



The reconstruction of the Teatro Galli in Rimini: the acoustic design

Lamberto Tronchin(1)

(1) DIENCA – CIARM, University of Bologna, Viale Risorgimento 2, Italy

PACS: 43.55.Fw; 43.55.Ka; 43.55.Nd

ABSTRACT

The town of Rimini, Northern Italy, was founded in 268 BC, in an area that had previously been inhabited by the Etruscans, the Umbrians, the Greeks and the Gauls. The Romans called this colony Ariminum, probably from the name of a nearby river, Ariminus (today, Marecchia). It was seen as a bastion against invading Gaul and also as a springboard for conquering the Padana plain. Rimini was a road junction connecting central Italy (Via Flaminia) and northern Italy (Via Aemilia that led to Piacenza and Via Popilia) and it also opened up trade by sea and river. Rimini drew the attention of many Roman emperors, including Augustus who did much for the city and Hadrian in particular. This great period in its history was embodied by the construction of prestigious monuments such as the Arch of Augustus, Tiberius' Bridge and the Amphitheatre and Galla Placida built the church of San Stefano.

During the 19th Century the town acquired an international reputation for the seaside, and a new theatre which was designed by Luigi Poletti succeeded in translating into Neoclassical form the ambitions of the ruling classes. The theatre was completely destroyed during II World War. In the following decades, many proposals were developed for the new theatre. In 2003, the final design was accepted, following the rule “where it was, how it was”.

In this paper the new design is analyzed, and the results from the simulations are evaluated and compared with other similar theatres.

INTRODUCTION

The town of Rimini, in the Adriatic coast, is very well-known for its coasts and sandy beaches. Nevertheless, Rimini has a long historical background and a city centre that was firstly realized by the Romans. During the summer season, from May to all September, the town of Rimini is crowded with millions of tourists that populate the beaches. The town of Rimini, however, is very active also in the winter season, with a wide range of cultural activities throughout all the year.

The Teatro Amintore Galli in Rimini represented for a long time an important building in the town, since it is located at the main square in the city centre (Piazza Cavour), between the Roman bridge and the Roman arch of the town. After its destruction during the Second World War, all the cultural and musical events of the town were forced to move to other buildings, much less fascinating than the Galli, and located not in the city centre of the town.

Since the 1950s, when Rimini became the most important and populated coastal centre in Italy, the local Municipality started a debate which involved the most outstanding cultural personalities of the town, about the reconstruction of the theatre. For many years a long debate involved not only the inhabitants of Rimini but all the cultural community of Northern Italy, in order to decide which could have been the suitable solution for the theatre.

In 1995 an International competition for the new theatres was launched. The final project that was chosen (arch. Natalini et al) proposed a totally new theatre, completely different from the Poletti theatre of 1857. This new theatre was presented to the city, but immediately a large number of cultural personalities expressed their perplexity of the project.

Moreover, after the burning of the two Italian theatres in Bari (the theatre Petruzzelli) and especially La Fenice in Venice, many other people disagreed with the project of the architect Natalini. At the beginning of the new millennium, according with the Regional and National authorities on cultural heritage (the Regional Supervisors and Ministry of Cultural Affairs), a new project was developed, following the rule “as it was, where it was”. This new position completely cancelled the previous project, and consequently a new project was developed.

THE HISTORY

The history of the teatro Amintore Galli in Rimini is similar to the histories of other theatres in Italy. The theatre was opened in August 16th, 1857. The theatre had a semi-circular shape, similar to the horse-shoe shape that characterises many other Italian theatres, and it could host about 800 people. Perhaps one of the most interesting characteristics of the theatre was the number of columns between the second and third order of the boxes, which characterised the hall.



Figure 1. The theatre (main hall) in 1910

The photograph taken in 1910 shows a very crowded hall, both in the stalls and in the boxes, and maybe the theatre in some cases could also have much more than 800 people. Perhaps the high number of people could compensate the high reverberation that it might be in the empty room, and the focalisations caused by the reflecting walls around the stalls at the first level.

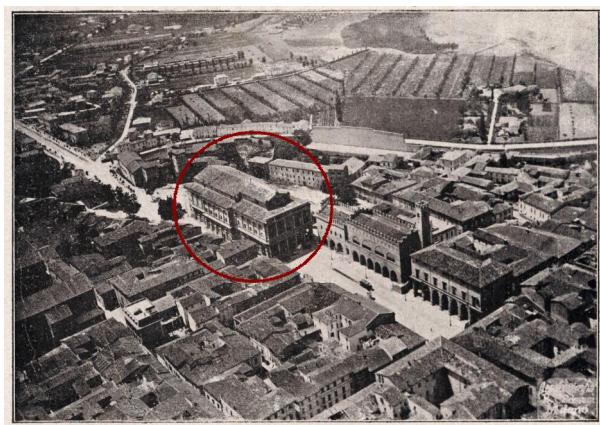


Figure 2. Aeral view of the theatre (1925)

The few opinions of the people that were in the theatre until its destruction in 1944 are in contrast: some of them reported about the good acoustics during the performances (therefore with occupied seats), other opinions reported about some problems experimented by the musicians in the stage area and in the stalls (i.e. with unoccupied seats).

After the air attack in 1944 that destroyed the main hall of theatre, whereas the foyer was only slightly damaged, the area of the theatre was temporary transformed into a gymns, and any further decision about the theatre was postponed.

The area occupied by the theatre is involved with an archaeological site. There are many different archaeological reperts, which range from the Roman period (a *domus romana*, a Roman road) until middle-age period (a Cemetery; a Castel with a movable bridge). Therefore, any work in that area requires the formal agreement of the regional Archaeological Supervisor, which certifies that no risks of damage would involve the monuments located in archaeological area and below the theatre.



Figure 3. The theatre after the bombing of 1944

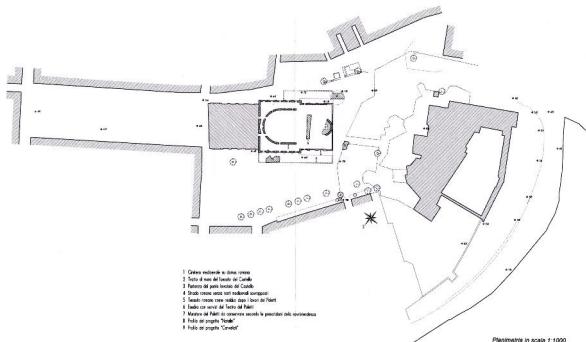


Figure 4. The theatre and the archaeological area

THE NEW THEATRE

The new theatre is designed following the rule “where it was, as it was”, in the same way as the theatres Petruzzelli and Fenice were rebuilt after the burning.

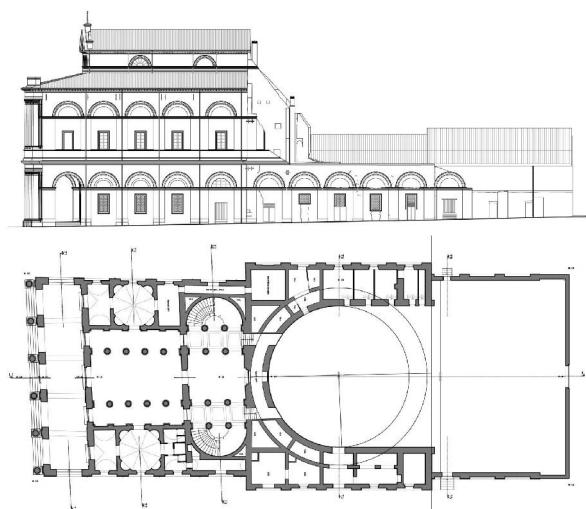


Figure 5. The theatre in 2008 (from 3D in situ analysis)



Figure 6. The theatre in 2008 (3D rendering)

However, the new project must to take into account all the technical requirements that a new theatre requires. The Municipality started to develop a design that included all the improvements that are requested by the musicians and the listeners.

The original semi-circular shape of the main hall was changed in a horse-shoes shape, which from the architectural perspective slightly differs from the original one, but from the acoustic perspective avoids the focalisation in the centre of the stalls.

ACOUSTIC DESIGN

The acoustic design has involved some aspects in the theatre: the introduction of acoustic panels in the walls and in the boxes; the realization of the orchestra pit with variable acoustics; the introduction of the acoustic shell in the stage area.

The main hall

In the main hall the acoustic enhancements are related to different aspects. The pavement is based on a cavity which will also host a water tank required for safety of the theatre, and it is made of wood.

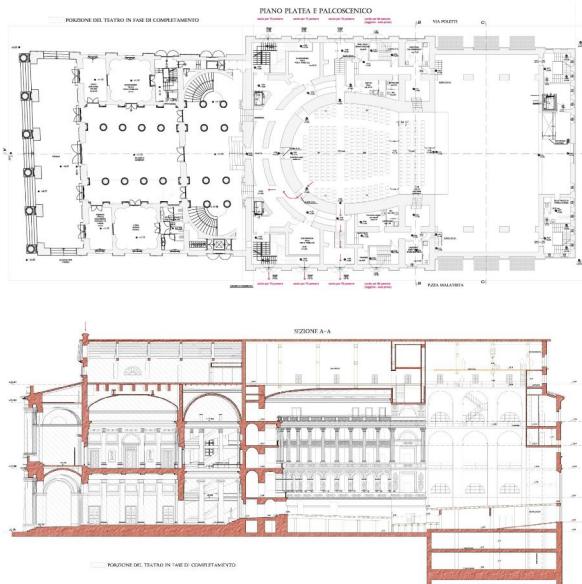


Figure 7. The new architectural design of the theatre

At the lateral walls, close to the seats, there will be positioned acoustic panels with both function of absorbers and diffusers.

On the boxes, in each vertical wall, a diffusing panel will be added, in order to avoid the strong reflected sound from lateral walls, which could provoke flutter echo within the boxes.

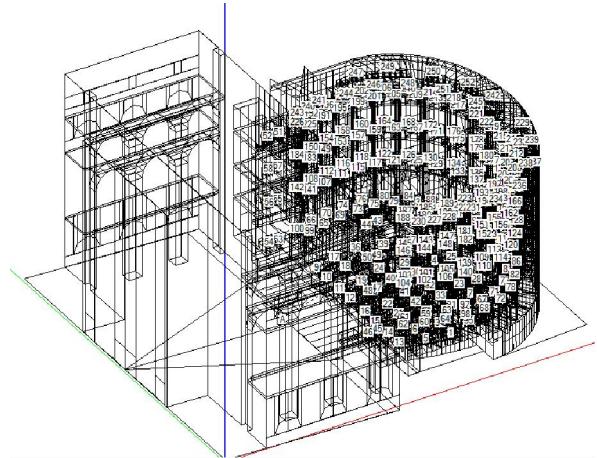


Figure 8. The numerical 3D model of the theatre

The orchestra pit

The orchestra pit is a completely new element in the theatre. The new orchestra pit is now enlarged (about 100 m²) and fully provided with variable acoustics. A set of acoustic panels could move, rotate and translate over all the lateral walls and on the ceiling (below the proscenium). The floor can move from the bottom to the stalls and further to the stage, giving three possibilities for the theatre. All these cases have been studied and optimised by means of a 3D, numerical model of the room.

The acoustic shell

One important acoustic element for the stage area is the acoustic shell. In the teatro Galli of Rimini the acoustic shell has been designed for three configurations, which have been considered the most significative cases of normal use of the theatre. The shell is modular, and the shape has been determined accordingly the dimension of the proscenium with the depth of the stage. The panels are made of different wood having different treatment depending of the position on the shell.

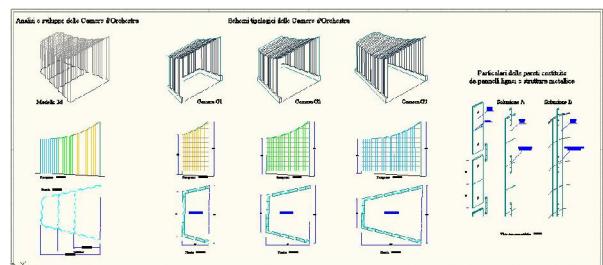


Figure 8. The acoustic shell

To improve the acoustic from the musicians perspective (and help their performance), the surfaces near the stage should reflect on the stage part of the sound energy produced. The other part of the energy can be directed toward the public. The acoustic shell is made of panels placed on a metal structure hang from three reticular beams.

RESULTS

In order to determine the acoustic characteristics of the hall with the acoustic treatments described above, since no acoustica data are obviously available, the numerical model has been realised considering the sound absorption characteristics of materials utilised in other similar cases.

Table 1. Average values of acoustic parameters in the theatre

Hz	63	125	250	500	1000	2000	4000
T20	2.68	1.98	1.64	1.51	1.56	1.5	1.07
EDT	2.16	1.59	1.32	1.23	1.24	1.21	0.99
C50	-2.16	-0.72	0.51	1.02	1.02	1.17	2.65
C80	-0.11	1.42	2.61	3.07	3	3.14	4.75
D50	37.79	45.87	52.94	55.87	55.85	56.71	64.82
Ts	142.2	103.9	82.5	75.1	75.8	73.4	54.9
G	5.1	3.8	2.3	2	2.1	2	1.3
RaSTI	0.65	0.69	0.7	0.7	0.7	0.7	0.75

The simulations have been repeated in different configurations, and the acoustic characteristics of the materials (walls, floors, ceilings, seats, etc.) have been modified until the target values of reverberation time (1.4 s at middle frequencies) and other parameters have been reached. In table 1 the average values of the main acoustic parameters are reported.



Figure 9. The main hall (rendering)

3D Auralisation

The final solution for the theatre has been rendered by means of a 3D auralisation. A short movie (5 minutes), which illustrates the architectural design, has been realised. The audio of the file has been obtained by means of convolution between dry music and the binaural impulse responses obtained from the simulations. The movie (the DVD could play both normal Stereo and Stereo-Dipole audio) could render also the sound quality in the main hall.

CONCLUSIONS

The Teatro Amintore Galli in Rimini, after almost 70 years from his destruction during the Second World War is going to be rebuilt. The architectural characteristics of the room will follow the rule “where it was, how it was”, but provided with all the technical and acoustical requirements that a new opera house should have in the 21st Century.

ACKNOWLEDGEMENTS

The author wishes to thank Giorgio Guidotti for his help during at the computed desk.

REFERENCES

- [1] A. Cocchi, M. Garai, L. Tronchin: “Effectiveness of different computer codes to assist the acoustic correction of a large multipurpose hall” Proc. of Euro-Noise, Lyon, France, 1995.
- [2] J.S. Bradley, G.A. Suloodre: “Listener envelopment: An essential part of good concert hall acoustics”, *J. Acous. Soc. Am.* **99**, 1, 22 (1996)
- [3] A. Cocchi, A. Farina, M. Garai, L. Tronchin: “Computer assisted methods and acoustic quality: recent application cases”, in Music and Concert Hall proceedings, edited by Y. Ando and D. Noson, Academic Press, London, 1996
- [4] L. Tronchin: “Acoustical design of diffusing panels in the Theatre Vittorio Emanuele, Messina, Italy”, Proc. of RADS, Room Acoustics: Design and Science, Awaji, Japan, 2004
- [5] L. Tronchin, G. Farolfi, A. Macuzzi, V. Tarabusi: “The acoustical design of the Auditorium of Firenze (Florence), Italy”, Proc. of RADS, Room Acoustics: Design and Science, Awaji, Japan, 2004
- [6] L. Tronchin: “The design of acoustical enhancements and diffusion in the opera house of Treviso, Italy” Proc. of 6th International Conference on Auditorium Acoustics, IOA, Copenhagen, Denmark, 2006
- [7] A. Farina, L. Tronchin: Measurement and reproduction of spatial sound characteristics of auditoria, *Acoustical Science and Technology*, **26**(2), pp 193-199, 2005
- [8] L. Tronchin, A. Farina: “Acoustics of the former Teatro “La Fenice” in Venice”, *Journal of the Audio Engineering Society*, New York, **45**(12), 1051-1062, 1997
- [9] L. Tronchin, A. Farina: Computer simulation of Binaural, Stereo-Dipole, B-format and Ambiphonics impulse responses, Proc. of 17th International Congress on Acoustics, Rome, Italy, 2001
- [10] A. Farina, “RAMSETE - a new Pyramid Tracer for Medium and Large Scale Acoustic Problems”, *Proc. EURO-NOISE 95*, Lyon (1995)