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DESIGNING OF THE SOUND RECORDING STUDIO OF THE M.I. GLINKA
NIZHNIY NOVGOROD STATE CONSERVATORY

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In clause results of acoustic designing of sound recording studio of the Nizhny Novgorod state conservatory are presented. The studio is intended for carrying out of musical and vocal products in execution of soloists or small collectives. During designing some primary goals in a complex were solved: maintenance of an optimum acoustic mode in premises of studio, decrease in noise of ventilating installation, development of soundproofing designs of doors and an observation window. At each stage of realization of design decisions control measurements and acoustic adjustment of premises that has allowed to achieve objects in view were spent.

The M.I. Glinka Nizhny Novgorod state conservatory settles down in historical city centre in a building of XVII century of construction. During the existence the building was repeatedly reconstructed and completed and today includes historical and modern parts. During the next reconstruction it has been decided to place in a building a complex of premises for a professional sound recording of musical and vocal performances. For this purpose the place of former house church which thickness of walls makes from 800 up to 2000 mm has been chosen successful. The given part of a building is located on 1-st floor and removed enough from noisy premises both in horizontal and in vertical directions, that in aggregate with massive walls has provided a good reserve on sound insulation.

The studio complex includes following premises: studio, equipment room, entrance tambours. Geometrical parameters of studio in an initial condition were the following: length x width x height: 8,6 m x of 5,1 m x of 4,4 m; the area of a floor: 44 m²; volume: 193 m³. Parameters of equipment room: length x width x height: 4,9 m x 2,5 m x 2,4 m; the area of a floor: 12 m²; volume: 29 m³. Proportions of premises as a whole have been recognized satisfactory.

By development of the project the complex of the interconnected problems which stage by stage can be reduced to following kinds was solved: 1) acoustic accomplishment of studio and equipment room; 2) maintenance of demanded sound insulation of constructions; 3) designing of decrease in noise of systems of ventilation.

Acoustic accomplishment of studio and equipment room. At the given design stage optimum acoustic parameters of a premise, first of all, have been certain. In view of small volume of studio time of reverberation should be within the limits of 0,4 - 0,6 sec. with [1]. However under requirements of the customer as optimum value 1,0 sec. with in all normalized range of frequencies 125 – 4000 Hz was accepted, that in the further would allow to create transformed acoustic design.

One of the primary goals of acoustic designing was maintenance of diffusion of a sound field in all range, especially on low frequencies. For this purpose were designed sound dispersion in the form of half of cylinder, executed of two sheets of plaster leaf stuck together among themselves (on 12,5 mm everyone). The given elements (shells) have been placed on longitudinal walls of studio (width of an element of 1,0 m; height of 2,1 m; depth 0,2 m) and on a ceiling in a cross-section direction (width of an element of 1,9 m; length of 4,5 m; depth 0,3 m).

It is necessary to note, that performance of shells from double stuck together of plaster leaf was a challenge, however, it has allowed to reach necessary weight of disseminating elements and to exclude the undesirable resonant phenomena. Face walls of a premise also have been executed curvilinear. Appearance of studio is shown on fig. 1.

For maintenance of the rectilinear frequency characteristic of time of reverberation in all range 125 – 4000 Hz in studio have been in regular intervals distributed sound-proof materials – resonant absorbers (sheets of plywood on distance from walls) [2], panels "Ecophon", a covering of a floor from carpet. By results of acoustic designing studio the settlement curve of time of reverberation has been constructed. In the further, after realization of the given actions in practice, control measurements which have proved design decisions – see fig. 2 have been lead.



Fig. 1. Acoustic design of surfaces of studio: *a)* the form of walls; *b)* the form of ceiling

In equipment room as optimum value of time of reverberation 0,3 sec. with in all range of frequencies 125 – 4000 Hz was accepted. For this purpose have been applied the low-frequency resonant absorbers (50% from the area of walls), the punched plaster plates, ceiling sound-proof panels "Eco-phon" (50% from the area of a ceiling), carpet to a covering of a floor.

Designing of sound insulation constructions. Walls of a studio complex differ the big massiveness, sufficient for isolation of direct ways of distribution of air noise. The same it is possible to tell and about interfloor overlapping which is executed from monolithic concrete by thickness of 200

mm. Thus, the primary goal at the given stage was the maximal decrease in the air and impact noise, getting indirect routes

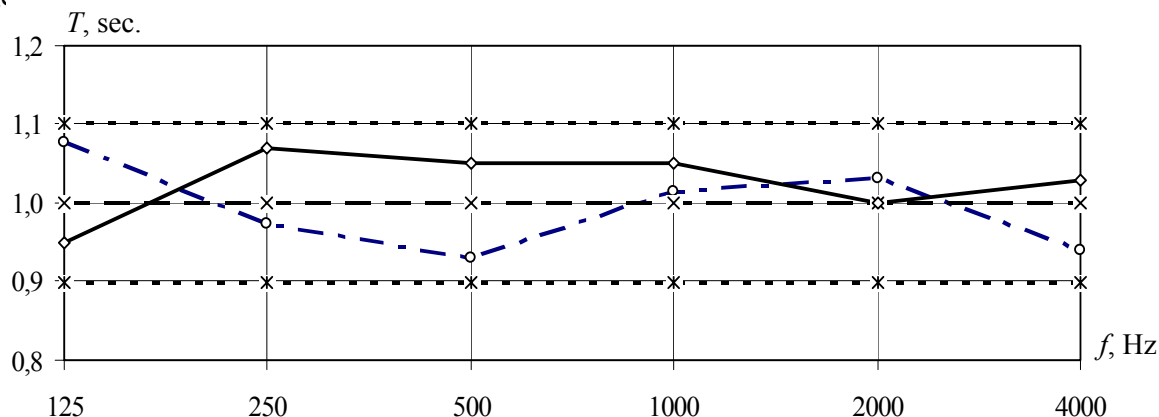


Fig. 2. Frequency characteristic of time of reverberation of studio

- Curve of estimated time of reverberation
- ×— Curve of optimum time of reverberation
- * - Curve of boundary of optimum time of reverberation
- ◇— Curve of measured time of reverberation after realization of the project

The decision of this problem was provided with disseminating elements and panel resonant sound absorbers, designed at the previous stage. These designs carry out not only the basic role, but also a role of sound insulation constructions. On an existing floor of premises the floor on the elastic basis with a concrete monolithic layer has been executed.

For protection of a studio complex against getting noise were designed of sound insulation constructions – an observation window, doors, entrance tambours. The observation window located between studio and equipment room, has threefold glass (thickness of glasses 8, 10, 8 mm). Thickness of a wall between these premises makes about 1 m that has allowed to execute greater air intervals between glasses (400 and 500 mm).

Entrance doors in premises (in tambours, studio, equipment room) have been executed multi-layered – wood panel by thickness of 50 mm, riveted with one of the parties sheets of plywood with thickness of 16 mm with an air interval. For maintenance of tightness of apertures have been executed double adjunction with rubber sealants on a contour.

Inputs in studio and equipment room are executed through tambours which provide additional protection against the noise getting from adjacent premises of a conservatory. Protecting surfaces of tambours are processed by sound-proof materials: walls by the punched plaster panels (top of walls) and sheets of plywood with an air interval from walls and with pasting carpet (a bottom of walls); the ceiling is processed by panels "Ecophon"; the floor is covered by a carpet.

Designing of decrease in noise of systems of ventilation. For studio and equipment room rigid demands on noise levels of ventilating systems are made [1]. Following actions have been developed for their performance in the project of a forced-air and exhaust ventilation: an arrangement of the rustling equipment (fans) outside of a building; performance of separate systems of ventilation for studio and equipment room; installation of mufflers of noise in two places of each system: near to fans, and also directly ahead of input in premises; installation of chamber mufflers for decrease in low-frequency noise; increase of sound insulation of ventilation canals by continuous processing damping and sound-proof materials.

All the actions have been realized in practice except for chamber mufflers. It has been caused by lack of free space of premises and financial problems of the customer. The control measurements of noise levels lead after installation of system of ventilation, have shown, that absence of chamber mufflers has led to excess of actual noise levels over admissible values on 3 – 17 db in a range of low

and average frequencies (see fig. 3). In this connection the alternative decision on decrease in ventilating noise by installation of the adjusting device for smooth change of speed of rotation of fans and, accordingly, was offered to speed of an air stream.

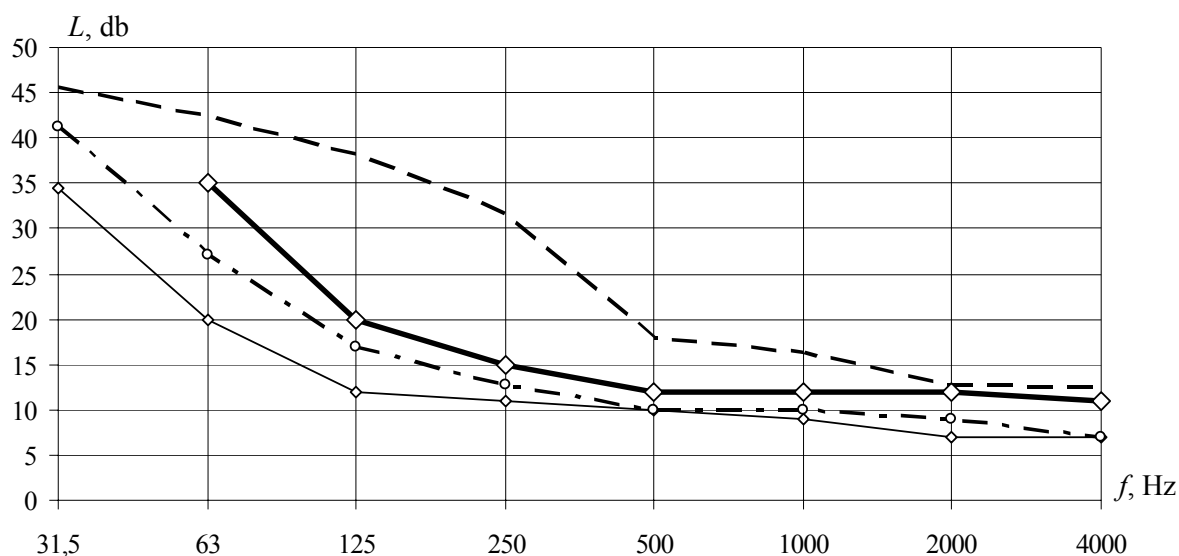


Fig. 3. Frequency characteristic of sound pressure level (SPL) of the ventilation systems

- Curve of SPL at disconnected systems
- — Curve of SPL at working systems (without adjustment)
- Curve of SPL at working systems (with adjustment)
- ◇— Curve of admissible values of SPL in studio

Final measurements of noise levels have shown, that by adjustment of speed of air in studio and equipment room it is possible to achieve performance of requirements [1] on admissible noise levels (see fig. 3). Thus frequency rate of air exchange of premises has made 1,5 (originally was 3), that was quite sufficient for work of executors and the personnel and met the requirements of the customer.

Thus, at designing studio premises of a conservatory in a uniform complex were designed on an acoustic accomplishment, sound insulation of constructions, designing of decrease in noise of systems of ventilation. At each stage of realization of the project control measurements of acoustic parameters were spent and, if necessary, corrective amendments were brought in the project. It has allowed to create in the Nizhniy Novgorod state conservatory a studio complex for a sound recording of separate executors and the small collectives, meeting modern requirements. Now the studio is started in work and functions in full in structure of faculty of musical sound direction.

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