Understanding Stage Sound Reflection Panels - Part 3

By Nobuhiko Hattori

In our November, 2009 newsletter, I wrote about the different standard storage methods for sound reflection panels in multipurpose halls. Also, I presented the benefits, limitations and examples of the two most common storage locations: storage above the stage and storage in space at the stage rear. In this article, I will discuss other, more unusual storage location options, with examples of each one.

Storing Stage Sound Reflection Panels below the Stage

Storing stage sound reflection panels below the stage involves designing a unitary system that is housed in space below the stage and raised onto the stage or lowered into storage as needed. This method has the key benefit of leaving the entire space above the stage for suspended lighting, other stage equipment and rigging. From the acoustical perspective as well, this method offers significant benefits. The shapes of the reflection panels and any desired three-dimensional elements of the reflection panels' design can be implemented with few constraints, and the reflection panel system can be built as a unitary structure, which minimizes gaps between sections of the system.

The main impediment to implementing a below-stage design for storing sound reflection panels is the substantial amount of space this method requires below the stage. The space requirements would significantly affect a project's architectural plans. Therefore, it is not unusual for this method (as well as the implementation of stage risers) to be eliminated from consideration because of space constraints below the stage.

Examples of Halls with Stage Sound Reflection Panels below the Stage

Tokyo Bunka Kaikan, which functions first and foremost as a classical music concert hall, also serves as the venue for opera and ballet performances. The hall opened in 1961 and, at the time, had a design that stored the rear portion of the stage sound reflection panels behind the stage and stored the side portions and overhead portion of the sound reflection panels as suspended units above the stage. Storing even a portion of the sound reflection panels above the stage obstructed desired arrangements for stage rigging, resulting in limitations on the lighting and baton arrangements for opera and ballet productions.

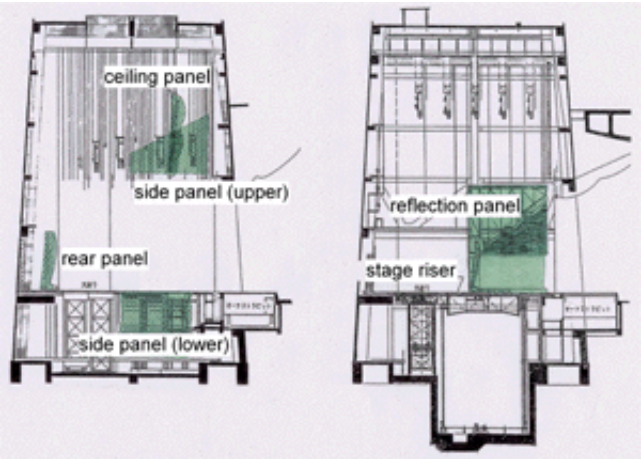


Figure 1 - Storage methods at Tokyo Bunka Kaikan before and after the renovations completed in 1999

To improve and enhance the stage rigging functionality of Tokyo Bunka Kaikan, two separate, significant renovation projects of the hall gave primary focus to changing the storage design and location of the stage sound reflection panels. First, in 1970, the stage's side sound reflection panels were divided into upper and lower sections, and the lower sections became stored below the stage. (See the left drawing of Fig. 1). Later, in 1999, when the hall underwent a major renovation (featured in our August, 1999

newsletter) to address and upgrade the whole building after nearly four decades of general wear and tear, the entire stage sound reflection panel system was reconstructed as a single unit and space was constructed below the stage to store it. (See the right drawing of Fig. 1). Providing a large enough space to accommodate the stage sound reflection panel system, which measures 21 m. wide x 13 m. high x 9 m. deep (69 ft x 43 ft x 29.5 ft) and weighs 81 MT (89 short tons) required an excavation of an additional 8 m. (29 ft) below the depth of the already existing Bunka Kaikan pit.

Left: The stage sound reflection panel system set up on stage

Center: The stage sound reflection panel system in the process of being moved to its storage location below the stage

Right:Tokyo Bunka Kaikan's stage when the sound reflection panel has been stored away

Three views at Tokyo Bunka Kaikan

Changing the storage location of the stage sound reflection panel system created a large amount of free space above the stage. The renovations also redesigned and strengthened the flytower structure and added additional batons to the rigging. Before the renovations, the hall had 29 batons and the renovations increased the number to 49. The renovations also substantially increased the stage equipment's load-bearing capacity.

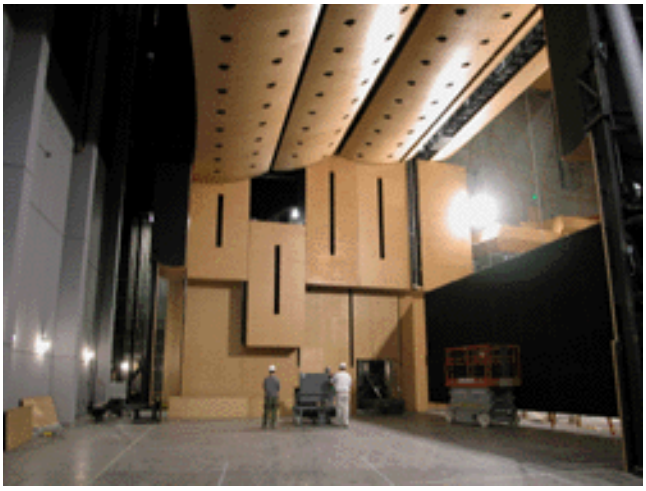
With regard to the hall's acoustics, because of Tokyo Bunka Kaikan's longstanding beloved reputation among performers and concertgoers alike, for the renovation specifications of the stage reflection panels and the stage floor we used the same materials and thicknesses that were used in the original hall so that the renovations would have no impact on the hall's acoustical characteristics. The reflection panels are constructed of three layers: two layers of 6 mm (0.2 in.) composite board between which is sandwiched a damping sheet. The stage floor is "hinoki" Japanese cypress and is 30 mm. (1 in.) thick.

Tokyo Bunka Kaikan required the implementation of a renovation project to become a hall that has its stage sound reflection panel system stored below the stage. In some other halls, this storage method was adopted as part of the original design. Examples of this kind of project include Izuminomori Hall in Izumisano City (part of the Osaka Metropolitan Area), Kiryu City Performing Arts Center and NHK Osaka Hall.

Examples of Unique Solutions for Storing Stage Sound Reflection Panels

Thus far, in this and previous articles, I wrote about the most prevalent and typical kinds of storage methods for stage sound reflection panels. In the final paragraphs of this article, I will introduce three unique and rarely used storage methods.

Acoustic Shell Storage at the Richard B. Fisher Center for the Performing Arts



Bard College

At Bard College in upstate New York, the multipurpose hall of the Richard B. Fisher Center for the Performing Arts (featured in our July 2003 newsletter) has an acoustic shell that requires significant manual labor on the part of hall personnel to set up and take down. The set up and take down processes use both manual labor and a forklift acquired specifically for this purpose. In general, in order for a stage sound reflection panel system to achieve the desired acoustical objectives, it must have a stable structure and be able to stand independently after it is set up. Also, setting up a stage sound reflection panel system often involves moving the structure incrementally until it is in exactly the needed location. As a result, even when a storage location offers easy and direct access to and from the stage, the set up and take down of the stage sound reflection panels can require a very significant amount of strenuous manual labor. At Bard College, the client decided to compromise ease of set up for cost-saving reasons, and accepted a labor-intensive process for storing and setting up the acoustic shell. The client understood the acoustical necessity and value of having a major stage sound reflection panel system with high ceilings and eaves and accepted that manual labor would be required each time the hall needs to be reconfigured.

Big Heart Izumo Hall in Shimane Prefecture

For Big Heart Izumo Hall's multipurpose hall (featured in our May, 2000 newsletter), we designed a system of sound reflection panels that combines fixed and movable elements. The reflection panels at the stage rear are permanently installed, while the side panel portions, and the balcony seating attached to them, can be moved to form an acoustic shell system with the fixed sound reflection panels at the rear of the stage. When the stage sound reflection panel system is set up, the balcony seating that is attached to the side sound reflection panels becomes connected to the balcony seating of the audience seating area, forming an uninterrupted perimeter around the stage and creating a feeling of unity between the stage and the audience seating area.

Big Heart Izumo Hall

In addition to this concert configuration, the hall's stage can be configured as a proscenium stage that has a clear separation between the stage and the audience. To do this, a stage curtain is unfurled in front of the stage rear sound reflection panels, the ceiling reflection panels are moved to a storage space above the stage and the side sound reflection panels are moved along rails embedded in the stage floor to a storage location in the stage wings.

Other halls have also implemented the approach of stage sound reflection panels that can be repurposed to more than one configuration. One example is Cerritos Center for the Performing Arts (acoustical consultant: Kirkegaard Associates) in Cerritos, California. Another example is Iwaki Performing Arts Center "Alios" (featured in our August, 2009 newsletter), where the use of modular side-frame units and banks of seating enable the hall to be converted to several configurations.

Monoucho Community Center in Miyagi Prefecture

Monoucho Community Center

For the hall of Monoucho Community Center (featured in our April, 2006 newsletter), a truly unique, space-saving and low-cost design solution to the stage sound reflection panel system was adopted by installing panels made of exposed damping material (Photo 4) as the ceiling sound reflection panel. The panel was constructed using a sheet of rubberized damping material and a wood frame. Also, with this design, we needed only a small steel-frame foundation because, compared with typical stage sound reflection panels made of composite board, the sound reflection panel is comparatively thin and lightweight. Likewise, this design enabled the use of an easy storage method for the sound reflection panel system. When not in use, the rubberized sheet, which requires minimal space, is simply raised out of sight using a baton above the stage.

This concludes my discussion of the storage methods for stage sound reflection panel systems.