SOUND TREATED ROOM AT KASTURBA MEDICAL COLLEGE HOSPITAL, MANIPAL

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One of the major requirements in hearing evaluation is a controlled acoustic test environment. There are different methods of constructing sound treated rooms. In addition to good design, there should be continuous supervision of the construction details. A sound treated room has been constructed at Kasturba Medical College Hospital, Manipal. This paper deals with the particulars of construction of the sound treated room. It is hoped that the particulars furnished here would be useful to those who are interested in the construction of sound treated rooms in their speech and hearing clinics at reasonably low cost.

Noise Level Measurements

Using a SPL meter fBruel and Kjaer type 2203), connected to a microphone (Bruel and Kjaer type 4145 and with an Octave filter (Bruel and Kjaer type 1613) set, the noise levels in the proposed test room location was measured at different positions during peak hours. The results of measurements are given in the Table 1.

TABLE 1. S.P.L. Values measured at K.M.C. Hospital, Manipal

Weighting net work	At 10.30 A.M. (Peak Hr)	At 11.30 A.M. (Peak Hr)
A-Scale	65 dB	62 dB
B-Scale	80 dB	72 dB
C-Scale	92 dB	84 dB
In Octaves		
31.5	90 dB	82 dB
63	84 dB	76 dB
125	74 dB	64 dB
250	70 dB	64 dB
500	62 dB	57 dB
I K	60 dB	54 dB
2 K	62 dB	46 dB
4 K	44 dB	42 dB
8 K	30 dB	36 dB

Note: Frequency in Hz
Intensity in dB. Ref: 0.0002 dynes/cm2

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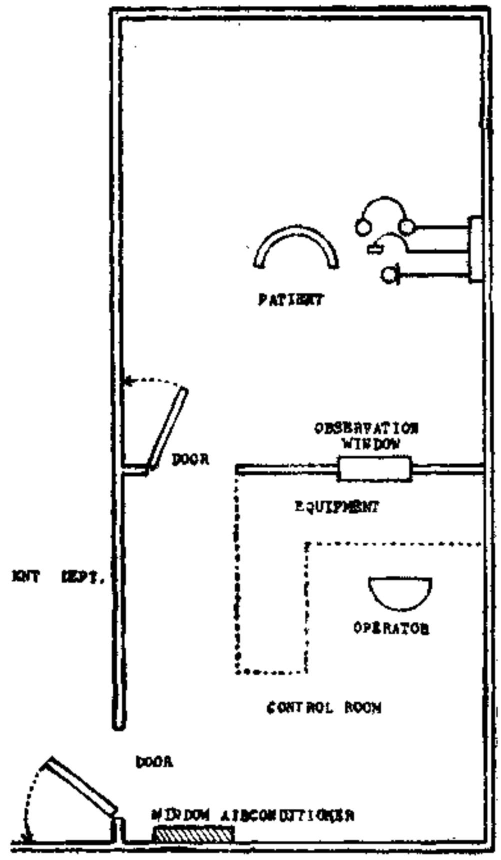
Dimensions of the rooms

The internal dimensions of the rooms were fixed at 9'X 12' for test room and 10'X 9' for the control room (where audiometer is installed) Figure 1 illustrates the dimension of the rooms.



I'lG. 1.

Construction of Walls

Having considered the noise levels, the attenuation characteristics of the bricks (Cook *et al*, 1957) and the required noise levels for testing purposes (Table 2 gives the maximum allowable noise levels proposed in the testing room for audiometers calibrated to ISO 1964) the thickness of the walls was decided. North, South and East side walls were constructed with a width of 131/2 (l1/2" brick wide walls). The west side wall was constructed with a width of 9" (single brick-lengthwise). A 5" air gap was provided between the west side wall and the existing wail. All the walls were constructed, using cement marter and lj" thick rough cement plaster. While constructing the walls, wooden studs of size 2"x2"x5" with a projection of 2" above the plastering at a distance of 2' for all the inside walls to fix wooden frames were provided. In the case of south side wall, the air gap between the wall and the wooden frame was 5". The stud's dimension for this wall was 2" x 2" X 2". The existing ventillators on the west side wall were covered by bricks.

TABLE 2. Maximum allowable noise levels in a sound treated room for audiometer calibrated to ISO 1964 and ASA 1951 (Hirschorn 1971)

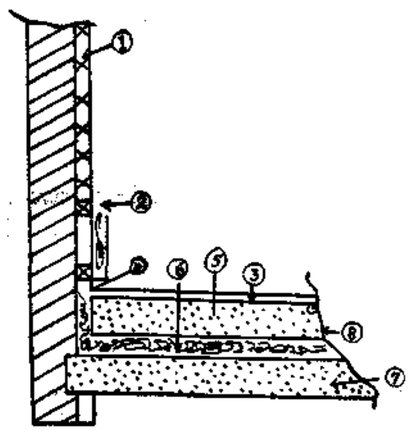
Audiometric frequency	Octave band	Proposed standard for ISO (1964) Sound Pressure level (dB)	ASA (1951) SPL
125	75- 150	31	40
250	150- 300	25	40
500	300- 600	26	40
1000	600- 1200	30	40
2000	1200- 2400	38	47
4000	2400- 4800	51	57
6000	4800- 9600	51	62
8000	9600-19200	56	67

Flooring

The four walls and the floor of the test room were isolated by 4" wide and 12" deep gap. This gap was filled with glass wool and covered by a hard board sheet. Figure 2.

FIG. 2.

1. Wall Treatment
2. Skirting with Minimum Contact
3. Linoleum
4. Air Gap
5. Wood Floor
6. Resilient Material
7. Cement Concrete
8. Water Proof Paper



Observation Window

The observation window consisted of two frames of dimension *21/2'* X2' separated by air gap of 8". It was fixed at a height of 2' above the floor as shown in the Figure 1. The two window frames were fixed with 1/4" thick glass panes. While fixing the glass panes a lining of glass wool and rubber was provided along the edges to avoid leakage of sound. The frames for fixing the window were made with 3" square teakwood bars. The glass pane fixed towards the control room was tilted by 10* on the top side. Figure 3.

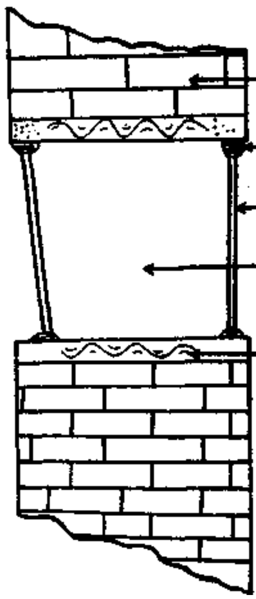


FIG. 3-

1. Brick Wall
2. Rubbed Gasket
3. *i"* Thick Glass
4. Air Space
5. Glass Wool

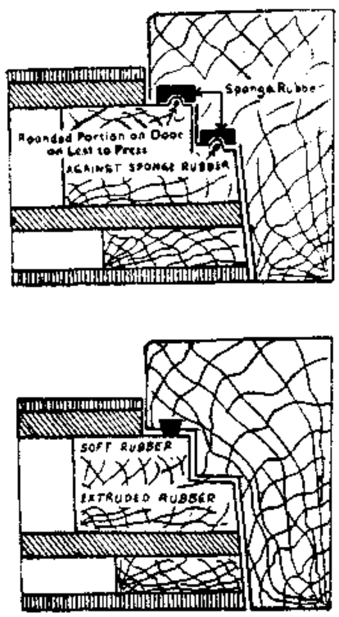


FIG. 4.

Door

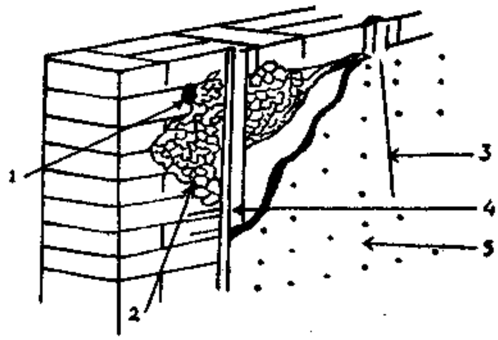
The door was **made of two** shutters and two frames The shutters were designed in such a manner that they opened in opposite directions (Figure 1). The inner dimensions of the teakwood door frame was 61/2'x3'. The teakwood frame of each shutter was 4" thick and it was fixed by two layers of 1/2" thick plywood sheets. The gap between the plywood sheets was filled with glass wool of 3" thickness. The door frames and the shutters were made as shown in Figure 4. The edges of all the door frames were fitted with a rubber lining (i'thick) with the help of an adhesive. The edges of the door frames were provided with 1" thick compressed glass wool and thick drill cloth. The shutters were provided with hydraulic closures. The door frame was installed in such a manner that the shutters were 3" above the existing floor to avoid the obstruction of the carpet. The shutters facing the test room and control room were covered by acoustic tiles.

Internal Acoustic Treatment

All the four walls were covered by 2" thick glass wool and acoustic tiles. To fix the glass wool and acoustic tiles a teakwood frame was provided over the studs fixed on the walls. To support the glass wool, a thin wire was placed over the teakwood frame. A lining was provided .with 3/4" wide,1/4" thick teakwood reapers to the acoustic tiles. The lining was painted with a suitable colour and the acoustic tiles were not painted. Figure 5 illustrates the internal acoustic treatment.

FIG. 5

1. 1" Gap
2. Wire Netting
3. Glass Wool
4. Wooden Battens
5. Perforating Lining Board



Ceiling

A false ceiling was provided 5" below the existing concrete roof. The false ceiling was made of teakwood framework with reapers *21/2'* X *21/2'* fixed at a distance of 2'. Below this frame-work a layer of wire gauze, 2" glass wool and acoustic tiles were provided. A lining was provided to the acoustic tiles as before Figure 6.

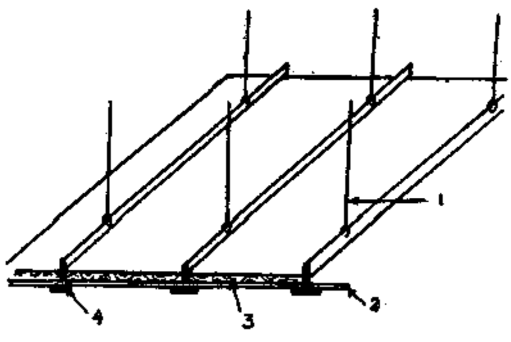


FIG. 6.

1. Chain
2. Lining Board
3. Glass Wool *1"* Thick
4. Bars

Floor

The floor was covered with a layer of *V* thick coir matting and 1" thick carpet.

Light

Indirect lighting was provided above the observation window. Additional power plug was provided as shown In the Figure 7.

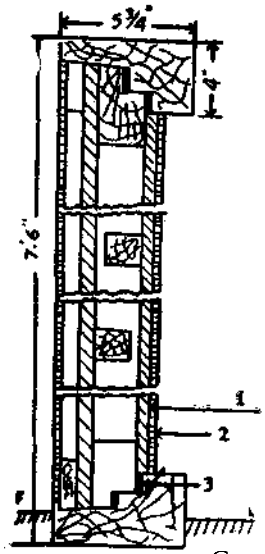


FIG. 7.

1. 1/2" Celotex
2. Glass Wool
3. Sponge Rubber

Connecting Cables

Six shielded microphone cables were provided from the control room to the test room. The cables were fixed before the walls were acoustically treated. The ends of the cables were fixed to suitable jaks which were connected to suitable boxes as shown in the Figuie 7. A polyethylene tube was used to carry the cables across the wall. (Figure 7).

Control Room

All the walls of the control room including the ceiling were covered with acoustic tiles using suitable teak wood frames *(1/2 "*thick, 2" wide) and studs were provided for fixing the frames to the walls. The ceiling frame was 8" below the concrete roof to provide air gap.

Ventilation

A l1/2 tonne window type air-cooler was recommended for sufficient ventilation for both test and control rooms. The cooler was installed just opposite to the door of the sound treated room (Figure 1),

Results

To verify whether the completed room satisfied the proposed standard levels for ISO (1964), wideband noise was generated outside the rooms using Arphi audiometer Model 700 MK II through the loudspeaker (Free field setting). The work levels outside the rooms and inside the testing room were measured using an SPL meter (Bruel and Kjaer type 2203) fixed with a microphone (Bruel and Kjaer type 4145) and Octave filter set (Bruel and Kjaer type 1613). The results are given in Table 3. When the values were compared with the maximum allowable levels proposed for ISO (1964) reference levels, it was found that at all octave bands, the levels in the newly constructed room were well below the prescribed levels. So it is felt that this design was effective and economical.

TABLE 3. SPL values of the new audiometric room at Kasturba Medical College Hospital, Manipai

Scale	Outside the rooms (dB SPL)	Inside the room (dB SPL)
A	85	18
B	87	17
C	90	25

In Octave (centred preferred Freq)	Outside the room	I aside the room	Max. allowable levels proposed for ISO (1964) reference levels (Hirschorn 1971)
125 Hz	84	24	31
2S0 Hz	86	21	25
500 Hz	82	22	26
1000 Hz	85	18	30
2000 Hz	78	17	38
4000 Hz	74	16	51
8000 Hz	74	16	56

Acknowledgement

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