

ACOUSTIC DESIGN BASE REPORT

BARNES HALL LAWRENCE SCHOOL, SANAWAR

Re-imagining Barnes Hall, Lawrence School

Acoustical Design Report

PROJECT INDENTITY-

Lawrence School Sanawar is one of the oldest co-ed residential school in Asia in built in 1847.

Barnes Hall undergoing up gradation in respect to Planning, Interiors, Stage lighting and Stage craft facilities. Having distinct character of balcony supported on four columns and timber roof.

The Barnes Hall as School Auditorium conducts various musical, cultural and speech discussion. The hall represents the cultural and lively aspect of the school inside the historical structure

PROJECT GOALS –

Historic is our link to past root and culture. It encompasses the cultural identity and heritage of our community.

Architectural landmarks, monuments or structures reflects the values, traditions, and craftsmanship of our community. Prioritising to conserve the heritage character of the structure.

It's not only about conserving buildings but safeguarding legacy, roots and ensuring that future generations can appreciate and learn from the architectural treasures.

The characters of the Hall are intended to be conserved while restoring and repairing.

With interventions that will included new technology for great experience with better visual sightlines and comfort with adequate space.

Upgraded sound and projection system to fulfil requirements for future generations and technology.

The Barnes Hall –

Evaluating existing interiors of the Hall-

- The Barnes Hall geometry is rectangular shape with absolutely no absorptive surfaces except the curtains on long windows.
- Side walls as well as rear walls are plastered and painted walls.

- Projected balcony having the balcony also treated with plaster and paint and decorated moulding.
- The roof is constructed with timber frame.
- The visual sight lines of existing Hall are obstructive with uncomfortable seating.

ACOUSTICAL STATEMENT –

Overall interiors surfaces of Hall are reflective. During musical programme, these materials will reflect sound waves and contribute to higher levels of reverberation.

Rectangular rooms since the parallel walls can cause sound waves to bounce back and forth continuously — creating undesirable reverberations that muddy the overall sound clarity.

Inadequate treatment to the false ceiling, the propagation of sound and no absorption at receiving end will reflect the sound waves back.

The travel of sound waves from source to the end of the Auditorium is compromised due to lack of reflective (diffuser) ceiling the front of stage.

ACOUSTICS DESIGN PRINCIPLES -

Bornes hall is used for various purposes. Since the ideal acoustics for speech are not the same as the ideal acoustics for music. This is because better speech intelligibility requires a shorter reverberation time than music. Designing for speech as well as for music is challenging.

The integration of architectural design and the acoustics in a multidimensional way becomes essential. It is necessary to create connection between performer and audience.

The hall will relate to acoustic design that will cater to speech intelligibility, lively music and sound and also shall have technical advance projection system.

Acoustics to be designed with following factors:

- Isolation of Hall from adjoining areas – to control sound travel from external noise break-in and/or internal noise break-out. By designing of Sound Transmission Criteria of Walls.

- Designing internal acoustics of a Room - to achieve desired Room Ambient Noise level. Speech intelligibility and clarity is important consideration and identifying appropriate surface finishes to control noise with also maintaining reverberant sound.

Balance of design materials as speech shall require shorter reverberation time than music. Sound insulating materials inside frame work of panelling and partition to absorb sound is recommended.

Sound absorption materials attenuate sound travel from one zone to another and also controls sound reflections within area to maintain and achieve required

To control Air borne Sound – high frequencies controlled by sound absorbing materials and insulation added on walls, ceilings.

- Control and mitigating of Flanking Noise - Flanking sound control by measures taken to mitigate sound leakage from doors, windows, from punctures of services in wall.
- Control of Mechanical services noise. - Reducing Background noise can be done by controlling internal noise levels from HVAC and other service systems, Mechanical services noise. Low frequency sound reduced by measures taken to control vibration from mechanical services and speakers.
- Design of Stage Craft for smooth and easy access to stage from back stage area. Maintaining privacy of back stage area. Enable quick change of sets and back drops with motorized mechanism during performances.

Design of Stage lighting with latest LED lighting, FOH for visual clarity of viewing performer's expressions. Mood lighting highlighting and adding emotions to the performance.

- Design of sound system to amplify sound for worthy experience. Sound system to have high quality amplified sound. Equal reinforcement of sound throughout the hall to the rear end and balcony area for musical as well as speech programmes.

DESIGN APPROACH –

Architecture of Barnes Hall –

Barnes Hall comprises of Main Hall with balcony. Stage and back Stage area with green rooms under it. Adjoining to Hall is Main lobby area with Passage area.

Space Planning - Seating arrangement –

The lower level of Hall having seating arrangement in two parts with front rows seating arranged at same floor level, last few rows of seating is tiered (stepped).

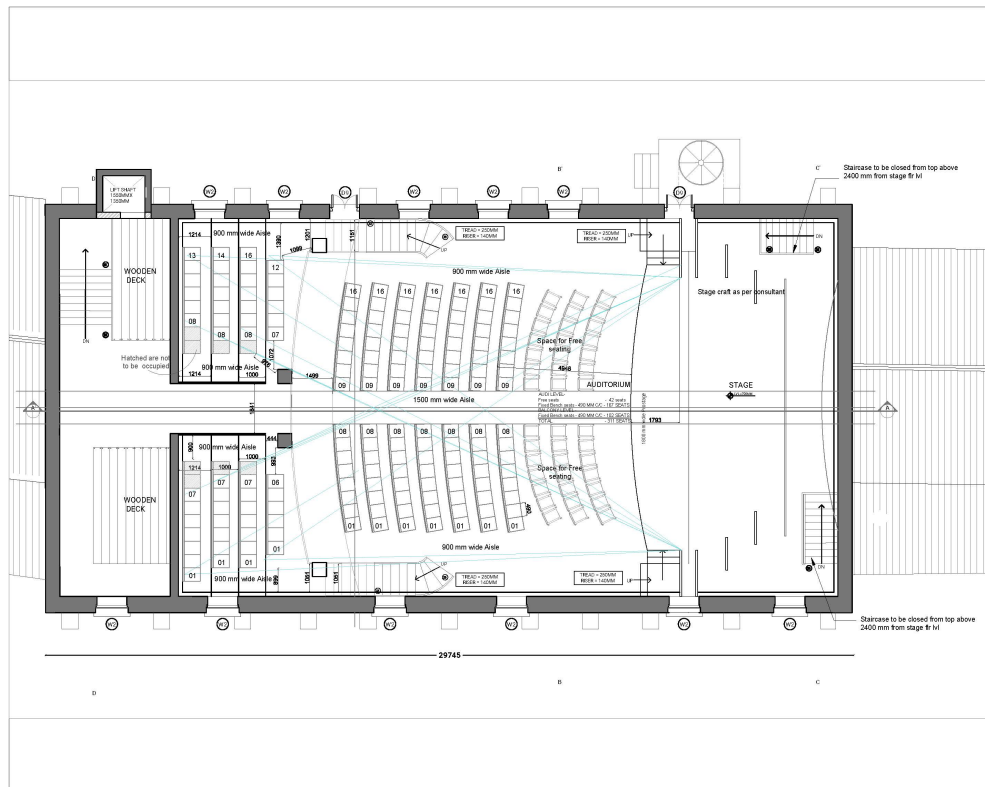
The balcony projects about half of the auditorium area below is supported on four columns. Accommodating more audience but unfortunately with visual obstruction.

Proposed seating layout –

Ground floor level –

1. Front six rows with have free stackable chairs/benches on ground level - 154 seats
2. Rear rows fixed seating 20" (510 mm) – 50 seats.

The arrangement shall be flexible type so the hall can also be used for gatherings.





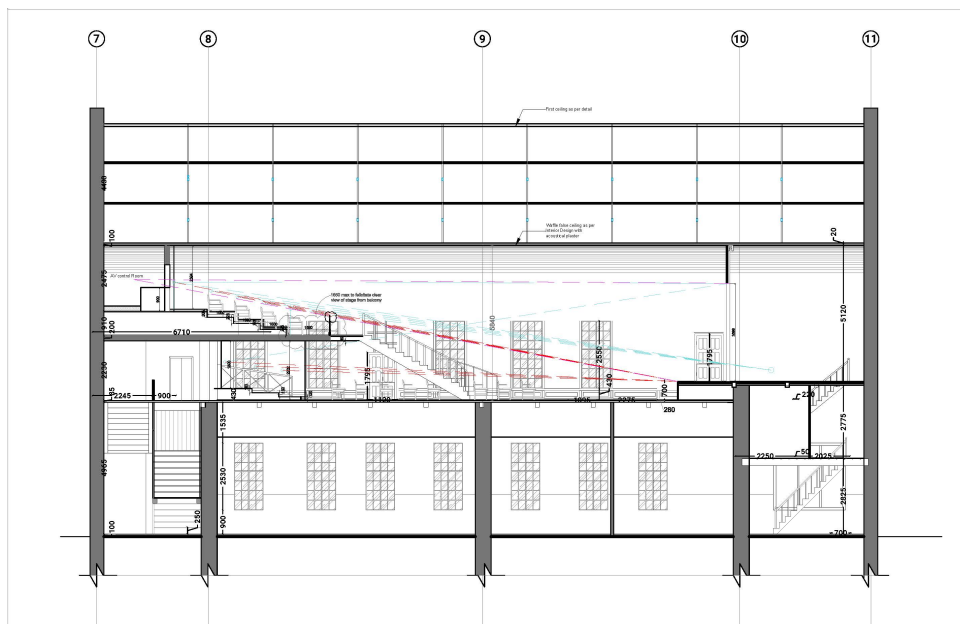
Stackable chair



Fixed push back mechanism chair

The existing balcony is supported on four columns. Balcony redesigned by increasing seating capacity and extended above Lobby area. Balcony strengthened with structural inputs by providing additional support at the balcony bottom thereby to eliminate four columns.

It is crucial to design sightline for every individual to get clear vision lines till the tip of stage from balcony. The decking for Balcony designed to cater clear visual sightline of stage for every audience.



SECTION WITH SIGHTLINE

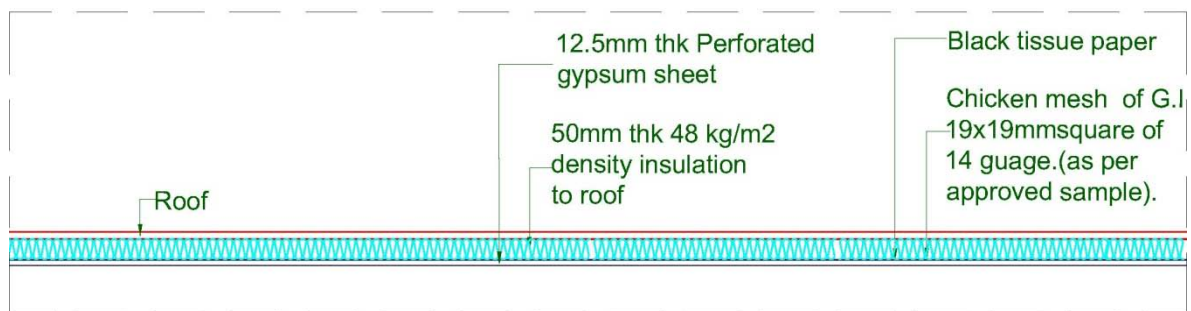
Sub steps also designed with almost equal risers for easy and comfortable climb.

ACOUSTICAL TREATMENT –

Isolation of Hall is necessary to control transfer for sound from ceiling as well as walls.

Roof of Hall to be treated with under deck treatment to mitigate impact sound of rain and adds to thermal insulation from the environment.

Ceiling below Roof - 12.5 mm thk Perforated Gypsum board (painted black) + 50 mm thk fibre glass insulation in between frame work below roofing sheet



TYPICAL SECTION - PERFORATED GYPSUM CEILING

To maintain the Room Ambient Noise of the Hall, it is necessary to treat surface area of hall exposed to sound source like walls, ceiling, and floor.

False ceiling –

From internal side the roof will not have false ceiling. The Hall's volume will not be defined by false ceiling.

Catwalk in MS fabrication suspended from Roof is used for maintenance of lighting system and HVAC ducting.

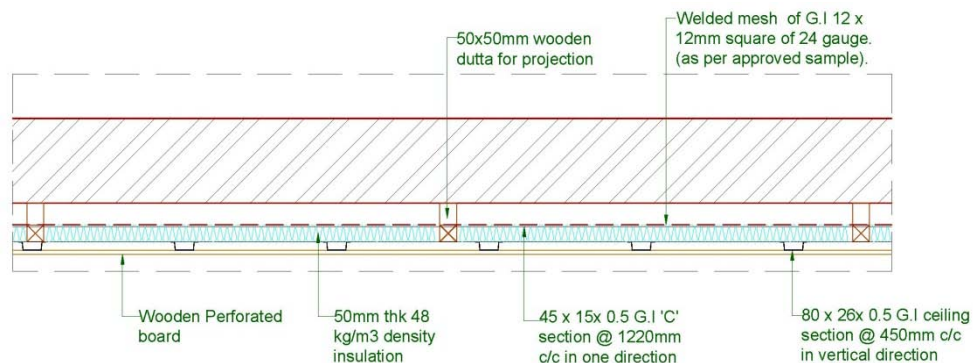
Walls–

To control transfer of sound from Hall and vice versa, the Sound Transmission Criteria of wall of Hall needs to be strengthen.

Sound Transmission Criteria of brick wall – 55 to 57 dBA.

To strengthen, Wooden Perforated panelling (0.9 NRC value) with insulation with air gap.

Balcony parapet wall too treated with Wooden Perforated panelling (0.9 NRC value) with insulation with air gap.



Wooden Perforated panelling

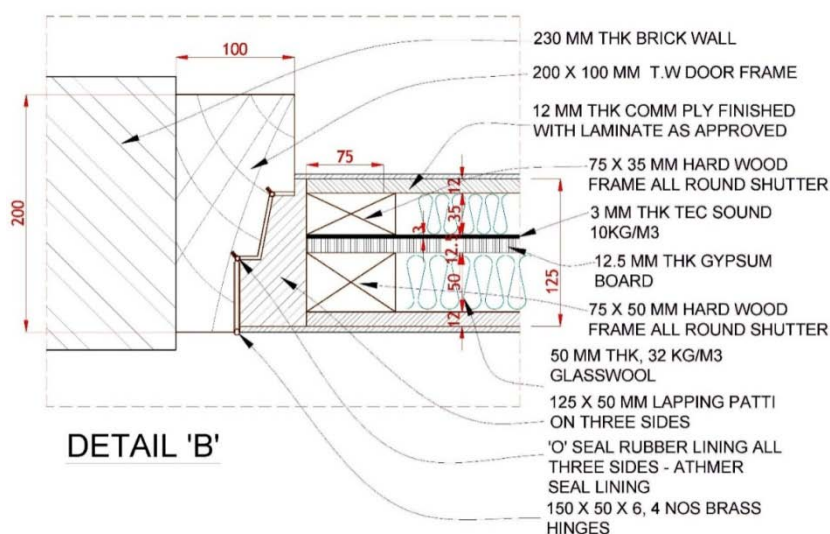
Flooring –

Hall at lower level used for multipurpose activities- wooden flooring or vinyl flooring with underlay is suitable and carpet for balcony. To mitigate and control transfer flanking sound through doors, windows or any openings in Hall, doors, windows need to be treated.

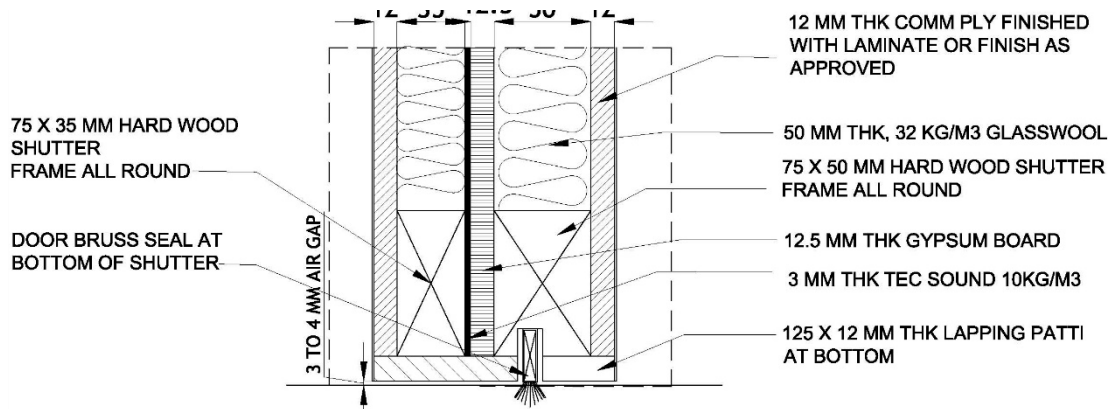
Doors & windows –

With total 302 seating capacity, four numbers of doors including entry and exit as per Fire norms are located.

Entrance doors and Exit doors of Hall will be 125 mm thk double shutter door with acoustical treatment. Frame of Door shall be with double rebate and frame shall be lined with 'O' seal at three sides of frame. Drop seal at bottom of the shutter.



Detail of Door at frame



Detail of door at shutter bottom

Double Glass unit windows – 38 dBA with characteristic existing pelmet designed furnished with appropriate curtain.

Reverberation Time-

In a general-purpose auditorium where speech should be heard clear and music to sound rich and full, the ideal reverberation time (the time it takes a sound to die away) is around 1.0 second.

- Reverberation Time – 1.0 second
- Ambient Noise of Auditorium – 40 to 45 dBA.
- NC Curve – 30 to 35 dBA

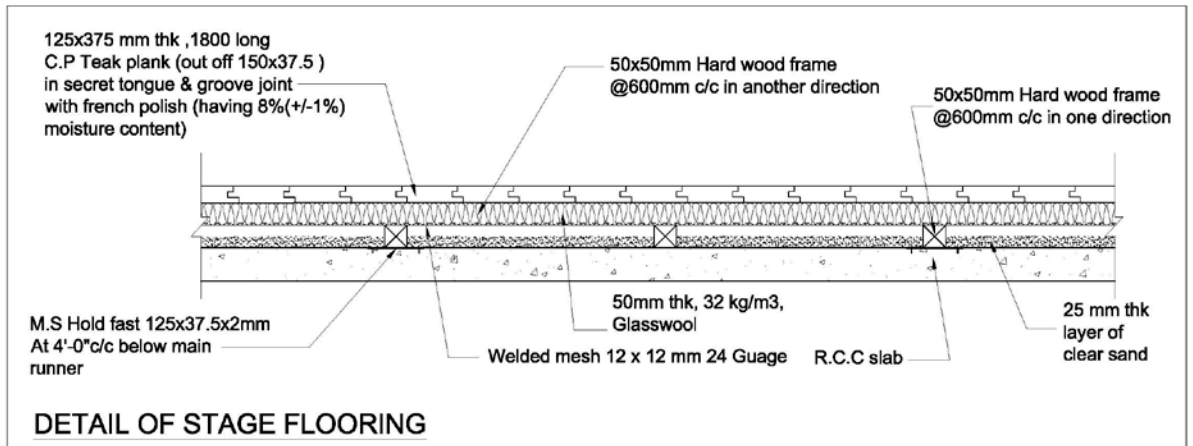
Stage –

- Stage size - Proscenium opening – 8.00 x 5.50mts.

Stage is designed with double height.

Side walls and false ceiling to stage treated for absorption of sound with 0.9 NRC.

Teak wood plank flooring with tongue and groove joint with double frame and insulation for resonance and mitigate impact sound of footsteps of performer on Stage.



- **Stage Craft** includes Main curtain, Mid-curtain, Cyclorama, Wings, Frills, Fly wings and 3-4 empty bars for props. Also includes provision of Mandapi for maintenance purpose above catwalk level.



STAGE WINGS, MOTORISED SCREEN



FRILLS, SCALLOP, PELMEET

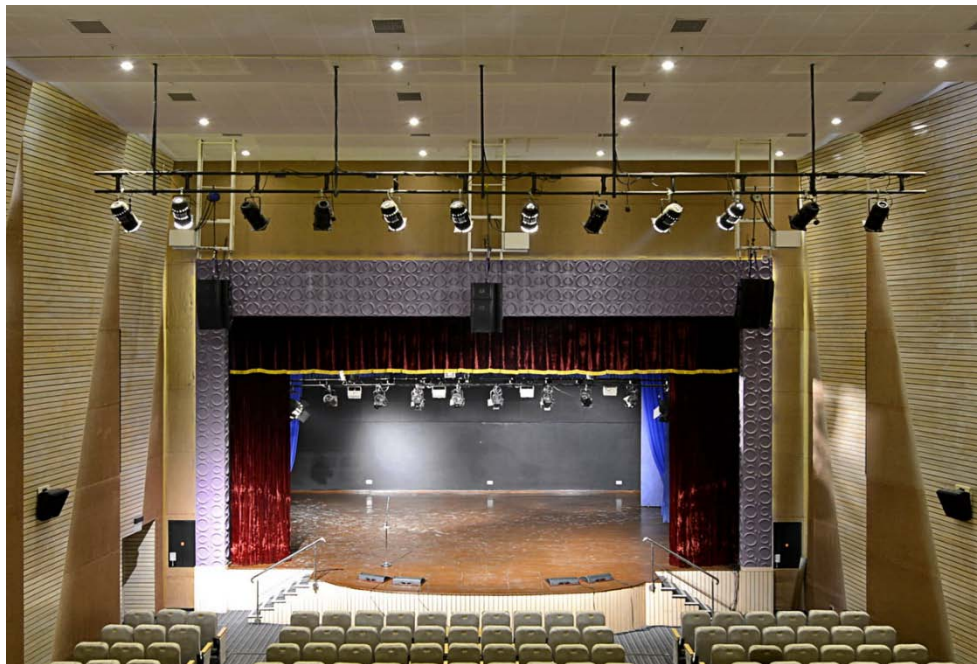


WINGS



MAIN CURTAIN & CYCLORAMA

- **Stage Lighting** is equally important for Stage area. Proposed Conventional Par lamps with cool lights and one can also explore the combination of led lights. FOH Light near stage area will be row of main lights illuminating the stage with diffused light. All lights to be on dimmer control panel.



FOH BAR AND STAGE LIGHTING



STAGE LIGHT BAR



STAGE LIGHT AND CRAFT ENSEMBLE

SOUND AND PROJECTION SYSTEM –

Sound system for Parker Hall shall comprise of Two Array speakers in suspended front of Stage for sound to travel up to last rows and cover major areas of Hall.

Three set of speakers – Centre, Right and Left concealed in proscenium frame.

Delay speaker placed on stage performer is able to listen to his own voice.



Centre, Right and Left speakers at Proscenium frame

Speakers in panelling to be mounted with rubber backing

Projector suspended from ceiling or fixed on Parapet of balcony with control on mixer console.

BACKGROUND NOISE-

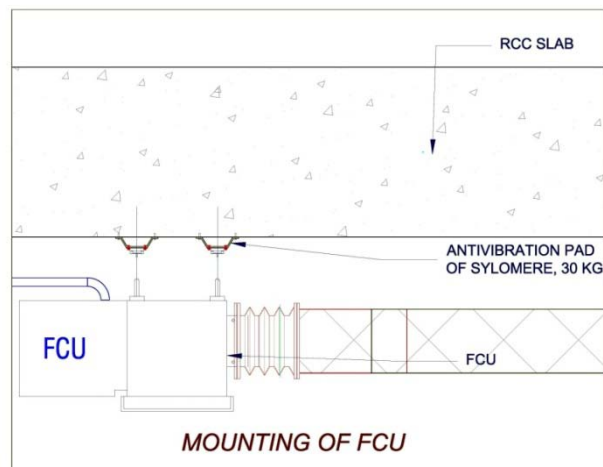
Background noise of a room plays vital role for achieving Required Ambient noise of a room. Controlling mechanical sound from HVAC will be important.

The ducting provided in the Hall is open type so the airflow through duct (CFM) will be design to avoiding sound of air throw from the diffuser of the duct.

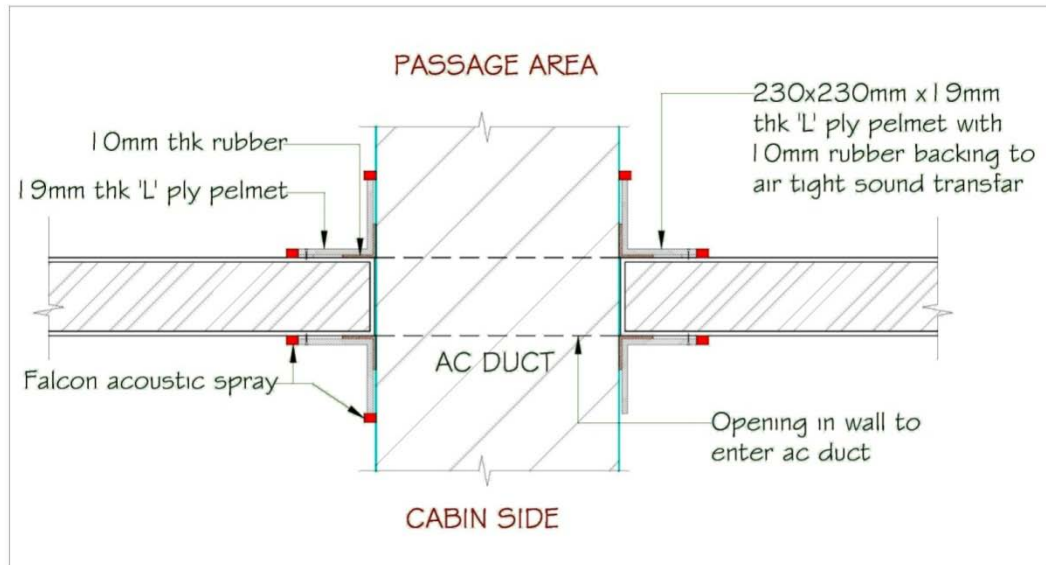
Insulation to the duct shall be required.

Recommended NC level will be 30 to 35 dBA

- AHU machines shall be mounted on Anti-vibration Pads.



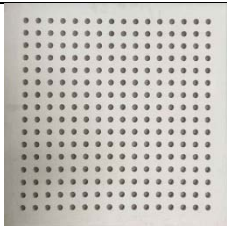
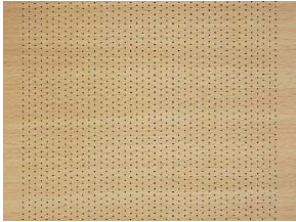
- Ambient Noise to be achieved should be not more than 40 dBA $\pm$ 2 dBA at Grill level. Accordingly, CFM will be planned.
- Trap door shall be sealed with Arma Sound rubber and made air tight.
- Ducting for Parker Hall shall be separate.
- All openings and punctures in wall for services shall be sealed completely with 'L' Ply pelmet & Acoustical Foam.



DETAIL OF 'L' PLY PELMET AT OPENING OF A/C DUCT

Recommended Materials & Makes-

INSULATION	
Fibre glass insulation (Rock wool, Knuaf insulation)	
Polyester fibre insulation (Mikron)	

Perforated Gypsum board (Ceiling, Stage panelling and behind Acoustical spray)AMF, Armstrong, Gyptech, Saint Gobain, Knauf, Techno Board 0.9 NRC or equivalent.	
Wooden perforated panelling. (Ecotone Acoustics, MQ Acoustics, Environ Tech system Limited)	
Double Glass window – (Saint Gobain)	
Carpet	
Vinyl	

Isolators (Getzner)



3D Illustration for proposed Auditorium Design as per Architects.

