

Fox Oakland Theater Renovation & Seismic Retrofit

By Hratch Kouyoumdjian, S.E., LEED AP

The KPA Group was an Award Winner for the Fox Oakland Theater Seismic Retrofit project in the 2010 NCSEA Annual Excellence in Structural Engineering awards program (Category – Forensic Renovation/Retrofit/Rehabilitation Structures)

The successful completion of an \$87 Million Seismic Retrofit and Renovation of the Historic Fox Oakland Theater revitalized the “Uptown” district of Oakland, where it attracts large audiences for every event.

The 3,400 seat theater opened in 1928, but was closed in 1966 and remained boarded up until 2009 when it reopened after an extensive seismic retrofit and complete restoration to its original splendor as a Performing Arts Theater and home to The Oakland School for the Arts.

As originally constructed, gold paint and other multicolored accents were lavishly applied on many parts of the theater giving the entire facility an opulent glow, enhanced by rich carpeting, drapes, light fixtures and decorative elements in what is often described as a “Moorish” or “Mystical” character. All theater walls were extensively ornamented with painted plaster decorative elements. Ceilings incorporated large decorative plaster elements integrated into an intricate pattern. Massive urns, statues, balcony rails, ramparts, and other intricate decorative elements were created from plaster and then positioned at various levels of the theater as part of the original ornamentations.

Ornaments were typically attached by an organic webbing of coconut husks and plaster wrappings. Interior walls were constructed from plaster supported off of rods or suspended from structural elements.

As an important historic theater, all painted surface, plaster details and ornamentations were deemed historic, and were to be preserved and restored as part of the seismic retrofit and renovation.

The Fox was constructed as a main theater building surrounded partially with two wrap-around wings that support a massive entrance dome. The theater was framed with a steel skeleton of riveted girders, trusses and columns that supported multiple levels. The theater floor slab was supported on subterranean walls forming heating tunnels and utility spaces. The balcony was framed with two-way cantilevered trusses.

The wrap-around buildings are steel framed structures with wood floors and brick exterior walls. A large concrete entrance dome projects above the roof and is supported on two

intersecting steel trusses, resting on four marginally braced columns that originally formed a tall open entrance that was in-filled during the 1950s.

Roof construction was of steel trusses supporting a thin cast-in-place concrete slab over the theater and wood trusses over the wrap-around buildings.

Typically, all columns and walls were supported on individual concrete spread footings bearing on a well compacted sand layer. Concrete was extensively employed as floor slabs, seating levels, walls and fire proofing for the theater. Wood framing and plaster were extensively used in the wrap-around buildings.

The Fox is located between two known major earthquake fault lines, the San Andreas and Hayward Faults. Major structural elements would be significantly overstressed and/or unstable if subjected to strong earthquakes that periodically strike the San Francisco Bay Area. Ensuring a reasonable level of seismic performance in different parts of the Fox, while preserving the historic elements, called for a number of unique solutions tailored for the particular areas.

Due to the unique characteristics of the original construction, and the wide variety of materials and details, several different retrofitting elements were developed and introduced to brace the different building parts. New elements were carefully placed such that the grandeur of the theater and its historic status was not adversely impacted.

Significant retrofitting elements included:

- New buttresses hidden in the adjacent wrap-around building on each side of the roof to stabilize the roof, and also connected to the balcony to resist seismic forces and reduce demands on diaphragms.
- A new steel frame behind the proscenium wall braced back diagonally to the main building corner columns.
- New shotcrete walls behind proscenium side walls, theater back wall, balcony side walls and other locations to enhance wall capacities.
- Two new U-shaped concrete walls constructed immediately to the north and south of the entrance structure and



doweled into the existing walls to brace the trusses supporting the Dome to resist earthquake forces.

- New concrete slabs to enhance diaphragm capacities at selected locations.
- Changes of the theater floor from fixed seating to multiple open platforms called for a series of elevated platforms over historic designated floors, and also resulted in a doubling of the floor live loads. A series of light gage steel supported platforms were devised to transfer loads off of existing floor slabs and on to tunnel side walls.
- New steel diagonal trusses below the roof and floor levels of the wrap-around buildings.
- New interior shear walls in the wrap-around building.
- New structural tubes epoxy bolted into the back of the walls and connected to new floor diaphragms.
- New steel channels added to reinforce brick pilasters and interconnected to new diaphragms.
- New shear walls anchored against overturning by micro piles.
- New floor diaphragms in wrap-around buildings.

Since opening, the Fox has become a prominent large music venue, attracting near sell-out crowds and transforming the newly invigorated “Uptown District”. ■

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