

Auditoria

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Max Wagner, executive director of the Gasteig in Munich, Germany

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Second life

The acoustic upgrade of the Joan Sutherland Theatre at the Sydney Opera House called for measures that have never been tried before



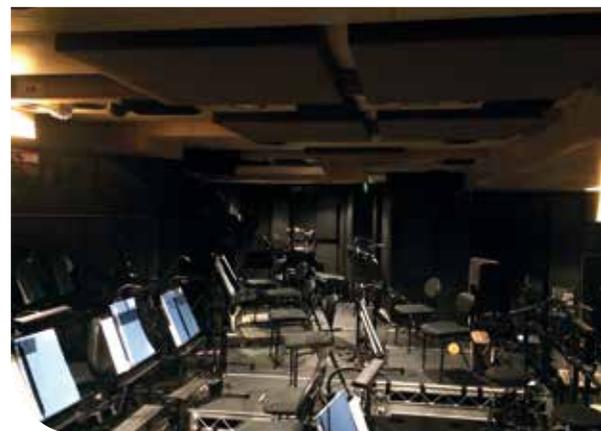
Australia's Sydney Opera House is one of the busiest cultural hubs in the world with probably the best-known external appearance – spectacular architecture designed by the Danish architect Jørn Utzon. More than 10 million visit the site annually, including more than 2.1 million performance and tour patrons.

However, the original design and construction of the building has left it with some challenges. “Beginning a project with an unrealistically low budget, starting construction before detailing important parts of the design and changing the fundamental requirements in the middle of a project will sound familiar to most readers,” comments Gunter Engel, project manager at Müller-BBM. “The good news is that all these issues do not necessarily stop a project from being a tremendous success. The bad news is that sometimes it takes decades until early mistakes are remedied.”

Cave-like pit

The Joan Sutherland Theatre is the opera venue at the Sydney Opera House, and the venue most impacted by changes made during the construction. As a result, the Sydney Opera House got a beautiful audience space with about 1,500 seats, but 70% of the orchestra pit is covered by the stage.

“For the audience, and even more for the orchestra, this impacted the acoustics,” says Engel. “The projection of sound from the pit to the audience was uneven, especially for instruments located deep in the covered part of the pit, and orchestra members had to play in an unusual formation with the woodwind section



cramped in the right side of the open part of the pit and the strings in the left part.”

After 40 years of nearly uninterrupted operation, the theater's stage machinery had to be replaced for safety and reliability upgrades. The closure of the theater from May to December 2017 offered a unique opportunity to improve the acoustics and so in 2015, Müller-BBM was appointed to deliver this.

Research mission

To gain an in-depth understanding of the situation, extensive acoustical measurements were performed together with multichannel recordings by means of dummy heads distributed all over the auditorium and in the orchestra pit. These recordings, in combination with attending numerous rehearsals and performances, provided valuable information about the existing situation.

The usual approach – extending the orchestra pit toward the audience – was not viable in the Joan Sutherland Theatre. Tie beams holding the



Main and top: The key challenge was that 70% of the pit is under the stage

Right: The pit now has a fixed diffuse, partly absorbent cladding and mobile absorber elements



ACOUSTICS

famous shells in place are located at the wall between the pit and the audience. Investigations on these tie beams revealed that relocating them would require a much longer downtime. Consequently, an extraordinary and innovative approach needed to be developed.

Acoustic enhancement

To improve the acoustics in the auditorium, an acoustic enhancement system was suggested. This would improve the acoustics for the audience and orchestra without having to change the footprint of the orchestra pit.

One task for the acoustic enhancement system is supporting the instruments located in the covered part of the orchestra pit with additional reflections. “These reflections simulate typical proscenium reflections; therefore, the projection of the instruments at various positions in the pit into the audience is much more balanced,” explains Engel.

Above: The acoustic enhancement system enables acoustic improvements without impacting the hall’s seat capacity, which is approximately 1,500

The Sydney Opera House opened in 1973



SYDNEY OPERA HOUSE RENEWAL

The renewal of the Sydney Opera House is a massive, multistage project with a total projected cost of A\$273m (US\$192m), the majority funded by the NSW Government.

The first stage included upgrades to the Joan Sutherland Theatre focusing on the acoustics, accessibility and safety, including replacing technical systems and equipment. This was completed in December 2017.

Similar work will be completed in the venue’s Concert Hall. The acoustics, stage and backstage areas, theater systems and accessibility will be addressed.

The project also includes upgrades to the building’s entry and foyer areas, plus the creation of two completely new spaces – a Creative Learning Centre for young people, and a new function center.



“Because the added reflections are designed in such a way that they do not affect the perceived location of the instruments, the resulting orchestra sound is as clear and transparent as if it was an entirely uncovered pit.”

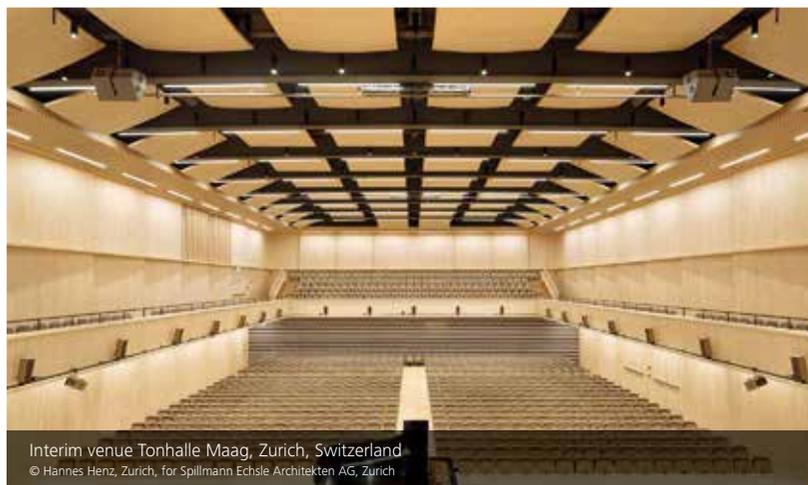
Flexible absorption

The second part of the solution was fundamentally new. Orchestral arrangements where the orchestra was able to play in a standard formation – with the string sections surrounding the conductor and the woodwinds positioned in the center of the orchestra – showed a much better acoustic impression. To make this orchestra arrangement possible for opera or ballet performances with a larger orchestration, the pit needed flexible absorption. In addition to a fixed diffuse and partly absorbent new cladding in the pit, mobile absorber elements were designed in collaboration with Scott Carver Architects to support an array of orchestral arrangements and increase the absorption in the pit where necessary. This helped to reduce the sound levels in the pit.

“To provide a more supportive acoustical situation for the musicians, a quite exceptional extension of the acoustic enhancement system was used, creating a sound field that is naturally impossible to achieve with the given pit volume,” says Engel. “This setup used very weak early reflections together with the reverberation tail of a large rehearsal hall. With this configuration, the musicians experience the room acoustics helpfully, supporting them without any adverse increase in loudness that a natural sound field would inevitably cause.”

Before starting the construction work, this solution was tested with a temporary installation on-site in two performance blocks with Opera Australia and the Australian Ballet. The results were then revealed at the reopening of the Joan Sutherland Theatre on New Year’s Eve 2017. “It was a memorable experience when the acoustical results exceeded all expectations, proving that innovative solutions can truly sound like a miracle,” says Engel. ■

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