PROaudio
SOLUTIONS

Acoustics Analysis and Solutions Report

For

Your Church

Gymnasium Retrofit

Anywhere, USA

Engineered and Prepared by Scott Oliver

May 3rd, 2011

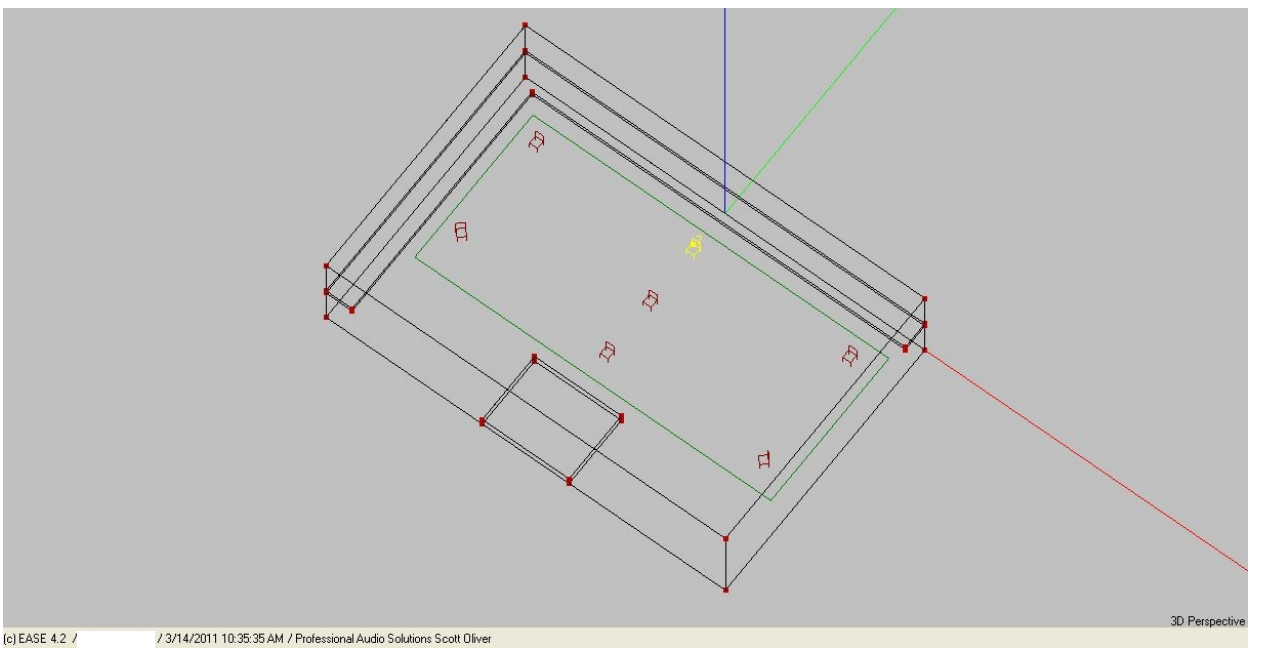
Executive Summary

The data contained herein was compiled using two calculation methods along with live RT60 verification measurements. Multiple methods were used in conjunction with each other to verify the validity and accuracy of each. The goal of this exercise is to convert the gym from a sports-only space to a multipurpose space used for contemporary worship services, banquets, meetings, drama, etc. To achieve the objective of producing maximum audio quality in the space, the RT60 (reverb times) and Ambient Noise Levels must be reduced to industry-acceptable levels. This study addresses these parameters through acoustical room treatments, proper floor treatments, and proper seating.

- 3D EASE modeling of the gymnasium space
- Sabine Calculations
- Live RT60 Impulse Response Verification

EASE

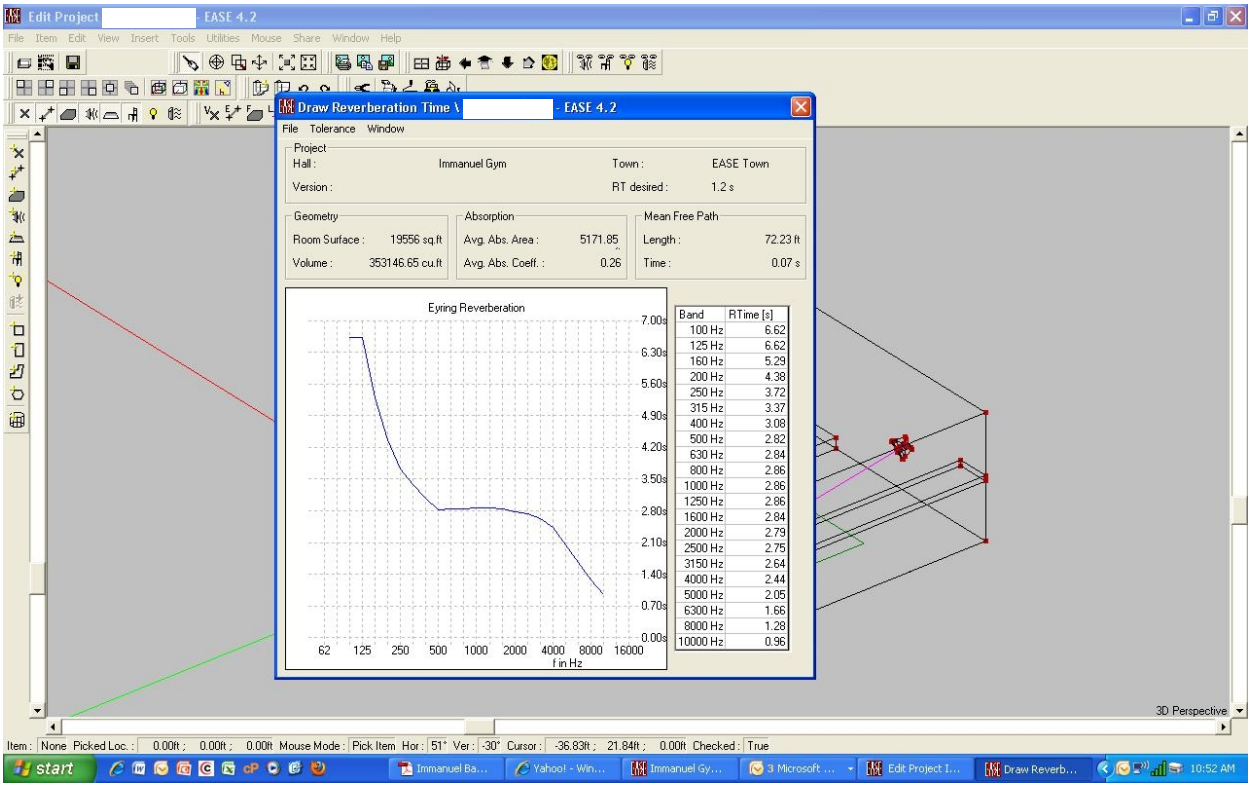
3 Dimensional Wireframe Model



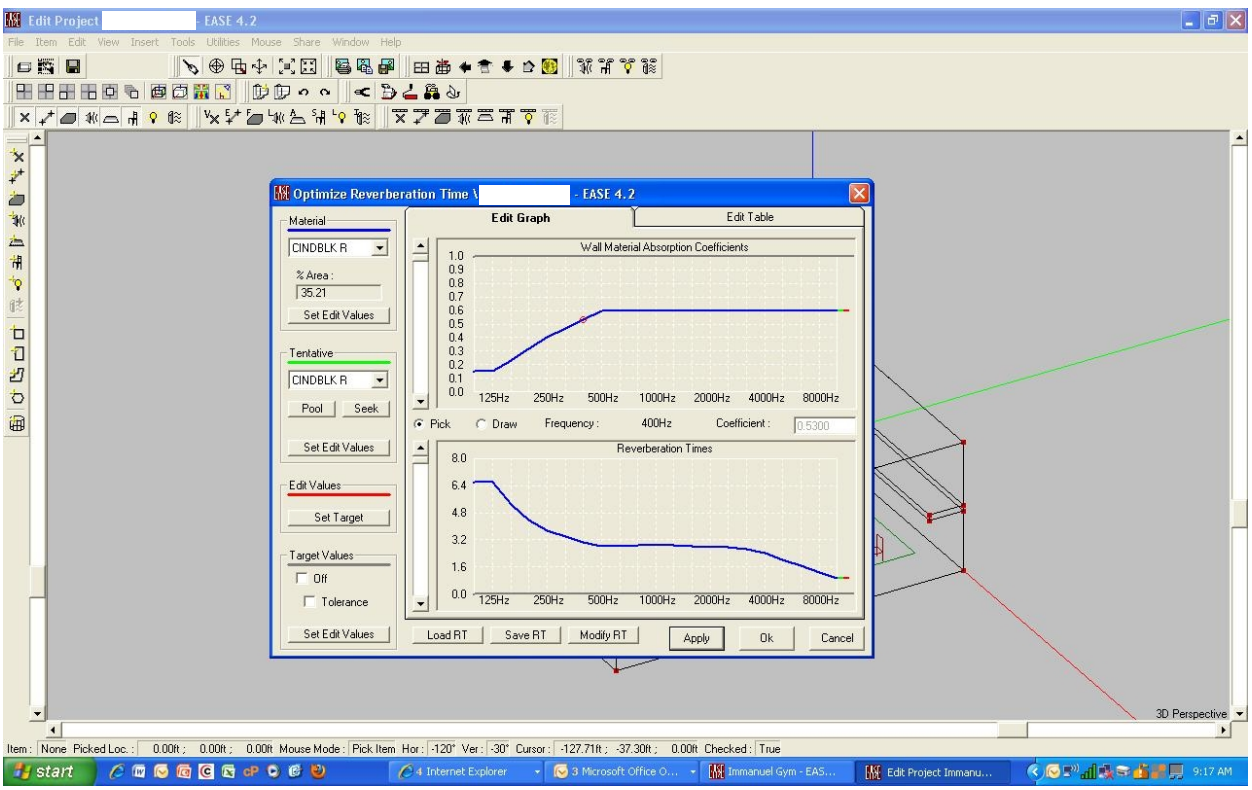
As-Built

Floor: Hardwood
Walls: Concrete Block
Ceiling: Steel Decking

➢ RT60 (Reverb Times) Model Calculation-As Built



➢ Room Absorption Calculation-As Built



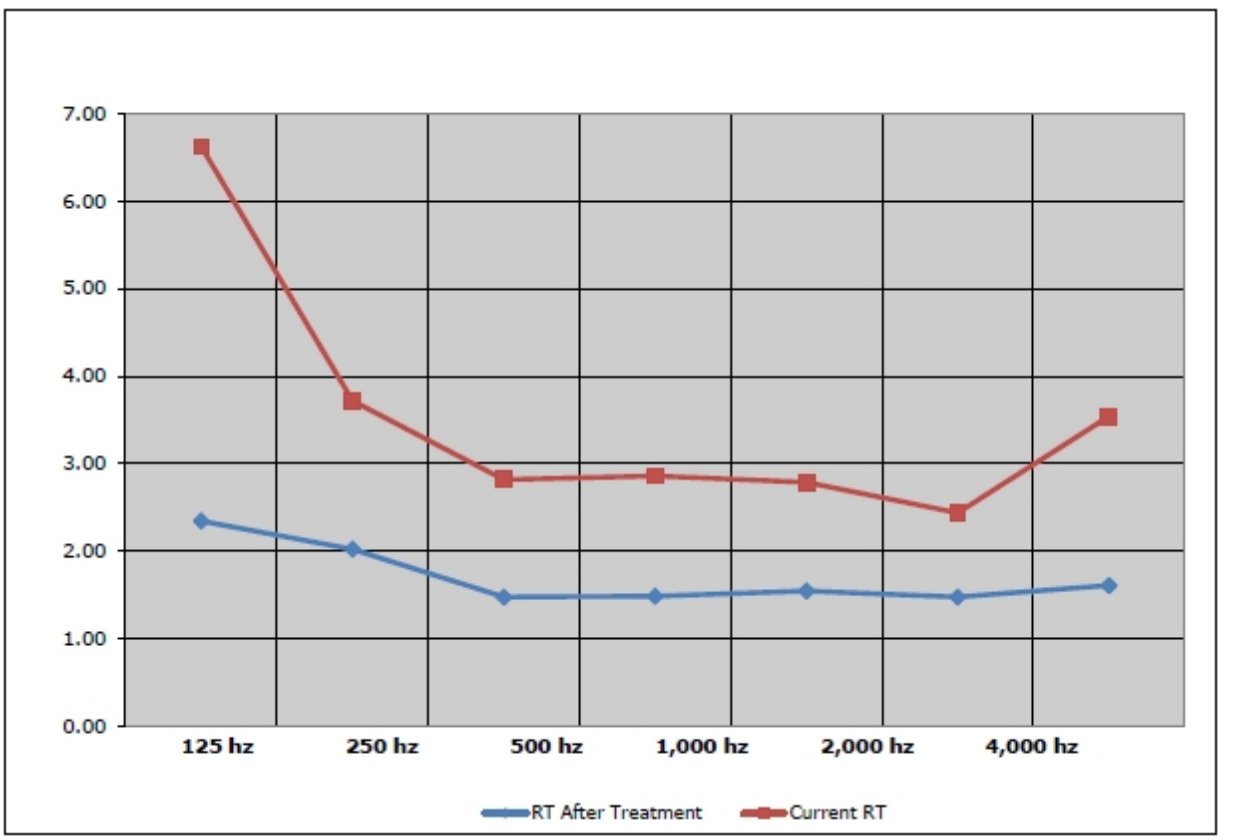
➢ Sabine RT60 Calculations

RT Work up for:
Scott Oliver - Pro Audio Solutions

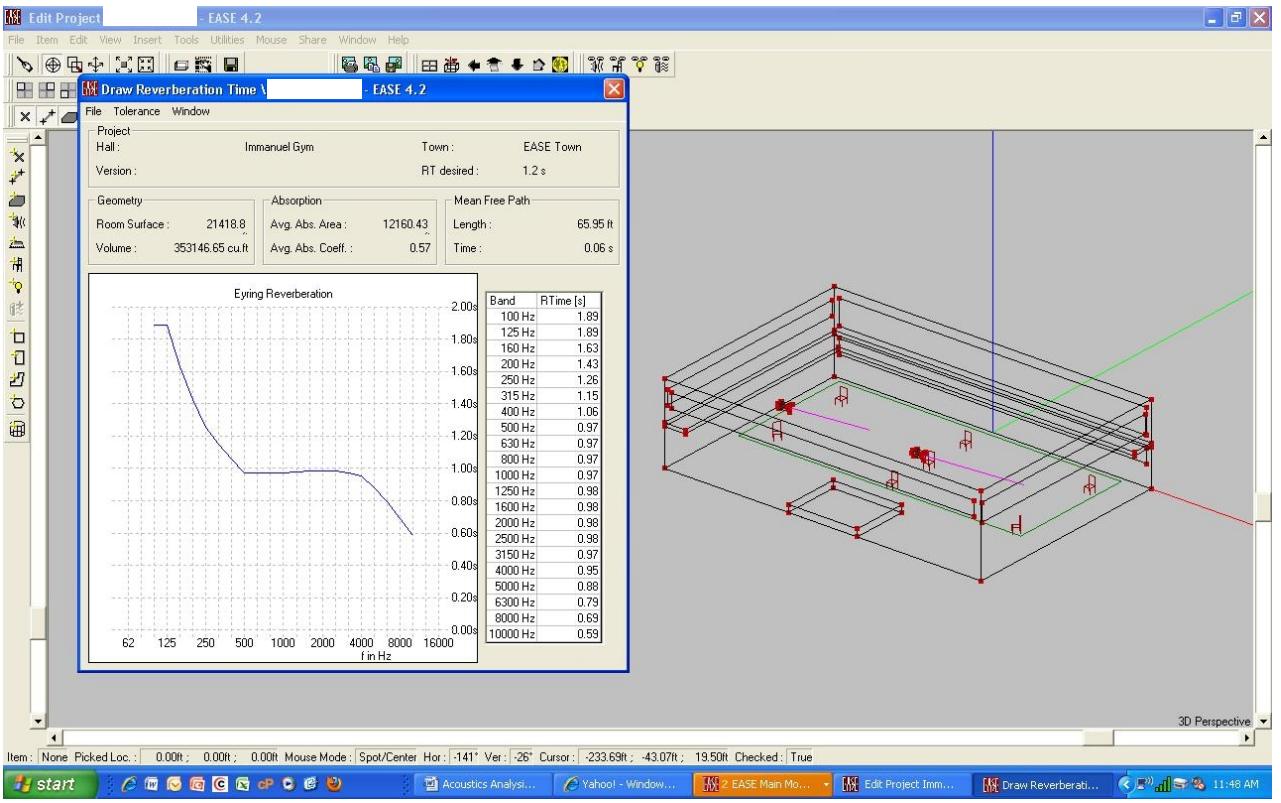
EconoMegaWedge	1876.00 SF
2" Hanging Sound Baffles	600.00 SF
28" 180 Diffsorber	111.84 SF
Room Volume	353146.65 Cubic feet

Product NRC (per freq.)	125hz	250hz	500hz	1000hz	2000hz	4000hz	Rooms Overall NRC Average
EconoMegaWedge NRC	1.42	1.61	2.19	2.13	1.89	1.75	1.95
2" Hanging Sound Baffles NRC	0.88	1.18	1.98	2.14	1.94	1.78	1.8
28" 180 Diffsorber	1.73	1.49	2.46	2.56	2.33	2.24	2.2
EMW Sabins	2663.92	3020.36	4108.44	3995.88	3545.64	3283.00	3658.20
2" Hanging Sound Baffles NRC	528	708	1188	1284	1164	1068.00	1080.00
28" 180 Diffsorber Sabins	1565.76	166.6416	275.1264	286.3104	260.5872	250.5216	246.048
Total Product Sabins	4757.68	3895.0016	5571.5664	5566.1904	4970.2272	4601.5216	4984.248
Curent RT	6.62	3.72	2.82	2.86	2.79	2.44	3.54
Curent room sabins	2613.93	4651.66	6136.24	6050.41	6202.22	7091.88	5760.13
RT After Treatmnet (sec)	2.35	2.02	1.48	1.49	1.55	1.48	1.61

➢ RT60 Graph showing “before and after” treatment.



➢ EASE RT60 Prediction after treatments

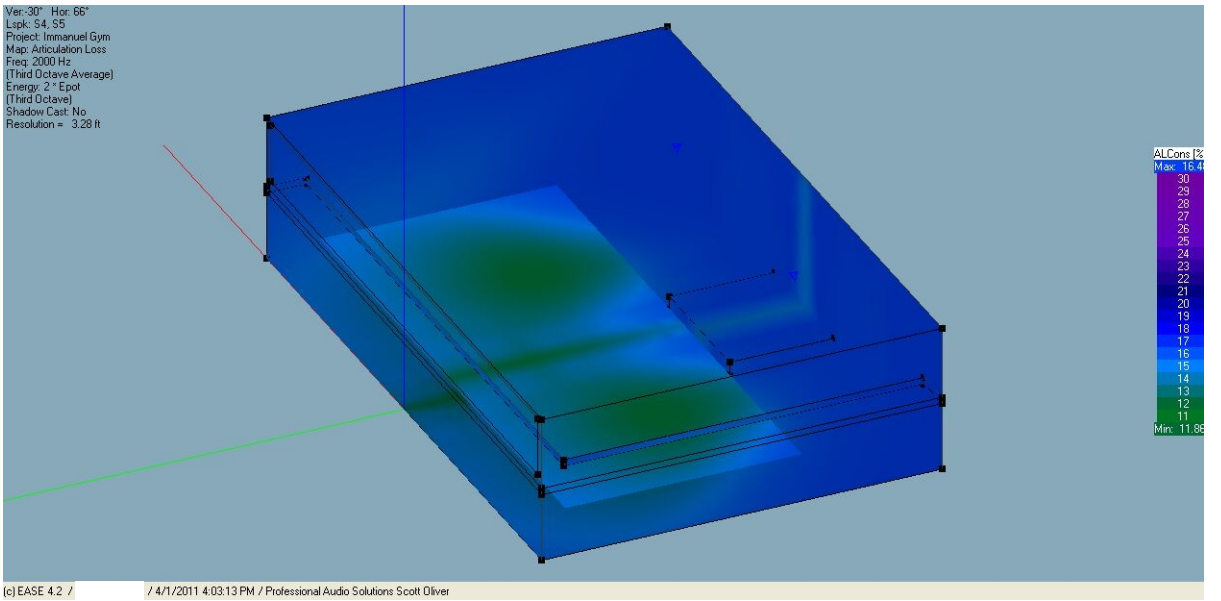


➢ EASE ALCONS before and after treatments (Acceptable Range: 1-15%)

Before Treatments:

Total Range 11.88%-16.4%

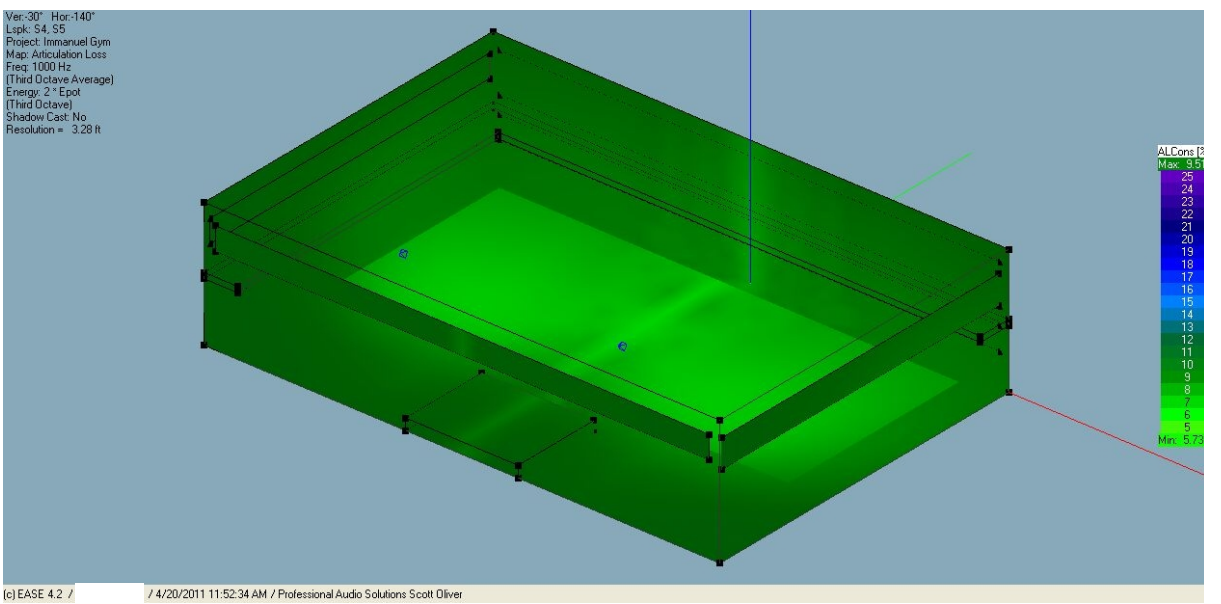
Seating Area Range 11%-16%



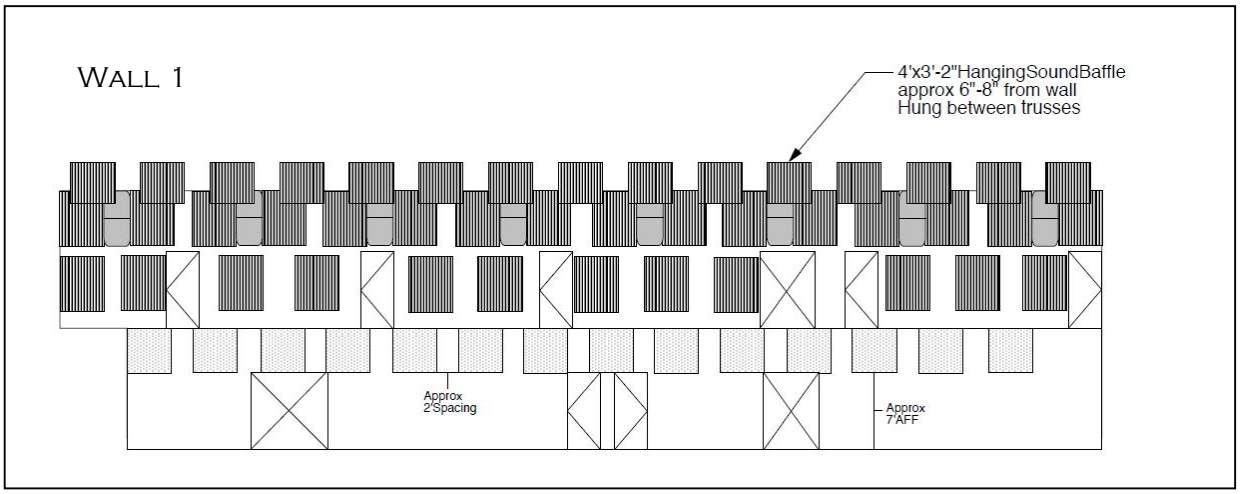
After Treatments:

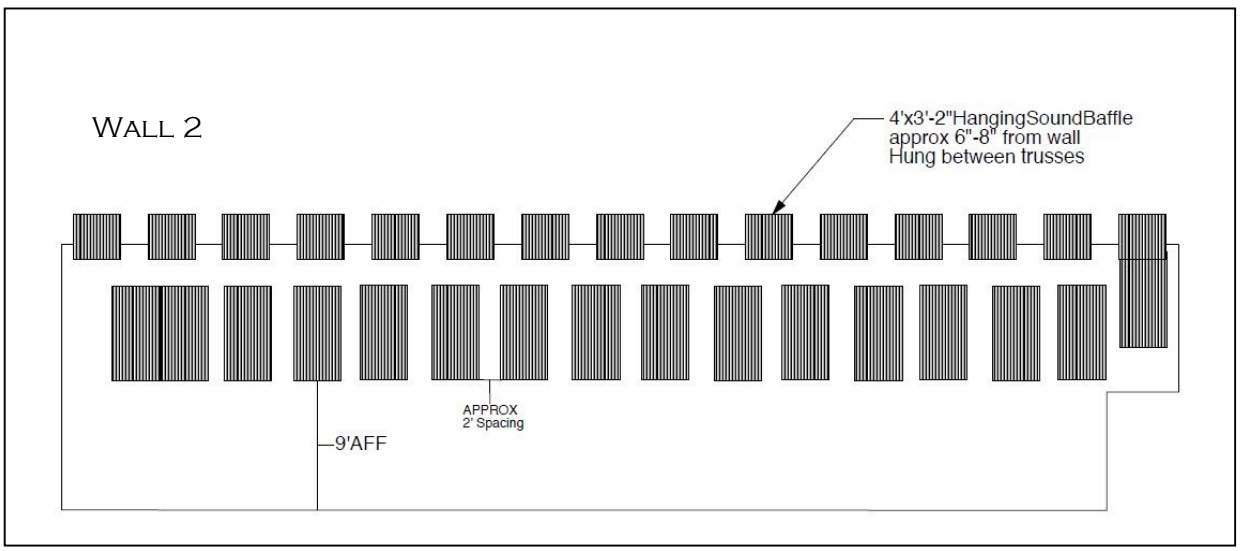
Total Area Range 5.73%-9.5%

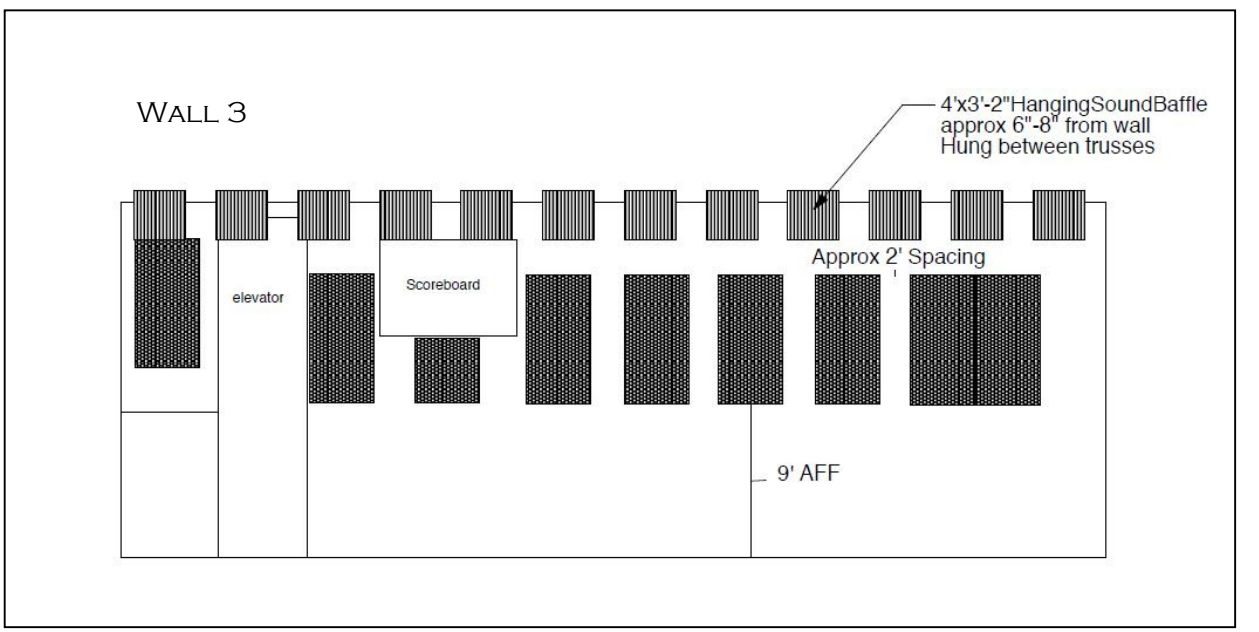
Seating Area: No more than 7%



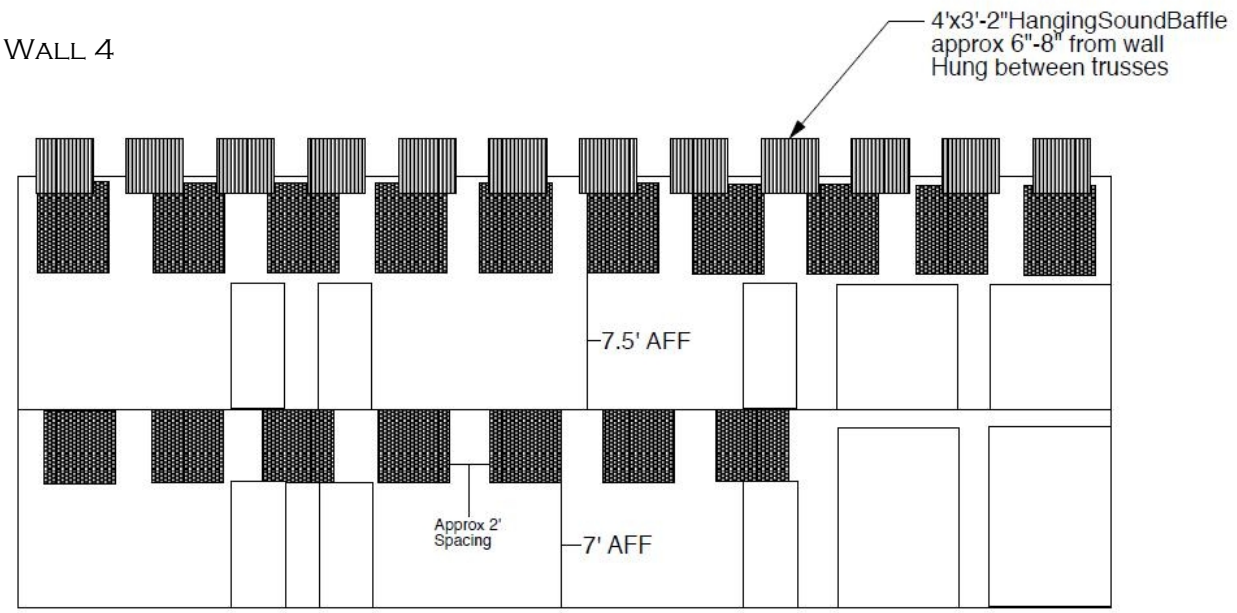
Wall Treatment Placement Elevations



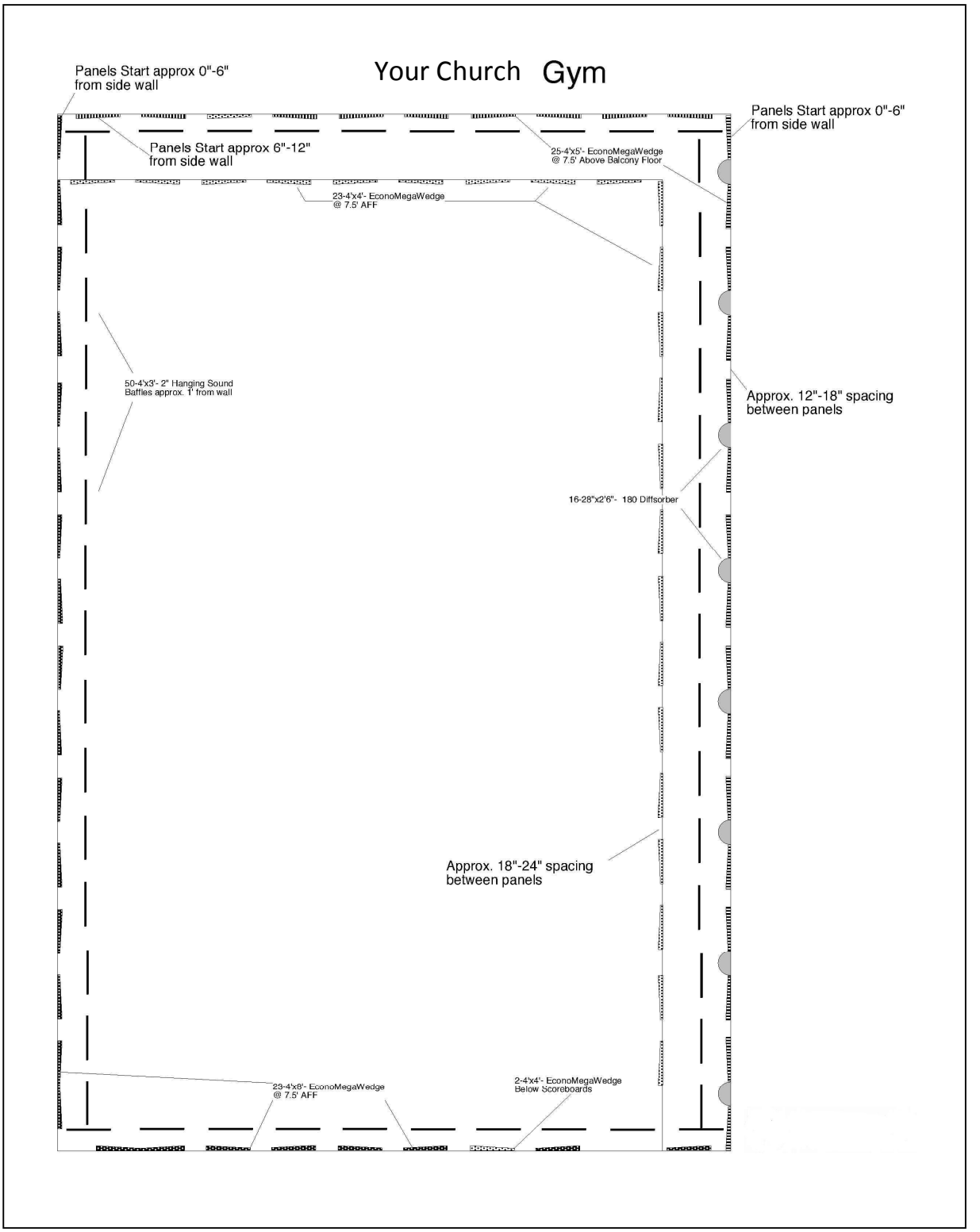




WALL 4


4'x3'-2"HangingSoundBaffle
approx 6"-8" from wall
Hung between trusses
7.5' AFF
Approx 2'
Spacing
7' AFF

➢ Wall/Perimeter Treatment Placement Floor Plan



PERDUE acoustics

Perdue Acoustics Panels use Mineral Fiber a.k.a. Rock Wool, cores. Unlike traditional compressed fiberglass, Mineral Fiber has a much higher coefficient of absorption at low frequencies.

EconoMegaWedge Diffsorber ☞

☜ **180 Diffsorber**

Perimeter Baffle ☞

➢ Floor Treatments

In order to reduce the significant amount of floor bounce associated with hardwood gymnasium floor, and in keeping with the “multipurpose” use of the gym, we are recommending the following portable treatments.

➢ Floor Coverings

It is our recommendation that a Vinyl Floor Covering be used as barrier between the seating, and the hardwood gym floor. This covering used in conjunction with thick padded seating will serve as the acoustical treatment for the floor. Reducing acoustical “Floor-bounce” is essential in achieving the desired R/T60 times. Putterman Athletics products are available through Pro Audio Solutions.

Putterman Athletics Vinyl Floor Covering with Roll-Up Rack

➢ Seating

It is our recommendation that stackable padded sanctuary seating such as the chair pictured below be used as a replacement for the metal vinyl padded chairs currently being used in the gym. These are not available through Pro Audio Solutions. A good source for these is Bertolini Sanctuary Seating. There are many sources for sanctuary seating, However, in the past we have recommended Bertolini for their excellent service and support and have never been disappointed.

BERTOLINI SANCTUARY® SEATING

http://sanctuaryseating.com/

➢ Ambient Noise Levels

*The ideal maximum ambient noise level for optimum audio reproduction is 40db. Ambient noise is effectively considered to be destructive interference. Reducing this interference as much as possible will result in better intelligibility and lower SPL levels from the audio system.

*The following sources were measured using a Galaxy Audio DB Meter using Both A-Weighted, and C-Weighted Measurements

A Weighting

The most common weighting that is used in noise measurement is *A-Weighting*. Like the human ear, this effectively cuts off the lower and higher frequencies that the average person cannot hear.

C Weighting

The response of the human ear varies with the sound level. At higher levels, 100 dB and above, the ear's response is flatter, as shown in the C-Weighted Response to the right. C-Weighting also factors in lower frequencies that can be felt, but not heard.

Source	A-Weighted	C-Weighted	
Water Cooler	58.5	68	
Entrance Frig. Pantry	57	65	
Roll Up Door Reflec.	58	67	
Gym Entrance Way	54	66	
Pantry Window in Gym	57	65	
Heater From 2nd Fl. 3'	65	72	
Heater 1st Floor Directly Under	57	68	
Gym Center All On	45	55	Heat Off
Gym Center All On	55	66	Heat On

➢ Recommendations for reducing Ambient Noise Level:

1: Install double glass door at gym entrance way.

2: Move water-cooler behind double glass doors.

3: Seal pantry gym window.

4: Replace gym lighting with LED retrofit kits. (Current lighting produces buzz noise)

5: Either replace heaters, or turn them completely off during services.