

The Academy of Music and its Ballroom Restoration

Lessons from the Past
By Constantine G. Doukakis, P.E.
and Amanda Gibney Weko



Courtesy of Tom Crane Photography.



Construction underway at the Academy of Music.

Philadelphia's National Historic Landmark Academy of Music opened its doors in 1857. As the nation's oldest grand opera house that is still used for its original function, the cultural center is home to opera, music, ballet, and community events. Its brick façade graces Broad Street's "Avenue of the Arts" just two blocks from City Hall.

The multi-phase, multi-million dollar Academy of Music for this 21st Century project involved significant structural repairs and re-strengthening, theatrical modernizations and upgrades to ensure the building's continued viability, and architectural restoration and historic preservation appropriate for a structure that sits at the cultural center of Philadelphia and on the National Register of Historic Places.

Few aspects of the project better characterize the complexity of structural engineering, intricacy of architectural design, attention to detail, and sensitive stewardship of the Academy of Music than the restoration of its grand Ballroom.

Guided by discovery of an 1860 photograph, the project returned the ballroom to its original design, including window restoration, an historically-accurate decorative paint scheme, reintroduction of gas light fixtures and chandeliers, and remediation of years of water damage.

The renovation involved extensive structural engineering, completed to seamlessly integrate with and support the historic building fabric. As structural engineer of record, Keast & Hood Co. designed repairs and supplemental framing. New steel beams were threaded through the roof to support original timber roof trusses. Additional steel framing was engineered to support new chandeliers.

A Look Back

Design for the Academy of Music was solicited by competition in October 1854. The winning firm of Napoleon Le Brun and Gustavus Runge competed against such notable architects as Edwin Durang and John Notman. Built from 1855-1857, the building's brick exterior was left simple as a markethouse with the expectation that it would later be faced with marble. Attention was paid to ornamentation, acoustics, and optics on the building's opulent interior.

Over its history, the Academy of Music has been home to the Philadelphia Orchestra and has hosted presidents and an impressive list of musicians and performers. It was added to the Philadelphia Register of Historic Places in 1957 and the National Register in 1966. By the late 20th century, the building was showing its age, and the orchestra was moving to the nearby, newly-constructed Kimmel Center for the Performing Arts.



New steel was inserted in the attic to support the historic timber roof trusses.

In 1987, during inspection for a new elevator, Keast & Hood Co. discovered a failed timber roof truss. The deterioration was so severe that an afternoon concert was evacuated. An intensive 17-day emergency stabilization effort ensued, including removing seating, constructing shoring towers to support the damaged structure, and repairing fractured trusses with structural steel reinforcements.

Project for the 21st Century

The Academy of Music for the 21st Century campaign commenced in 1994. The ambitious capital program sought to retain the academy's architectural and functional viability through patron, performer, and operational improvements.

From 1994 through 2002, Keast & Hood Co. principal and structural engineer Constantine (Dean) Doukakis, oversaw the structural design for the significant back-of-house modifications to accommodate modern set loading and increased performance potential. An orchestra pit was created, the stagehouse was underpinned, new mini-pile foundations were installed, and the basement elevation was lowered. The existing stage sloped 30 inches from front to back – beneficial for visibility of operas, but a challenge for ballet dancers. The stage was rebuilt level with a sprung floor and stage traps. A new orchestra pit was constructed with a lift that creates a prow stage when raised, bringing sound out past the proscenium. New supplemental steel trusses were incorporated in the roof above the auditorium to bolster existing timber trusses.

The stage house gable roof, including the timber truss system, was demolished and reconfigured in structural steel with dormers to permit modern theatrical lighting and rigging. The new grid is suspended from W40 steel beams that span from the historic rear wall to a new bolted steel truss adjacent to the proscenium. The entire roof, loading gallery, grid, and fly gallery system are supported on a new steel braced column system around the three sides of the stagehouse. The historic sandbag counterweight system was replaced with a modern tee-bar and weight system capable of supporting thousands of pounds of sets.

“Changing the profile of the stagehouse roof flew in the face of historic preservation,” explained Doukakis. “But the argument was that this effort would preserve the longevity of the building and its continued success as a performance venue.” He likened the process to surgery, without which the patient might not survive.

Just over \$40 million was spent between 1993 and 2002. While the Ballroom restoration was initially planned for this timeframe, fundraising budgets pushed it to 2007 when Keast & Hood Co. and



Detail of the framing and roller supports to guide W24 girders into their bearing pockets.

architect KlingStubbins teamed with a cadre of construction specialists for the jewel-box restoration of the room.

The Ballroom's main façade – its Broad Street fenestration – was sealed in the early 1900s. The room's original doors were removed and its walls covered with an array of beveled mirrors. The room remained untouched from this point, less minor lighting modifications. The room's floor loading capacity was initially verified to ensure it could be fully scaffolded for interior painting. Steel inserted in the 1920s was discovered in the floor structure, rendering additional upgrades unnecessary. This finding paved the way for work to begin.

The structural scope for the Ballroom restoration took place primarily in the attic, where sections of large steel beams (W24 x 84s) were first temporarily suspended from, and then moment-spliced together adjacent to, existing timber roof trusses. This methodology avoided the need for shoring towers or penetration through the historic plaster ceiling. The steel beams were pocketed into the interior wall and set upon an existing ledge in the brick front wall, where a new high-strength concrete bearing pad was installed to spread the load. New channels span between the W24 steel beams, just above the bottom chords of the timber trusses. A saddle assembly picks up the historic trusses, relegating the old system to the role of load collector, while the new steel supports the roof. Also, a sideways restraint detail was designed to keep the beams from moving north-south.

In order to access the framing, temporary roof hatches were cut consistent with 1996 structural modifications performed in the auditorium. Upon project completion, the roof was re-sheathed with lead-coated copper.

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Rooftop view of steel being inserted into the Academy of Music attic.



Courtesy of Tom Crane Photography.

Historic Restoration

KlingStubbins restored the Ballroom's architectural detail. Architects salvaged what original fabric remained, removed all non-original alterations, and designed historically accurate reproductions of replacement components. Project director and design team lead, John Trosino, described the process as iterative and evolutionary, requiring exhaustive research into the room's original design and on-site exploration of remaining details hidden within the walls. The project took on both architectural and archeological qualities, as the team studied the building and archival records of the Ballroom's 1857 appearance.

The design team worked with REVIT to model the 40-by-80-foot room. When a two-by-three-inch 1860 photograph was discovered in the archives, the image was enhanced and turned into an electronic file that could overlay the REVIT model. According to Trosino, the magnification bordered on "spy technique" with the final image enlarged

Philadelphia's Academy of Music Ballroom Restoration displays complex structural engineering, intricate detailing, and sensitive stewardship of a historic building.

to show crystals on the chandeliers and intricacies in the paint. From the vantage point of the photo, the room's real-life dimensions were modeled in the computer, allowing screen shots to replicate modern views, and helping designers accurately size new components to their historic predecessors.

"It was an interesting luxury to bridge today's technology with hand-crafted elements of the past," said Trosino. "It brought a romantic, magic quality to the discovery process."

Matching intricacies of handcrafted millwork, doors, and windows was a challenge. Although original examples of trimwork existed, modern computer drafting could not replicate the curvilinear details. Craftspeople re-created replicas by hand, while safeguarding the historic pieces that did remain.

Replication and installation of 12 chandeliers plus wall sconces required additional support framing. Keast & Hood Co. designed a detail mirrored on each end of the room in which joists were sistered where a portion of the exterior rafter had been removed for the steel beam installation. Framing was added above the ceiling joists to support the chandeliers and within the masonry to support sconces. Sconces that cantilevered from a single point were ensured that they would not sag.

The Ballroom restoration has been called "a once-in-a-lifetime opportunity" by design team members L.F. Driscoll Company, LLC (general contractor); PHY Engineers, Inc.; Horton Lees Brogden Lighting

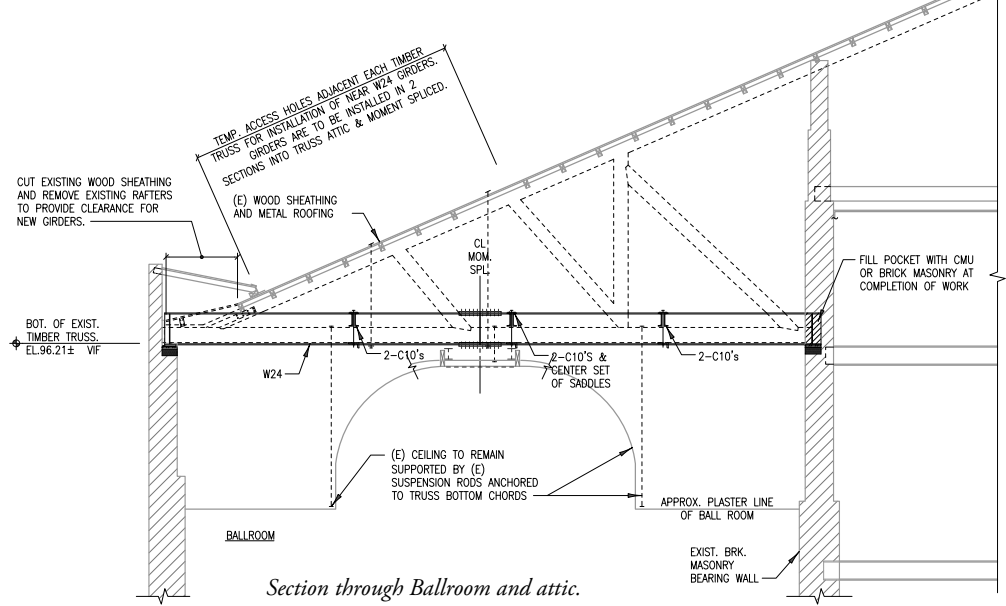


Attic view showing construction crew guiding new steel into place.

Design; John Canning Painting & Conservation Studios; Arnold Wood Conservation, LLC; Artistic Doors and Windows, Inc.; Ball and Ball; Brintsons; Femenella and Associates; Mathieu Lustrerie; The Art of Glass, Inc.; and Tom Crane Photography. A stunning conclusion to the project is how a present day photo can be overlaid atop the enlarged 1860 photo and the details match almost precisely.

Recognition

The Academy of Music Ballroom Restoration has been recognized with local, state, and national awards, including the American Institute of Architects' national Institute Honor Award for Interior Architecture, Pennsylvania Society of the American Institute of Architects Architectural Excellence Citation of Merit, Preservation Alliance for Greater Philadelphia Grand Jury Award for Interior Restoration, Preservation Pennsylvania Award for restoration of an historic interior, and American Institute of Architects Philadelphia Chapter Honor Award for Historic Preservation. Jurors have called the project "a thoughtful, meticulous restoration in which technical improvements are ingeniously concealed" and a "beautiful execution of historic preservation." ■



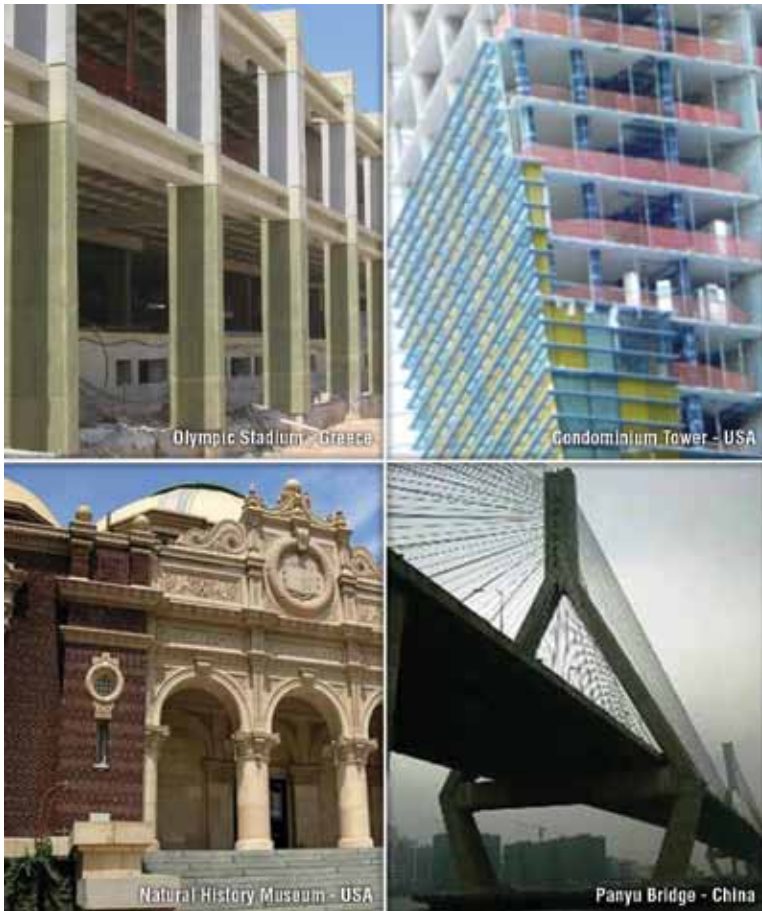
Section through Ballroom and attic.

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