

MBJ CASE STUDY: CHILDREN'S THEATRE



Location: Minneapolis, MN
Square Feet: 45,000
Construction Cost: \$24 million
Design Architect: Michael Graves
Architect of Record: RSP Architects
Contractor: JE Dunn

CHALLENGES

The Children's Theatre Company wished to add a second stage, classrooms, a dance studio, rehearsal hall, multi-purpose performance room, and other miscellaneous spaces to its existing facility. Several challenges met the design team as planning began for the 45,000 square foot expansion: a horizontally and vertically restricted site, the management of sound and vibrations within the new and existing spaces, the need for large column-free spaces, and the potential for differential settlement of site soils.

SOLUTIONS

Site

Because the site is located in a dense urban neighborhood and directly flanked by the Minneapolis Institute of Arts to the north, there was little room for lateral expansion, so one of the solutions had to include efficient use of the vertical space within the new site plan. Structurally, this meant adding a below grade level, which houses the new McGuire Education Center classrooms. To achieve the programming requirements of this space, a unique system of concrete struts and post-tensioned concrete ties was used, whose function was to shunt loads away from the existing adjacent foundation wall and ensure overall stability of the structure. The system also helped meet the challenge of providing column-free spaces in the above theater, rehearsal, hall, and dance studio.

Stage Addition

Ordinarily, theaters are constructed using slab-on-grade to limit externally produced noise and vibration. Because the confined Children's Theatre site required vertically stacking different functions within the

facility, the flexible, 300-person capacity theater addition was located directly below the new dance studio and above the McGuire classrooms, making the option to use slab-on-grade impossible. Instead, the designers used a "box within a box" approach, surrounding the theater (the inner box) with a 3-inch buffer of air (the outer box) that protects it from exterior noise. The theater floor is composed of a 4-inch concrete slab supported on high capacity neoprene bearing pads. The pads elevate the floor slab 3 inches above the wide-module pan-and-joist concrete first floor system. The theater's perimeter is composed of upturned concrete curbs that support 45 foot tall load-bearing concrete masonry-unit walls. The result is a space in which actors' voices and production sounds are undisturbed by outside noise. Another unique structural feature of the theater is the use of two structural steel Vierendeel trusses at the theater's roof. The trusses support a system of structural steel purlins, trolley beams, and pipe hangers, from which a lower catwalk and removable grid system of rigging and lighting spanning the entire width of the theater are suspended.

Soil

To address soil issues and potential construction noises that would disturb the existing theater facility, MBJ used auger cast piles, which extend to bedrock, thereby increasing the allowable soil bearing capacity in comparison to the existing building. Columns, piling, and unusually sized pile caps were meticulously designed and located between existing footings of the building and coordinated with the programming spaces of the four floors above. One of the results is a building with very few columns given the square footage of the typical floor. Piling also helped limit the potential for differential vertical settlement between the existing building and the new addition. The auger-cast piles, while slightly higher in costs, allowed the existing theatre to remain open and continue to generate revenue as well as provide the owner lower maintenance costs typically associated with problems involving differential settlement.