La Fenice - acoustical planning in the scope of a historical reconstruction

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The famous Teatro La Fenice in Venice was built in 1792. This typical Italian opera house burnt down in 1836 and again in 1996. Opera enthusiasts, musicians, critics as well as town officials demanded a precise reconstruction. They expected that thereby the well accepted "acoustics" of the famous opera could be achieved again.

However, when starting any rebuilding, immediately modern requirements on security, stage machinery, air-condition and enlarging of the orchestra pit arise. The relatively high demands on the room acoustical quality of the house, the extremely limited space of the whole building complex in connection with the requirement of an increased number of rooms require a sophisticated room and building acoustical planning and realization.

REQUIREMENTS SET BY THE COMPETITION

Already in 1996, i.e. shortly after the destruction of the theatre, the city of Venice put a very detailed competition out to tender. The competition regulations stated that the audience area and stage area should be reconstructed completely according to the historical model by using the original materials and applying historical working techniques in order to restore the excellent acoustical conditions. A total reconstruction is also required for the Sale Apollinee, which includes the foyer and entrance zones and also some rehearsal rooms.

For the wings adjoining in the north and in the south, in which the side stage, several rehearsal rooms, changing-rooms, and cloakrooms, workshops, and the administrative rooms are situated, more freedom was granted although the partly existing outer shell of the building had to be respected.

In the scope of the strict requirements for the reconstruction, modern safety standards - particularly those concerning fire protection as well as the improvement of the air conditioning and the extension of the room programme had to be taken into account.

According to the competition, the technical rooms, which are necessary for this purpose and further room requirements had to be integrated in the building.

At the same time, the demands for an enlargement of the volume of the orchestra pit, an equipment of the stage with the latest technique and an increase of the number of audience seats without impairing the room acoustical conditions were established.

ROOM ACOUSTICAL PLANNING

A complete reconstruction according to the historical model of the audience room, the stage including the orchestra pit with the aim of achieving the originally good room acoustical quality leads to the question in how far a "room acoustical planning" is necessary at all. If it was necessary to follow this goal exclusively based on all construction details and construction elements, one could come to the conclusion that this task can be fulfilled by an architect only. Special safety requirements and particularly those concerning fire protection make it, however, necessary to replace the original combustible materials at some places by fire-resistant ones. In this connection, the acoustical adequateness must be achieved by applying properly chosen materials. Sometimes this must also be proven by acoustical measurements.

The acoustically relevant boundary surfaces such as the ceiling of the hall as well as the ceilings of the boxes will be reconstructed with the original special plaster which is characterized by a constantly varying material thickness and bending stiffness. In connection with the sprinkler system of the ceiling cavity above, a system meeting today's requirements for fire protection can be chosen.

The same is valid of the gallery balustrades, which can be produced with completely reflecting wooden surfaces, which comply with modern safety standards. The relatively short reverberation times which are typical for Italian theatres with galleries should be increased as far as possible. This is achieved by reproducing the fabric curtains which have an exclusively decorating effect out of gypsum and sticking fabric on them.
The required enlargement of the orchestra pit can be realized only below the stage by maintaining the front edge of the orchestra pit and the lateral boundary surfaces. A movable rear wall of the pit allows a rear boundary as in the historical model. In case of large orchestras, a simple, variable adjustment will be possible.

Minor modifications at the balustrade of the orchestra pit as well as the realization of portal reflectors below the lighting bridge lead to an improvement of the contact between musicians in the pitch and singers on stage and vice versa.

For concerts, in the stage room a concert shell will be installed. Thus, an optimal acoustical contact between the musicians and an acoustical coupling as well as an effective enlargement of the room acoustically effective volume will be achieved. It will be possible to increase the reverberation times for concerts compared with the reverberation times for opera performances.

Due to the limited space the ventilation control had to be situated above the audience area. Because of fire protection and acoustical reasons, a reinforced concrete ceiling was necessary in contrast with the historical concept.

As between the ceiling of the hall and the new ceiling to the technical control room there is an air cavity of approx. 2 m, no influence on the room acoustical quality of the audience room has to be expected.

For the Sale Apollinee a certain number of different types of wooden beam ceilings have to be reconstructed. The different room separations partly require very expensive ceiling constructions. To make matters even more complicated, all room areas have to be supplied with air conditioning in contrast to the historical concept. The necessary cable feedthroughs were mainly done in invisible slits in the area of the outside walls and in the ceiling cavity.

The close neighbourhood which is typical for Venice requires an utmost caution for the planning of air inlet and outlet openings and for the mounting of technical devices inside the building.

As a Venetian distinctive feature, the ship traffic on the adjacent channels and on the bridges in the neighbourhood must be taken into account. Big transportation cranes and the relatively short distance from the façades lead to relatively high acoustical requirements for the exterior construction elements.

BUILDING ACOUSTICAL PLANNING

The wings adjoining the audience area in the north and in the south, can be separated effectively by an acoustical joint.

A very high noise protection standard can be achieved also for the new rehearsal halls which will be situated below the audience area.

A less effective acoustical separation is, however, possible between the corridor zones and the audience hall which is surrounded by them. The reconstruction requires a construction with wooden beams made out of terrazzo which is typical of Venice. Terrazzo results in a relatively low noise protection which is typical of historical opera houses.

The single doors to the boxes will confirm the originally existing low noise protection.