International Journal of Research in Engineering, Science and Management
Volume-1, Issue-10, October-2018
www.ijresm.com | ISSN (Online): 2581-5782

Acoustical Calculations in Existing Hall

Saurabh Gaur[1], Urvi Agrawal[2]
[1]*Assistant Professor, Department of Architecture, SDPS Women's College, Indore, India*
[2]*Student, Department of Architecture, SDPS Women's College, Indore, India*

***Abstract*—The aesthetically designed convention facility is a large air conditioned place with audio – visual facility. Auditorium can be found in entertainment venues, community halls and theaters, and may be used for rehearsals, presentations performing arts productions, or as a learning space. There are two types of auditorium i.e. continental and multi aisle. The centrally and the most important visual comfort should be taken care under 3 considerations – sightlines, acoustics and room shaping. The auditorium should have good acoustics so as to cut noise pollution. The reverberation time should be properly calculated. The calculation for the reverberation time for existing auditorium is been done and also the proposal for the treatment is been given in the report.**

***Index Terms*— Reverberation Time, Sabine's Formula, Decibel**

I. Introduction

A symbol for the culture that a city adorns i.e. Auditorium. It not only serves as a platform for showcasing cultural talent but also promotes social interaction. It started as a mere platform, pulpits and forums in early century has been morphed into large auditoriums of today. This gave birth to sound echo, seating and visuals etc. hence these had to be considered for planning of auditorium. Architectural acoustics is the study of how sounds are reflected in rooms. The indirect sound changes the quality of sound we hear in a room. The major factors affecting sound is the amount of sound absorbed by walls, ceiling, floors and also the shape and size of the room. The more sound is absorbed, the fewer sound reflections will lead to less indirect sound.

II. Objective

As the study of the SDPS women's college auditorium my research is limited to acoustical treatment in existing design of the auditorium by incorporating proper material and acoustical technologies. These are the following objectives:

1. To study the best suited standards for designing such buildings keeping in mind new technologies and treatment available.
2. To study the acoustical functions in such building type
3. To research about latest acoustical design techniques and material used.

III. Methodology

Scope of this topic is very vast including designing and planning of auditoriums, use materials and techniques for designing such spaces.

1. Study of acoustical treatments
2. Literature case study
3. Live case study
4. Data analysis
5. Acoustical treatments in existing building structure
6. To find ways of incorporating the strategies
7. Acoustical calculations for the auditorium
8. Provide proposal for the auditorium.

IV. Case Study

A. Ravindra Natya Grah, Indore

1. It has capacity of 800 people
2. Ceiling material: RCC
3. Combination of concave and convex shape is used in ceiling for reflection of sound.
4. Wooden plank and quilt are used as wall treatment.
5. Cloth is fitted behind wooden plank for better sound absorption.
6. Flooring material: RCC
7. Acoustic treatment: Glass wool and carpet.
8. Stage is covered with wooden planks and wooden flooring is done.

Fig. 1. Ceiling material

Fig. 2. Combination of concave and convex shape is used in ceiling

V. CALCULATIONS

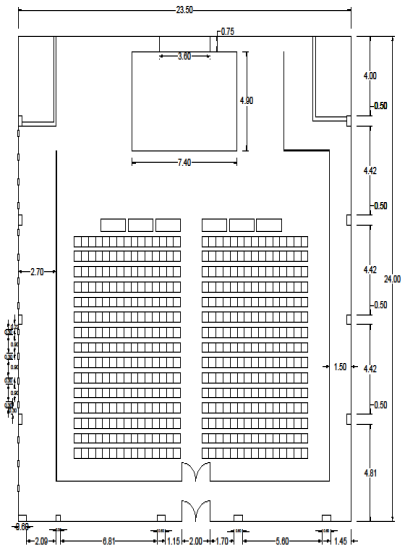

Fig. 3. Plan

- Length = 24m
- Breath = 23m
- Height = 7.5m
- Capacity = 450 people

Total absorption unit when auditorium is empty = 689 M^2-SEBIN
Now, the absorption power in M^2-SEBIN of an adult is 0.46
Hence net increase = 0.46 – 0.02 = 0.44 M^2-SEBIN
Therefore, absorption unit for adults = 450*0.44 = 198 M^2-SEBIN
Total absorption unit with full capacity of audience = 689 + 198= 887 M^2-SEBIN
Volume of auditorium = 24m * 23m * 7.5m = 3780 M^3
Calculation for reverberation time

By Sabine formula,

RT = 0.16 v/a

TABLE I
PARAMETERS

S. No.	Surface	Area (M^2)	Absorption Coefficient	Absorption Unit(M^2-Sebin)
1.	Brick wall	500	0.02	25
2.	Solid wood	125	0.10	12.5
3.	Plywood	45	0.08	3.6
4.	Fabric	40	0.21	8.4
5.	Concrete	535	0.02	10.70
6.	Chair (foam)	18	0.43	7.74
7.	Gypsum board	500	0.80	400
8.	Chair (plastic)	450	0.14	63
9.	Tiles (floor)	500	0.05	25
10.	Mud	60	0.6	36
11.	Metal	60	0.2	12
12.	Bamboo	40	0.95	38
13.	Curtains (medium)	125	0.3	37.5
14.	Glass	6	0.02	0.12
15.	Plaster	500	0.02	10
			Total	689

Where, RT = reverberation time
V = volume of the space
A = Area of absorbing materials

For empty auditorium

RT = 0.16 3780/689
RT = 0.87 sec
RT = 0.9 sec

For auditorium with full capacity

RT = 0.16 3780/887
RT = 0.68 sec
RT = 0.7 sec

Now, optimum reverberation time for auditorium with full audience is 2 secs
Calculation for extra absorption unit (s)

RT = 2 secs
RT = 0.16 3789/s

S = 0.16 3780/2
S = 302.4 M^2-SEBIN
= 302 M^2-SEBIN

VI. Conclusion

The following conclusion is obtained from the present study: The reverberation time of the existing auditorium is 0.7 sec. Optimum reverberation time required is 2 seconds. Wood wool slabs can be used as treatment on walls for obtaining the absorption unit of 104 M^2-SEBIN as its absorption coefficient is 0.60.

References

[1] Architectural Acoustics (applications of morden acoustics) by marshall long.
[2] Builing construction by sushil kumar.
[3] Architectutral acoustics by david egan.
[4] Building acoustics-wikipedia.
[5] National Building Code for standard acoustical data.
[6] Building construction by rangwala for absorption coefficient.