
College of Education Tiered Classroom

— Ryker Belnap and Kira Langer —

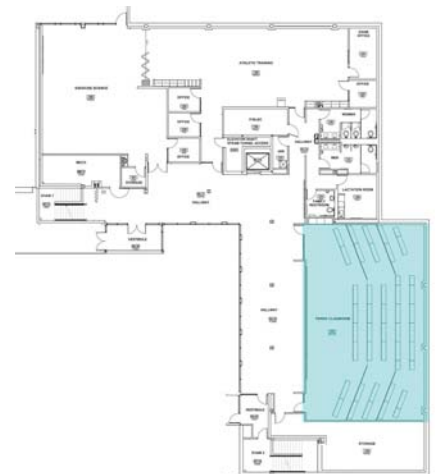
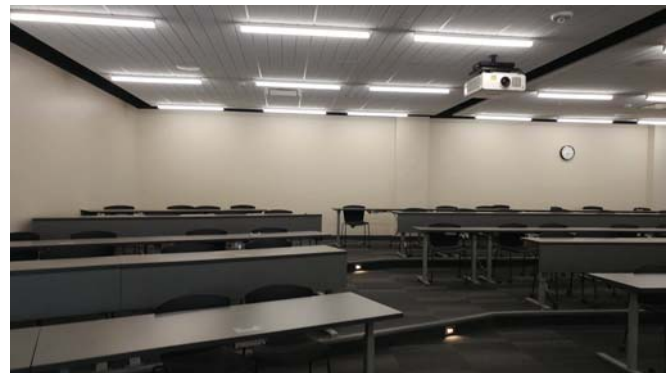
College of Education Tiered Classroom 141

Space Analysis:

- This is the largest room in the Education Building.
- Located on the first floor of the building.
- It is set up as a lecture hall with tiered seating, using raised platforms.
- The presentation space is at the front of the room.
- No adjacent rooms, only mechanical space

Noise Analysis:

- The white board in the front of the room causes the room to echo really badly.
- The HVAC system causes a lot of noise in the room.



Acoustic Materials

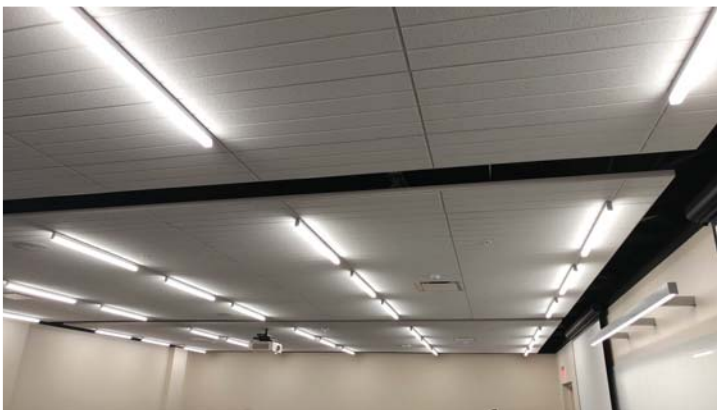
White Board - very reflective



Carpet - fairly absorptive

Acoustic Materials

ACT Ceiling Tiles - very absorptive



Gypsum Wall Board
- Fairly reflective

Acoustic Analysis

Room(Full Occupancy)@ 500 Hz				
Surface	Material	Area (sq. ft)	Absorbency	Absorption(S)
Ceiling		0	0	0
Ceiling, absorptive	ACT 2x2	2257	0.5	1128.5
Side Wall	Gypsum Bd.	333	0.05	16.65
Side Wall	Gypsum Bd.	333	0.05	16.65
Rear Wall	Gypsum Bd.	549	0.05	27.45
Front Wall	Gypsum Bd.	549	0.05	27.45
Floor	Carpet on concrete	2257	0.14	315.98
Audience	seated in plastic seats	350	0.4	140
	Volume (cu. Ft.)	Total Absorption		1672.68
Room Volume	20313	Reverberation Time		0.60

Total Absorption: 1672.68

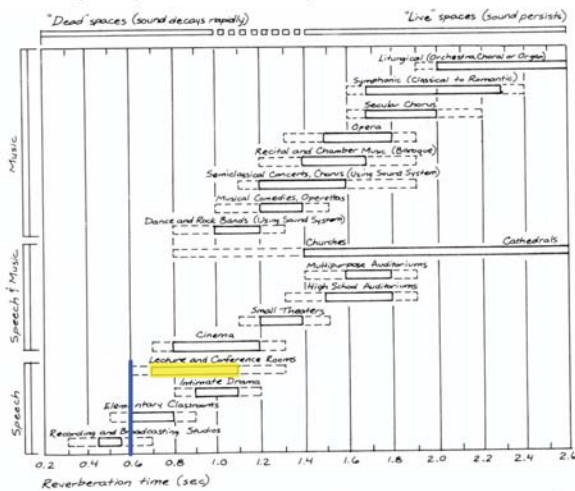
Material Absorption Numbers Found At:
https://svetlanaroit.files.wordpress.com/2009/11/visual_values2.pdf

Total Reverberation Time: 0.6

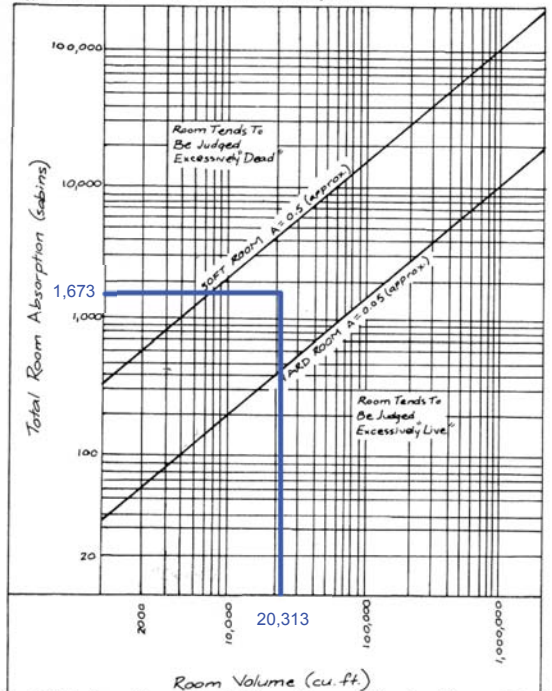
Acoustic Analysis

Absorption:
 Currently sits in the preferred area for absorption without changes.

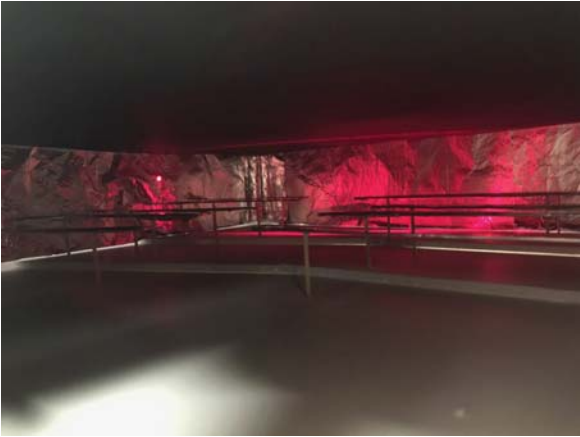
Reverberation Time Chart:
 Blue= Current
 Yellow= Goal



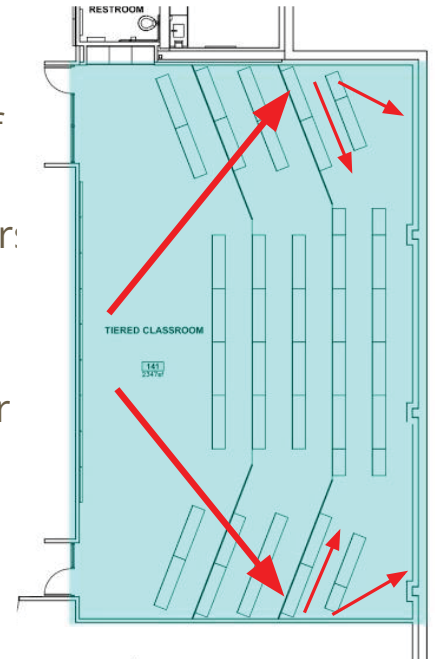
Typical Limits of Room Sound Absorption



Sound Model



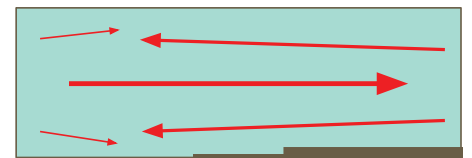
- Sound reflecting off side walls helps reach distant corner:
- Sound near speaker has much shorter reverb times



Sound Model



- All angled sound absorbed by carpet and ceiling
- Direct sound against back wall echoes back at whiteboard causing echo cycle



Are The Acoustics Appropriate For The Space?

- The white board in the front of the room and reflective back wall cause the room to echo really badly. This can be countered by adding acoustic panels to the back wall.
- The reverberation time needs to be increased to make the space acceptable for a lecture space.
- Reverberation rate at the back and sides of the room is significantly higher than the front rows.

Redesign Acoustic Materials

Acoustic Panels on the Rear Wall
- Very absorptive



Wooden Ceiling Panels
- Fairly reflective

Redesign

Room(Full Occupancy)@ 500 Hz				
Surface	Material	Area (sq. ft)	Absorbency	Absorption(S)
Ceiling	Wood Panel	1129	0.05	56.45
Ceiling, absorptive	ACT 2x2	1129	0.5	564.5
Side Wall	Gypsum Bd.	333	0.05	16.65
Side Wall	Gypsum Bd.	333	0.05	16.65
Rear Wall	Acoustic Wall	549	0.5	274.5
Front Wall	Gypsum Bd.	549	0.05	27.45
Floor	Carpet on concrete	2257	0.14	315.98
Audience	seated in plastic seats	350	0.4	140
	Volume (cu. Ft.)	Total Absorption		1412.18
Room Volume	20313	Reverberation Time		0.70

Total Absorption: 1412.18

The redesign decreased the absorption by: 260.5

Total Reverberation Time: 0.7

The redesign increased the reverberation time by: 0.1

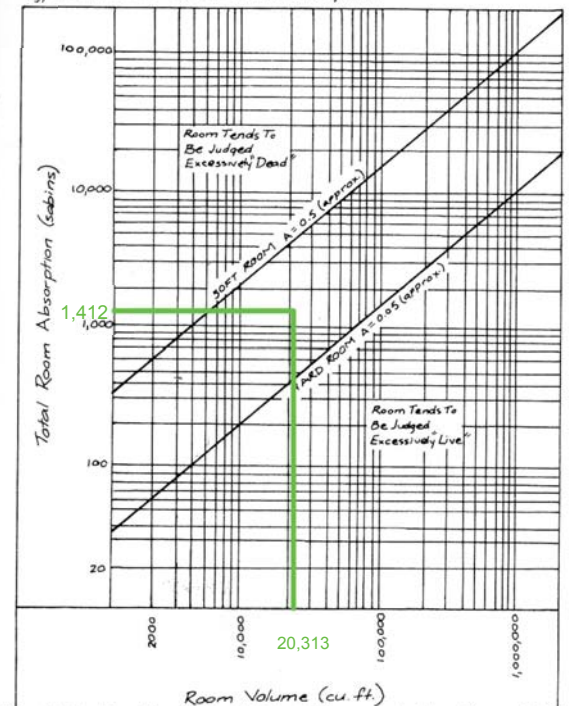
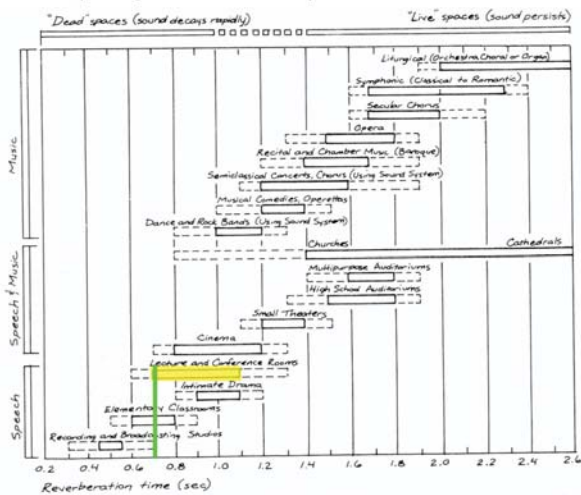
Redesign

Absorption:
Our room is still comfortably
in the desired range after the
redesign.

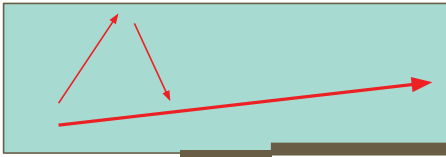
Reverberation Time Chart:

Green=Redesign reverberation time
Yellow=Goal

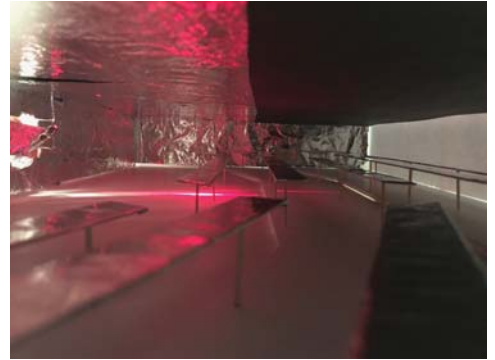
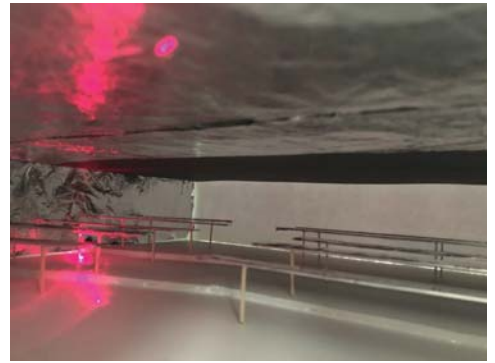
The redesign placed our room into the
desired amount for a lecture hall.



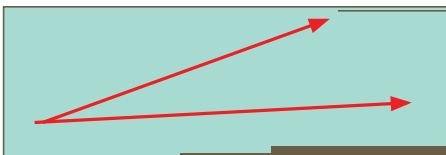
Redesign Model



- Reflective ceiling near speaker increases front row reverberation time to be in line with back rows, increasing reverb consistency
- Overall reverb time increased due to reflective surface area increase



Redesign Model



- Absorptive ceiling in back half of room keeps reverberation time from increasing too high
- Absorptive back wall stops echo cycles in back of room



Conclusion

- Absorptive back wall stops the severe echo problem between the front and back rows, removing negative sound reflection areas
 - Semi-reflective wood ceiling panels along the front half of the room's ceiling increase reverberation time to be similar to the back of the room, leading to better reverberation time consistency.
 - Increase of overall reflective surface area due to wood ceiling tiles makes up for the loss of the reflective back wall and raises overall reverberation time into the recommended range for a lecture hall.
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