



The acoustic design of the Teatro Eschilo, Gela (Italy)

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ABSTRACT

The "Teatro Eschilo", in the town of Gela, Sicily, Italy, was built in 19th century, and refurbished many times in the early 20th century. During those refurbishments the main hall was completely modified: a huge balcony on two rows made in concrete, substituted the original 5 orders of balconies, and the proscenium was totally redesigned. The walls were heavily upholstered, to limit the reflection of the concrete, and a fresco of the School of the Sicilian painter Gut-tuso was painted in the ceiling. After a while people started to complain about the acoustics. Moreover, after the Second World War, the theatre was slowly abandoned and it definitely closed in 1982.

The original acoustics of the theatre was poor. The Opera was not fully appreciated, and musical performances were strongly unsatisfying. Therefore, the reopening of the theatre would have required to be accomplished by an acoustical design, which could enhance the reverberation, limit the focalisation and increase the strength in the far seats.

In 2000 an architectural design was proposed. The acoustical project consisted in a set of diffusing panels mainly located in the stage, and in a treatment in the ceiling and in the lateral walls. The panels were designed following Schroeder's number theory, and the location in the theatre was analysed by means of a numerical code. The results of numerical calculations, as well as examples of the panels, are here presented.

HISTORICAL BACKGROUND

Since its foundation, in the early 19th Century, the Teatro Comunale Eschilo has been one of the most important cultural centres in the Island of Sicily. Moreover, until the 1938, no other theatres or halls were realised in the town of Terranova di Sicilia (the former name of the town of Gela), apart from the Teatro Eschilo. The original name of Teatro Maria Teresa, given to the theatre since its opening in 1832, was later converted into "Giuseppe Garibaldi", the Italian patriot that unified the Country in 1860.

In early 20th Century, the theatre required some restoration works, due to the partial collapse of some elements in the lateral walls. Therefore, the Municipality of Terranova di Sicilia proposed to demolish and reconstruct the external structure of the building, and afterwards decided to demolish and to completely reconstruct the internal main room. After the first and second World war, the theatre was lightly damaged and slowly abandoned. After 1970, the theatre was definitely closed for safety, due to the bad condition of the building.

After a long time of discussion among the community of Gela and all the Province of Caltanissetta, The Municipality decided to start the refurbishment of the hall in 2000. The external façade of the theatre was demolished and fully reconstructed as they were in early 19th Century. In the internal room, the lateral walls were demolished and reconstructed. In 2009 the works restarted, and involved the acoustic charac-

teristics of the theatre. The opening of the theatre is programmed for the 2011.

THE ARCHITECTURAL DESIGN

The Municipality of Gela presented in 2000 an architectural design for the refurbishment of the theatre, which included the rebuilding of the external structure and the façade, and a new shape of the main hall. The architects decided to replace the rectangular shape of the stalls (which substituted the horse-shoe shape in 1930) with a new rectangular shape of the stalls, and substituting the two large balconies (made in concrete), with three different balconies, changing the structural element of the floor and the fence. The ceiling and the roof of the theatre were completely replaced with a wooden, ventilated roof, as it was before the 1930.

Moreover, the architectural design developed in 2000 included a large new stage, and included an orchestra pit. A special care was finally devoted to all the thermal plants: Since Gela is located in the southern coast of Sicily, the thermal conditions of that area required a fully-efficient conditioning system especially for the summer season, and the noise emissions due to the thermal plants, air pipes and air ventilations needed to be fully controlled, avoiding to compromise the acoustic quality of the hall.

The theatre opened in 1832, and it is located in the very city centre of Gela. Therefore also the urban noise caused by road traffic could affect the overall acoustic quality in the main room.



Figure 1. The façade of the Teatro Eschilo at early ‘900



Figure 2. Inside the theatre (about 1965)

THE ACOUSTIC DESIGN

Experimental measurements

Before starting the architectural design of the new hall, in 1999 a preliminary measurement campaign was undertaken by some acousticians in order to determine the original acoustic condition of the theatre. However, as the indoor conditions of the room were not satisfactory, those measurements were not utilised for the forthcoming acoustic design. The measurements made in 1999 included the captures of the impulse responses in some positions in the stalls and few others in the balconies by means of a pistol shot, located in the stage. The acoustical data obtained after the post processing of the IRs were not suitable to be used for the calibration of the numerical model, as the condition of the room could not be properly reproduced in the model. Therefore, the acoustical characteristics of the materials utilised during the simulation were chosen by comparison between the solutions proposed by the architect and other material previously utilised by the authors in other similar cases. The errors that we would obtain from the calibration of the model with the experimental data of 1999 would be greater than the errors that we would have with the simple estimation of acoustic sound absorption and diffusion of the materials.



Figure 3. Inside the theatre (after 1982)

The new theatre

The refurbishment of the theatre was designed starting from the previous history of the building. The building that was originally realised in 1832 (that was initially called “Maria Teresa” and afterwards “Garibaldi”) had a typical horse-shoe shape, a wooden-structured roof and ceiling with a fresco painted by a Sicilian painter. The inner part of the building was decorated with stuccoes velvets and other materials, following a post-baroque style that was in use at that time. Rumors from that time reported that the acoustics was appreciated, maybe thanks to all the decorations of the hall, which made the sound much diffused in the room.

However, the theatre in the last 80 years of 20th Century had a total different shape. It included two balconies made of concrete, and a stalls area in which there were located upholstered seats. Only in the case of fully occupied seats in the stalls and in the balconies (as in figure 2) the acoustics of the hall was acceptable. Nevertheless, many listeners and inhabitants of the town still appreciated the hall for its shape, despite the bad acoustics that characterised the hall. This general opinion of the majority of the inhabitants, lead the architects to develop a design that still included the rectangular shape and the two balconies in the hall, even if they decided to partially modify the roof and the ceiling.

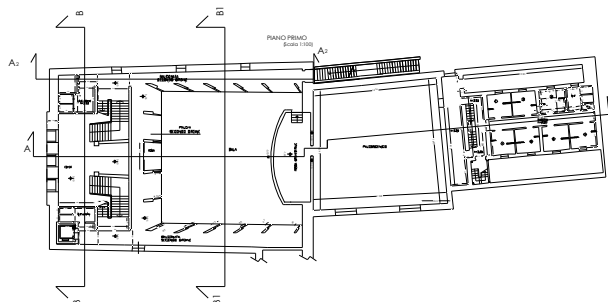
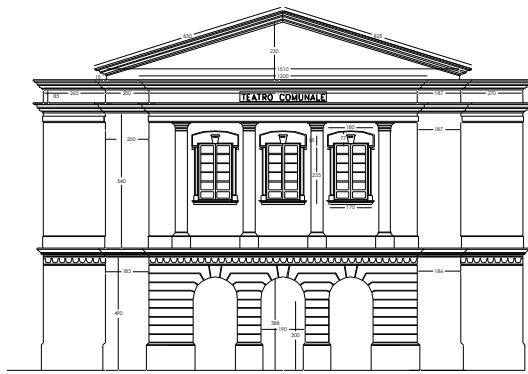
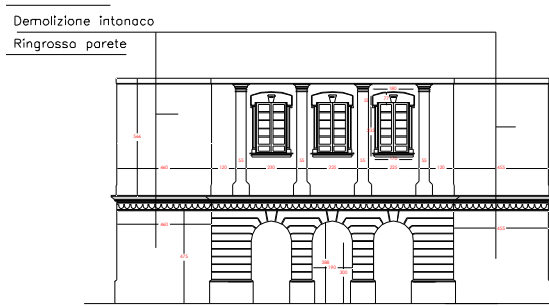


Figure 4. Plan of the “Teatro Eschilo”

The two lateral balconies were totally modified from the former theatre. The structures of the floors, and the fences, which constituted a unique structure made of concrete, are now changed into separated structures, with a wooden floor. The fences are now made in wood and glass, and based on a light structure, and could be covered with tessues, depending on the specific performance in the theatre.



PROSPETTO PIAZZA SALANDRA



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Figure 5. The façade of the Teatro Eschilo

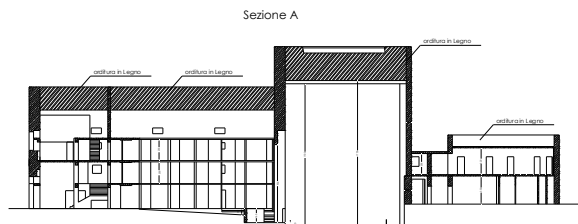


Figure 6. The longitudinal section of the Teatro Eschilo

A special care has been devoted to the stage. The orchestra pit (not existing in the former theatre) has been designed provided with a variable acoustics. Moreover, several diffusing panels have been properly calculated and designed for the orchestra pit.

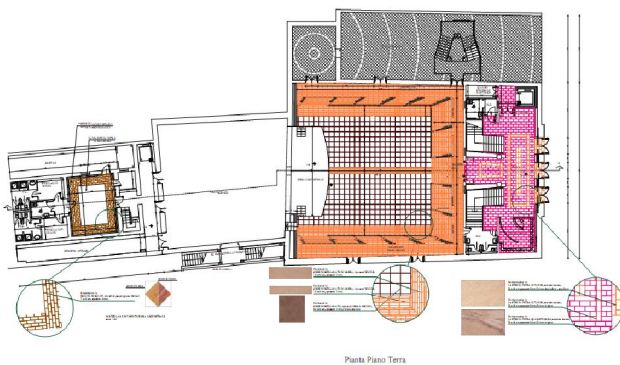


Figure 7. The floors in the Teatro Eschilo

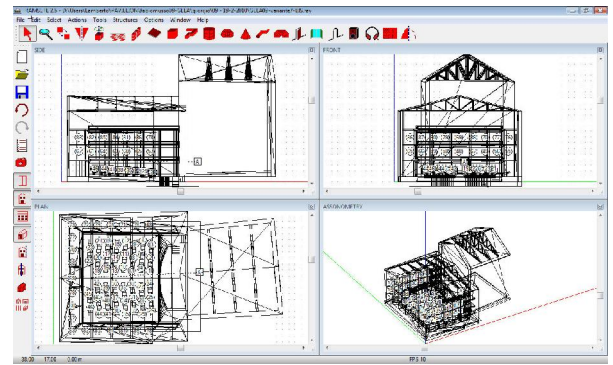


Figure 8. The numerical model of the theatre

The acoustic design of the theatre was realised starting from a numerical model of the room. The absorbing coefficients of the materials have been obtained from other several example of similar theatre previously examined during the last 10 years, all of them previously calibrated with experimental measurements. In this way the uncertainties due to the conditions of the room during the measurements in 1999 (the room was in very bad situations) were avoided.



Figure 9. The Theatre in early 2010

The simulations were conducted in order to determine the effects on the acoustics of the theatre caused by the roof and the lateral walls. The original design of the room (which included a set of heavy curtains on the lateral walls, and several baffles on the ceilings) was changed into a slightly reverberant solution, which included few components made in glass and wood, located on the lateral walls. This treatment could still maintain a good component of acoustic energy coming from lateral walls that could still ensure the effect of spatialisation in the room. At the same time, the design of a proper shape of the seats in the stalls could allow a sound propagation until the rows close to the foyer. The original solution for the seats was therefore abandoned and substituted with a different model.

The balconies are fully designed to ensure a good sound level in the seats that are located in the far positions from the stage, and a good sound envelope in all the area. A special acoustic treatment (made in wood) has been developed. The new orchestra pit (that was not existing in the former building) was especially designed for obtaining a variable acoustics in the area. It would allow the musicians to modify and change the acoustics in the pit accordingly with the musical requirements.

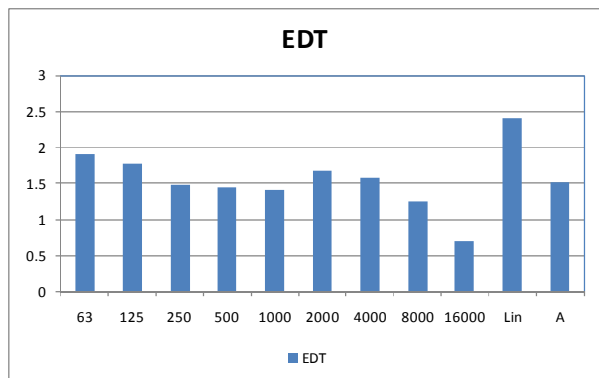


Figure 10. Early Decay Time (EDT) obtained after the simulations

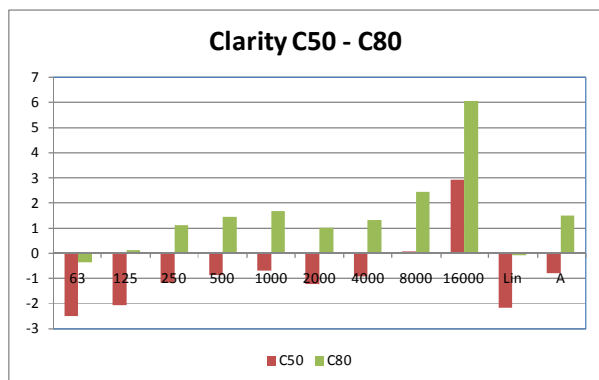


Figure 10. Clarity (C50 and C80) obtained after the simulations

CONCLUSIONS

The new Teatro "Eschilo" in Gela is scheduled to open in 2012. The inhabitants of the town look forward to having their theatre opened again after 30 years of inactivity of the room. The theatre will open with many acoustic and architectural improvements, both in the listening area (stalls, balconies) and in the orchestra pit.

The enhancements both in the functionality of the stage area (*machina teatrale*) and in the acoustics of the theatre and stage, should effectively improve both the performance of the artists and musicians, and the overall comfort of the listeners.

Perhaps the Sicilian musicians are the most interested in the new opening of the theatre, and the very useful talks that the architects and the acousticians have had in the last 10 years could be a good opportunities for enhancing the acoustic quality of the theatre, and the architectural aspect of this room.

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