Acoustic problem in Maharaja Ranjit Singh Punjab Technical University, Bathinda, Punjab & Its solution.

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ABSTRACT
An institution is place where people go to gain knowledge & to become a professional and it requires a disruption free environment for that purpose. A sound can be noise if it is beyond the level of tolerance and causes unpleasant environment and effects on health of those who spend 6 to 8 hours under the influence of that noise. MRSPTU is state technical university of Punjab, India. The newly constructed building has mechanical cooling system installed i.e.2 SPS-18 unit of Symphony Company per floor due to that these classrooms in these buildings found to have decibels beyond permissible level as per IS code. There are various sound absorption products available in the market like Natural rubber, Coconut fibres, Flax fibres, Sheep wool, Cellulose flocks etc. These material are natural and sustainable but these material are not locally available in Punjab. There is a waste product that is burned after paddy to grow crop for next season i.e. Stubble (Parali) might have the potential to resolve the noise problem. Hence this study was conducted in order identification of noise problem & understand the noise problem and finding the solution. The study was conducted in following steps- scenario one, scenario two. Scenario one had two stages .Stage one includes the measurement of sound decibel in selected classroom of the university in order to know the exact numerical value to decibel in the environment. Stage two includes the testing the potential of Stubble (Parali) blocks temporarily installed in classroom. Results generated in stage two of scenario one proved the potential of material tested by almost bring down the decibel to required level when measured on multifunctional environmental meter. Scenario two includes the testing of final solution of the problem for this panels made of ½ inch thick plywood filled with Stubble (Parali) covered with clothing material on both side having thickness – 3 inches. The result of scenario two showed that though there is potential in the Stubble (Parali) to regulate noise but requires thickness greater than 3 inch which will affect the sitting capacity of the classroom. So the further study is required to find a solution that includes different approaches like use of different materials that has sound absorption property etc.

Key words- MRSPTU, noise decibels, sound absorption materials, stubble (parali).

1.0 Introduction:
The newly constructed building of MRSPTU, Bathinda, Punjab, India has poor acoustics that seems to be a problem for student well as teachers during lectures.
The major reason behind this seems to be mechanical cooling system installed in the buildings of MRSPTU campus.
Since the campus is newly constructed not much of lectures took place in the classroom of these building, according to few people that have occupied these building i.e. teacher and students the system is fail as during lectures as the student sitting in last row can't even understand what the teacher say in the front. This is huge setback as it has a negative effects on workability of classroom as well as health of students and teacher as they spend 6 to 8 hours in classroom on working days.
There are following some the material available for acoustical treatment of a building.
- Natural rubber
- Coconut fibres
- Flax fibres
- Sheep wool
- Cellulose flocks
- Expanded Polystyrene
- Foam glass
- Glass fibre
- Mineral wool

These are not locally available material that solves this problem since Punjab is an agricultural based economy with paddy and wheat is its main crop produced.

There is a waste product that is burned after paddy to grow crop for next season i.e. Stubble (Parali). Though is well known stubble is used as an insulating material but does it have a potential to reduce the sound to maximum bearable level in these building?

2.0 Need of the Study:

An institution is place where people go to gain knowledge & to become a professional and it requires a disruption free environment for that purpose. A sound can be noise if it is beyond the level of tolerance and causes unpleasant environment in classroom. MRSPTU is state technical university of Punjab, India. The newly constructed building has mechanical cooling system installed i.e.2 SPS-18 unit of Symphony Company per floor is believed to be the source of noise generated in the newly constructed campus of MRSPTU. So there is need investigation of the building in order to provide understand the problem and develop a solution.

3.0 Aim of the Study:

To explore alternative material like Stubble (Parali) to reduce sound decibels in classrooms of MRSPTU generated from the source i.e. ducts and vents.

4.0 Methodology:

In order to evaluate the noise problem the live study was conducted in following scenarios with various equipment and technique's developed and selected on the basis of case study and comparative analysis of the result generated from scenario one, scenario two & acoustics standards is done. On basis of results generated various recommendations are given.

Scenario one (pilot study) - The Scenario one has two stages. Stage one includes the testing in order to understand the actual extent of noise of problem. Stage two include the potential of Stubble (Parali) as a noise absorbing material.

Scenario two- The Scenario two includes test the final solution i.e. panels filled with Stubble (Parali) developed on the basis of results of scenario one.

5.0 Case study:

5.1 Auditorium: A Case Study on Acoustic Design (1).

- Name of Auditorium: Calvary Convention Centre.
- Location: Jalan Jalil Perkasa 1, Taman Teknologi Malaysia, 57000 Kuala Lumpur, Wilayah Persekutuan Kuala Lumpur.
- Type of Auditorium: Multipurpose Auditorium, Holistic-driven events
- Total Built Up Area: 600,000 square feet
- Year of Completed: 2013
- Total Seats: 5,000 seat auditorium, with upholstered tip-up theatre seat covered of 2,965 square meter and timber padded retractable tip-up seat covered of 420 square meter.

5.1.1 Measuring instruments.

- Sound Level Meter.
- Digital SLR Camera.
- Smartphone.
- Laser Distance Measurer.
- Measuring Tape.
- Portable Bluetooth Speaker.

5.1.2 .Data collection methods.

Two site visits were conducted to gather information and obtain the measurements required. Many meetings were held over a one month period to analyse and compile the data we obtained. Architectural drawings such as the floor plans and sections were kindly provided to us by the architects at T.R. Hamzah & Yeang Sdn.Bhd. After gaining

permission from the convention centre's management, we conducted our first site visit on the 7th April 2018.The auditorium was unoccupied at the time which gave us the freedom to carry out our analysis unhindered and gather as much acoustical data as we can. Besides that, we were guided and supervised by Mr David, the assistant sound engineer throughout our visit who was very kind in answering any questions and inquiries about the site. A second site visit followed the next Sunday during the church service. We were allowed to join in the service and experience the acoustics while the hall was occupied. We sat in different locations to gain a better perspective and correlated this experience with the data we collected from the first site visit. However, we were not permitted to take any measurements at any point during the service. Using the tools that were described above, we gathered all the data that was required to the best of our ability, as well as observing and recording the overall acoustical design, layout, sound proofing methods and materials as well as notable acoustic components.

5.2 Sound absorption study on acoustic panel from kapok fiber and egg tray (2).

5.1.1. Panel details.

The basic materials in producing the sound absorption panel were kapok as the primary absorbs material, egg tray as a layer and plywood as a base. The material was prepared with diameter of 100mm and 28mm.

The preparation of this material was to analyse the characteristics of sound absorption through the impedance tube test.

The process of the panel with size 60 mm by 60 mm produced by using plywood, egg tray layer and the top layer was coated with cotton fiber. Thick fabrics will be used as a finishing layer of the panel.

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The process of the panel with size 60 mm by 60 mm produced by using plywood, egg tray layer and the top layer was coated with cotton fibre.

Thick fabrics will be used as a finishing layer of the panel. The panel was tested in the reverberation chamber to analyse the reverberation time. The test material should not be put parallel with the wall of the room in order to minimize the influence of the wall horizontal axis.

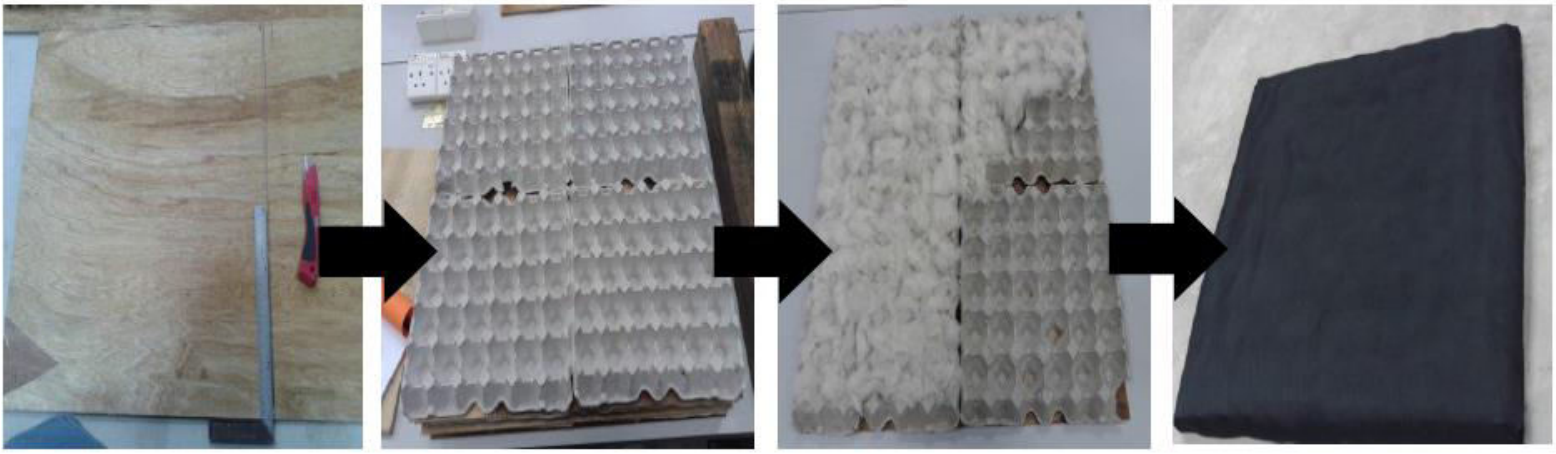

FIG 1.
(The process of producing sound absorption panel).

5.1.2. Equipment details.

Measurements made in this room are by way of a stationary noise of 01dB using following.

- Portable analyser.
- Noise sound source
- The two microphones.

6.0 Acoustics standards.

Type of Building	Noise Levels in db.
Office	50 to 60
Houses and Flats	45 to 55
Schools (classrooms)	45 to 50
Hospitals	40 to 50

TABLE 1.
(Maximum acceptable noise levels).
(Source- Table IV, Indian standard 1950-1962-Code of practice for sound insulation of non-industrial buildings). (Fifth Reprint MARCH 1995 page 10).

7.0 Live study:

7.1 Selection of Equipment.

The RH87 model of Omega Engineering is a digital multifunctional environmental meter which combines the following functions was selected for as an instrument for measuring sound decibels in the selected area(3).

- Sound level
- Luminometer
- Relative humidity meter
- Temperature meter
- Anemometer.

FIG 2.
(Multifunctional environmental meter used).

7.2 Selection of Area.

For this study classroom with following specification was selected for physical investigation as it is similar to classrooms constructed in MRSPTU campus buildings as all buildings have similar mechanical system installed. 10 location points are selected in classroom to in order to know the decibel's across the classroom.

Selected classroom has following statistics.

1. Room number-D209
2. Location – First floor, D-Block, MRSPTU.
3. Class Room Dimensions-13.7M X 6.4M.
4. Classroom has 4 vents of mechanical cooling system installed in the building has following dimensions- .6MX.25M.
5. Building is a G+3 structure has 2 SPS-18 unit of Symphony Company per floor. 6. Size of openings

- Door-2.4MX2.7M.
- Window- (W8)-.45MX2.4M.
- Window- (W2)-2.4MX1.8M.

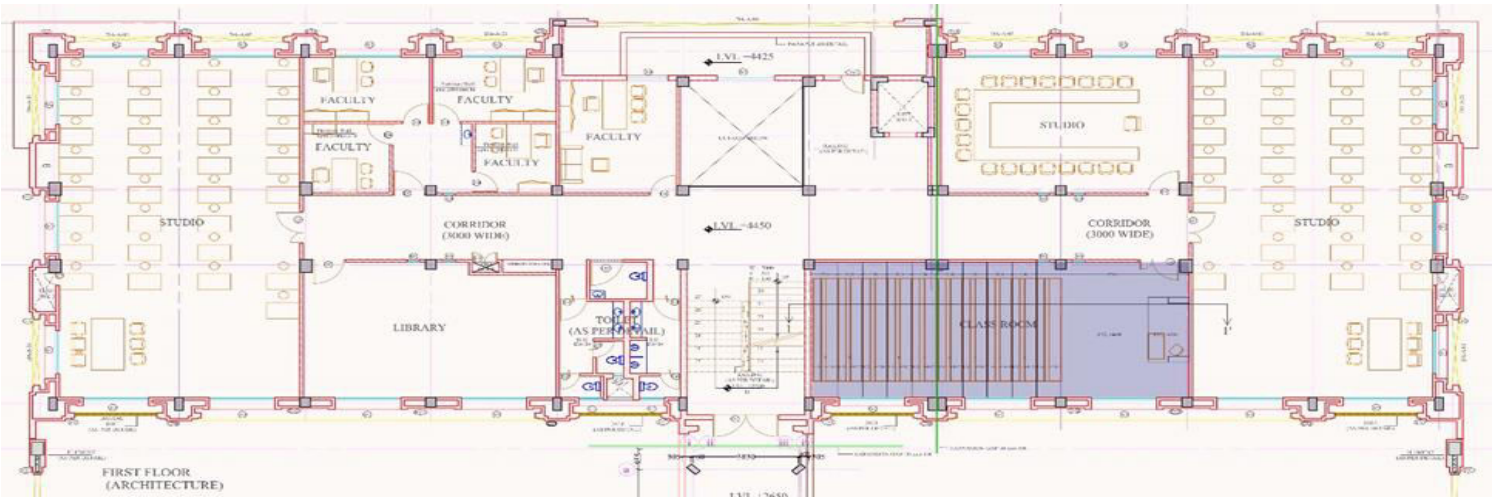

FIG 3.
(Location of Study Area in plan of Architecture block).
(Source- G.N.D.U Architecture department).

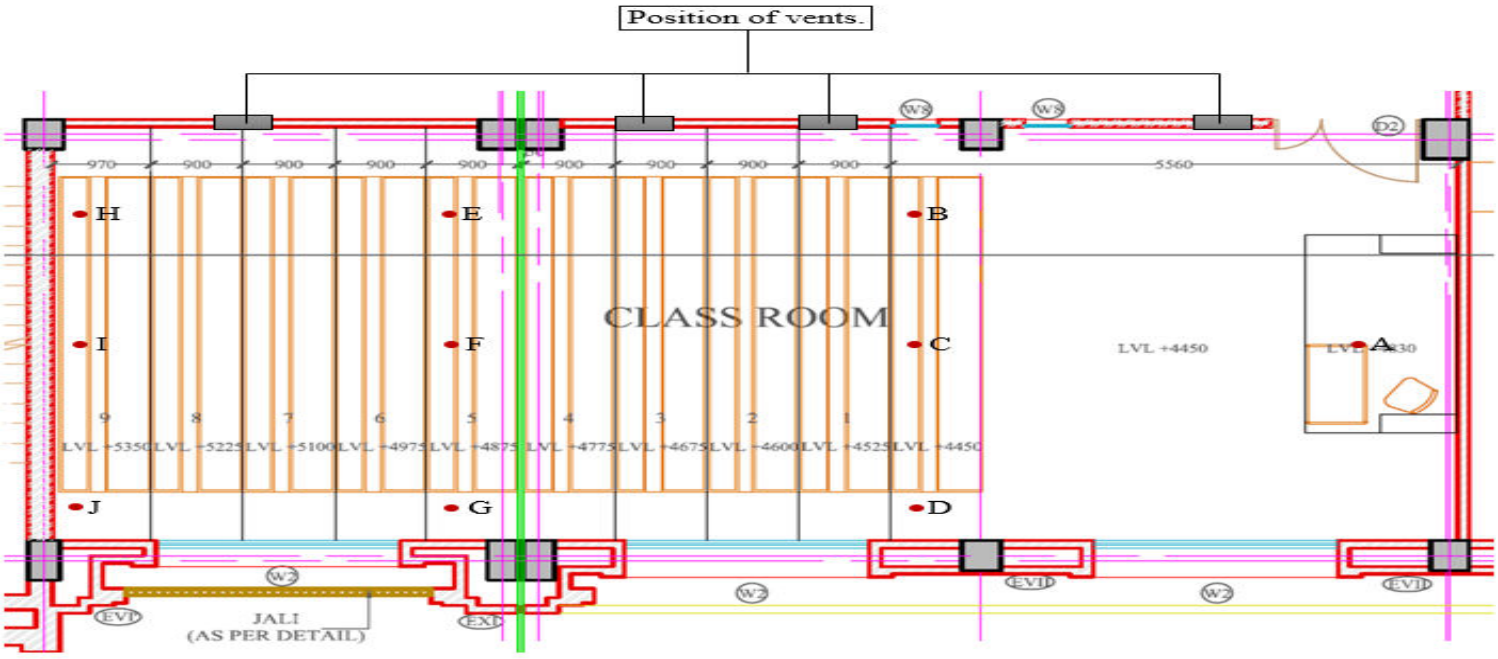

FIG 4.
(Plan of selected room along with selected location points).
(Source- G.N.D.U Architecture department).

FIG 5.
(Image showing one of the four vent of mechanical system).

FIG 6.
(Image showing measurement of velocity of air movement across the classroom).

7.3 Scenario one (Pilot study).

7.3.1 Stage one.

In stage one data was recorded by using Multifunctional environmental meter to know the actual condition.

7.3.2 Stage two.

In stage two Stubble (Parali) blocks with following dimensions were used in the classroom and then readings were taken using Multifunctional environmental meter.

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FIG 9.
(Dimension of parali block).

FIG 10.
(Classroom after installation of temporary walls of Stubble (Parali)).

7.4 Scenario two.

7.4.1 Specification of wooden penal.

- The panels had following specification.
  - Height-8 ft.
  - Width -Various dimension as per requirement.
  - Thickness - 3 inch.
- Material used to construct panel.
  - 9 pieces of Plywood having following dimension.
    - Height-8 ft.
    - Width - 4ft.
    - Thickness - .5 inch.
  - Sun shade net multipurpose greenhouse netting.

- Full Voile (a soft, sheer fabric, usually made of 100% cotton or cotton blended with linen).
- Iron nails.
- Stubble (Parali) as a filling material.

FIG 11.

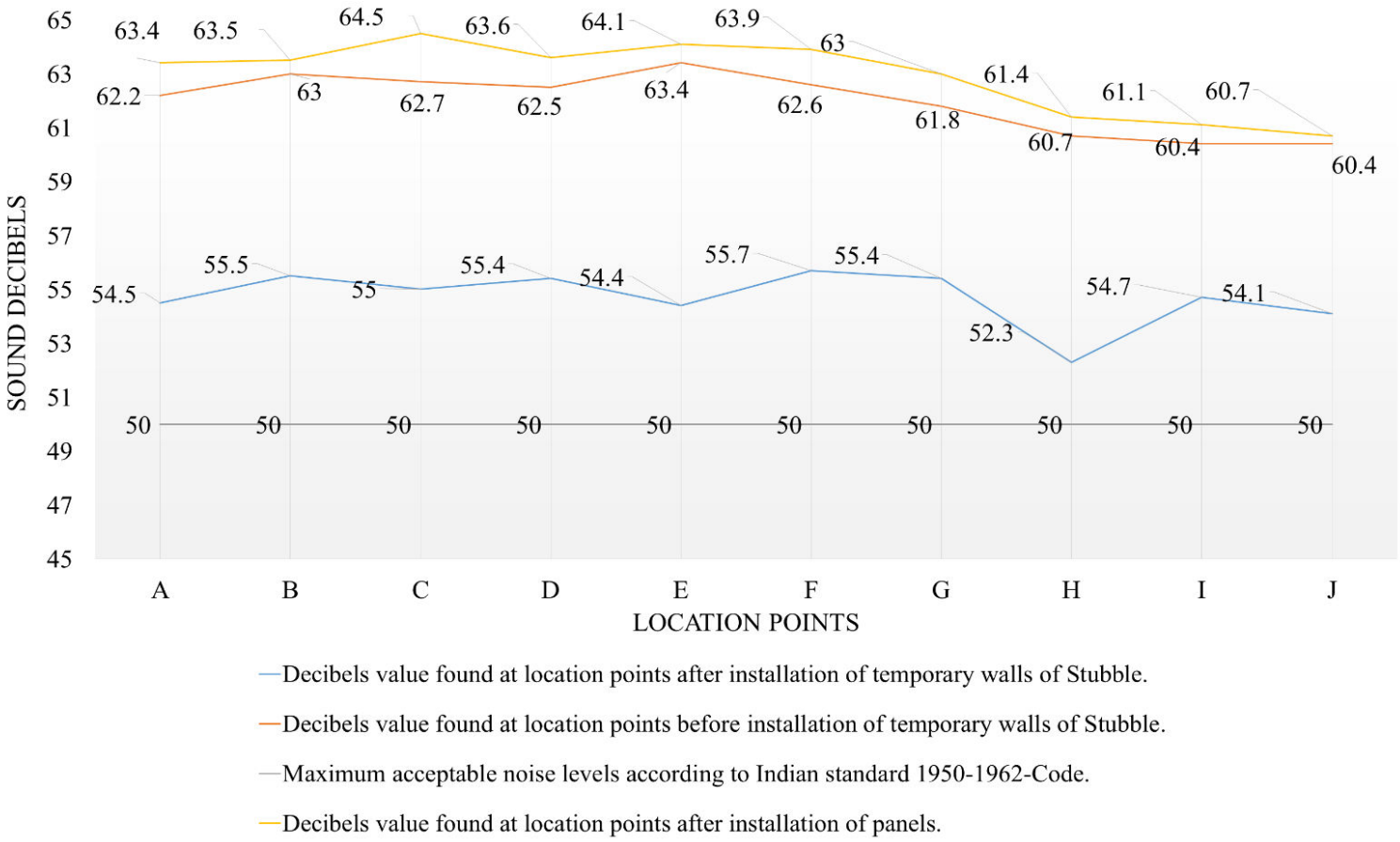
(Image showing the specification of various material used to construct the panels).

FIG 12.

(Classroom after installation of panels temporarily placed).

8. Comparative analysis of result of Stage one & two of Scenario one, Scenario two, & Indian

standards.



GRAPH 1.
(Graph of stage one & stage two of scenario one, scenario two & Indian standards).

9. Conclusion.

Following conclusion are made from results generated from this study.

In the stage two of Scenario one the study has proven the acoustical properties of Stubble (Parali) are capable to regulate sound decibels up to 9 dB (maximum) and at least 6.3 dB.

Sound decibels were almost regulated to maximum acceptable noise levels as per Indian standards i.e. 50 dB as shown in GRAPH 1 by creating temporary wall made of Stubble (Parali) blocks.

After stage two of Scenario one sound decibels at the location points near the source i.e. the vents shows the maximum decrease resulting in developing maximum sound decibels at location points at central area of the classroom this proves that Stubble (Parali) has controlled decibels but only in a limited distance and not uniformly throughout the classroom.

Temporary walls of Stubble (Parali) is not a permanent solution as Stubble (Parali) block occupies a significant space of classroom in this particular form.

In order to find permanent solution Scenario two was initiated by constructing panels with specified specifications defined above and temporary installation in the classroom.

The results of Scenario were negative and provided following conclusions.

1). The acoustic problems can't be dealt just by reducing symptoms only i.e. by using Stubbles (Parali) as an external remedy for the acoustical problem. A deeper study should conducted for better understanding and finding permanent solution through different approaches focusing in the source of problem.

2). The use of another natural sustainable in the place if stubble (parali) might have better result.

10. Further scope of study.

There is still scope to find a permanent solution of this acoustical problem at our hand. For the purpose there are following approaches to be explored.

1). Development of title from Stubble (Parali) that can be used to cover ducts of mechanical air-cooling system from inside might lower the vibrations. According to various studies rice husk can be used as substitute to make Bricks (4), based on this research there is scope of developing porous titles/panels to installed in ducts that might regulate vibrations in source.

2). Development of system to regulate airflow in the rooms and inside ducts in between different points from source to vent opening might help to lower the vibrations leading to decibel control.

3). Explore various other sustainable material i.e. jute cloth etc.

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