Teaching and Learning Center
Room 044

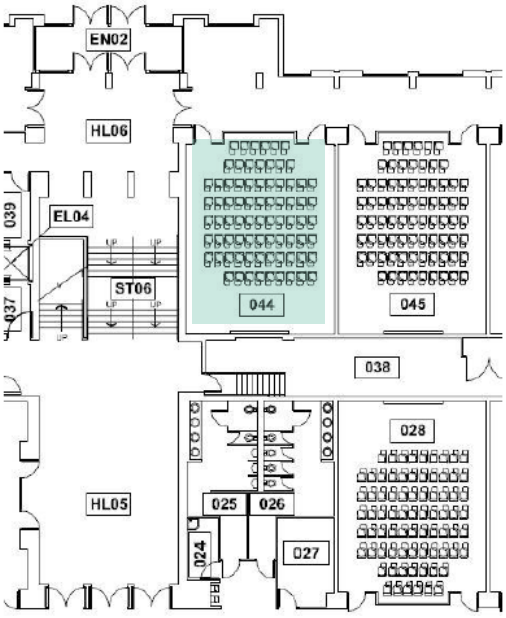
Kalyn Dorendorf | Catie Buck | Matt Fuhre

Building Description

Space Analysis:
-The space consists of 61 chairs with the two doors at the back of the room and the main presentation and white-board space at the front.

-The space is slanted downward which gives the audience a better view also allowing the room to be set up as an auditorium for presentations and lectures.

-TLC 044 is located on the lower floor of the Teaching and Learning Center.



Noise Analysis:
-When inside the classroom, if nobody is talking then you can hear people out in the hallway talking as they walk by.

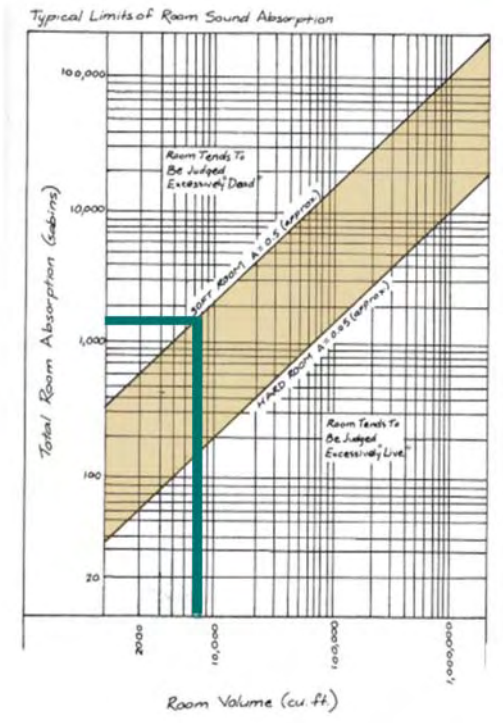
-The lights have a humming sound and you can also hear the air movement system if the classroom is empty.

Material Absorbency
500hz and 1000hz

Room(Full Occupancy)@ 500 Hz				
Surface	Material	Area (sq. ft)	Absorbency	Absorption(S)
Ceiling	Gypsum Bd.	800	0.83	664
Ceiling, absorptive	Poly-Foam	400	0.8	600
Side Wall	CMU, painted	1220	0.8	97.28
Side Wall, absorptive	CMU	316	0.1	31.2
Rear Wall,lower	Heavy carpet	400	0.14	56
Rear Wall,balcony	Heavy carpet	260	0.05	13.15
Aisles	Carpet on concrete	140	0.83	119.52
Orchestra Pit & Apron	Wood	45	0.1	4.5
Stage Opening	(furinished)	15	0.18	2.7
Audience	seated in upholstered seats	350	0.8	320
	Volume (cu. Ft.)	**Total Abosrption**		1308.35
Room Volume	7600	**Reverbation Time**		0.28

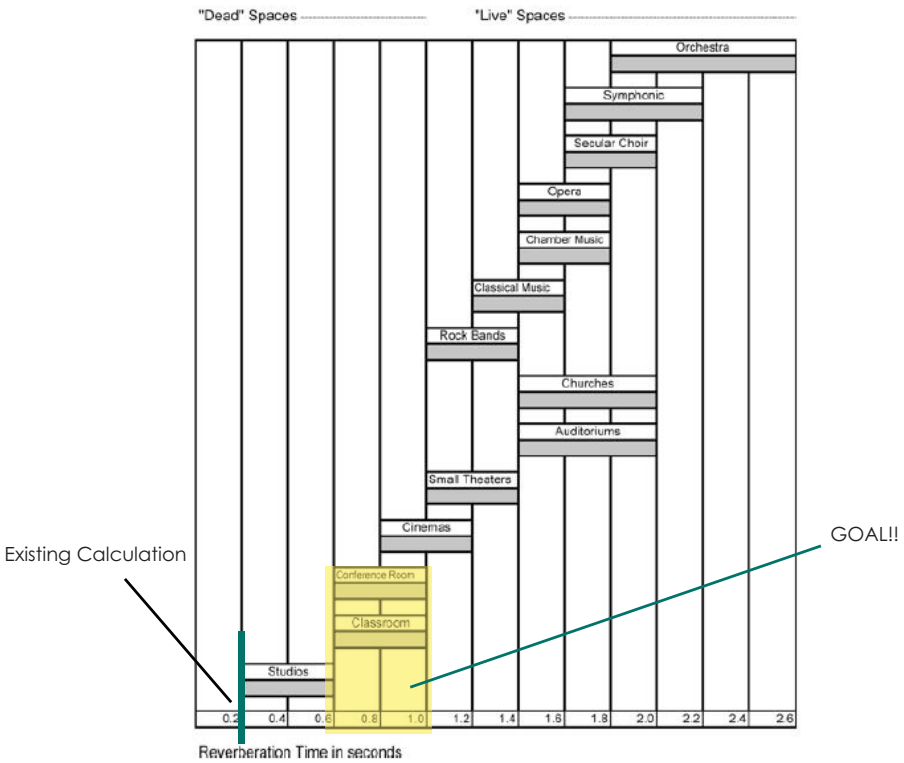
Room(Full Occupancy)@ 1000 Hz				
Surface	Material	Area (sq. ft)	Absorbency	Absorption(S)
Ceiling	Gypsum Bd.	800	0.99	792
Ceiling, absorptive	Poly-Foam	400	0.6	600
Side Wall	CMU, painted	1220	0.04	48.64
Side Wall, absorptive	CMU	316	0.08	24.96
Rear Wall,lower	Heavy carpet	400	0.37	148
Rear Wall,balcony	Heavy carpet	260	0.04	10.52
Aisles	Carpet on concrete	140	0.99	142.56
Orchestra Pit & Apron	Wood	45	0.08	3.5
Stage Opening	(furinished)	15	0.12	1.8
Audience	seated in upholstered seats	350	0.94	376
	Volume (cu. Ft.)	**Total Abosrption**		1548.08
Room Volume	7600	**Reverbation Time**		0.24

Absorbancy and Reverberation



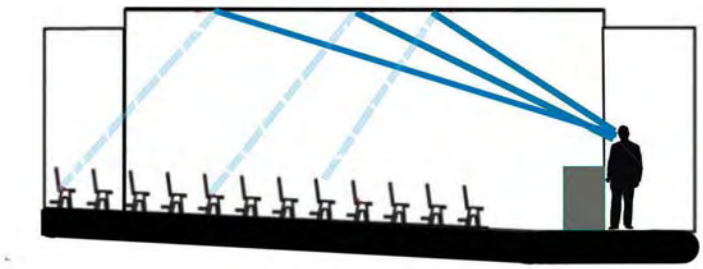
The average room reverberation time is about 0.26 which is low for a lecture hall.

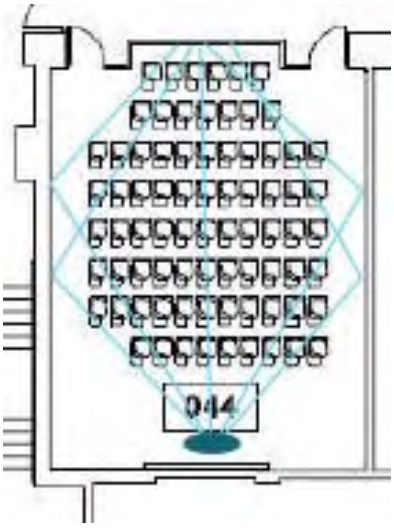
Reverberation Range



The reverberation time needs to be increased by at least 0.40 because it is similar to an elementary classroom considering it is used as a lecture hall.

Estimated Reflections





Are the Room Acoustics Appropriate

-The sound from the hallway needs to be muted to make the space more reasonable for listening to lectures

-The reverberation time needs to be increased for it to be appropriate for a classroom lecture space.

-Changing the lighting fixtures can help with the buzzing sound that they make when turned on.

-The room is susceptable to echo from sound reflection off the back wall's glass sidelights and doors. Side to side horizontal echos could occur as well from the gypsum board walls.

How can the scheme be improved

Installing [illegible] lights that are [illegible] new florescent that would light indirectly from behind a diffuse reflector

The sidelights can use Acoustical glass to eliminate reflection and sound from the hallway. The door can be acoustically treated as well.

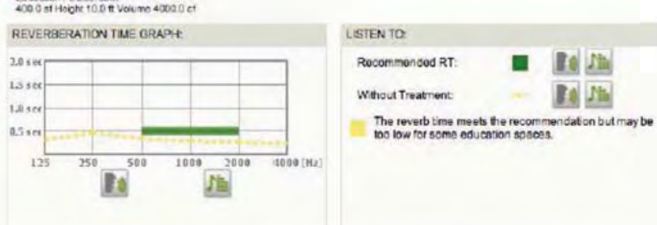
Installing diffuse reflectors from the ceiling can help increase the reverberation time.

Angled diffuse reflectors on the walls to prevent side to side echoing and increase reverberation

Calculation Summary:

1 Reverberation Time Calculation Result Summary

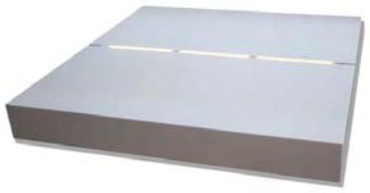
Building Space & Description:
Education / Classroom
400.0 sf Height 10.0 ft Volume 4000.0 cf



FREQUENCY:	125	250	500	1000	2000	4000
Recommended RT with proper treatment			0.4-0.6	0.4-0.6	0.4-0.6	
Existing RT of the space:	0.31	0.46	0.33	0.28	0.25	0.23

SPACE SURFACES	PREDOMINANT MAT.	SF	OTHER	TREATMENT
Wall 1	Drywall (1/2" or 5/8")	240.0	-no-	-no-
Wall 2	Drywall (1/2" or 5/8")	400.0	-no-	-no-
Wall 3	Drywall (1/2" or 5/8")	240.0	-no-	-no-
Wall 4	Drywall (1/2" or 5/8")	400.0	-no-	-no-
Floor	Carpet, commercial	800.0	-no-	-no-
Ceiling	Generic ceiling , NRC = 0.5	800.0	-no-	-no-

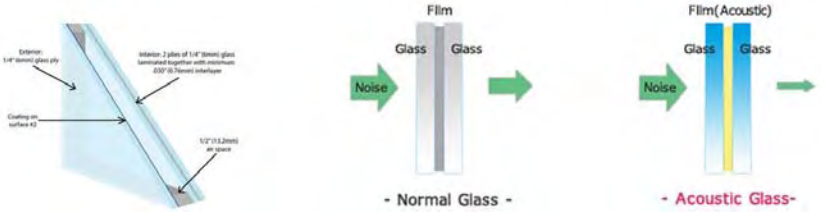
Noise Pollution from Lights



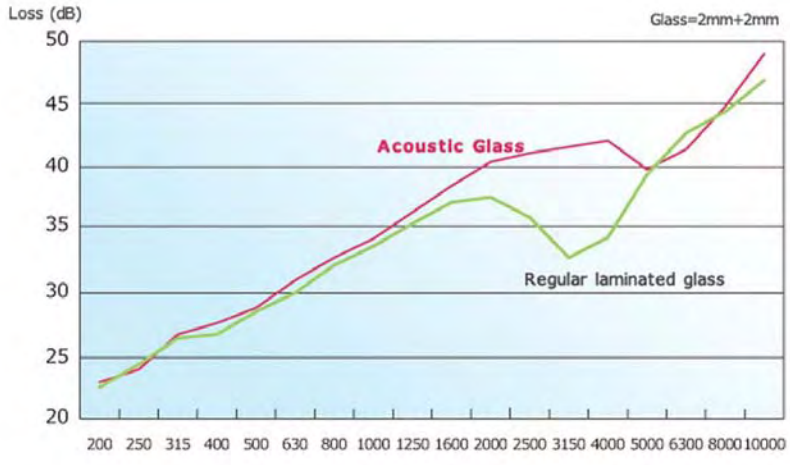
LED lights integrated with acoustic ceiling panels can help eliminate noise pollution from lighting sources. LED's run silent in comparison to flourescent lights.

Ceiling hung indirect flourescent fixtures that are aoccoustically designed can help disipate the noise from the lights upwards to the acoustic panels in the ceiling and the fixture can act as a diffusive reflector for acoustics.

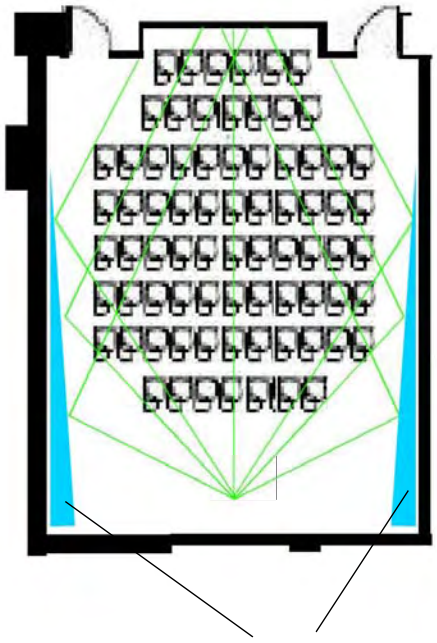
Acoustic Glass Sidelights



Acoustic glass will prevent noise pollution from the adjacent hallway as well as reduce the amount of sound that is reflected back to the audience thus reducing the occurance of echoing.



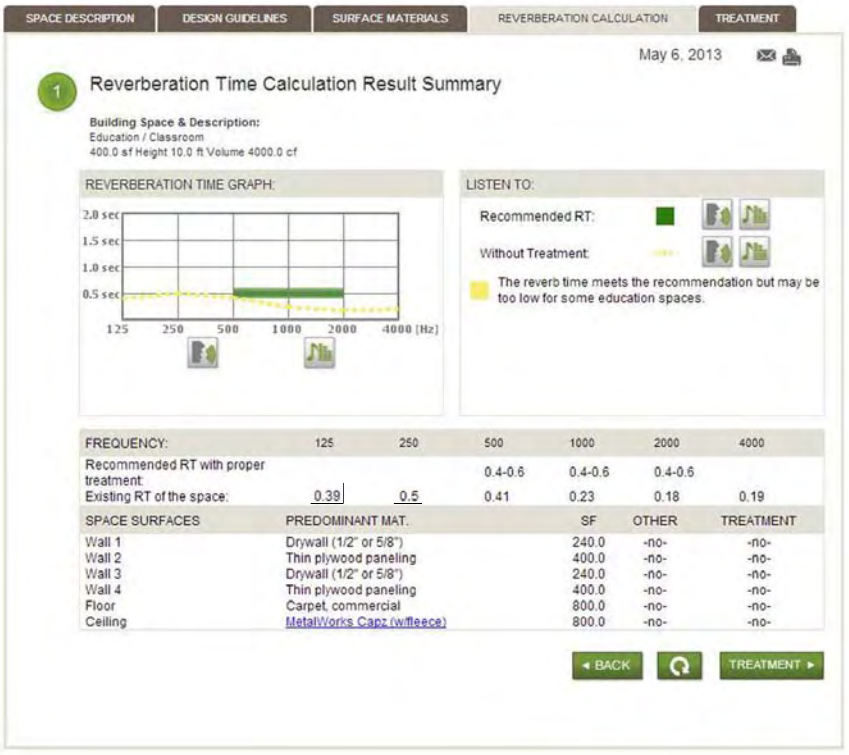
Angled Diffuse Wall Reflectors



To increase the reverbeation time of the space as well as create a more even distribution of sound the class-room could utilize diffusely reflective accoustic panels on the walls.

These acoustic panels could be angled to help the sound propegate evenly as well as prevent side to side echoes from occuring by eliminating parrallel and perpendicular angles.

Redesign Performance



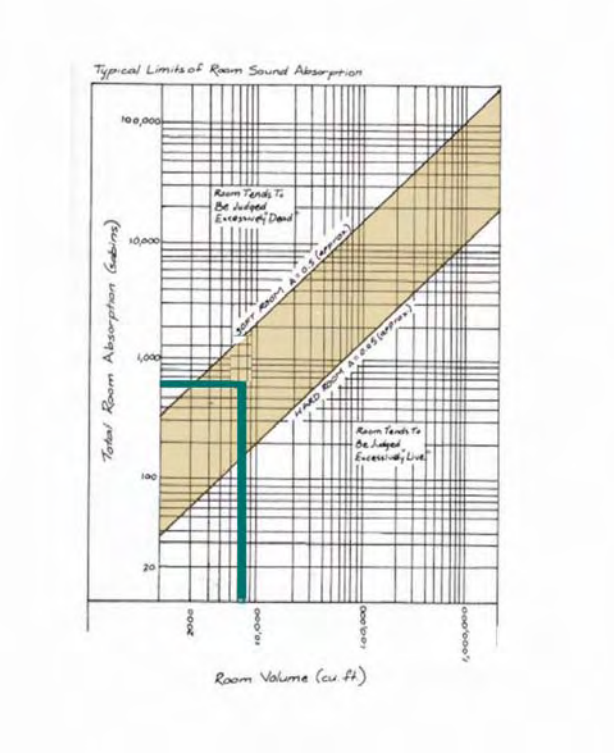
Reverberation time was increased to 0.5 which is ideal for a classroom

Material Absorbency
500hz and 1000hz

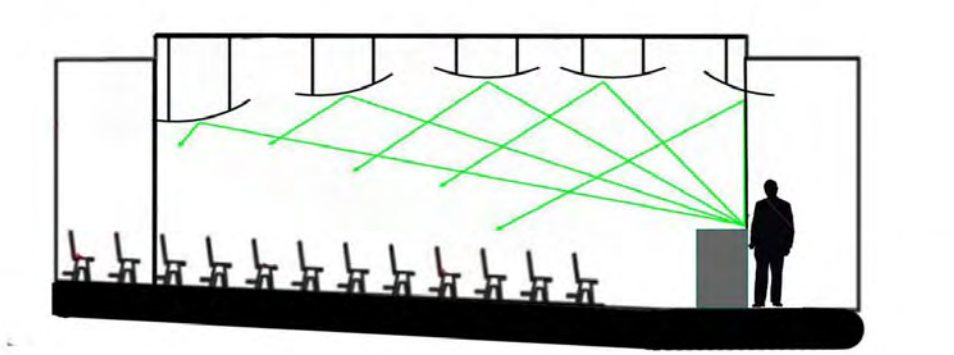
Room(Full Occupancy)@ 500 Hz				
Surface	Material	Area (sq. ft)	Absorbency	Absorption(S)
Ceiling	Gypsum Bd.	0	0.63	0
Ceiling, absorptive	Poly-Foam	800	0.08	64
Side Wall	CMU, painted	1220	0.09	97.4
Side Wall, absorptive	CMU	315	0.1	31.5
Rear Wall,lower	Heavy carpet	400	0.14	56
Rear Wall,balcony	Heavy carpet	263	0.05	13.15
Aisles	Carpet on concrete	144	0.83	119.52
Orchestra Pit & Apron	Wood	45	0.1	4.5
Stage Opening	(furinished)	15	0.18	2.7
Audience	seated in upholstered seats	400	0.8	320
	Volume (cu. Ft.)	**Total Abosrption**		708.35
Room Volume	7600	**Reverbation Time**		0.54

Room(Full Occupancy)@ 1000 Hz				
Surface	Material	Area (sq. ft)	Absorbency	Absorption(S)
Ceiling	Gypsum Bd.	0	0.68	0
Ceiling, absorptive	Poly-Foam	800	0.08	32
Side Wall	CMU, painted	1220	0.1	48.64
Side Wall, absorptive	CMU	315	0.08	25.92
Rear Wall,lower	Heavy carpet	400	0.37	142
Rear Wall,balcony	Heavy carpet	263	0.05	10.53
Aisles	Carpet on concrete	144	0.99	142.56
Orchestra Pit & Apron	Wood	45	0.08	3.8
Stage Opening	(furinished)	15	0.15	1.8
Audience	seated in upholstered seats	400	0.94	376
	Volume (cu. Ft.)	**Total Abosrption**		794.08
Room Volume	7600	**Reverbation Time**		0.54

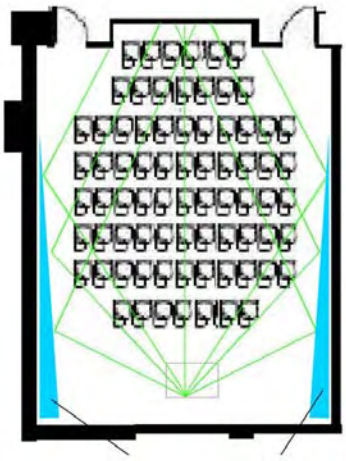
Absorbancy and Reverberation Redesign



Redesign Reflections



redesign with diffusely reflective ceiling panels



redesign with diffusely reflective wall panels

Conclusion

Switching the flourescent lights to LED's or using fixtures that prevent the noise from polluting down to the audience would improve the acoustical experience

Using acoustically treated glazing for the side lighting would both reduce the amount of noise pollution from the hallway and reduce the possibility of echoes from reflecting sound back to the audience

Utilizing diffusely reflective angled wall panels will increase the reverberation time as well as create a more even distribution of sound

Hung diffusely reflective ceiling panels will also increase the reverberation time by increasing the reflective properties of the ceiling