approximately 1 1/2 inches [38 mm].

Because the upper portion of the west wall appeared to be bowed, plumb bob measurements were taken over the height of the wall from the personnel lift. According to the plumb bob measurements, the wall is bowed out from 2 to 7 inches [51 to 178 mm] over the height of the wall; most of the bowing occurs in the upper portion of the wall, above the belt course at the second story level.

The wall is bulging outward significantly between the first and second windows from the north end. A screwdriver could be placed full-depth into the joint at this location, and the wall appeared to be hollow behind the stone units. The worst bowing has occurred around the first and second windows from the north, and around the second window from the south end of wall. The least bowing has occurred around the center window. All significant bowing has occurred between the top of the stone wall and the top of the belt course. Where the stone surround at the northernmost window is cracked, the distance the wall has moved outward can be seen. This crack is open approximately 2 inches [51 mm].

Investigation of the interior face of the west wall indicated that previous repairs have been implemented, apparently to address this outward bowing. While the rest of the exterior walls are constructed entirely of stone, a portion of the upper west wall has been rebuilt with brick on the interior face. The rebuilt area is located approximately along the middle third of the west wall at the second story level.

At the west side of the north elevation, at the second floor level, some old iron hooks remain in the wall. There are also remnants of old ivy growth. Various repointings have been done in this area of the wall. Localized ferrous staining was also observed on all elevations.



The slate roofing and round limestone window frames were replaced.

whose west wall bulged 18 inches [457 mm], the result of perennial freezing and thawing of water seeping through the stonework from poor roofing and clogged drains. The original timber and cast iron structural members were unable to support current loading requirements. Furthermore, evolutionary changes and deterioration through the years had eliminated or damaged many of the historic architectural details including the cut stone and patterned slate roof." (For a complete analysis of the limestone's deterioration, see "Surveying the limestone at the Logan Museum," page 30).

"Since the building sits in a historic district, we wanted to be as pure about the restoration as we could," Saylor said. "No original drawings existed, and to accomplish the restoration to Secretary of Interior Standards, historic photographs and extant original specifications were studied. The overall image is very much in keeping with the 19th Century photos we worked from."

Piece by piece

To repair the 18-inch (457 mm) bulge in the west wall, each stone in the problem area was removed, numbered and returned to its original location. According to William Ballou of Ballou Masonry, which completed the work, the stone itself showed very little deterioration. "We put very few pieces of new stone in," he said, estimating that only 5% of the west wall's veneer had to be replaced.

Although the original limestone was from Wisconsin, the replacement material was actually quarried in Minnesota by Vetter Stone Co. "We spent some time trying to match the color of stone," Saylor recalled. "We received several color samples, and [the Minnesota limestone] really blends very well."

To enhance the appearance of the existing limestone, each piece was lightly pressure washed with a 20-degree nozzle. This, according to Ballou, was enough to remove the residue from the entire building.

Before the stone was re-installed,

There was substantial displacement of the stone above the window head, as well as evidence of previous pointing. Leaks were observed just above this area.

workers poured a reinforced concrete beam the full length of the west wall, from which a block wall was built. The limestone was then attached as a veneer to the backup wall, which ran the full height of the building, Ballou explained. For additional support, the wooden internal structure was removed and replaced with steel to brace the wall.

While much of the veneer was saved, all of the round limestone window frames were replaced with stone conforming to original profiles from nearby original quarries, and the entire exterior was repointed. "The most difficult part of the installation was fitting the round window trims, which weighed 3,000 pounds [1,360 kg] each," Ballou said. The circular trims were made from four separate pieces which were assembled on the ground, lifted into place and anchored with stainless steel dowels.

"One of the debates was when to stop replacing stone," Saylor said.

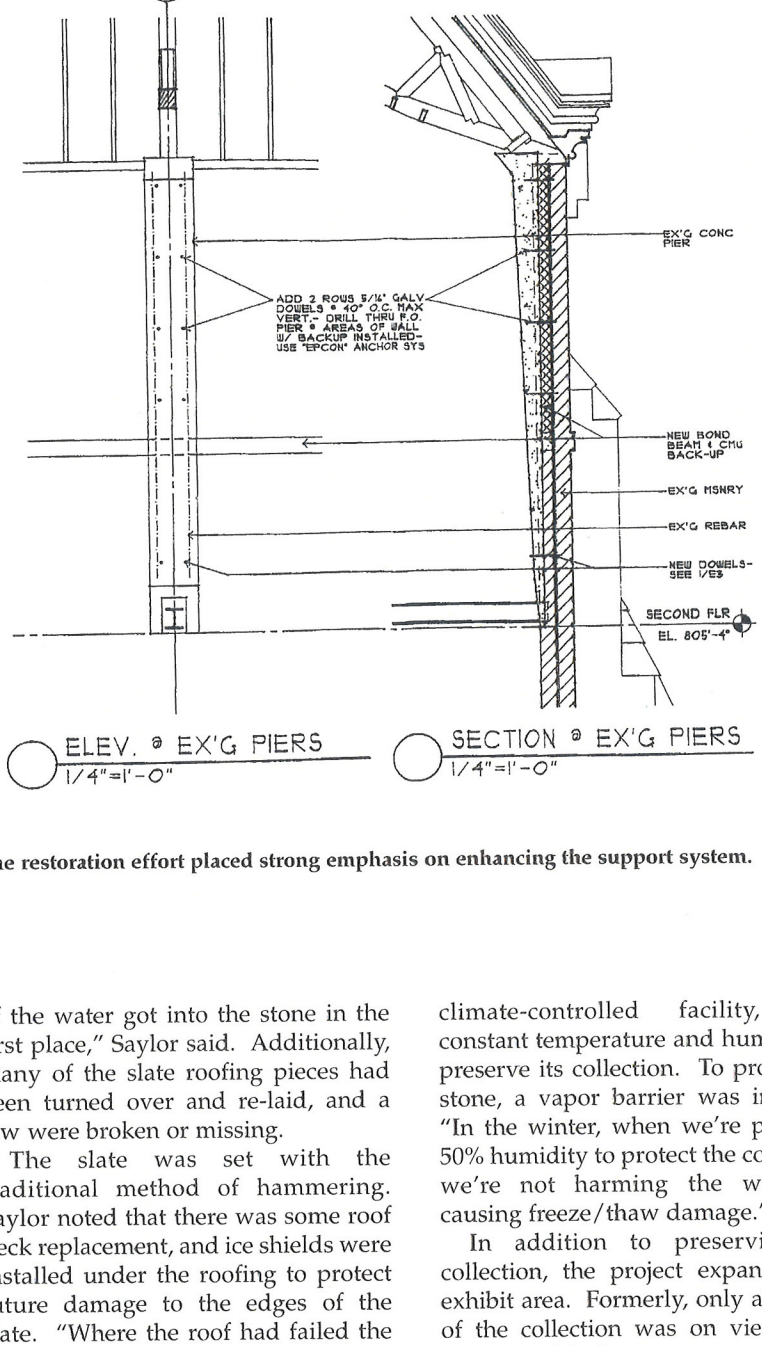
Before the stone at the west wall was re-installed, workers poured a reinforced concrete beam the full length of the west wall, from which block backup wall was built.

Areas of the slate roof had little or no flashing, and had been repaired a number of times in the past. Many of the slate roofing pieces had been turned over and re-laid, and a few were broken or missing.

"We made an executive decision that all the cut stone circles would be new, and we replaced almost all of the sill pieces. Even though some areas are weathered, we were able to sharpen the key architectural features."

Another area of need was the mortar, which Saylor said was in "terrible shape." "It had been patched several times, so there were different colors." The existing mortar was raked out and repointed, and it now has a uniform color and texture that has "dressed the building back up again," he said.

The slate roof also had to be replaced. "The internal guttering system had failed, which is why a lot



The restoration effort placed strong emphasis on enhancing the support system.

of the water got into the stone in the first place," Saylor said. Additionally, many of the slate roofing pieces had been turned over and re-laid, and a few were broken or missing.

The slate was set with the traditional method of hammering. Saylor noted that there was some roof deck replacement, and ice shields were installed under the roofing to protect future damage to the edges of the slate. "Where the roof had failed the most was at the gutters, so we had large gutters built at the bottoms of the roof slopes," he said. "Dealing with the roof was the first step in assuring the other problems wouldn't get worse."

Looking back on the project, Saylor commented: "There were a couple of major challenges. The idea of removing and rebuilding the structure was a critical challenge. It had everybody on pins and needles, and none of us wanted to see a pile of rubble in the process. The other challenge was the integration of state-of-the-art technology in the building."

Today, the Logan Museum is a fully climate-controlled facility, with constant temperature and humidity to preserve its collection. To protect the stone, a vapor barrier was installed. "In the winter, when we're pumping 50% humidity to protect the collection, we're not harming the wall and causing freeze/thaw damage."

In addition to preserving the collection, the project expanded the exhibit area. Formerly, only about 2% of the collection was on view. Now 75% is visible from a two-story "glass box" on the first floor or a series of cases and drawer units on the second floor.

Construction, which began in 1994, was completed in March of 1995. Throughout, Dagit-Saylor was in contact with the local historical commission. "They were very interested in it, and they were delighted with the level of detail we intended to apply." Since its renovation was completed, the building has received awards from the local historical society, the Wisconsin Trust and the Philadelphia Chapter of the AIA . ❑