Acoustical Design of the Sumida Triphony Hall
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Abstract: The Sumida Triphony Hall was opened near JR Kinshityo railway station on October 1997. The facilities consist of two concert halls, the Main Hall with 1,801 seats as the home of the New Japan Philharmonic and the Recital Hall with 252 seats, and three rehearsal rooms. Beside the room acoustical design of the two concert halls, the main subjects of acoustical design were insulation against vibration and noise caused by the railway, and sound insulation among the two auditoriums and rehearsal rooms. This paper reports on the acoustical design and properties of the two concert halls.

HEADING

The concept of the Sumida Triphony Hall has been developed as a keystone project based on the Musical Metropolis Concept of Tokyo’s Sumida Ward, “Building through Music,” promulgated in 1981. One of the most popular activities derived from this concept is the event known as “5,000 People Singing Beethoven’s 9th,” held annually in the Kokugikan Sumo Arena since 1985. In addition to musical activities, the new projects aims at development of the north side of JR Kinshityo Station located in eastern Tokyo. Facilities including a concert hall with about 2,000 seats were finally decided on and agreement was reached on the Orchestra Franchise Plan. The franchise contract was concluded between Sumida Ward and the New Japan Philharmonic (NJP) in 1988. This contract has attracted attention as the first such case involving classical music activities in Japan.

The Main Hall is shoe-box hall with 1,801 seats as the home of NJP, while the Recital hall is a typical shoe-box hall with 252 seats. The architect is Nikken Sekkei Co., Ltd.

CONTROL RAILWAY NOISE

The main subject in the acoustical design of this project was isolation of the noise and vibration caused by railway traffic running adjacent to the south side of the building site. At an early stage of the overall planning, one block of multifamily high-rise dwellings was allocated between the hall and the JR railway. To achieve sufficient vibration insulation to assure that the noise level in the concert halls would be below NC-15, vibration-isolating rubber sheets of 100 mm in thickness were embedded around part of the outer south wall of the building.

Vibration-isolating structures were also adopted partly in the Main Hall and entirely in the Recital Hall.

ROOM ISOLATION

By introducing vibration-isolating structures in the Recital Hall and three rehearsal rooms, high sound insulation enabling simultaneous use of the hall and rooms was achieved.

ROOM ACOUSTICAL DESIGN OF MAIN HALL

The Main Hall is shoe-box configuration, which was prescribed as the basic room shape by both Sumida Ward, the owner and NJP to assure excellent acoustics for classical music. Two layers of balconies are allocated around the ground floor. To minimize the overhang over the lower sections, single-raw seating is adopted in the side balconies.

The space impression of this hall is characterized by the sloped ceiling running at 12.5 degrees toward the back of the hall parallel to the slant of the main floor. This both enables the line of sight by the sloped floor and assures the room space over the rear seating blocks. An organ with 66 stops manufactured by Jehmlich Orgelbau in Germany was installed on the organ balcony located 3.5 m above the stage.

The main subject of the room acoustical design was the room dimensions, especially the width of the audience area and the height of the stage area. The computer simulation was carried out to study the basic room dimensions. In our study, the distribution of the early reflections over the audience was observed. As a final study, 1/10 scale model experiments were conducted to check the details of the interior finishing.

The plan and cross section of the Main Hall are shown in figure 1. The main issues of the room acoustical design were as follows.
We believe that the width and height of a space are the most influential factors relating to the acoustics of a shoe-box auditorium. Therefore, we examined both factors carefully through computer simulation. As a result, the height of the ceiling above the stage was set at a maximum of 15 m and the width of the audience main floor at 22.8 m.

Reflecting panels were hung over the stage area. These panels were installed in response to strong requests from Artistic Director Emeritus Seiji Ozawa and the orchestra members after the first trial concert held in May 1997. These panels can be set at any height, and can even be removed. Following this, a trial concert to ascertain the height of the panels was carried out by Seiji Ozawa and NJP. As a result, the height was decided as 11.5 m for the present time.

As board panels for finishing, boards with a minimum thickness of 26 mm and a maximum thickness of 54 mm, were used on the ceiling and lower side walls to avoid excess absorption at low frequencies.

The sound-absorption characteristics of the audience seats are the most influential elements relating to the reverberation time. Therefore, structures for the audience seats were acoustically checked and those with lower absorption at the low-frequency range were selected.

A large acoustical curtain was hung from the ceiling to minimize the discrepancies in reverberation time between occupied and unoccupied conditions.

**ROOM ACOUSTICAL DESIGN OF RECITAL HALL**

The Recital Hall is a typical shoe-box hall and is designed for chamber music, recitals and similar performances. An acoustical curtain was installed on the stage back walls so that the acoustics could be easily tuned by the musicians and/or hall operators.

**ACOUSTICAL PROPERTIES**

1. The measured noise level caused by the JR trains is below NC-15 in the Main Hall, and cannot be perceived in the Recital Hall.
2. The measured level difference between the Main Hall and the Recital Hall is more than 85 dB at 500 Hz.
3. The measured reverberation times of the Main Hall and the Recital Hall are shown in figure 2.

**ACOUSTICAL IMPRESSION IN MAIN HALL**

Since the opening programs, many concerts have been held, mainly by NJP. The acoustical impression so far is that the orchestra sounds very natural and honest, and the definition of each instrument's sound is also clear. We are looking forward to seeing the growth and progress of the skills and ensemble of NJP, and expect the creation of original orchestral tones in this new orchestral space through powerful franchise support.