Project Profile

Concert Halls Thrive with Traditional Plaster

Application/Building Type:
Entertainment Facilities
Project Names:
Benaroya Hall
Orchestra Hall
Locations:
Seattle, Washington
Chicago, Illinois
Architect:
LMN Architects
Acoustical Consultant:
Kirkegaard & Associates
Featured Products:
Structo-Base® Gypsum Plaster
Structo-Gauge® Gauging Plaster
Imperial® Veneer Plaster System
Structocore™ Security Wall System
Structocore™ Forming Sheets
Structocore Forming Sheet Lath
Red Top® Gauging Plaster

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Two 1990s concert halls are superb examples of how plaster systems can give the audience the best acoustical experience possible. Benaroya Hall, home of the Seattle Symphony, is designed in the traditional shoebox shape, and with a proscenium stage. Orchestra Hall is a 95-year-old concert hall that was renovated to improve its acoustics. It is an open-stage design and has a more square shape dictated by the existing building.

Benaroya Hall, Seattle, Washington

"Building on the acoustical design tradition of great concert halls of the past, we used plaster in Benaroya Hall for critical elements," explained James Cade, project manager, LMN Architects, Seattle. "For instance, the ceiling in the main auditorium is suspended plaster. It's faceted with truncated, inverse non-symmetrical pyramids, providing different planes that reflect varying wavelengths of sound. It was constructed using 3/4-inch-thick plaster on metal lath. The backside of the assembly was also sprayed with plaster 3/4 inches thick, for a total of a 1-1/2-inch-thick membrane. This thick mass of plaster, along with a special suspension system, also keeps outside sound from being transferred inside."

"Benaroya Hall was a fixed-stage shell, which is not common except in dedicated music halls. It is constructed with heavy plaster over concrete masonry units (CMU) to reflect the music as well as enable the musicians to hear the entire orchestra. The walls are precast concrete and are finished with wood panels. The next major plaster element is the balconies. Both the soffits and fascias of the balconies were finished with heavy plaster (3/4 inches thick) on metal lath over steel studs. The studs were sprayed with plaster to help reduce their vibration in the assembly. Shapes of balcony fronts and the angles of the soffits were varied to help reflect the sound throughout the room," Cade said.

Most of the plaster applications in the main auditorium and a recital hall in the same complex consisted of high-density, job-sanded Structo-Base® gypsum plaster over metal lath on steel studs. These applications were finished with Structo-Gauge® gauging plaster and finishing lime. Other areas of the complex used the Imperial® veneer plaster system for durability and appearance.

Orchestra Hall Renovation, Chicago, Illinois

This multiphase project was completed over several years and is part of a total complex called Symphony Center. The plasterwork in the main hall, called Orchestra Hall, was described in a previous issue of *Form & Function* (Issue 2, 1997, pages 6-8). The final phase, completed in October 1997, consisted mainly of roof-structure work and rebuilding the stage and ornamental plaster shell above while adding seating behind the stage.

In the renovation, the emphasis was on changing the size and shape of the hall to increase the reverberation time and eliminate echo conditions to provide the best and most exciting listening quality for symphonic music. An important factor in reverberation time is the acoustical reflection of the wall and ceiling surfaces.

"The more massive a surface is, the less energy loss occurs each time the sound bounces off that surface," explained Dawn Schuette, project manager, Kirkegaard & Associates, Downers Grove, Ill., the acoustical consultants. "Also, the best-quality sound is a full-frequency response, which means that the full range of musical sounds is sustained. Low-frequency sound, in particular, requires surfaces of high mass and density to reflect it efficiently."

High-strength conventional plaster was the best material to use to obtain the needed mass and density. Plaster on sidewalls and some parts of the ceiling was 4 inches thick. Also, on sidewalls, some plaster was applied directly to the CMU or existing brick, which provides substantial mass and minimal low-frequency absorption.

Rib-shaped elements running up the walls and across the ceiling have the dual function of diffusing sound while their bowed shape resists vibration. Above some sound-transparent areas of the ceiling, efficient sound reflectors were created by applying 4-inch-thick plaster over suspended heavy-duty metal lath. These reflectors help the sound get from the stage to the audience quickly and maintain presence and clarity.

The principal plaster elements are 8-foot-wide "ribs" that run up the walls and across the ceiling, and the large ceiling reflectors. To attain the 4-inch-thick plaster on vertical portions and 2-inch-thick plaster on horizontal portions of the ribs (across ceilings), two layers of metal lath were needed. At upper walls, a layer of lath was screw-attached to the backside of 4-inch steel studs. Then high-density, job-sanded Structo-Base gypsum plaster was applied to a thickness equal to that of the studs, followed by another layer of lath attached to the front side of the studs, and more plaster. The finish was Red Top® gauging plaster and finishing lime. The same materials were also used on ceilings. However, the second layer of metal lath was suspended by pencil rods tied back through the first layer of plaster.

Creation of the ceiling reflectors used a novel application of the STRUCTOCORE™ security wall system, a system designed for prisons and other high-security spaces. Because the STRUCTOCORE™ forming sheets are extremely strong, they made an ideal support for the heavy plaster ceiling assemblies. A layer of 18-gauge STRUCTOCORE forming sheet lath was suspended from the roof structure. Then STRUCTO-BASE gypsum plaster was applied both from below and above the lath to form a 4-inch plaster membrane. A finish coat of RED TOP gauging plaster and finishing lime were then applied. Prior to application, the finish coat mix was dyed black so that the plaster would not be visible behind perforated metal panels that were suspended below the reflectors to conceal them.

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