

The Quigg Newton Auditorium & Ellie Caulkins Opera House

By C. Ben Nelson, P.E.

The Quigg Newton Auditorium & Ellie Caulkins Opera House project involved the complete renovation of the historic civic auditorium theatre building in the Denver Performing Arts Complex. The 1908 building's interior was demolished, preserving only the historic masonry and riveted steel frame shell. The two year renovation marked the third such major project in the building's ninety-seven year history. The reconstructed theater is home to local opera and ballet, and features 2100-seats, orchestra pit, double-warped seating bowl, three sloping and warped balcony levels, stage lifts, theatrical rigging support, seating wagon storage, as well as several back-of-house performance and rehearsal spaces. A significant piece of Denver's history was preserved while creating a state-of-the art theatre for opera/ballet lovers to enjoy for years to come.

Creativity / Complexity

Demolition of the building interior and the bracing of the historic masonry shell involved several engineering challenges. The thirty-inch thick historic brick and limestone walls had no internal reinforcing.

The Engineer of Record and general and demolition contractors coordinated to create



Opening Day, 1908, Democratic National Convention.
Courtesy of Denver Public Library Archives.

a bracing system to allow dismantling of the interior, bracing of the exterior and reconstruction of the new interior. The bracing scheme was updated on a weekly basis based upon what original structure was being removed and what new structure was being installed. Most of the bracing scheme required multiple bracing points as the braces were relocated to erect new materials. Adding to the complexity was coordination of the bracing with foundation excavation and underpinning work, materials delivery and the interior concrete "drum wall" construction.

One of the seven massive original roof trusses interfered with the new position of the much taller fly tower. Following approval

from the Historic Landmark Commission, the design of the new fly tower created another significant design and construction challenge. The truss required shoring, its central portion cut and removed and its remaining ends modified to bear on the stage's concrete walls. New infill framing had to be added surrounding the new fly tower.

Innovation / Ingenuity

Each of the original seven built-up steel roof trusses are supported by a pair of built-up steel columns at each end. Several of the 1908 lattice columns and surrounding bracing were incorporated as an aesthetic feature of the lobby space. Ninety-seven years of paint and refinishing were carefully removed and the in-place steel columns were re-finished and finely painted. Missing rivets within the latticework were replaced with salvaged rivets from other locations on site. The resulting exposed structural steel columns yield a glimpse of the structural history of the building, and have been featured in virtually every critic's review of the opera house.

Structural steel is the primary material used in practically every corner of the building. During demolition, steel tubes and cable were used extensively to brace the thirty-inch thick, seventy-five feet tall historic masonry walls. Tapered steel sections are used in the multi-tiered balconies to offer opera lovers' unobstructed sight lines while allowing the seating bowl to be both warped and curved, pushing the seats ever closer to the action on the stage.

A concrete wall curves around the perimeter of the House forming the "drum wall" and provides the needed acoustical separation from the lobby as well as structural support of the balconies, ceiling, catwalks and extensive rigging program requirements.

Teamwork

The City and County of Denver expected the renovation project to attract more business to the City by creating a unique, world-class opera house. Structural design played an integral part in accomplishing the City's goals under a tight budget and aggressive schedule. The team met the challenges unique to this

Project Team

Structural Engineer of Record

Martin/Martin, Inc.

Owner

City & County of Denver

Architect

Semple Brown Design

Acosta Architects

Acoustics Consultant

Robert F. Mahoney and Associates

MEP Engineer

M-E Engineers, Inc.

Civil Engineer

The Lund Partnership

Geotechnical Engineer

Kumar & Associates

General Contractor Joint Venture

PCL Construction Services, Inc.



Concurrent Demolition, Foundation Underpinning, Structural Bracing And New Construction. Courtesy of Martin/Martin.



State-Of-The-Art And Acoustically Superb Opera House. Courtesy of Ron Pollard, Photographer.

project by applying their technical knowledge and commitment to excellence. The theatre was built completely within the massive volume of the original Auditorium Theater, constructed in 1908 and opened to great national fanfare by hosting the 1908 Democratic Convention. Now, 100 years later, “Ellie” is taking the Denver Cultural scene to the next level.

Supreme acoustics, unobstructed sight lines and modern theatrical rigging capabilities were the factors driving design decisions. Constructing the new theater within the restricted confines of an existing ninety-seven year old shell created the need to orchestrate nearly every move during demolition and re-construction. The construction process was often referred to as “building a ship in a bottle”, but those close to the project joke it was more like “trying to stuff a salmon in a sardine can.”

Buildings like the Ellie Caulkins Opera House get built because of the determination of the key participants involved. ■



Existing Built-Up Columns To AESS Standards Restored. Courtesy of Ron Pollard, Photographer.

C. Ben Nelson, P.E. was the Principal-in-Charge and Engineer-of-Record for the “Ellie” and has 24 years experience with Martin/Martin. He is the Colorado delegate to NCSEA and currently serves on the NCSEA Board of Directors. Mr. Nelson may be reached via email at BNELSON@martinmartin.com.

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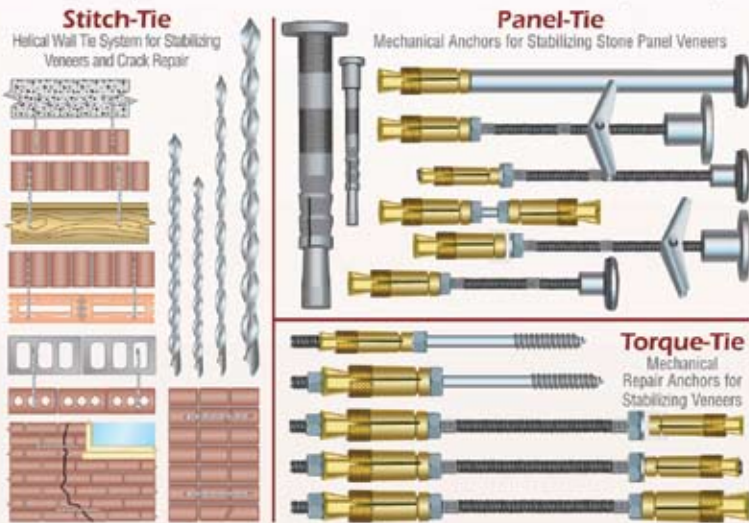
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