ACOUSTIC MEASUREMENT AND SIMULATION OF A SPORT CENTRE IN ITALY

Salvatore Barbaro *[1], Rosario Caracausi[1], and Gaetano Cognata

[1]Department of Research in Energetic and Environment, Palermo University
Viale delle Scienze, 90128 Palermo, Italy
sbarbaro@unipa.it, caracaus@neomedia.it

Abstract

This study was carried out to evaluate and compare the results of acoustical simulations (carried out by means a 3D model) and measurements concerning the acoustical climate of a sport centre in Italy. This sport centre will be used also as a concert room. The 3D model was drawn up according to architectural plans. The acoustic model was calibrated by means preliminary measurement in situ.

Some procedure of room acoustic correction were identified to be able to ameliorate the acoustic climate (for sport and concert utilisation) of the sport centre

INTRODUCTION

This study was executed taking into account the growing utilisation of sport centre as concert hall and taking into account the problem to reconcile the utilisation of the structure for the concerned activities. The study was effectuate thanks the sensibility of the technical managers of work.

SURVEY PROCEDURE

The acoustic survey of the room has been led by a multitude of complementary activities:

- the first one was aimed at gathering information about: geometry of the room, surfaces, materials acoustic characteristics, room utilization (spectacle, sport) so as to characterize the more important sources of noise and enjoyment of the room;
- the acoustic measure of RT and parameters concerning the room criteria was carried out (room acoustic characterization) for the current configuration

(without facing of walls, large steps and floor). Measurements were carried out in a grid of points for the model calibration;
- 3D modelling of the room;
- choosing of absorbing coefficient of materials;
- acoustic simulations;
- feedback procedure for model calibration (comparison between RT measured with RT calculated) and modification of the acoustic model;
- final simulation for the configuration ante operam;
- choosing of procedures for the acoustic adjustment of the room;
- acoustic simulation and measurement post operam.

SITE CHARACTERIZATION

The sport centre is located at few km to the historical centre of Cefalù (an important tourist centre in Sicily as showed in fig. 1) in a scarcely populated area.

Figure 1 – Cefalù an historical and sea-town

The sport centre is located next to the national road linking Palermo with Messina as showed in figure 2. In figures 3 and 4 the 3D view of the sport centre are showed.

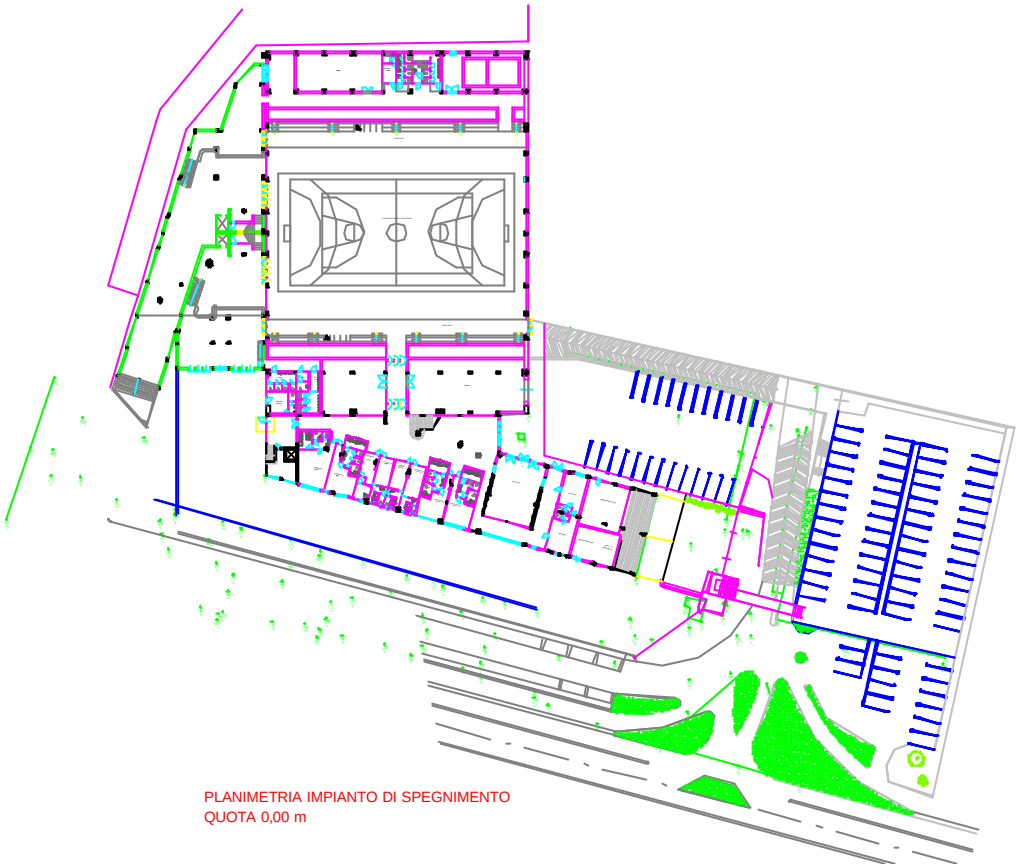

Figure 2 – Plan of the involved area

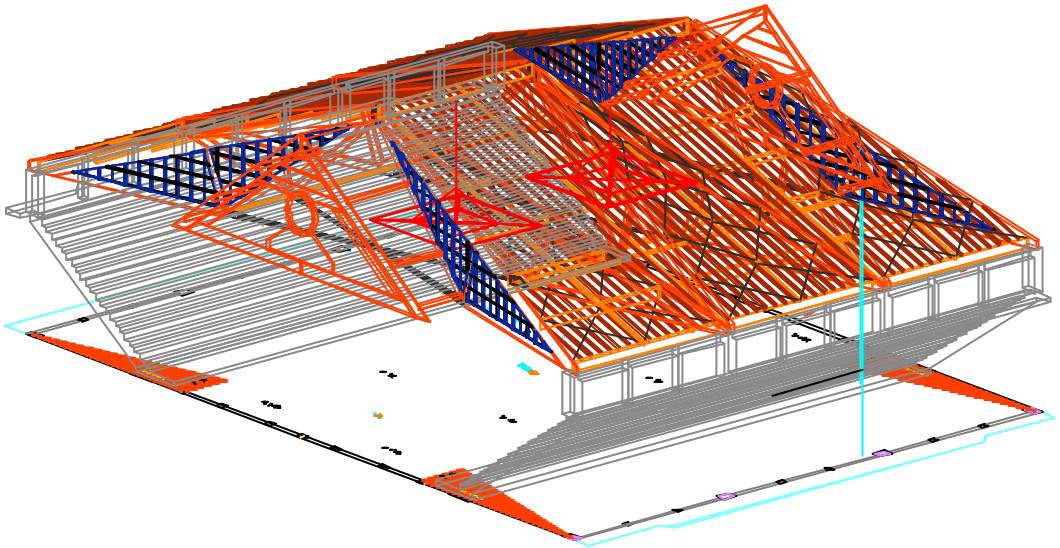

Fig. 3 – 3D view of the sport centre

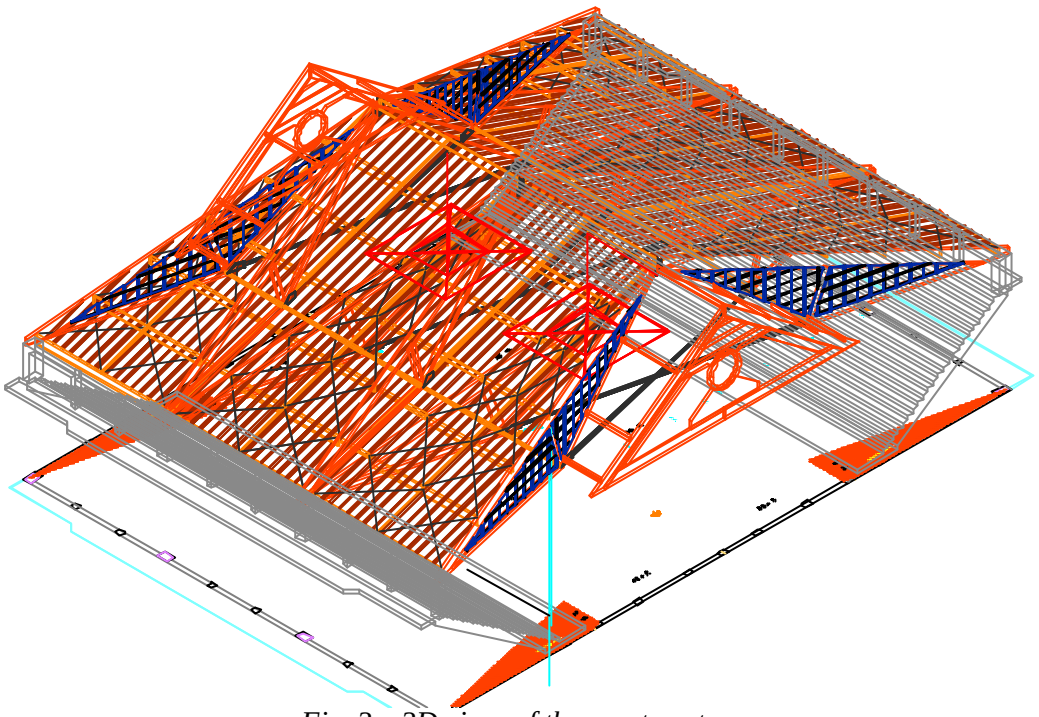

Fig. 3 – 3D view of the sport centre

3D MODELLING

The 3D modelling give a wide range of performance analysis and simulation functions. The 3D modelling aide to conceptual design as well as final design validation. Designers can start generating vital performance-related design information before the building form has even been developed. It is possible to start with a detailed acoustic analysis to calculate the potential effectiveness of various passive design techniques or to optimise the use of materials. It is possible to test some scenarios before gradually developing up the final design. etc. The room shape was developed through extensive 3D computer modelling.

After drawn the model it is necessary to perform the material assignment. The effect of choosing a different material depends on the element type of the object. For objects such as walls, roofs, floors, and ceilings the incorrect evaluation of existing material or new materials (for a new project) could give errors estimated between 100% and 300%. For windows, doors, panels, voids, and sources could give also important errors of RT evaluation.

Material assignments is important in particular concerning the evaluation of absorption coefficients.

ACOUSTIC SURVEY

The experimental measurements has led us to characterize the hall in a grip of point as showed in figure 4. The impulsive source was placed as showed in figure 4. In figures 5 and 6 the results of RT measurement in the point 7 and 8 are showed as an example.

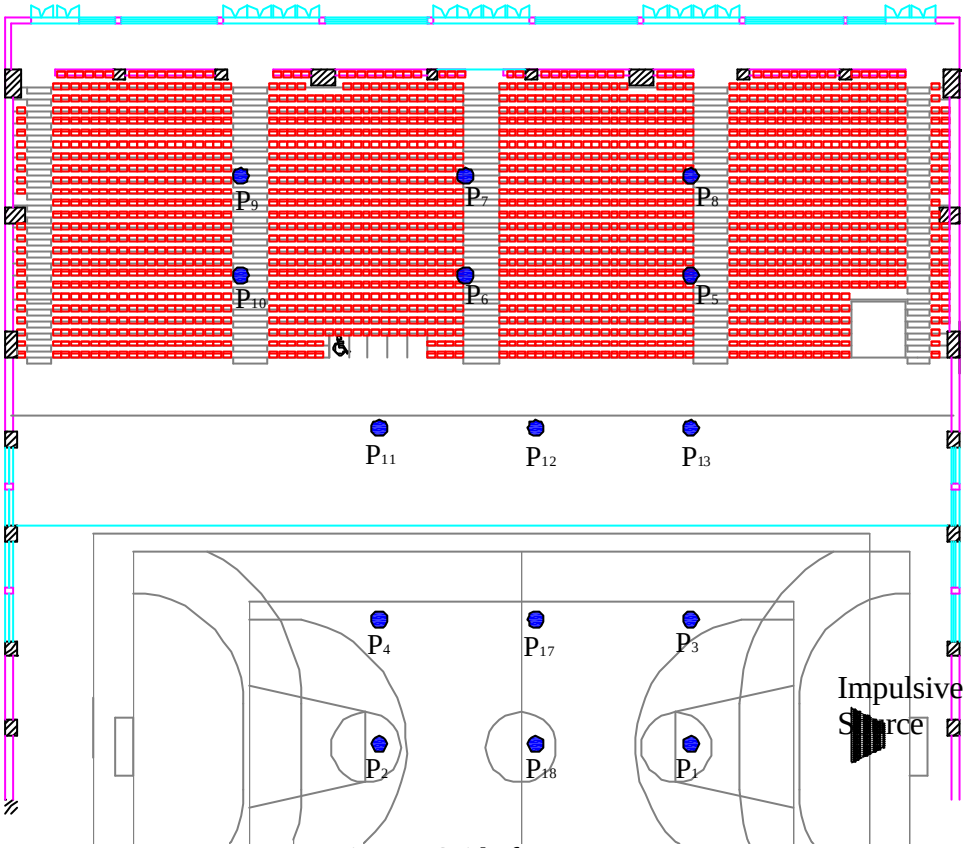

Fig. 4 – Grid of measurement

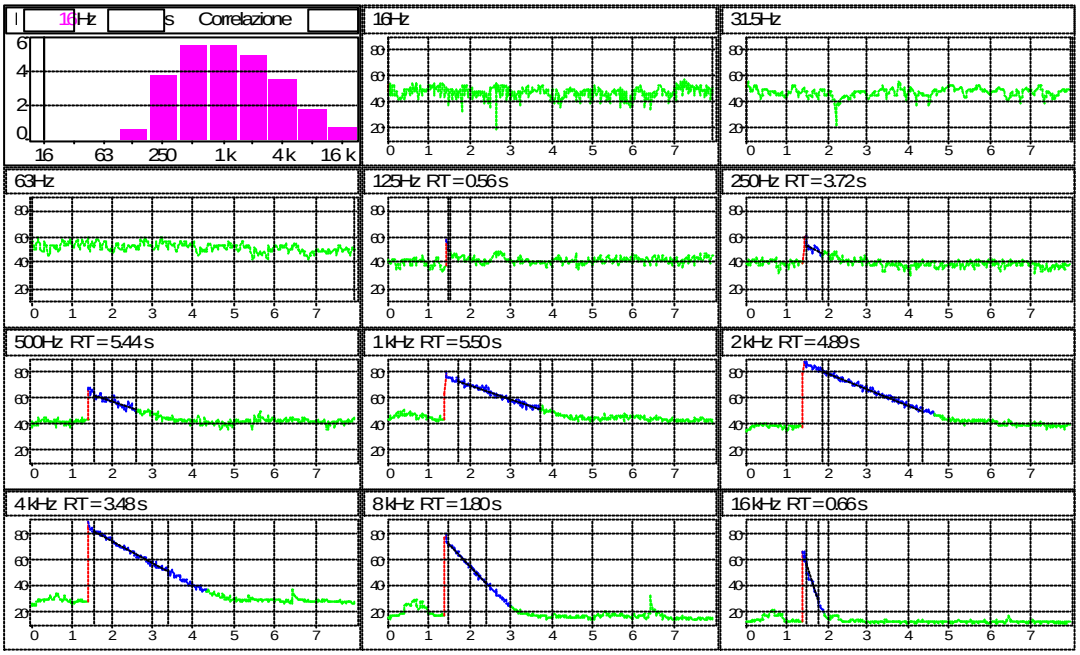

Figure 5 – Point 7: RT values

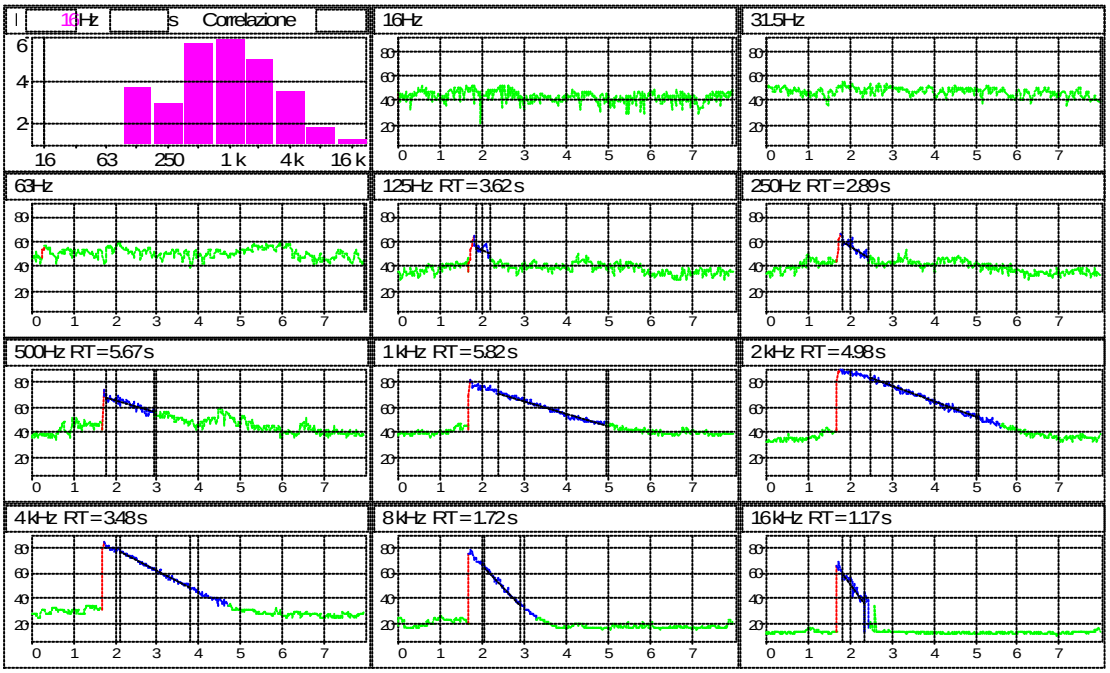

Figure 6 – Point 8: RT values

The results of the measures in the same points but with the impulsive source placed at the centre of the field were comparable to the previous. In figure 7 RT values measured in point 7 are showed.

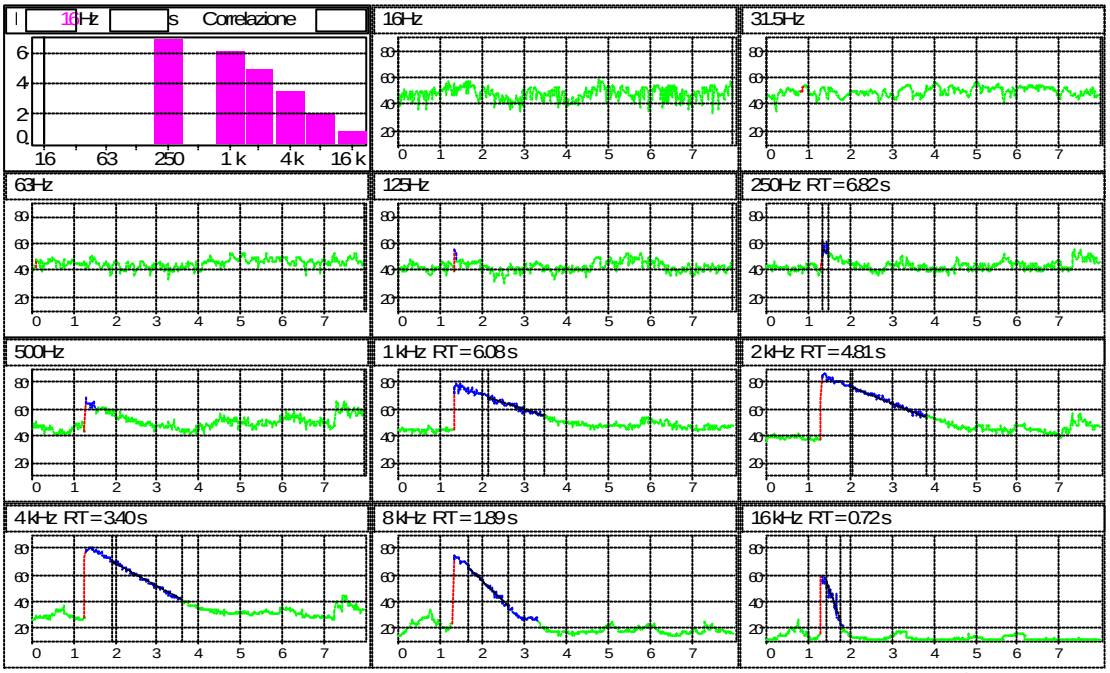

Figure 7 – Point 7: RT values with an impulsive source placed at the midfield.

The executed measures were necessary to calibrate the 3D acoustic model. In figure 8 the results of the first simulation are showed.

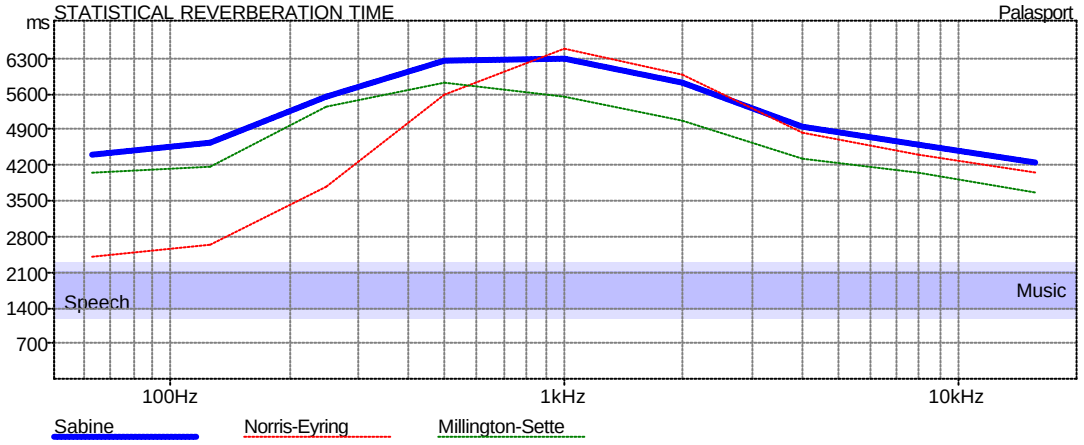

Figure 8 – Simulation: Statistical reverberation time.

After a feedback procedure with small correction of model the simulation give results comparables to measure.
A first idea of mitigation RT was to ameliorate the acoustic absorption of the ceiling and the results are showed in figure 9.

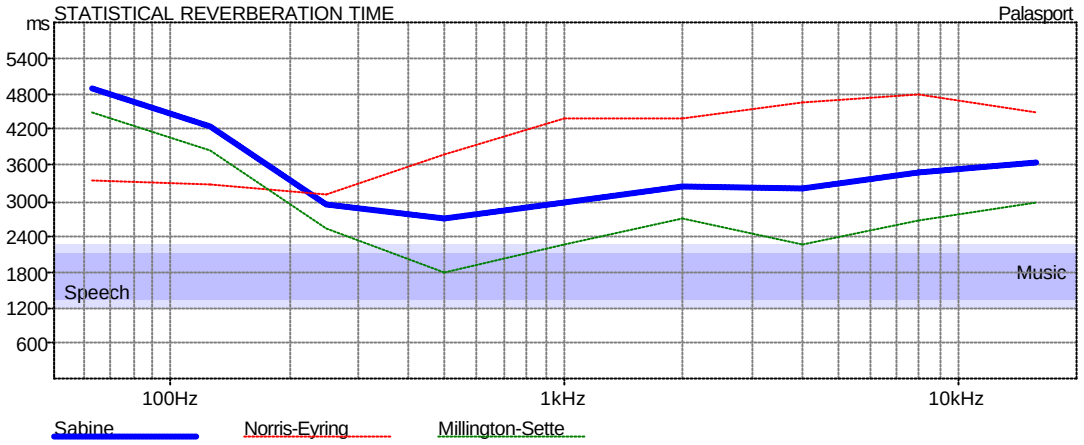

Figure 9 – Simulation: Statistical reverberation time after ceiling modification..

Finally, after the facing of the walls (particularly care of the upper area of the walls was carried out) the RT values were considerate acceptable taking into account a compromise between architecture and acoustics. Results of measurement of other room criteria are omitted in this paper.

SUMMARY

In this paper a procedure for assessing the acoustic response of a multipurpose sport centre (used also as a concert hall) is applied.

Some procedure of room acoustic correction were identified to be able to ameliorate the acoustic climate (for sport and concert utilisation) of the sport centre.

REFERENCES

Books: M. Meisser, *L'acoustique du bâtiment par l'exemple*. (Le Moniteur, Paris, 1994)

Others: ?1?. CSTB, Acoustique, REEF- volume II, science du Bâtiment. CSTB, Grenoble, 1992

?2?. Giuliani A., Cocchi A., *Elementi di Acustica tecnica*, Libreria Editoriale Petroni, Bologna 1973.

?3?. UNI EN ISO 3382, *Misurazione del tempo di riverberazione di ambienti con riferimento ad altri parametri acustici.*