PROJECT 3: MUSIC ROOM ACOUSTICS - PART 2

a) Why is it important to control room acoustics? (positive and negative reasons)
It's important to control room acoustics because the artist wants people to hear the full range of frequencies in a song without the room affecting the song. There can be too much treatment in a room, however, which would cause the music to sound dead and make talking sound isolating. There isn't a right answer to how much treatment is needed but it is easiest to just feel it out.

i) In a music room (with unamplified music)
A music room is important to control the acoustics in because it is easier to mix a more isolated sound and add reverb in post than it is to remove it.

ii) In a drama theatre (with unamplified voice)
On average an auditorium should have a reverb time of around 2 seconds (HyperPhysics, n.d.) in order to project a voice without a microphone to the back rows of the audience. The treatment wouldn't be to decrease reflections but to increase reflections.

iii) In a typical classroom
According to the Ministry of Education the reverb time of a classroom should be 0.5 to 0.6 seconds so treatment would have to be added to treat reflections in the room and lower the background noise (Ministry of Education, 2020). Background noise can affect a student's ability to focus and retain information so it is important to have the room treated (Braconnier, 2011).
A sentence or two on each will be sufficient (use referencing)

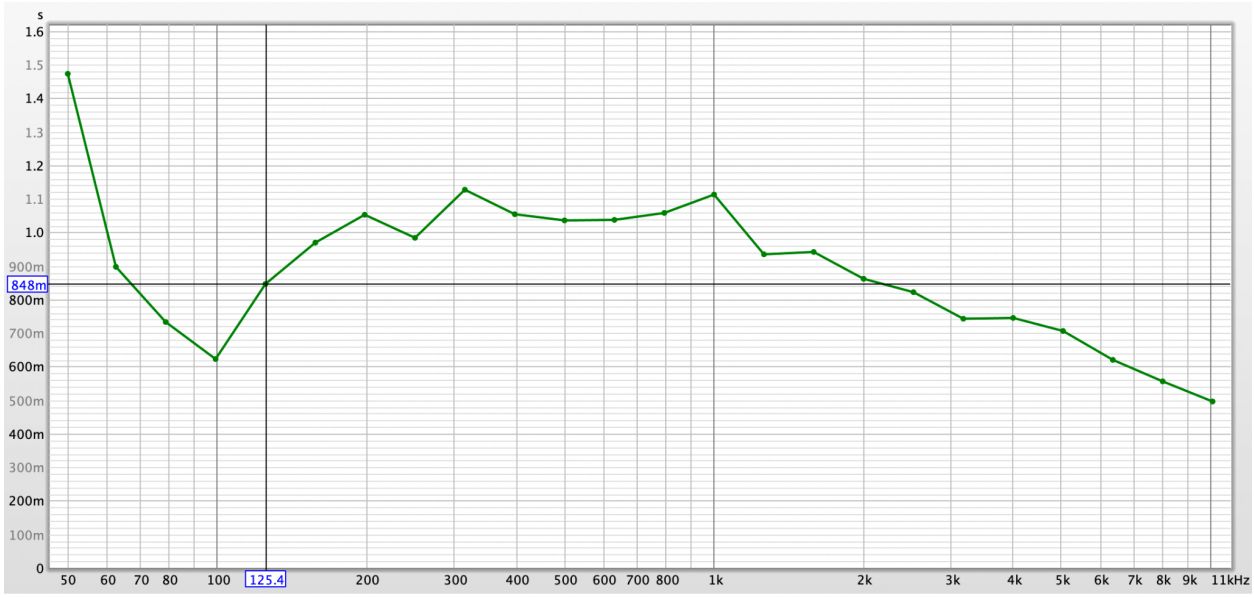
MUSIC ROOM ACOUSTIC TREATMENT APPRAISAL
a) TARGET ACOUSTICS - What were the acoustic targets (RT60) for the room as Music Teaching/ Rehearsal room? (refer to the NZ QLS standard as necessary)
The RT60 for a music teaching room in the NZ DQLS standards is 0.5 to 0.8 seconds. This standard is for mid-frequencies (the average of 500Hz and 1kHz).
For lower frequencies in music rooms it is desirable to have a bass rise in RT60 of 40% at 125Hz.

(1) What was the average absorption coefficient target for the mid frequencies?
0.23α

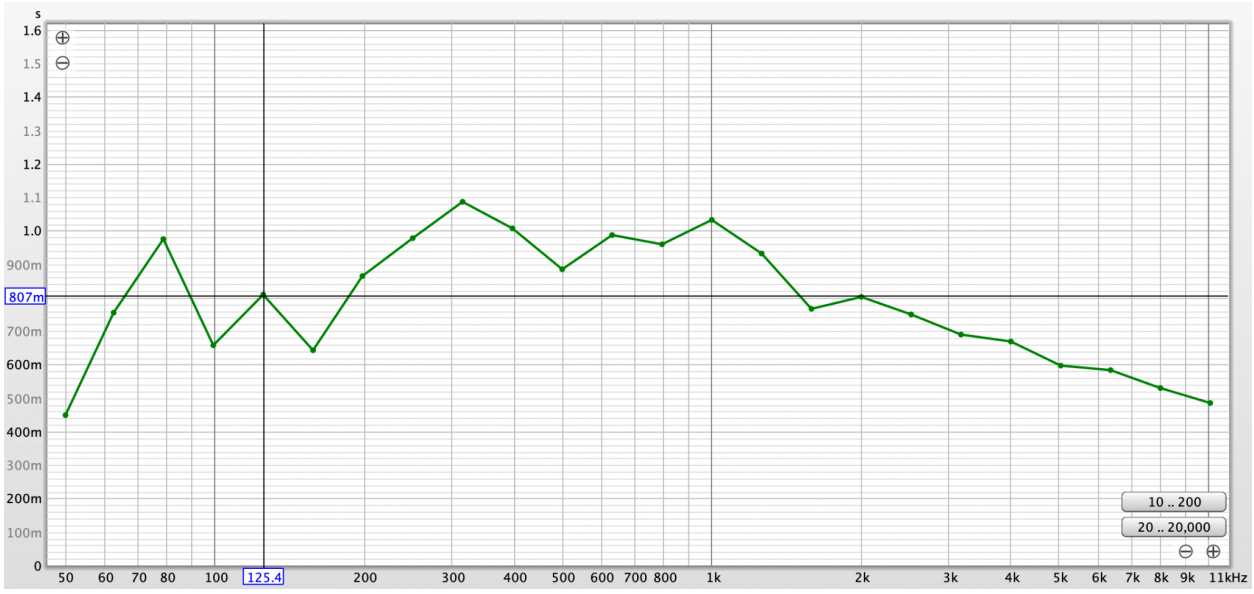
(2) What area of absorption does this equate to?
54.01m^2

EMPTY ROOM MEASURED ACOUSTICS -
What were the acoustic measurements for RT60 in the empty room?
In the empty room measured in project two it was 1.016s

i) Refer to the REW measurements taken in the empty room



LHS



RHS

ii) The RT60 measured average for mid frequencies?
1.016s

iii) The RT60 measured for 125 Hz?
800-850m

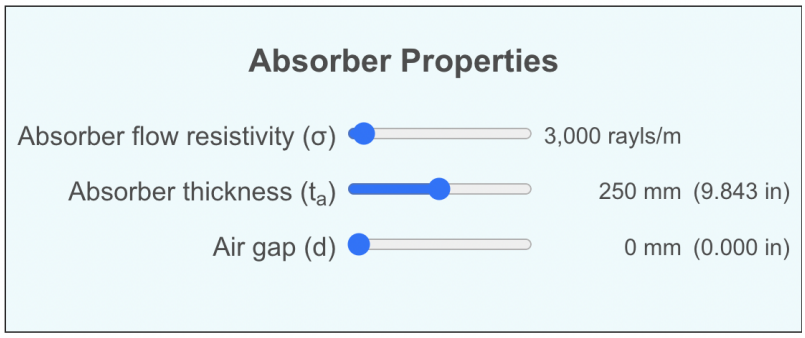
(1) What was the average absorption coefficient for these measured mid frequencies?
0.146α

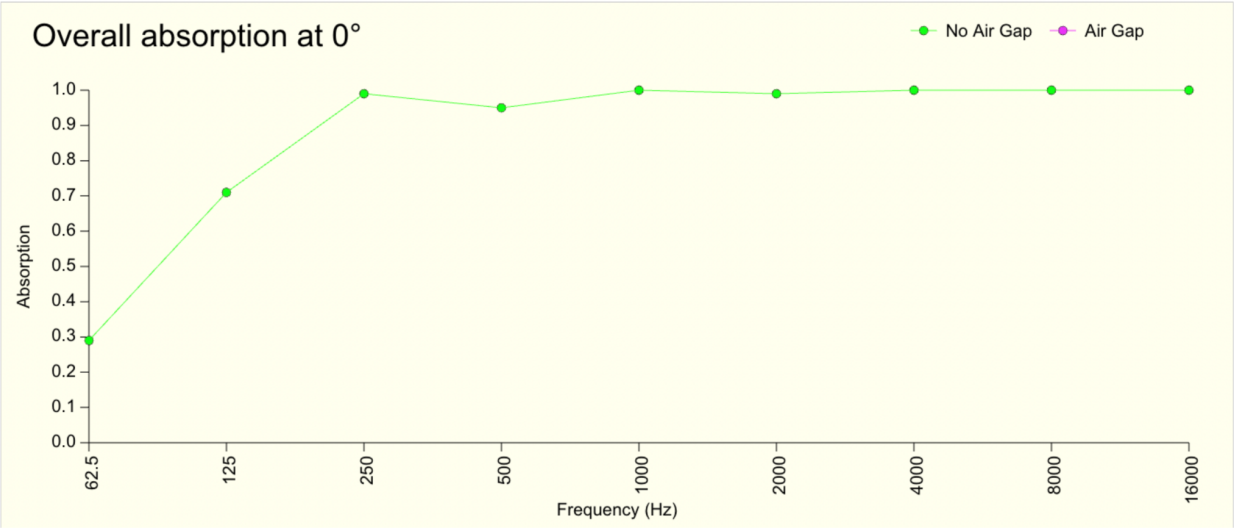
(2) What area of absorption does this equate to?
S*α= 234.83*0.146= 34.285m^2 (3dp)

TREATMENT REQUIRED
i) The required acoustic treatment is the difference between the target and the measured existing values
(1) What is the Required Treatment area (in m^2) to achieve the target?
20m^2 (0dp)
(a) Find the difference between the Target Absorption and Existing Absorption areas

(b) If the acoustic panels are 2m x 1m square, how many would be required?
10
ii) Given the absorption material is Greenstuf (polyester and flow resistivity is approx.. 3000 rayls), how thick does a panel need to be to fully absorb down to 250Hz?

250mm with no air gap





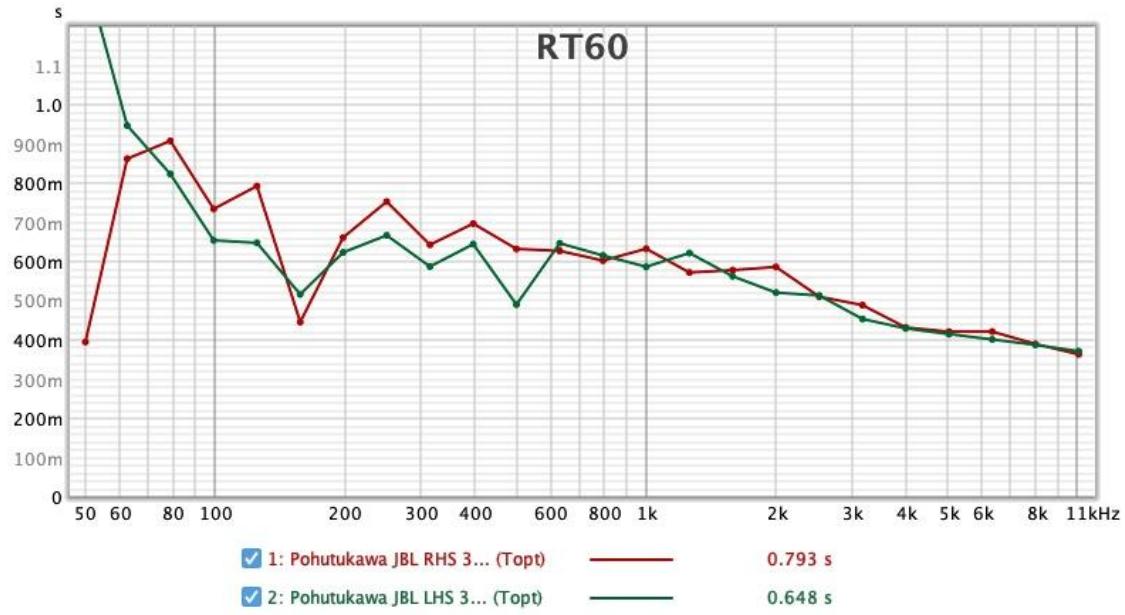
TREATED ROOM ACOUSTICS
a) How close did the treatment get in the mid frequencies (500 and 1kHz)?

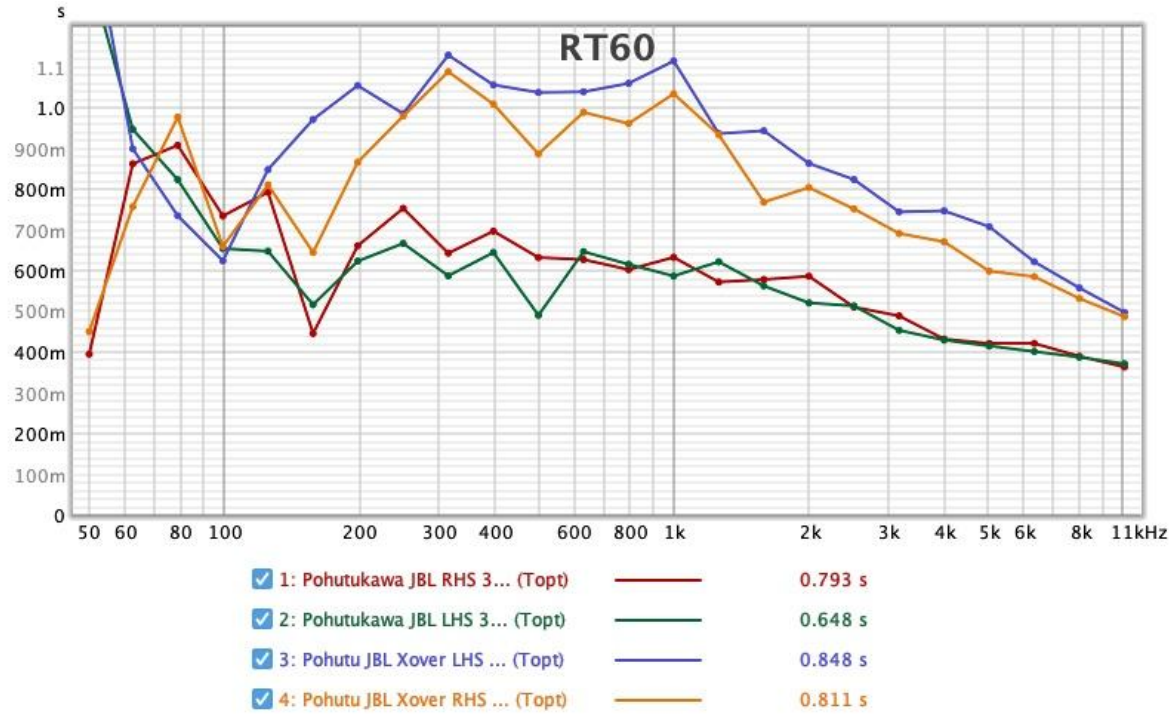
i) State the Treated Room measured values for 500Hz and 1kHz
LHS RT60:

500Hz: 453m
1kHz: 572m

RHS RT60:
500Hz: 629m
1kHz: 620m

453+572+629+620= 2274. 2274/4= 568.5m



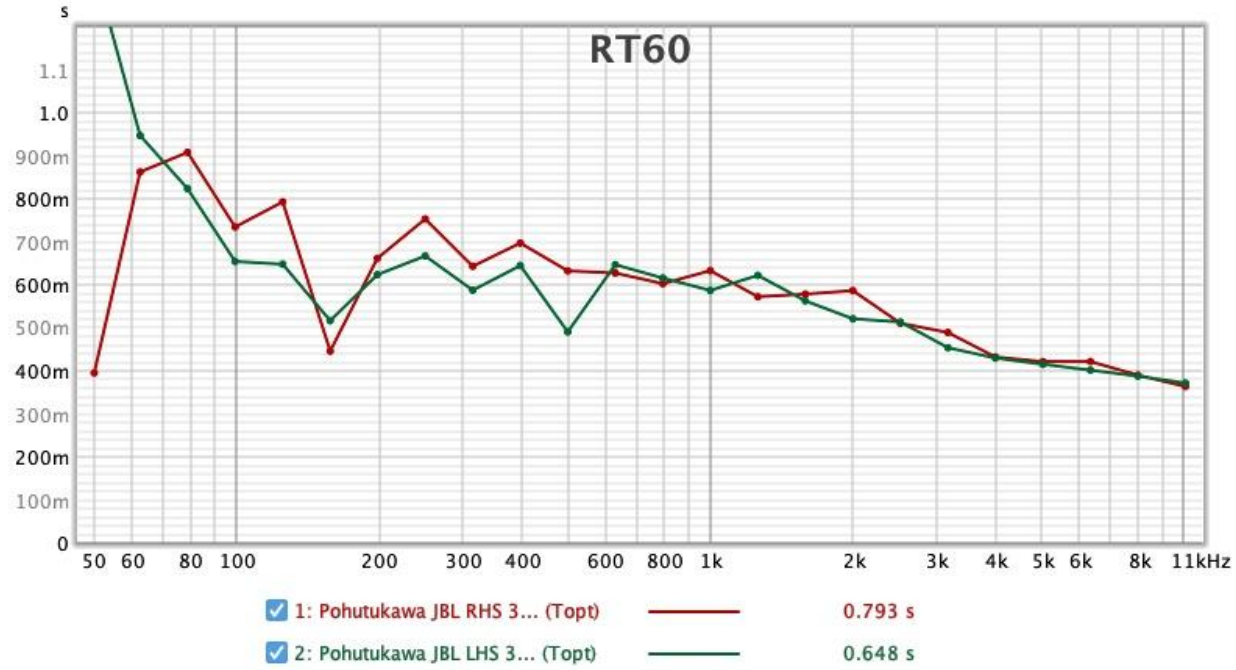


Treating the room has given a new mid-frequency RT60 average of almost half the untreated room. The RT60 now is within the DQLS standards of a music room. When comparing the treated measurements with the yellow and blue lines (the untreated measurements) there is a clear difference. The new measurements follow the same peaks and troughs as the old ones except at an overall lower RT60. However, there is a new peak at 125Hz that goes up to 790m. This is strange and may have something to do with an air gap in the treatment or a resonant frequency.

How close did the treatment get in the low frequency range (125Hz)
 i) State the Treated Room measured values for 125Hz

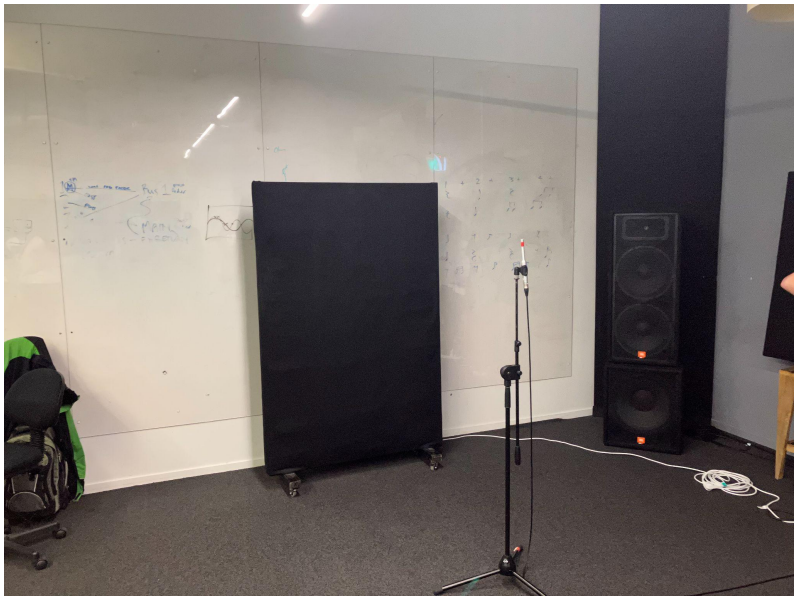
RHS: 790m
LHS: 643m

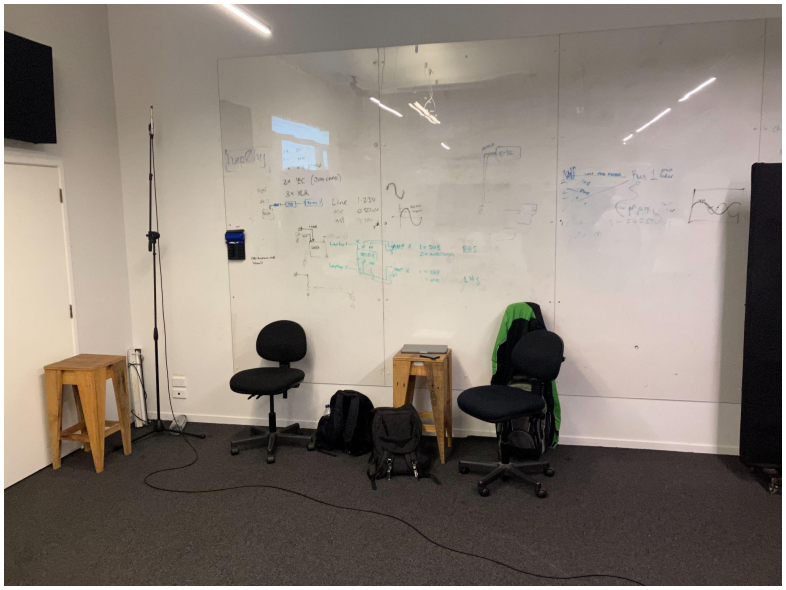
Overall average= 790+643= 1433. 1433/2= 716.5m

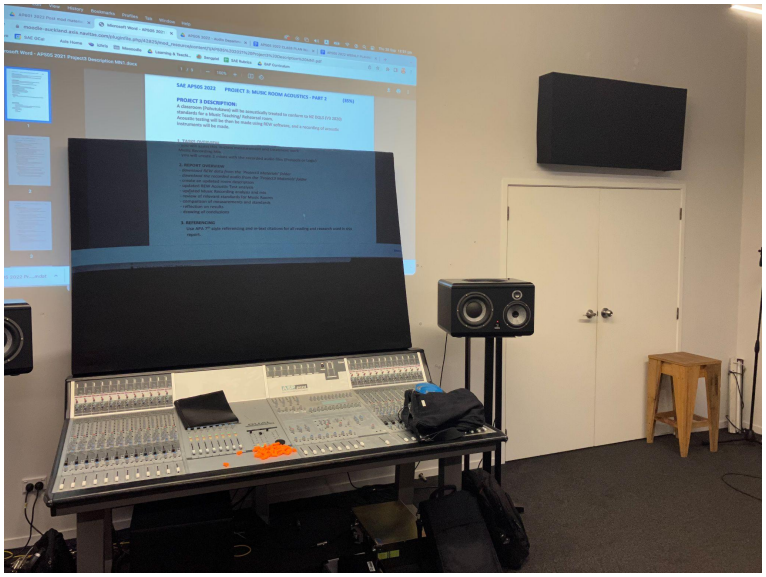


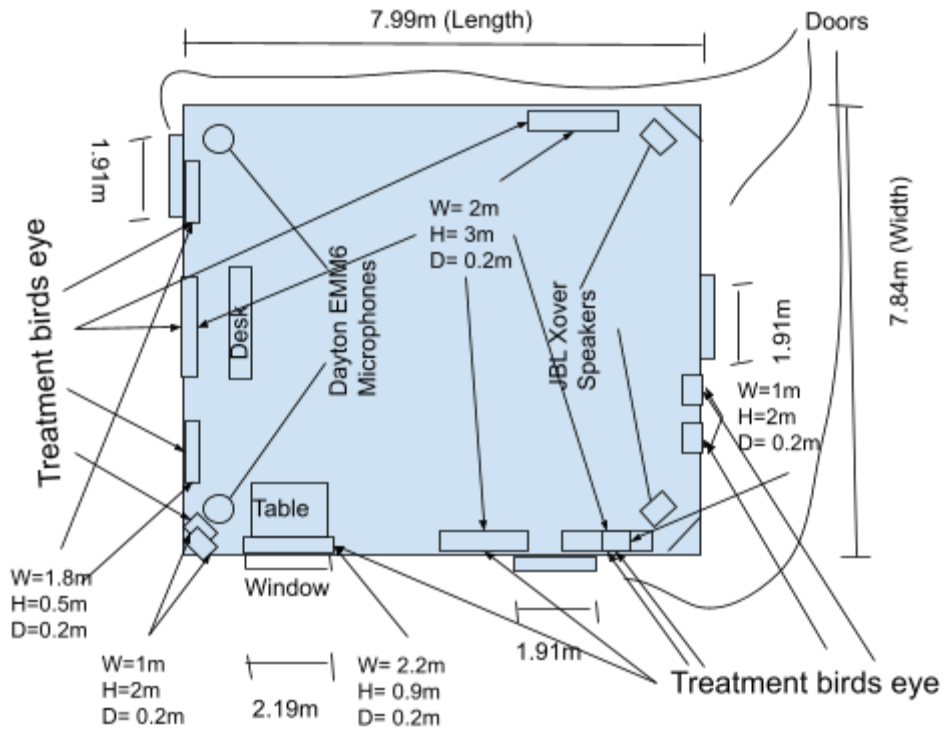
40% of 568.5 for bass rise standards in a music room.
568.5*0.4= 227.4
568.5+227.4= 795.9

A 40% bass rise at 125Hz would be 795.9m which is almost perfectly what the right speaker measurement does. The overall average between the left and right measurements is 716.5m which is only 79.4m off being a 40% increase. The goal was achieved because the NZ DQLS standards state that it is up to a 40% increase at 125Hz.









It would have been ideal to treat the ceiling or remove the carpet as to create more symmetry as that is important in acoustic treatment. Another is the need for air gaps which could cause ripples in the frequency response but it treats lower frequencies better.

i) Assess and comment on panel areas versus total required
2.2*0.9= 1.98m^2 (window panel)
2*3= 6m^2 (3 wheeled panels and 1 desk panel)
6*4=24m^2
1.8*0.5= 0.9m^2 (2 hanging panels)
0.9*2=1.8m^2
2*1=2m^2 (student-made panels)
2*5=10m^2

Overall surface area of treatment added: 37.78m^2

This is ideal because 20m^2 of treatment was necessary to get the room within NZ DQLS standards and it worked.

ii) Assess and comment on panel thickness versus ideal depth
The panels were all 200mm thick which was enough because of the quantity of the panels we had to use. Next time I would have preferred to have little to no air gap between the walls and the panels as I think some ripples in the reflections of the room may occur.

The massive drop at 137Hz in the RHS treated room goes to 82dBs. This may have been from air gaps in the treatment. There is also a new spike at 1.9kHz in the LHS measurement for the treated room which goes to 92dBs. This could also be the air gaps. There is also a much steeper drop off toward 20kHz for the RHS treated room measurement. This could be because there was more treatment on the left wall so it absorbed more than the LHS measurement which faced the right wall.

LAEQ Measurements

My phone isn't working (waiting for a new one so I am using an average from the class's measurements with LAEQ.

A/C and projector off: 26dBs
A/C and projector on: 36dBs

The old measurements were 28dBs and 32dBs. I suspect that with the A/C and projector on in the untreated room it should have been noisier. This may have been at the fault of my now broken phone.

It does seem that the treatment did work for the machines being off LAEQ measurement by lowering it. This keeps the background noise within the standards.

Recording comparison

) MIX REPORT
a) Comment and reflect on the recordings made in the Treated Room Mix compared to the Untreated Room Mix recordings made as part of Project 2

The direct microphones weren't too different. The bongos had a huge difference though. There was a lot more room sound in the original recording of them. Daryl's voice is also more audible in the guitar recording in the treated room. This is due to a less muddied sound.

ii) The Room1 MS mics inside the Critical Distance
They are more clear and have a less low end in the newer recordings. The REW graph shows a new massive dip in SPL at 125Hz for the RHS measurement so that is probably a reflection of what I am hearing. This could be due to bass being absorbed by the treatment.

iii) The Room2 MS mics outside the Critical Distance
The new recordings are a lot less muddied.

The impulse responses are very different as well. The original response is more boomy and reverberated whereas the new one is quicker and sounds like a bundle of sticks dropping.

References

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HyperPhysics. (n.d.). *Reverberation time*. HyperPhysics. Retrieved October 7, 2022, from http://hyperphysics.phy-astr.gsu.edu/hbase/Acoustic/revtim.html

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