RNS ACOUSTICS

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## Acoustical Insulation Improvement Analysis

Analysis Date: 14 April 2019
Performed By: Ryan Sema
Performed For: [redacted]
Analysis Performed: Expected Improvement Analysis

### Overview:

This report was prepared by RNS Acoustics at the request of [redacted] for a Jiu Jitsu studio to determine the expected noise reduction due to the installation of additional wall assemblies at [redacted] Carlsbad, CA 92008. Current wall assemblies are insufficient to prevent noise generated by the regular Jiu Jitsu studio activities from disturbing adjacent tenants. Additional sound insulating wall assemblies are to be installed along existing walls shared with other tenants highlighted in Figure 1. The expected results of installing the additional wall assemblies were prepared in this report.

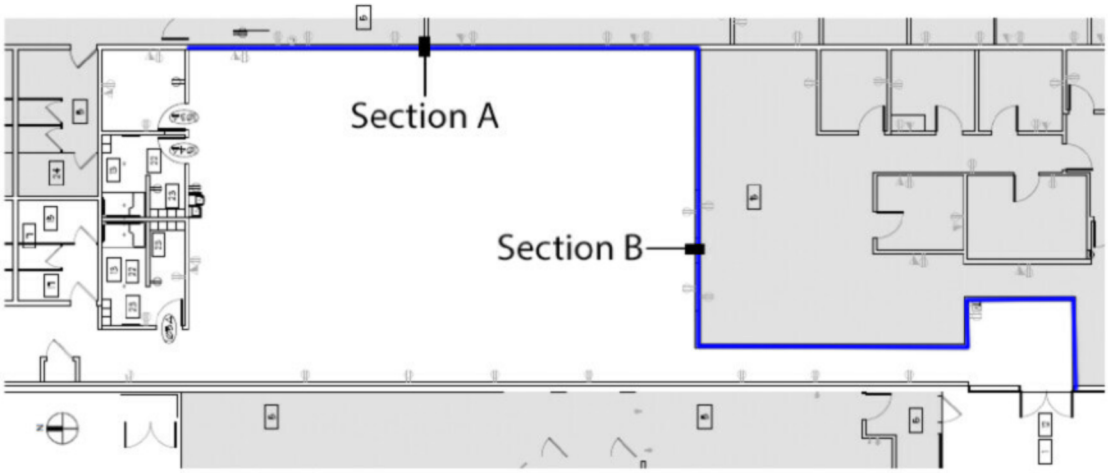



Figure 1. Highlight (Blue) of where additional noise insulating wall assemblies will be installed.

### Definition of Terms and Limits:

LAeq – The equivalent continuous sound level. This single number value represents the level of noise that contains the same amount of energy as a time varying signal.

A-Weighting – The level in decibels as measured on a sound level meter using the A- Weighted network. The A-Weighted network is the network for measuring sound that most closely resembles what the human ear hears. Sound measured using the A-weighted network is designated dBA.

1/3 Octave Bands – Displays the frequency spectrum content of a signal divided into 3 bands per-octave. The 1/3 Octave Bands are more useful for data interpretation and practical applications.

Transmission Loss – The level in decibels a barrier attenuates a noise. The transmission loss is presented in attenuation per 1/3 octave frequency band.

STC – The Sound Transmission Class of a barrier. The STC rating roughly equals the overall transmission loss of noise when passing through the barrier.

Results:

Existing wall assemblies were modeled using INSUL 9.0, an acoustical properties modeling software, to determine the STC of the assembly. The acoustical improvements were then modeled using the same software. A spectral analysis of a recording during regular activities was analyzed and the peak and average LAeq were determined. The results of the spectral analysis were then compared to the results from the computer models. Figures 2 – 3 show the existing wall acoustical profile on the left with the improved acoustical profile after modifications on the right. Tables 1 – 2 show the additional attenuation for each 1/3 octave band due to the improvements. Refer to Figure 1 for wall Section A and Section B locations.

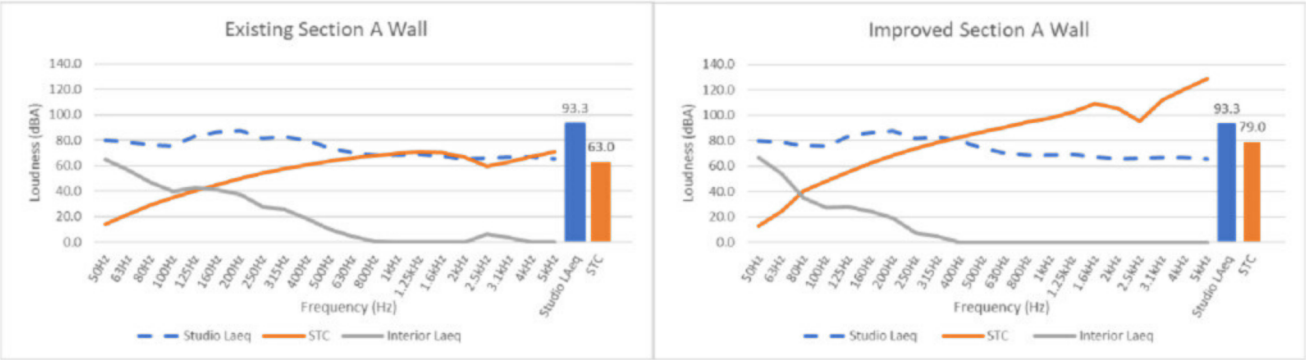



Figure 2. Existing Section A wall transmission loss on the left and the same wall with improvements on the right.

| Comparison of Existing Section A Wall and Predicted Improved Wall STC | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 50Hz | 63Hz | 80Hz | 100Hz | 125Hz | 160Hz | 200Hz | 250Hz | 315Hz | 400Hz | 500Hz |
| New STC | 12.9 | 24.3 | 40.8 | 48.1 | 55.4 | 62.3 | 68.4 | 73.7 | 78.5 | 82.8 | 86.9 |
| Old STC | 14.4 | 21.9 | 29.1 | 35.2 | 40.6 | 45.5 | 50 | 54 | 57.6 | 60.9 | 63.8 |
| Improvement | -1.5 | 2.4 | 11.7 | 12.9 | 14.8 | 16.8 | 18.4 | 19.7 | 20.9 | 21.9 | 23.1 |
| | 630Hz | 800Hz | 1kHz | 1.25kHz | 1.6kHz | 2kHz | 2.5kHz | 3.1kHz | 4kHz | 5kHz | STC |
| New STC | 90.8 | 94.6 | 98 | 102.7 | 109.3 | 105.2 | 95.6 | 112 | 120.6 | 128.7 | 79 |
| Old STC | 66 | 68 | 69.6 | 70.7 | 70.6 | 66.5 | 59.8 | 62.9 | 67.1 | 71.2 | 63 |
| Improvement | 24.8 | 26.6 | 28.4 | 32 | 38.7 | 38.7 | 35.8 | 49.1 | 53.5 | 57.5 | 16 |

Table 1. Additional attenuation achieved by the improved wall vs the old wall for Section A.

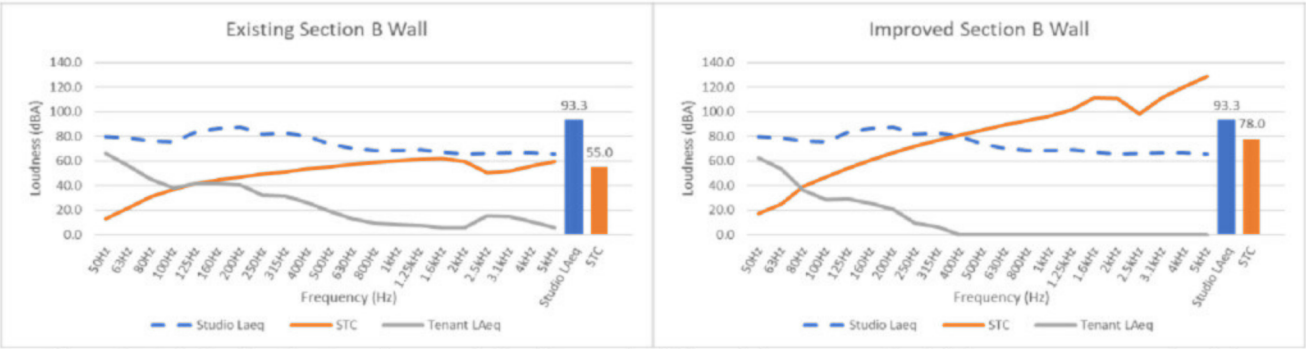



Figure 3. Existing Section B wall transmission loss on the left and the same wall with improvements on the right.

| Comparison of Existing Section B Wall and Predicted Improved Wall STC | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 50Hz | 63Hz | 80Hz | 100Hz | 125Hz | 160Hz | 200Hz | 250Hz | 315Hz | 400Hz | 500Hz |
| New STC | 17.3 | 24.9 | 39.4 | 46.9 | 54.2 | 60.8 | 66.8 | 72 | 76.8 | 81.2 | 85.3 |
| Old STC | 13.3 | 22.3 | 30.9 | 37.2 | 41.5 | 44.6 | 47.1 | 49.3 | 51.4 | 53.4 | 55.3 |
| Improvement | 4 | 2.6 | 8.5 | 9.7 | 12.7 | 16.2 | 19.7 | 22.7 | 25.4 | 27.8 | 30 |
| | 630Hz | 800Hz | 1kHz | 1.25kHz | 1.6kHz | 2kHz | 2.5kHz | 3.1kHz | 4kHz | 5kHz | STC |
| New STC | 89.3 | 93.1 | 96.7 | 101.8 | 111.4 | 110.6 | 98.5 | 111.5 | 120.2 | 128.6 | 78 |
| Old STC | 57.1 | 58.8 | 60.3 | 61.4 | 61.7 | 59.8 | 50.7 | 51.8 | 55.8 | 59.8 | 55 |
| Improvement | 32.2 | 34.3 | 36.4 | 40.4 | 49.7 | 50.8 | 47.8 | 59.7 | 64.4 | 68.8 | 23 |

Table 2. Additional attenuation achieved by the improved wall vs the old wall for Section B.

The results from the computer models suggest an STC improvement of 16 dBA for wall Section A and 23 dBA for wall Section B. Figures 3 – 4 suggest that noise with a frequency over 400Hz should be almost completely attenuated.

The wall improvements will consist of additional 3-5/8" wall studs with two layers of 5/8 Type-C gypsum board on the exterior mounted to a resilient channel. The additional wall assembly should have an air gap between it and the existing wall of 2". 3" Mineral wool insulation should be used in the new wall assembly. The gypsum board should be staggered to minimize leakage. Non-hardening acoustical sealant should be used between the gypsum board and roof and ceiling decks. All piping egresses should be caulked and sealed with non-hardening acoustical sealant.

Section A of the wall improvement ends at the adjoining offices as shown in Figure 4, terminating at the existing wall. Capping the wall in the configuration in Figure 4 will minimize available flanking paths and maximize noise reduction. Section A will terminate at wall Section B as shown in Figure 5. Wall Section B will extend to the exterior wall of the building.

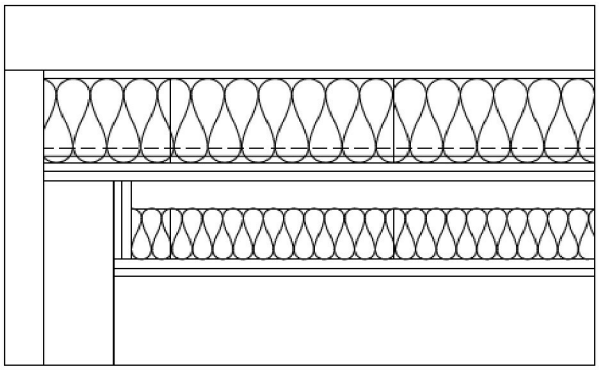


Figure 4. Section A wall terminated and capped at office.

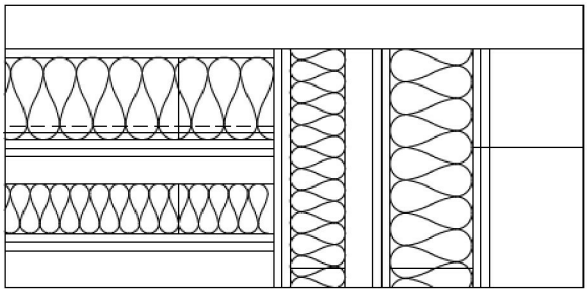


Figure 5. Section A wall terminated and capped at Section B wall.

Using standard techniques for creating noise models such as this can expect an error margin of +/- 3dBA. The error can be due to varying climate conditions, estimations and the simplifications necessary to produce the models. All recommendations for noise control are based on the best information available at the time our consulting services are provided. However, as there are many factors involved in sound and impact transmission, and RNS Acoustics has no control over the construction, workmanship or materials, RNS Acoustics is specifically not liable for final results of any recommendations or implementation of the recommendations.

# Appendix A

GENERAL NOTES:

1) EXISTING WALLS 6" METAL STUDS, NEW WALLS ARE 3-5/8" METAL STUDS.

2) RESILENT CHANNEL ON WALL A & 1/2" SOUND BOARD ON 3-5/8" STUD WALL (SEE SECTION A)

3) ALL INTERIOR WALLS OF THE GYM SPACE ARE TYPE C 5/8" GYP BD.

4) PERIMETER SEALANT BY KNC IS ON BOTH SIDES OF THE WALLS ON TOP AND BOTTOM.

5) 1/2"CAULKING AIR TIGHT BACKER ROD SEALANT (TYP) ON TOP AND BOTTOM OF DEMISING WALL AND KINETIC WALL. ( SEE WALL SECTIONS FOR DETAILS)

6) TYP C 5/8" GYB DRYWALL 2 LAYERS TOTAL ON INSIDE OF 6" METAL STUD WALL
(SEE SECTIONS FOR DETAILS)

7) ALL OUTLETS (IF ANY) ON THE DEMISING WALL SHALL BE COVERED WITH QUIET PUTTY OR SIM.

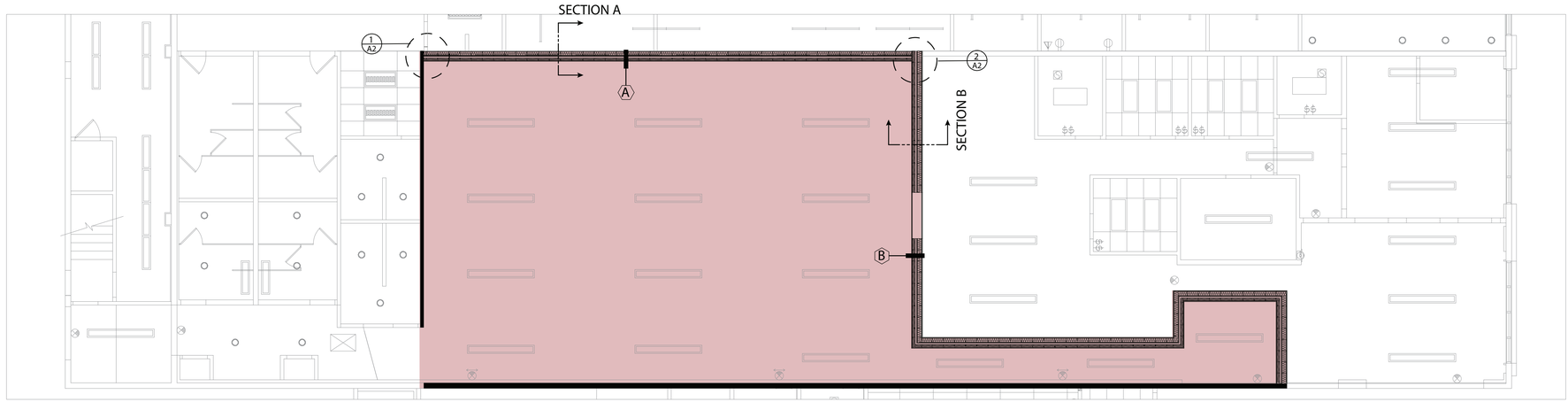
8) WALL STUD JOINT DETAILS ON A-2

9) HOLD BACK DRYWALL 1/4" GAP FROM DECKING CEILING

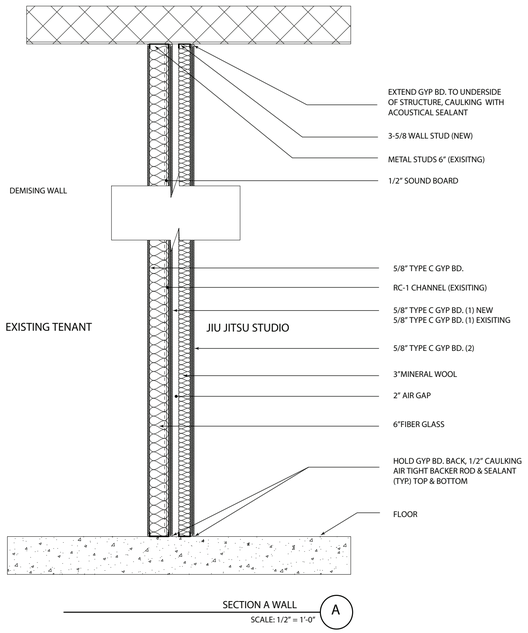
10) 1/4" ANNULAR CLEARANCE FOR ALL PENETRATIONS DON'T TOUCH THE DRYWALL, SEAL WITH CAULKING OF ACOUSTIC SEALANT

11) DRYWALL IS ALTERNATING FOR ASSEMBLY (SEE A-2 FOR LAYERING DETAIL)

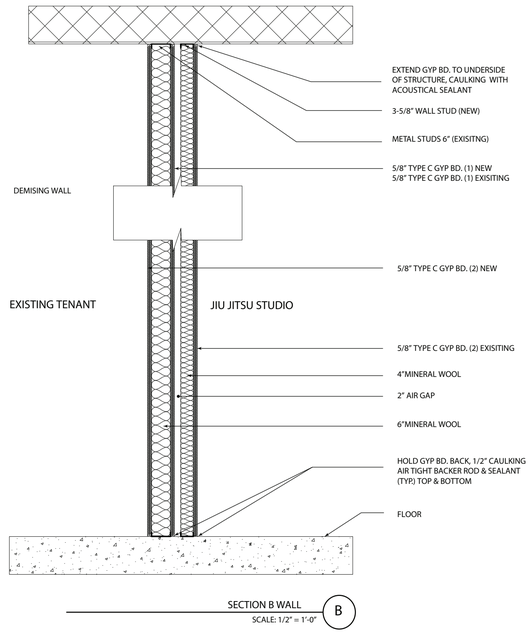
12) CEILING DECK FOR WHOLE CEILING (SEE A-2 FOR DETAIL)




JIUJITSU WALL STUD PLAN
SCALE: 1/8" = 1'-0"
1




SECTION A WALL
SCALE: 1/2" = 1'-0"
A




SECTION B WALL
SCALE: 1/2" = 1'-0"
B

LEGEND

AREA OF IMPORTANCE

SECTION CALLOUTS

RNS ACOUSTICS
7964 ARJONS DRIVE
SUITE H 105
SAN DIEGO CA, 92126

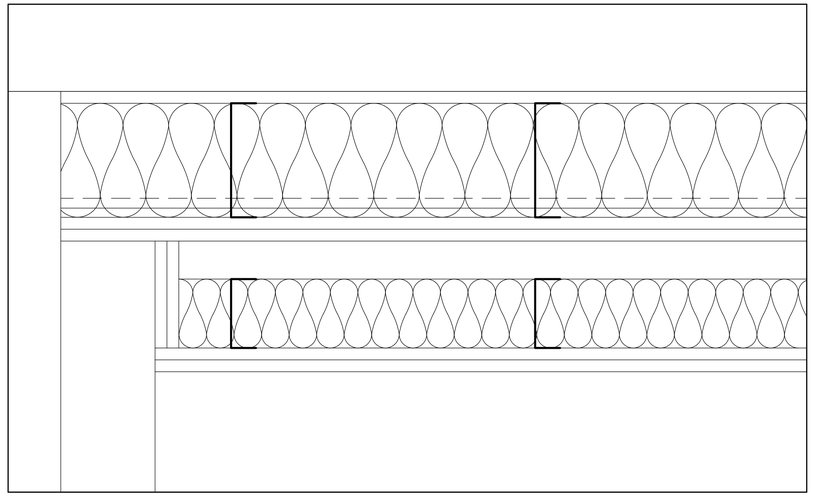
JIU JITSU STUDIO

DRAWN BY
MAXWELL KUBOTA

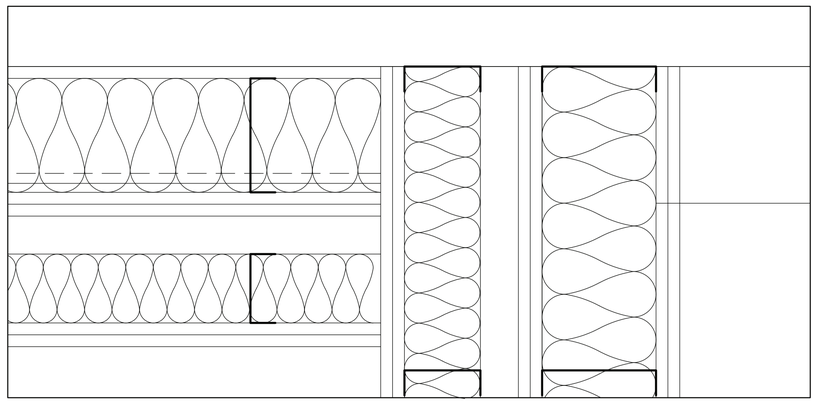
DATE
11/13/18

DRAWING TITLE
JIU JITSU STUDIO

SHEET NUMBER
A-1

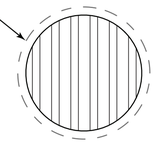


ELEVATION WALL STUD
SCALE: 6" = 1'-0"
1



ELEVATION WALL STUD
SCALE: 6" = 1'-0"
2

1/4" DIA, ANNULAR CLEARANCE FOR ALL PENETRATION CAULKING W/ ACOUSTIC SEALANT

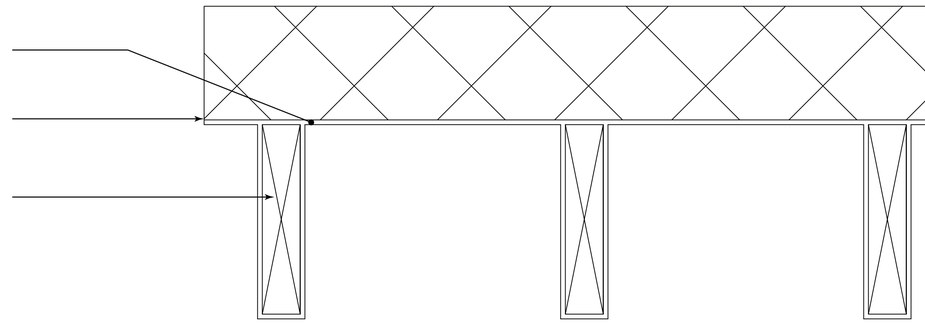


ANGULAR CAULKING
SCALE: 1" = 1'-0"
C

HOLD BACK DRYWALL W/ 1/4" GAP.
CAULK GAP W/ ACOUSTIC SEALANT

DRYWALL TYPE C 5/8" GYB.

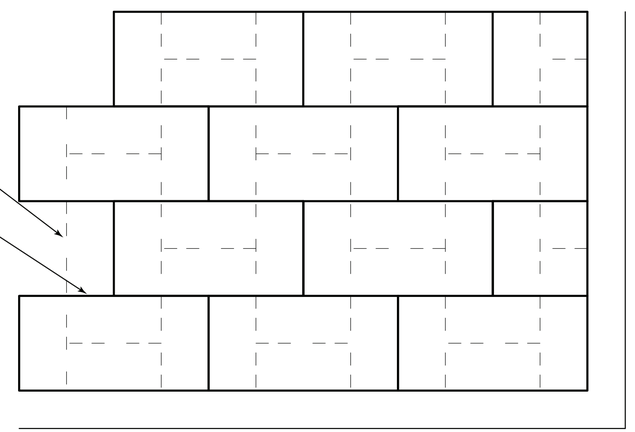
2X10 JOIST



CEILING DECK DETAIL
SCALE: 3" = 1'-0"
D

SECOND LAYER

FIRST LAYER



DRY WALL LAYERING DETAIL
SCALE: 1" = 1'-0"
E

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SUITE H 105
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DRAWN BY
MAXWELL KUBOTA

DATE
11/13/18

DRAWING TITLE
JIU JITSU STUDIO

SHEET NUMBER
A-2

# Appendix B

# Sound Insulation Prediction (v9.0.14)


margin of error is generally within STC +/- 3 dB
RNS Acoustics - Key No. 4848
Job Name:
Job No.: Initials:Ryan
Date:11/16/2018
File Name:jiu jistu Wall_spa.ixl

Notes:

STC 78
OITC 57

Mass-air-mass resonant frequency = =35 Hz , 61 Hz

Panel Size = 8.9 ft x 13.1 ft

Partition surface mass = 16.7 lb/ft2

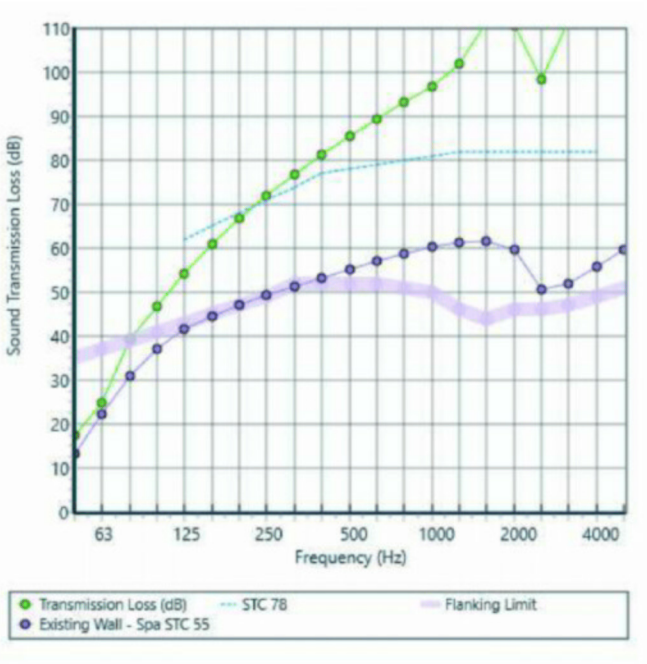
## System description

Panel 1 : 2 x 0.63 in Type X Gypsum Board

Frame: Steel Stud (22g) (6 in x 1.5 in ); Cavity Width 6 in ,Stud spacing 24 in , 1 x Mineral wool I (3.8 lb/ft3) Thickness 6.0 in
Panel 2 : 2 x 0.6299 in Type X Gypsum Board

Frame: Right steel stud + air gap (3.6 in x 1.4 in ); Cavity Width 4.61 in ,Stud spacing 24 in , 1 x Mineral wool I (3.8 lb/ft3) Thickness 4.0 in
Panel 3 : 2 x 0.6299 in Type X Gypsum Board

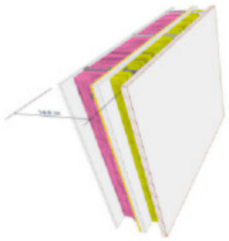
| freq.(Hz) | TL(dB) | TL(dB) |
|---|---|---|
| 50 | 17 | |
| 63 | 25 | 21 |
| 80 | 39 | |
| 100 | 47 | |
| 125 | 54 | 51 |
| 160 | 61 | |
| 200 | 67 | |
| 250 | 72 | 70 |
| 315 | 77 | |
| 400 | 81 | |
| 500 | 85 | 84 |
| 630 | 89 | |
| 800 | 93 | |
| 1000 | 97 | 96 |
| 1250 | 102 | |
| 1600 | 111 | |
| 2000 | 111 | 103 |
| 2500 | 98 | |
| 3150 | 112 | |
| 4000 | 120 | 116 |
| 5000 | 129 | |



# Sound Insulation Prediction (v9.0.14)

Program copyright Marshall Day Acoustics 2017
margin of error is generally within STC +/- 3 dB
RNS Acoustics - Key No. 4848
Job Name:
Job No.: Initials:Ryan
Date.:11/16/2018
File Name:Jiu Jitsu Wall.ixl

Notes:



STC 79
OITC 59

Mass-air-mass resonant frequency = =39 Hz , 57 Hz

Panel Size = 8.9 ft x 13.1 ft

Partition surface mass = 15.2 lb/ft2

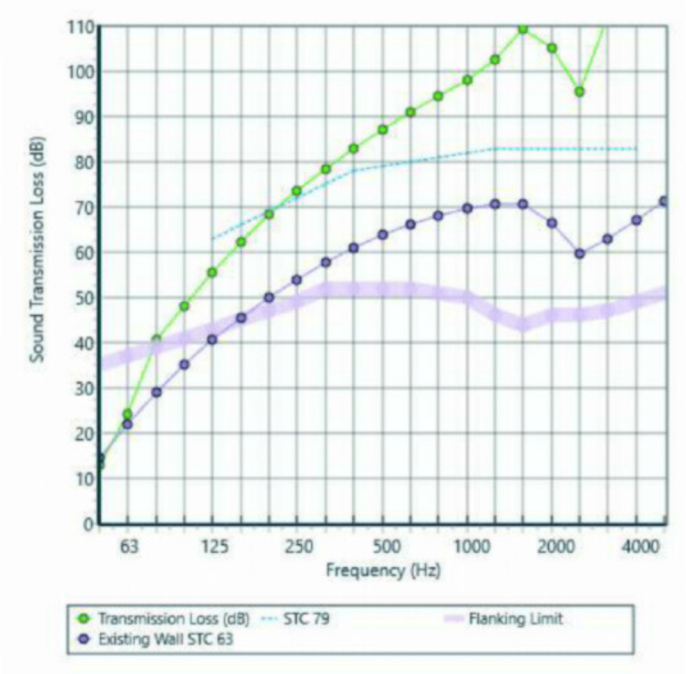
## System description

Panel 1 : 1 x 0.63 in Type C Gypsum Board

Frame: Steel Stud + resil. rail (5.9 in x 1.4 in ); Cavity Width 6.38 in ,Stud spacing 24 in , 1 x fiberglass (0.6 lb/ft3) Thickness 6.0 in
Panel 2 : 1 x 0.5 in Homasote 440 Sound Barrier + 1 x 0.6299 in Type C Gypsum Board
+ 1 x 0.6299 in Type C Gypsum Board

Frame: Right steel stud + air gap (3.6 in x 1.4 in ); Cavity Width 4.61 in ,Stud spacing 24 in , 1 x Mineral wool I (3.8 lb/ft3) Thickness 3.0 in
Panel 3 : 2 x 0.63 in Type C Gypsum Board

| freq.(Hz) | TL(dB) | TL(dB) |
|---|---|---|
| 50 | 13 | |
| 63 | 24 | 17 |
| 80 | 41 | |
| 100 | 48 | |
| 125 | 55 | 52 |
| 160 | 62 | |
| 200 | 68 | |
| 250 | 74 | 72 |
| 315 | 78 | |
| 400 | 83 | |
| 500 | 87 | 86 |
| 630 | 91 | |
| 800 | 95 | |
| 1000 | 98 | 97 |
| 1250 | 103 | |
| 1600 | 109 | |
| 2000 | 105 | 100 |
| 2500 | 96 | |
| 3150 | 112 | |
| 4000 | 121 | 116 |
| 5000 | 129 | |



# Sound Insulation Prediction (v9.0.14)

Program copyright Marshall Day Acoustics 2017
margin of error is generally within STC +/- 3 dB
RNS Acoustics - Key No. 4848
Job Name:
Job No.: Initials:Ryan
Date:11/16/2018
File Name:jiu jistu Wall_spa.ixl

Notes:

STC 78
OITC 57

Mass-air-mass resonant frequency = =35 Hz , 61 Hz

Panel Size = 8.9 ft x 13.1 ft

Partition surface mass = 16.7 lb/ft2

## System description

Panel 1 : 2 x 0.63 in Type X Gypsum Board

Frame: Steel Stud (22g) (6 in x 1.5 in ); Cavity Width 6 in ,Stud spacing 24 in , 1 x Mineral wool I (3.8 lb/ft3) Thickness 6.0 in
Panel 2 : 2 x 0.6299 in Type X Gypsum Board

Frame: Right steel stud + air gap (3.6 in x 1.4 in ); Cavity Width 4.61 in ,Stud spacing 24 in , 1 x Mineral wool I (3.8 lb/ft3) Thickness 4.0 in
Panel 3 : 2 x 0.6299 in Type X Gypsum Board

| freq.(Hz) | TL(dB) | TL(dB) |
|---|---|---|
| 50 | 17 | |
| 63 | 25 | 21 |
| 80 | 39 | |
| 100 | 47 | |
| 125 | 54 | 51 |
| 160 | 61 | |
| 200 | 67 | |
| 250 | 72 | 70 |
| 315 | 77 | |
| 400 | 81 | |
| 500 | 85 | 84 |
| 630 | 89 | |
| 800 | 93 | |
| 1000 | 97 | 96 |
| 1250 | 102 | |
| 1600 | 111 | |
| 2000 | 111 | 103 |
| 2500 | 98 | |
| 3150 | 112 | |
| 4000 | 120 | 116 |
| 5000 | 129 | |