SUB BALLROOM
STUDENT UNION BUILDING

UNIVERSITY OF IDAHO I MOSCOW I IDAHO

BEINING SUN I EAMONN PARK I XUE FENG

STUDENT UNION BUILDING BALLROOM
BUILDING DESCRIPTION

Location: 709 Deakin Ave, Moscow, ID 83844

The SUB Ballroom is located on the University of Idaho campus in the Student Union Building. It is being across the street from the University Book Store. The north has lot a small parking.

STUDENT UNION BUILDING BALLROOM
DESCRIPTION

The SUB Ballroom is the Student Union's largest room. With a varied capacity, depending on the seating and table setup, the SUB Ballroom can hold large formal dinners, multicultural events and full concerts. This place provides sound and lighting for most events in the Ballroom. The built-in sound system provides for simple con-ferences and speakers.

Building 'full concert system' is ideal for concerts in the SUB Ballroom and includes the following:

Crown ampli ied EAW speakers

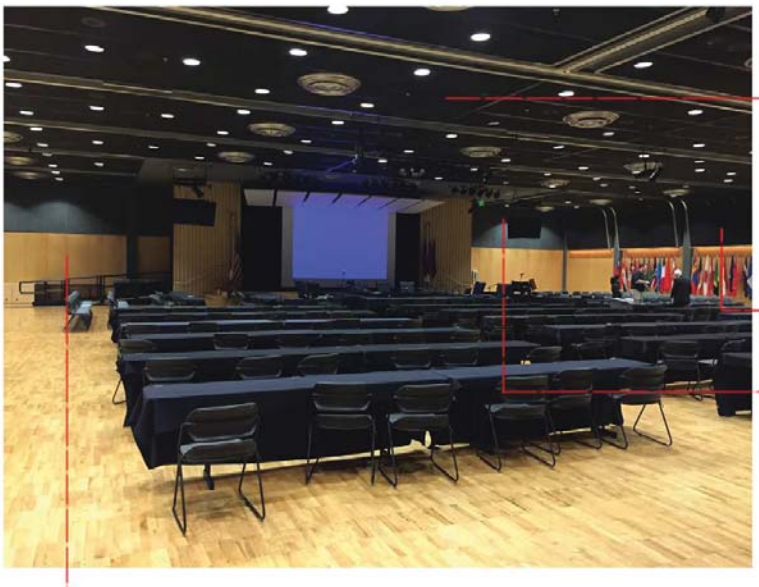
Separate monitor board

ETC computer controlled lighting system

(U of I Official Website)

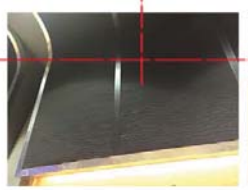
STUDENT UNION BUILDING BALL ROOM

ACOUSTIC ANALYSIS - ACOUSTIC MATERIALS



01 Absorbing Ceiling Panels

The absorbing ceiling panel are covered entire space in order to reduce the sound reflection



02 Acoustic Panels

Two types of acoustic panels cover upper of the sorrounding walls

04
Wood Wall

3/4 of the wall surpace are covered with wood as perimary material

03
Angular dry wall

Angular dry wall distributue at the back side of the rppm

STUDENT UNION BUILDING BALL ROOM

ACOUSTIC ANALYSIS - ACOUSTIC MATERIALS

01
Gypsum board

Overing hanging above the stage to reflect sound

02
Wood absorb panels

Distribute along the stage, with soft material in between

04
Audience

Maximum occupancy of the room is 1520 people based on building code

03
Speakers

2 groups of speakers toword the audience seat and pointing different derictions

STUDENT UNION BUILDING BALL ROOM

ACOUSTIC ANALYSIS

REFLECTIVE


Wood Floor


Wood Wall


Drywall


Gypsum board

ABSORBTIVE


Acoustic Panels


Sound Absorbing Ceiling panels


Sound Absorbing wall panels


Audience in Upholstered seats

Room(Full Occupancy)@ 500 Hz				
Surface	Material	Area (sq. ft)	Absorbency	Absorption(S)
Ceiling	dry wall	10200	0.05	510
Ceiling, absorptive	Acoustic CMU	8200	0.52	4264
Side Wall	plywood panels	2100	0.05	105
Side Wall, absorptive	soundsoak wall panels	1050	0.6	630
Rear Wall,lower	Drywall	1950	0.05	97.5
Front wall	plywood panels	1250	0.52	650
Front wall, absorptive	soundsoak wall panels	600	0.6	360
Floor	Wood	9700	0.1	970
Stage Opening	Draped absorbing material	1000	0.88	880
Audience	seated in upholstered seats	9650	0.1	965
	Volume (cu. Ft.)	Total Abosrption		9431.5
Room Volume	205800	Reverbation Time		1.06920426
Room(Half-Occupancy)@500Hz				
Auditorium (less audience)				8466.5
Seats	Well-upholstered seats	300	0.56	168
Audience	seated in upholstered seats	500	0.8	400
		Total Abosrption		9034.5
		Reverbation Time		1.12

ROOM VALUME: 205800

Total Abosrption: 9431.5

Room Reverbation Time: 1.12 **Surface Reverbation Time:1.06**

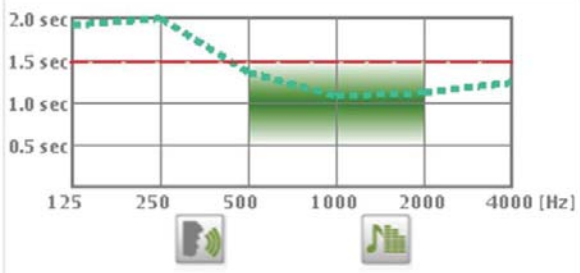
STUDENT UNION BUILDING BALL ROOM

ACOUSTIC ANALYSIS ARMSTRONG

FREQUENCY:	125	250	500	1000	2000	4000
Recommended RT with proper treatment:			0.5-1.5	0.5-1.5	0.5-1.5	
Existing RT of the space:	1.91	2.35	1.35	1.08	1.11	1.24

SPACE SURFACES	PREDOMINANT MAT.	SF	OTHER	TREATMENT
Wall 1	Thin plywood paneling	2100.0	Soundsoak 60 Wall Panels, 1050.0	-no-
Wall 2	Thin plywood paneling	1260.0	Soundsoak 60 Wall Panels, 630.0	-no-
Wall 3	Thin plywood paneling	2100.0	Soundsoak 60 Wall Panels, 1050.0	-no-
Wall 4	Drywall (1/2" or 5/8")	1960.0	-no-	-no-
Wall 5	Thin plywood paneling	150.0	Soundsoak 60 Wall Panels, 75.0	-no-
Wall 6	Thin plywood paneling	150.0	Soundsoak 60 Wall Panels, 75.0	-no-
Floor	Wood parquet on concrete	10290.0	-no-	-no-
Ceiling	Drywall (1/2" or 5/8")	10290.0	Cortega, 8232.0	-no-

REVERBERATION TIME GRAPH:



ARMSTRONG RECOMENDED Tr= 1.5 SEC

ARMSTRONG RECOMENDED Tr= 1.35 SEC

Result from
http://www.armstrong.com/reverb/step.jsp

ACOUSTIC ANALYSIS

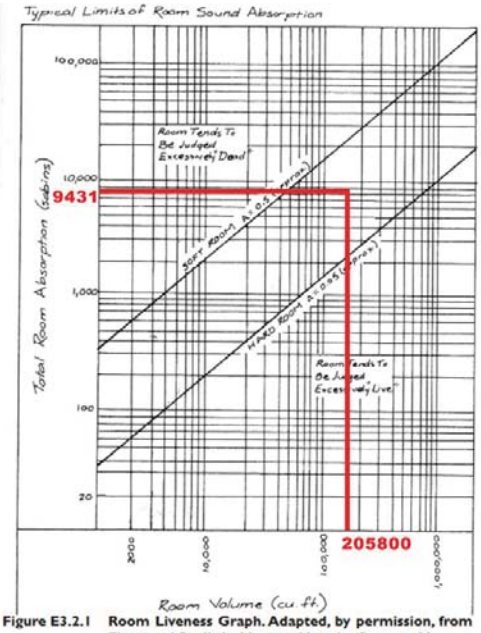


Figure E3.2.1 Room Liveness Graph. Adapted, by permission, from Flynn and Segil, *Architectural Interior Systems*, 66.

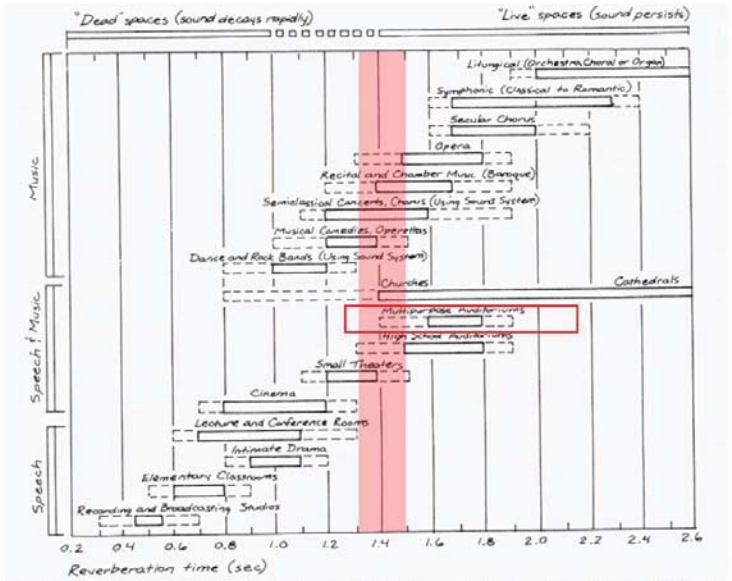
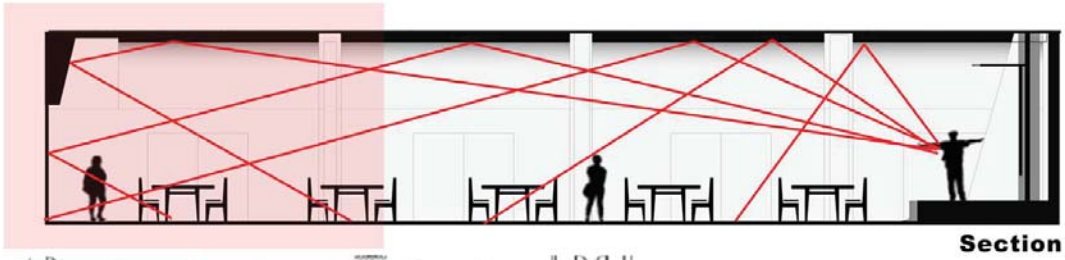


Figure E3.3.1 Recommended Reverberation Times. Adapted, by permission, from Egan, *Architectural Acoustics*, 64.

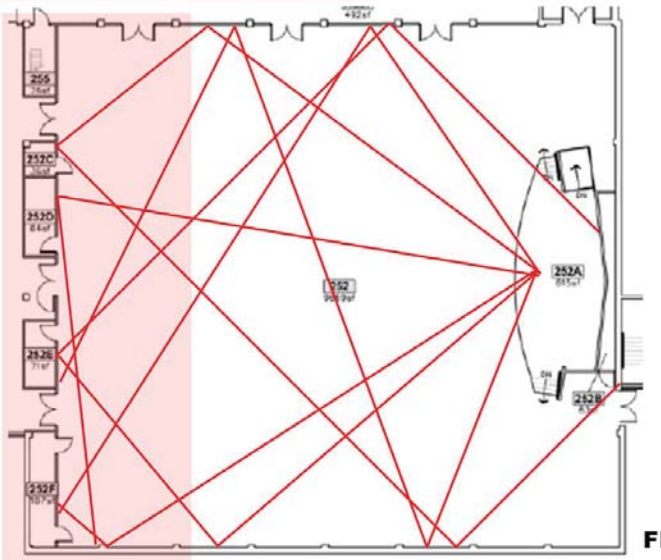
STUDENT UNION BUILDING BALL ROOM

ACOUSTIC ANALYSIS

RAY TRACING



Section



Floor Plan

As you can see from the plan and section, the back side of the room is not designed the best. Especially in the plan view, the room is big and the walls are causing the sound to reflect poorly

STUDENT UNION BUILDING BALLROOM

ACOUSTIC ANALYSIS ACOUSTIC MATERIALS REDESIGN

+ THE ADJUSTMENTS NEEDED TO ACHIEVE AN ACOUSTICALLY BETTER ROOM WE SUGGEST MAKING SOME MINOR CHANGES TO THE STUDENT UNION BALLROOM. FIRST, REPLACING A MAJORITY OF OF THE ABSORTIVE CEILING MATERIAL WITH REFLECTIVE CEILING TILE. SECOND, THE ADDITION OF ELECTRONIC SPEAKERS AT THE REAR OF THE ROOM WILL HELP TO FULFILL A FULLER AND MORE COMPLETE SOUND.

STUDENT UNION BUILDING BALL ROOM

ACOUSTIC ANALYSIS

REFLECTIVE

Gypsum board

Room(Full Occupancy)@ 500 Hz				
Surface	Material	Area (sq. ft)	Absorbency	Absorption(S)
Ceiling	dry wall	10200	0.05	510
Ceiling, Reflective	Gypsum, smooth finish	7000	0.02	140
Ceiling, absorptive	Acoustic CMU	1200	0.52	624
Side Wall	plywood panels	2100	0.05	105
Side Wall, absorptive	soundsoak wall panels	1050	0.6	630
Rear Wall,lower	Drywall	1950	0.05	97.5
Front wall	plywood panels	1250	0.52	650
Front wall, absorptive	soundsoak wall panels	600	0.6	360
Floor	Wood	9700	0.1	970
Stage Opening	Draped absorbing material	1000	0.88	880
Audience	seated in upholstered seats	9650	0.1	965
	Volume (cu. Ft.)	Total Abosrption		5931.5
Room Volume	205800	Reverbation Time		1.700109584
Room(Half-Occupancy)@500Hz				
Auditorium (less audience)				4966.5
Seats	Well-upholstered seats	300	0.56	168
Audience	seated in upholstered seats	500	0.8	400
		Total Abosrption		5534.5
		Reverbation Time		1.82

ROOM VALUME: 205800

Total Abosrption: 5931.5

Room Reverbation Time: 1.82 **Surface Reverbation Time: 1.70**

ABSORBTIVE

Acoustic Panels

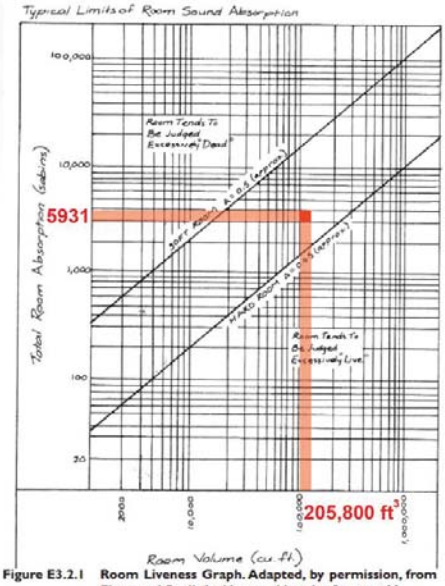
Sound Absorbing Ceiling panels

Sound Absorbing wall panels

Audience in Upholstered seats

STUDENT UNION BUILDING BALL ROOM

ACOUSTIC ANALYSIS AFTER REDESIGN



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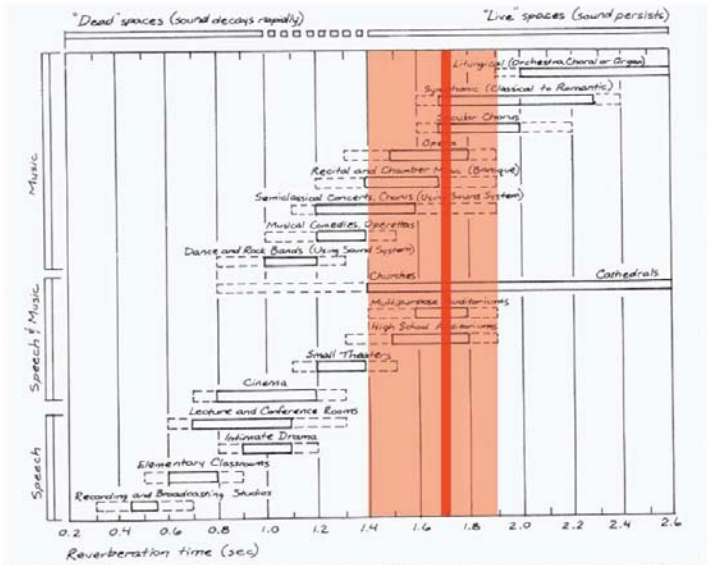

Figure E3.3.1 Recommended Reverberation Times. Adapted, by permission, from Egan, *Architectural Acoustics*, 64.

+ BY ADJUSTING THE AMOUNT OF ABSORBTIVE AND REFLECTIVE MATERIALS IN THE BALLROOM WE HAVE IMPROVE THE ROOM'S TOTAL ABSORBTION FROM 9,431 TO 5,931

+ ADJUSTING THE VOLUME OF THE STUDENT UNION BALLROOM COVERED BY ABSORBTIVE MATERIAL HAS HELPED US TO REACH A MORE APPROPRIATE REVERBERATION TIME OF 1.70 SECONDS FOR A MULTI-PURPOSE SPACE

STUDENT UNION BUILDING BALLROOM

ACOUSTIC ANALYSIS CONCLUSION

+ OUR INITIAL INVESTIGATION OF THE STUDENT UNION BALLROOM, AS WELL AS THE INSIDE OUT EXCERCISES HAVE ALLOWED US TO DETERMINE THAT THE ROOM'S CURRENT CONDITIONS DO NOT PERFORM IDEALLY FOR A MULTIPURPOSE ROOM OF ITS SIZE BECAUSE THE ACOUSTIC MATERIALS ARE TOO ABSORBTIVE, DISALLOWING SOUND TO REVERBERATE THROUGH THE ROOM IN AN APPROPRIATE TIME.

+ OUR SOLUTION TO THE BALLROOM'S REVERBERATION ISSUES ARE SIMPLE. IN ORDER TO ACHIEVE BETTER SOUND QUALITY IN THE SUB BALLROOM ROUGHLY 85% OF THE ABSORBTIVE CEILING MATERIAL NEEDS TO BE REPLACED WITH A SMOOTH FINISH GYPSUM THAT ALLOWS MORE SOUND TO REFLECT FROM ITS SURFACE. IN ADDITION, ELECTRONIC SPEAKERS NEAR THE BACK OF THE ROOM WOULD PROVIDE A FULLER SOUND DURING PRESENTATIONS AND PERFORMANCES.