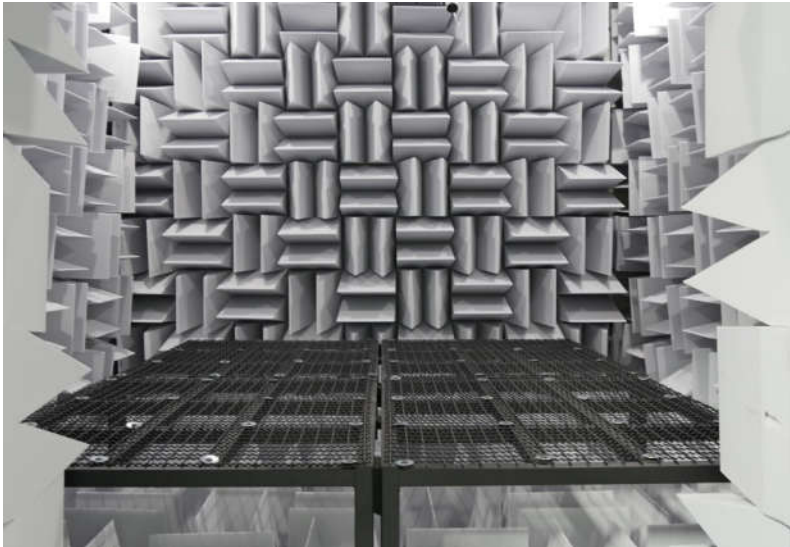


Architectural Acoustics Home/Work - 101

- ACOUSTIC TERMS
- ACOUSTIC PROBLEMS
- ACOUSTIC TREATMENTS



Acoustic Terms



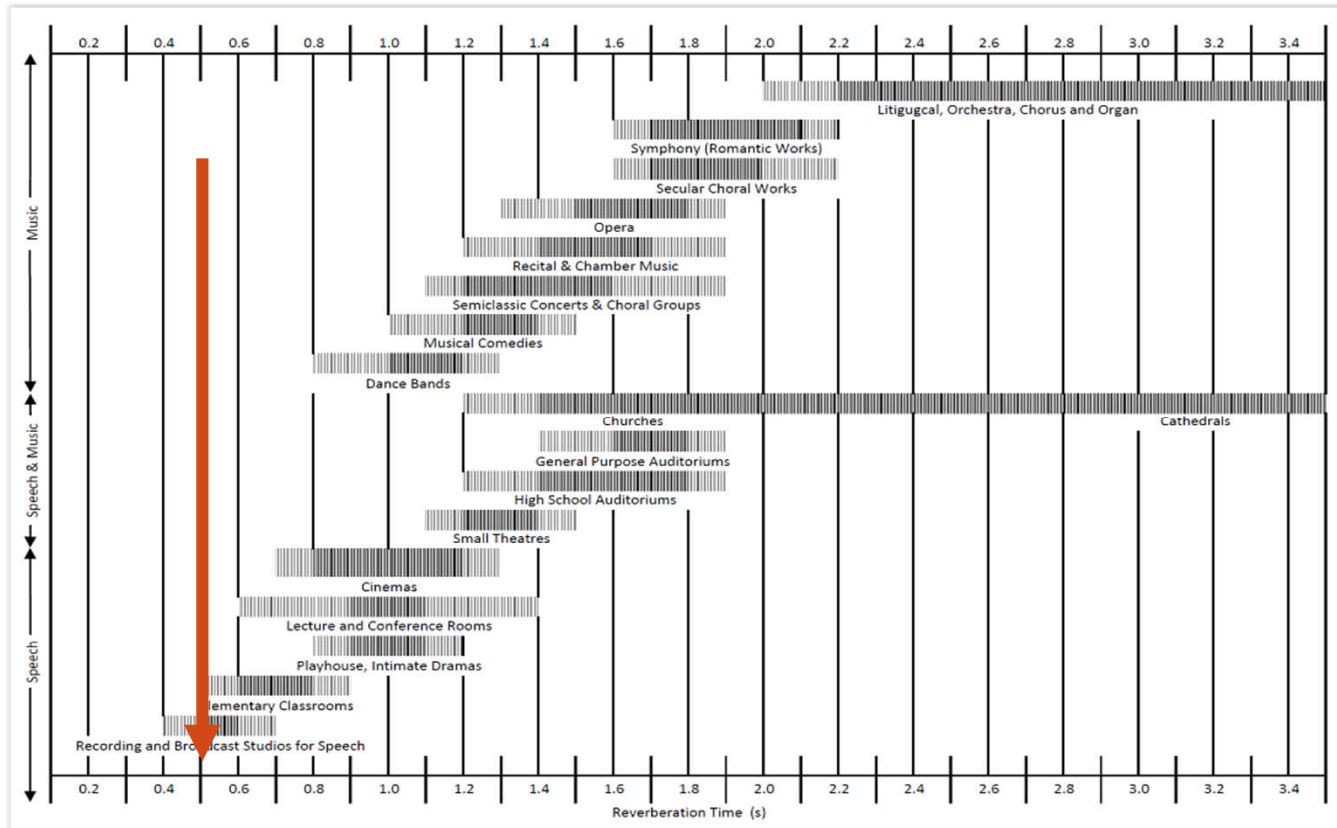
- dB: **Decibel** is a unit used to measure the intensity of sound.
- RT-60 = reverberation time
- NRC: **Noise Reduction Coefficient** is a scalar representation of the amount of **sound** energy absorbed upon striking a particular surface. An NRC of 0 indicates perfect reflection; an NRC of 1 indicates perfect absorption.
- STC: **Sound Transmission Class** is an integer rating of how well a building partition attenuates airborne **sound**.

Acoustic Terms



- dB: **Decibel** is a unit used to measure the intensity of sound.
 - 3 dB difference is barely perceptible.
 - 5 dB is noticeable
 - 10 dB sounds 2x as loud or quiet
 - 20 dB sounds 4x as loud or quiet

Acceptable Echo Time in Rooms



NRC Values for Various Materials

Id														Source
		Thickness (mm)	Cavity (mm)	Absorption layer (mm)	Perforation (%)	age		125 Hz	250 Hz	500 Hz	1 KHz	2 KHz	4 KHz	
	Ceilings													
	Floorings													
2000	N/A							0.00	0.00	0.00	0.00	0.00	0.00	
2001	Perfect Absorber							0.99	0.99	0.99	0.99	0.99	0.99	
2002	80% Absorbent							0.80	0.80	0.80	0.80	0.80	0.80	
2003	60% Absorbent							0.60	0.60	0.60	0.60	0.60	0.60	
2004	40% Absorbent							0.40	0.40	0.40	0.40	0.40	0.40	
2005	20% Absorbent							0.20	0.20	0.20	0.20	0.20	0.20	
2006	10 mm soft carpet on concrete							0.09	0.08	0.21	0.26	0.27	0.37	B.I. Dalenbäck, CATT Acoustic Software
2007	5 mm rubber carpet on concrete							0.04	0.04	0.08	0.12	0.10	0.10	B.I. Dalenbäck, CATT Acoustic Software
2008	Board on joist floor							0.15	0.20	0.10	0.10	0.10	0.10	B.I. Dalenbäck, CATT Acoustic Software
2009	Carpet 1.87 kg/m ²	4.5						0.01	0.02	0.04	0.15	0.36	0.32	Acoustics-Engineering
2010	Carpet 1.87 kg/m ² on under-lay	4.5						0.05	0.13	0.60	0.24	0.28	0.32	Acoustics-Engineering
2011	Carpet 1.98 kg/m ²	5.3						0.01	0.03	0.05	0.11	0.31	0.58	Acoustics-Engineering
2012	Carpet 1.98 kg/m ² on under-lay							0.04	0.10	0.31	0.70	0.93	0.74	Acoustics-Engineering
2013	Carpet heavy, on concrete							0.02	0.06	0.14	0.37	0.60	0.65	Handbook of Acoustical Measurements and Noise Control
2014	Carpet heavy, on hairfelt or foam rubber							0.08	0.24	0.57	0.69	0.71	0.73	Handbook of Acoustical Measurements and Noise Control
2015	Carpet heavy, with impermeable latex backing on hairfelt or foam rubber							0.08	0.27	0.39	0.34	0.48	0.63	Handbook of Acoustical Measurements and Noise Control
2016	Carpet, heavy, cemented to concrete							0.02	0.06	0.14	0.37	0.60	0.65	B.I. Dalenbäck, CATT Acoustic Software
2017	Carpet, heavy, over foam rubber							0.08	0.24	0.57	0.69	0.71	0.73	B.I. Dalenbäck, CATT Acoustic Software
2018	Carpets, 2 cm							0.10	0.14	0.20	0.33	0.50	0.60	B.I. Dalenbäck, CATT Acoustic Software
2019	Concrete floor							0.01	0.01	0.02	0.02	0.02	0.02	B.I. Dalenbäck, CATT Acoustic Software
2020	Concrete or terrazzo							0.01	0.01	0.02	0.02	0.02	0.02	Handbook of Acoustical Measurements and Noise Control
2021	Concrete, painted							0.01	0.01	0.01	0.02	0.02	0.02	Acoustics-Engineering

0 to 1 scale

Building Shell – Exterior to Interior

Things to Consider

- Windows
- Exterior Wall Assembly
- Vents/Gables



Building Shell – Windows and Wall

- Standard Vinyl dual pane windows typically have STC ranging between 25 to 28.
- Typical 2x4 wood stud-stucco wall has STC 35 to 41.

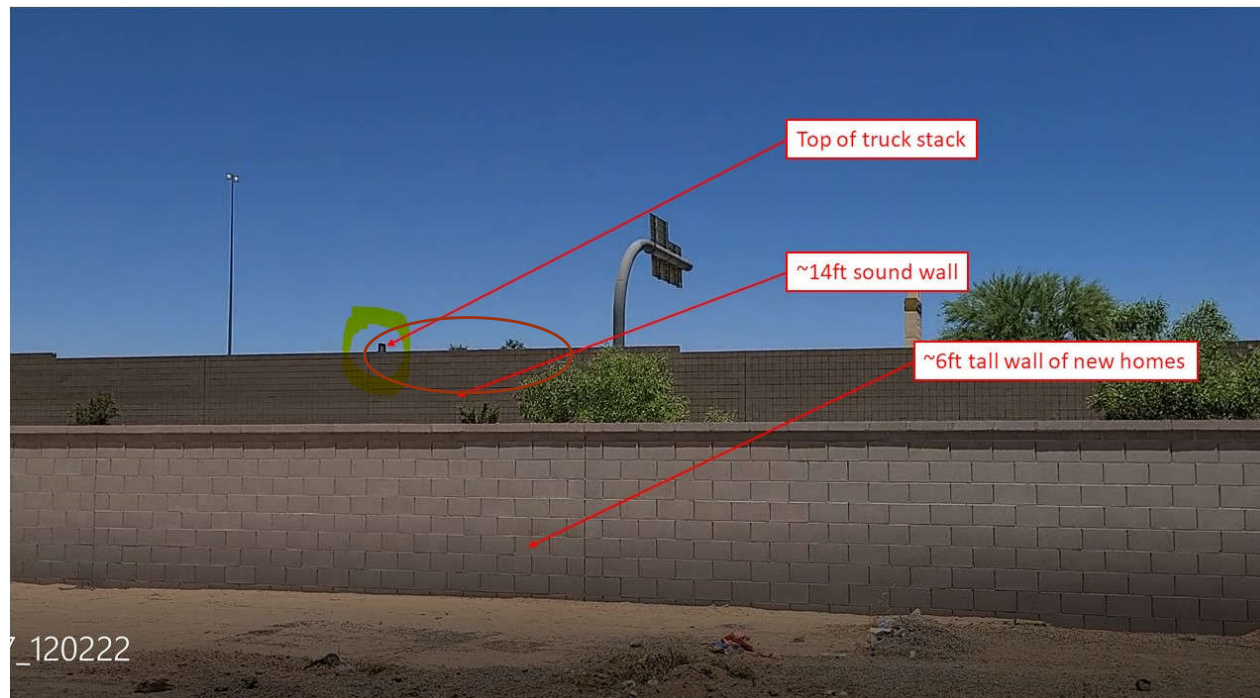


Building Shell – Roof Assembly

- O-Hagin Vent systems allows sound to transfer into attic and then through the ceiling. In noisy locations (e.g. airport, freeways, this has potential to allow noise to flank into home.



Site Planning - Acoustics



Summary of Building Shell Weak Points

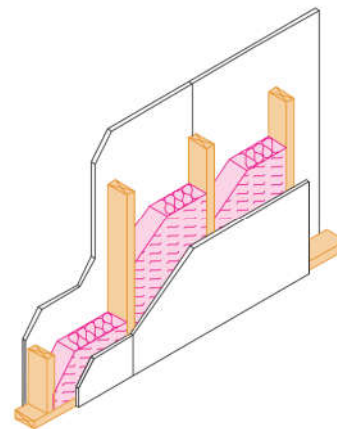
- Acoustically weakest part of a home building shell are the window and sliders
- Attic vents, bathroom exhaust and gables
- Exterior/interior wall (2x4 v. 2x6 makes a nominal difference in acoustical performance)

STC Partition Design

- How the wall, door or floor/ceiling assembly is constructed
- The heavier the material the better the sound attenuation
- Air gaps and spacing provides further attenuation



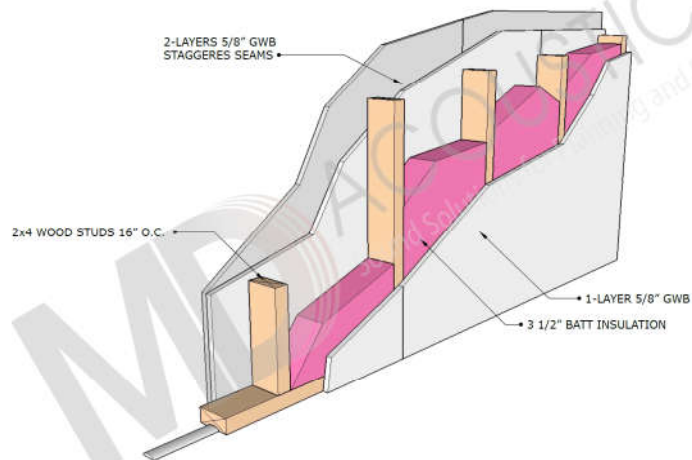
STC Partition Design



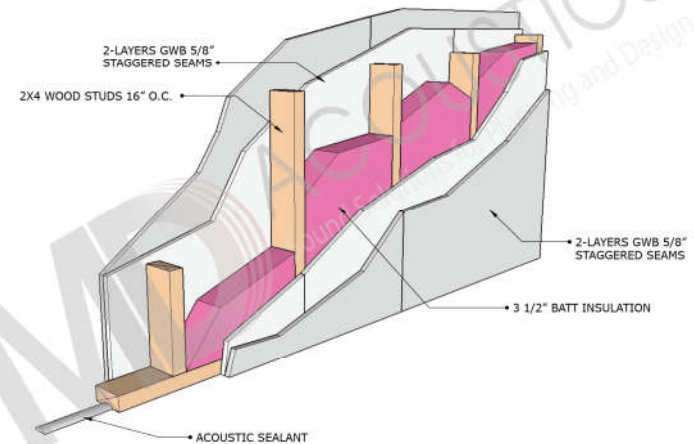
Single Layer Wood Stud Wall

FIRE TEST NO.	FIRE RATING	TEST NO.	STC	WALL ASSEMBLY NO.	CONSTRUCTION DESCRIPTION
*UL-U305 & *UL-U309	1 h, L.B.	NBC-W2b	38	SWS097	Single wood studs spaced 400 mm (16") or 600 mm (24") o.c.; double layer 12.7 mm (1/2") type "x" gypsum board each side; one thickness, 89 mm (3-1/2") thick FIBERGLAS PINK® Batt Insulation
NBC-W2b	1 h, L.B.	NRC	N.A.		
	1.5h N.L.B.	W2569	45		

STC Partition Design

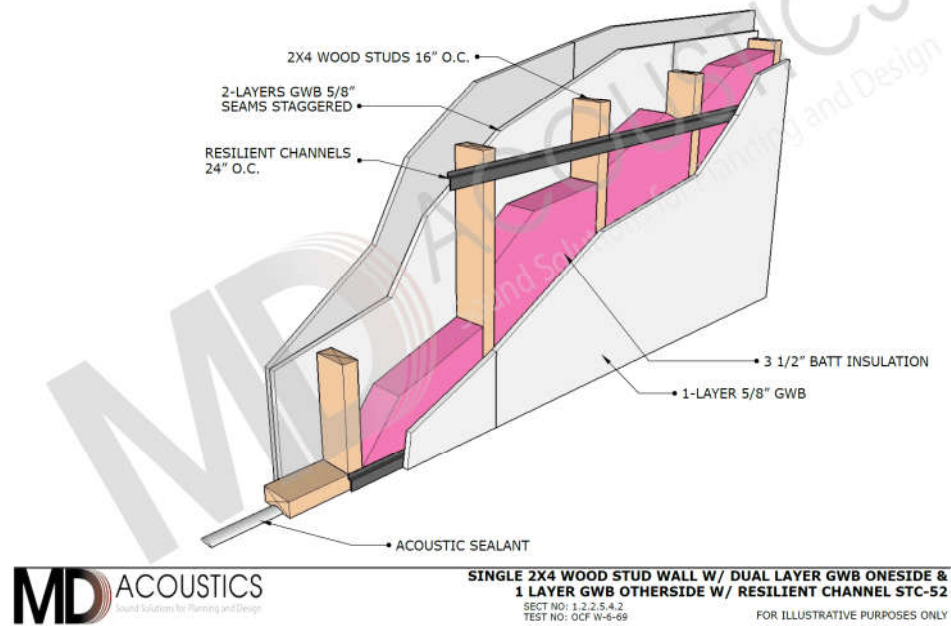


**SINGLE 2X4 WOOD STUD WALL W/ DUAL LAYER GWB
ONESIDE & 1-LAYER GWB OTHERSIDE STC-40**
SECT NO: 1.2.1.5.4.5
TEST NO: DCF W-24-89
FOR ILLUSTRATIVE PURPOSES ONLY



**SINGLE 2X4 WOOD STUD WALL W/ DUAL LAYER GWB ONESIDE &
DUAL LAYER GWB OTHERSIDE STC-45**
SECT NO: 1.2.1.2.4.14
TEST NO: DCF W-25-89
FOR ILLUSTRATIVE PURPOSES ONLY

STC Partition Design



Doors – Solid v. Hollow Core

Hollow Core

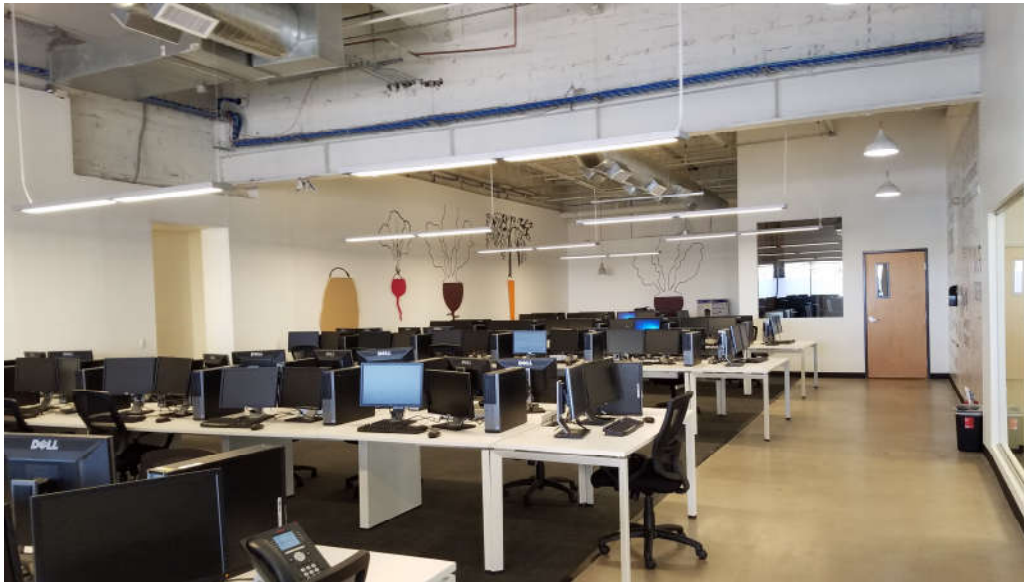
Provides minimal sound privacy
STC ~ 17

Solid Core

Provides better sound privacy
STC~25



Typical Interior Acoustical Problems



- Large (e.g. long and tall) echoey rooms
- Hard surfaces
- Direct line of sight to adjacent neighbor
- Lots of people congregate in one area (open concept)

Sample Treatment Materials

- Acoustic Isolation and Sound Absorption Products

<https://pacinternationalllc.com/>

<https://acoufelt.com/>

<https://www.mbiproducts.com/products/cloud-lite-acoustical-baffles/>

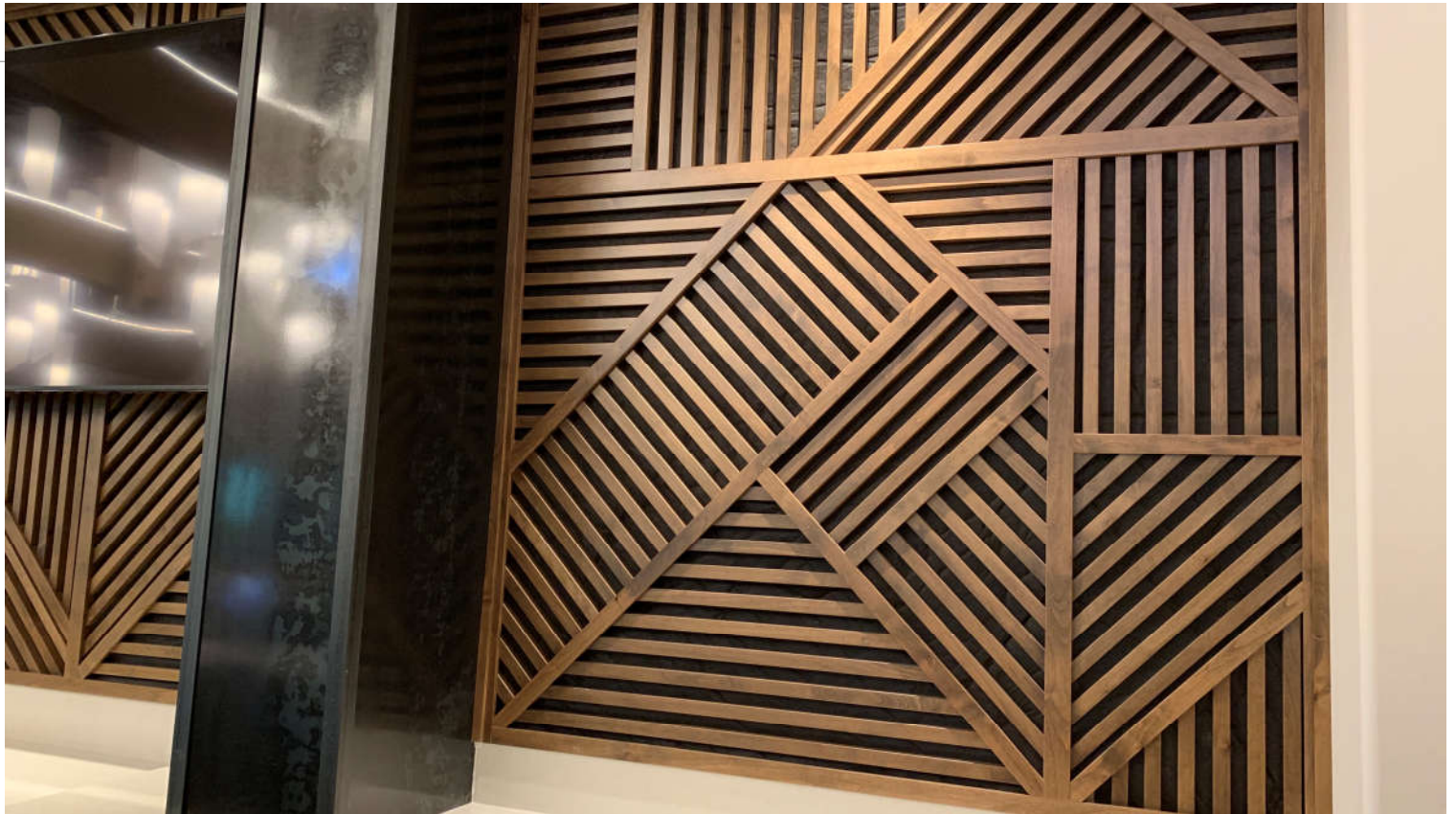
<https://www.pabcogypsum.com/standard-interior-products>

[https://www.owenscorning.com/en-us/insulation/residential/products?category\[\]=fiberglass-insulation](https://www.owenscorning.com/en-us/insulation/residential/products?category[]=fiberglass-insulation)

Window Treatments



Wall Treatments



Wall Treatments



Sample Treatment Materials

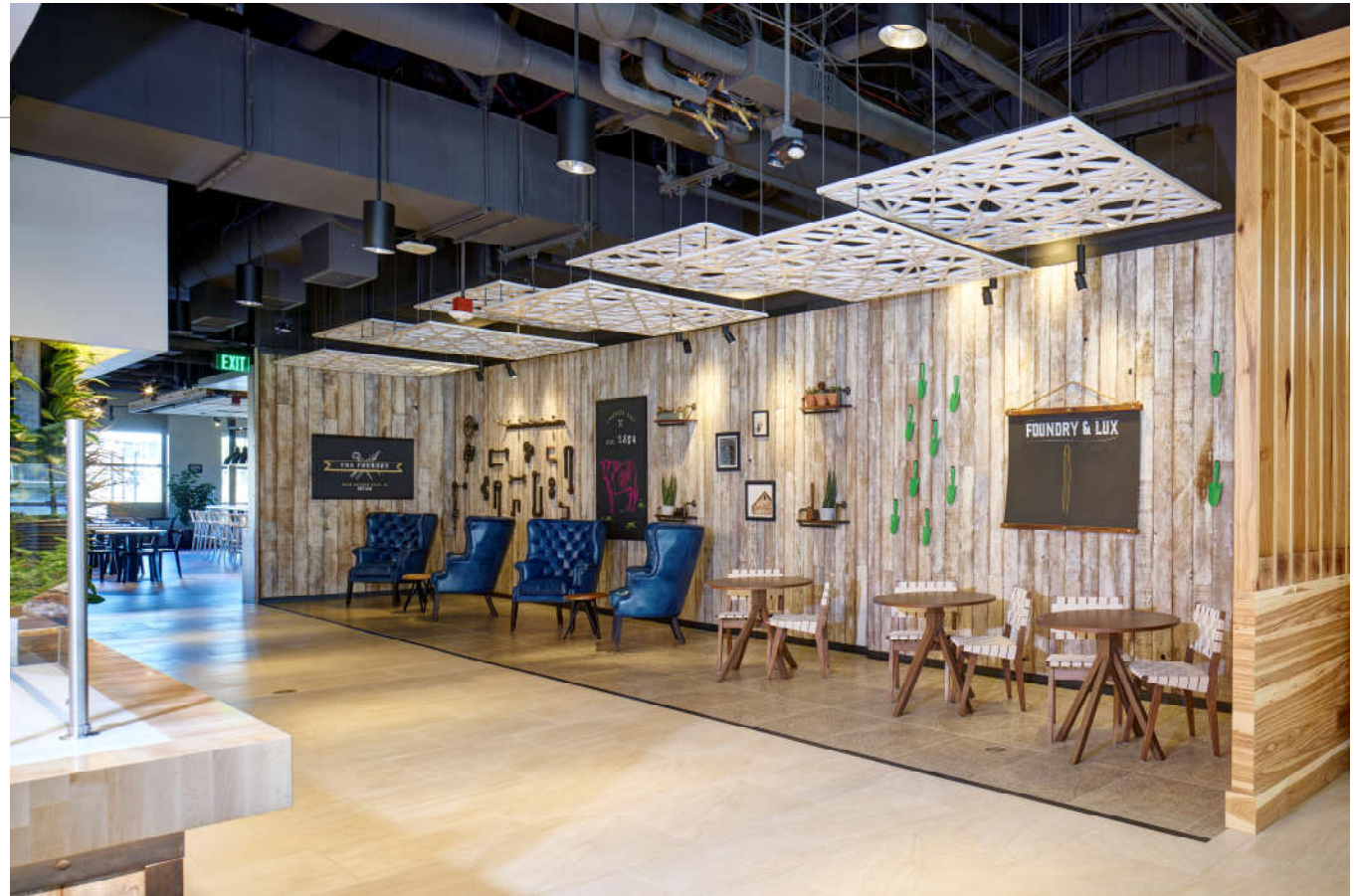
- Acoustic Panels / Clouds / Baffles / Ceilings

<http://www.qtechsys.com/products.html>

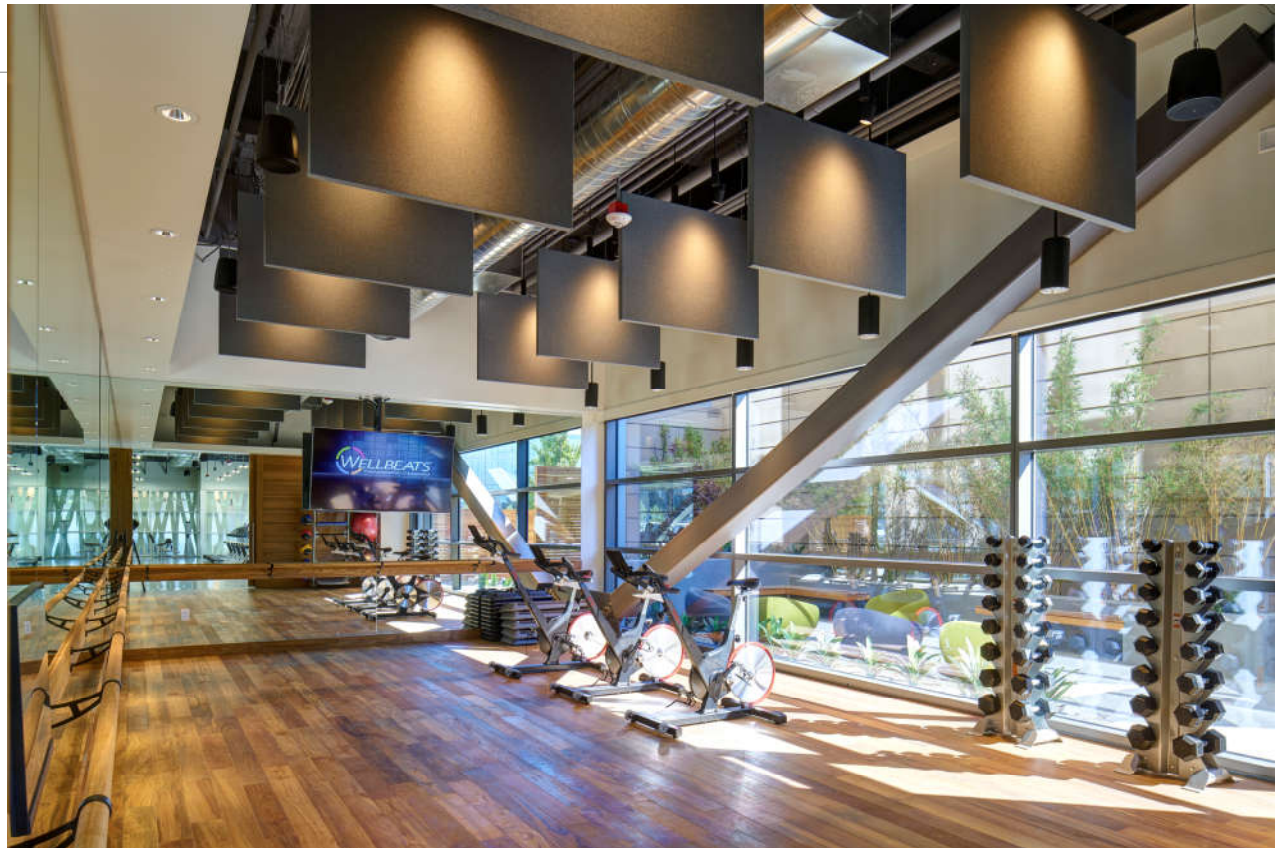
<https://www.sonusna.com/product-filter?product-type=surface-mounted>

<https://whisperwalls.com/>

Clouds



Baffles



Baffles



Acoustics should be included during the concept phase

Evaluated during the design development phase

Many different ways to include acoustics into the overall design/aesthetics

It's always easier to include acoustics into the design/aesthetic upfront vs. retrofitting