# Acoustical Damping for Poly Canyon Village's Music Room

**Jayvee Martir**
California Polytechnic State University
San Luis Obispo, California

Poly Canyon Village was a project by Clark Construction and Architect Niles Bolton Associates that was completed in 2009 that provided housing for upcoming and continuing students. One of the buildings, labeled "Aliso" has constructed the music practice room for students to either play their musical instruments or have it become a convenient area to record, with one particular band "Tin Kitty" having problems with being too loud. Even so, there is potential for this music room to become much more than what it currently is. This paper is a research paper that covers the various materials and methods of acoustical damping, or sound proofing, and various methods used in typical music studio rooms that can further be applied for Poly Canyon Village's Music Practice Room. The research will provide a background of what acoustical damping is to have readers be familiar with the concept and why each material and method presented can and will be beneficial. This will also be an opportunity to allow readers to be familiar with the concept as it is being applied for a possible renovation for the music room.

**Key Words:** Acoustical Damping, Soundproofing, Poly Canyon Village, Cal Poly, Music Studio Room

## Introduction

Poly Canyon Village was a $250,000,000 project by General Contractor Clark Construction and Architect Niles Bolton Associates that was completed in 2009. A residential housing community located at California Polytechnic State University, San Luis Obispo, this village structure has nine residential buildings that provided over 2,600 campus beds for students to reside in. The Aliso building has a music practice room located in the first floor lounge with the intended purpose for students to play musical instruments together in a dedicated enclose space. A group of students that made up of the band "Tin Kitty" had trouble taking advantage of the space due to noise complaints from other students and with the acoustics of the room not providing enough damping for their sound. A member saw potential for what the music practice room can be if the room was redesigned or reconstructed similar to typical music studio rooms that not only provided better acoustics for sound quality, but also dampen the sound so that other students outside will not be as affected.

In order to consider improving Poly Canyon Village's music practice room, one must know what acoustical damping is and how it can be applied in order to produce a higher quality and soundproofed music room that will allow more possibilities of what the room can provide without the trouble of noise complaints and subpar acoustic sound quality. The acoustical conditions of a room can take affect over how the quality of the sound is (Leduc, 2009).

This paper will be a research-based paper that will take the information learned regarding acoustical damping to be applied on redesigning Poly Canyon Village's music practice room to be more similar to a studio-type music room. Since this will focus on one music room, the methods that will be considered for a possible renovation will be limited but open for expansion in the future.

## General Background

In order to begin considering the renovation of the music practice room, one must have a considerable amount of knowledge about acoustical damping. Acoustical damping can be best described as sound being forced through a porous resistive material, which for example could be through mineral wood, fiberglass or acoustic foam (Cox and D'Antonio, 2004, p.13). Sound takes a form of a mechanical wave that results from the back and forth vibration of particles of the medium in a wave that is moving. This soundwave moves along the air where particles will be

displaced both rightward and leftward in a parallel, longitudinal wave (Techquickie, 2015). For PCV's music room, there are a number of ways to help dampen the sound for the room. Information on the overall acoustics available, materials and methods that will be applied, how other music studio rooms are designed and knowing about the previous construction of the PCV music room will be necessary.

## *Acoustics*

Acoustics in a room can come in two classifications that will be the main topics involved for this paper. The first comes down to quietness acoustics, and the second comes to internal room acoustics (Storyk, 2004). Quietness acoustic comes down to keeping sound produced outside the room from entering another room, and this can also be known as sound isolation. An example would be the use of earphones for listening to music, as their design allows the sound produced to enter the wearer's ear while at the same time prevent any background noise to help produce the best quality possible. Internal room acoustics come down to sounds being created from inside the source, and this idea comes down to having a good quality sound within the room since quality is something that listeners would want to preserve when it comes to the actual source of sound (Rochman, 2012). How sound travels and bounces off materials can be described as reverberation.

## *Reverberation and Live-Room/Dead-Room*

Reverberation can be described as the collection of reflected sounds from the surfaces in an enclosure like an auditorium, also short of reverb, and is created when a sound or signal is reflected causing a large number of reflections to build up and then decay as the sound is absorbed by the surfaces of objects in space (Hyperphysics, 2000). Reverb travels over a period of time in a form of sound energy, eventually down to a measure of 60 dB (Everest, 2013). When it comes to determining if a room is either live or dead, it all comes down to how fast the sound drops to the 60 dB mark. In a dead room, the sound energy quickly drops down. In a live room, the sound lingers around the room and reflects one another (Feinstein, 2016). A simple way to determine whether the room is either live or dead is by clapping with your hands once. You'll want to hear and listen for that echo of the clap sound that follows. If the echo is loud, then the room is live. If not much is followed or you can't hear the echo, then the room's dead.

Sound comes down in two kinds that affect the live and dead characteristics, direct and reflected sound. Direct sound is the sound that reaches your ears directly from the sound source that's use for gauge direction and generally tonal quality, while reflected sound is the sound that bounces off walls, floors and ceiling before reaching your ears, and this is used to gauge the distance we are from the sound source and size of the space (Feinstein, 2016). The mix of these different sounds affect the qualities of the room which leads back to the live and dead room characteristics. A good mix of these sounds and characteristics provide the best quality of sound to a person's ear at a given space. Finding the right balance between live and dead rooms come down to knowing what materials to use and how they're placed and structured in order to do so.

## *STC Ratings*

STC is an acronym for Sound Transmission Class, an integer rating of how well a building partition attenuates airborne sound (SPC, 2006). This integer is used to rate interior partitions, walls, ceilings, floors, basically anything involved in a room. Though limited, this is the most common type of measurement in use and at best can give a rough idea for what can be expected on how much sound can be blocked off. This rating is calculated by taking the transmission loss (TL) values tested at 16 standard frequencies over the range of 125 Hz to 4000 Hz and plotted on a graph (SPC, 2006). Figure 1 provides STC example descriptions for a general idea.

**STC Examples**

| STC | Track Application |
|---|---|
| 25 | Normal speech can be easily heard and understood |
| 30 | Loud speech can be easily heard and understood |
| 35 | Loud speech heard, but not understood |
| 40 | Loud speech now only a murmur |
| 45 | Loud speech not heard, music systems / heavy traffic noise still a potential problem |
| 50 | Very loud sounds such as musical instruments or a stereo can be faintly heard |
| 60+ | Excellent soundproofing |

*Figure 1.* STC descriptions for soundproofing. The higher the number, the more soundproof the room (SPC, 2006).

## *Soundproofing*

By means of construction, soundproofing a room allows it so there will be less sound leakage and allow the source to be contained within. This paper will be focused on using drywall-over-studs walls, which are considered to be quick to build and inexpensive overall (FHM, 2018). Since the PCV music room is fairly small to medium sized, the workload isn't as intensive as compared to a home theatre. A number of materials can be considered for soundproofing construction (Toht,). For insulation, acoustic batts are a type of insulation specifically designed for higher levels of soundproofing as compared to standard R-11 fiberglass insulation due to the amount of density that the batts contain. For drywall, type X 5/8-in. is a good choice for the high density that adds protection from sound leakage on top of its focus on fire-resistance. For gypsum boards or panels, the use of QuietRock EZ-Snap panels are a good choice as they provide high STC performance and lack of paper or metal in the center allows for easier installation. A resilient channel is a thin metal channel that is intelligently designed to substantially improve sound insulation of drywall, sheetrock, plasterboard walls and ceilings and effectively isolates drywall from the framing studwork, which results in the weakening of sound waves substantially (SSP, 1997). This are cheap and act similarly to shock absorbers, similar to shock absorber microphones. For walls, ceilings, and floors, you can use mass loaded vinyl barriers that are a soundproofing layer that's placed under un-nailed areas to reduce sound transfer, installed as shown in figure 2 (SSP, 1997). Materials like these contribute to the STC rating where it can be found acceptable for sound proofing purposes. Because of the possibility of how loud the PCV music room can get, a high STC rating is highly welcomed and recommended.

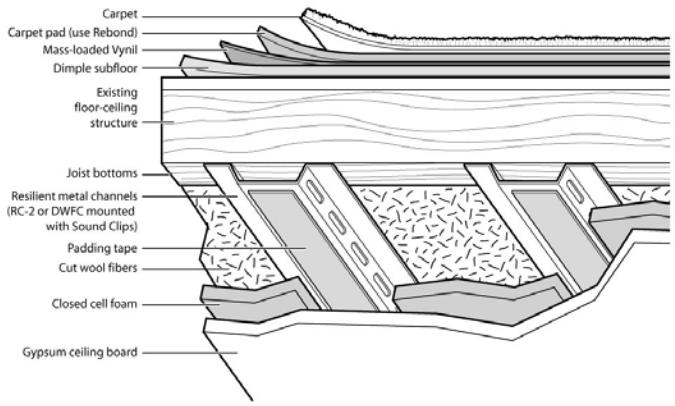


*Figure 2:* An example of MLV and resilient metal channels installed in a ceiling structure.

## *Typical Studio Music Room*

Studio rooms tend to be made along with the control room for music engineering purposes. The studio room is where you would have most of the sound being generated along with installed materials such as slat resonators, high frequency absorbers, diffusions, bass traps, etc. while the control room is where you would have your sound engineers making sure the quality of the sounds produced in the studio room sounds great in quality (Benediktsson,

2018). The goals for the studio rooms are to have the best balance between live-end and dead-end for the quality in audio and have the room constructed to be soundproofed as well. While the typical studio music rooms prefer the audio quality over the soundproofing aspect, both can still be achieved by means of construction and materials. Materials for the studio rooms is done through acoustic treatment where you reduce the reflections bouncing off the walls (Sayers, 2000). Slat absorber walls are designed to absorb low-mid frequencies very efficiently, usually in the form of panel absorbers. High frequency absorbers are absorbers set up in the back of the room, usually the control room, that absorbs the sound in front so that it doesn't get reflected back. Diffusion is the process of spreading the reverb sound evenly through a room, which not only prevents standing waves by also eliminates dead spots, such as places where components of the sound are missing through phase cancellation. Bass traps are focused more on the low frequencies of the room that are placed in the corners or joints of connecting walls and ceilings (Sayers, 2000). Having a balanced control of all ranges of the frequencies will lead to a much cleaner and brighter sounding studio room. Though all studio rooms are unique from one to another in terms of design, most are typical when using materials as mentioned earlier.

## Objectives

The planning for the renovation of the PCV music room will come down to three objectives that will be ideal for a successful plan. The main goal of this paper is to have a plan laid out so that someone else can take these ideas and execute as necessary.

The first objective is to take ideas of acoustical damping into consideration to focus on soundproofing the room, as it is the overall core to the design and is still under the apartments of numerous students. This will be stripping down the current drywalls and insulation and installing the discussed materials.

The second objective is to convert the given room space into an actual studio music room using materials discussed for typical studio rooms. There won't be a proper control room for sound engineers, but this way the music room can give opportunity for musician to perform and record in a room that's a good alternative to an actual studio room.

The final objective is to make sure that this can be done with only a handful of workers in a short or reasonable period of time. Low labor allows for affordability for whoever is paying for the project, since obtaining the materials necessary is costly enough due to their purposes. As a bonus, the research provided may be an interesting subject to be discussed in residential construction management courses.

## Methodology

By having a deeper understanding in the topic of acoustic damping and how this correlates into studio rooms as a whole, we now see the potential that the PCV music room can become. Soundproofing is the main objective for the renovation project idea that this paper is proposing, and with more knowledge of how typical studio rooms are designed, this allows a much bigger project to represent and to add on top of the acoustic damping as well. By studying and researching ahead of what to expect for this renovation project, this allows anyone attempting the project to be fully aware of what is needed to be done.

### *Poly Canyon Village's Music Practice Room*

Figures 3 and 4 shows the plansets for the PCV music practice room that is focused upon for the renovation proposal plan. Since the soundproofing will mostly be along the walls, most of the information that will be needed regarding the music room will be the wall types used. The figures show that there are four different types of walls that are being used for the music practice room, H3, L1, L3 and K. The wall right next to the stairs on the east side is an L1 type.

The south side wall has the H3 wall, so the overall thickness will be 7 ¼" with 6" metal studs and a Type X gypsum board. What's interesting is that this wall has sound attenuation blankets for the insulation, similar to the acoustic batts mentioned earlier for soundproofing. These types by themselves increase the STC rating by 4 at a minimum. West side walls are K types, which are 5 ¼" thick, 4" metal studs, 5/8" gypsum boards, and, similar to the H3 walls, have sound attenuation blankets. The L1 type walls are 3 1/8" thick overall, with a 2 ½" metal stud and a 5/8" Type

X gypsum board on the interior side.  These walls don't have any insulation, so these walls will be prioritized for acoustical damping. A good note to keep track is that some of soundproofing was attempted prior to the construction of the music room. Though already constructed, room for improvement is present and this paper is what's focused on.

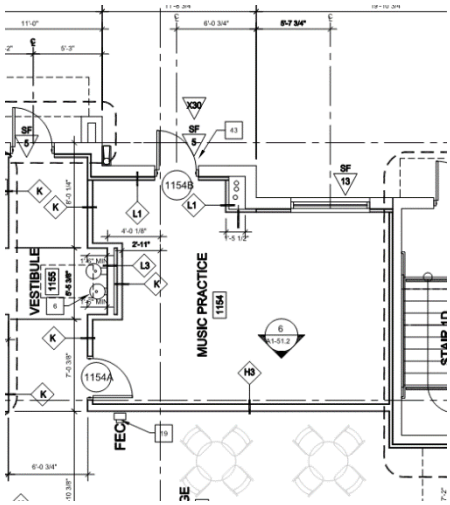


*Figure 3:* PCV music practice room outlining all the different wall types.

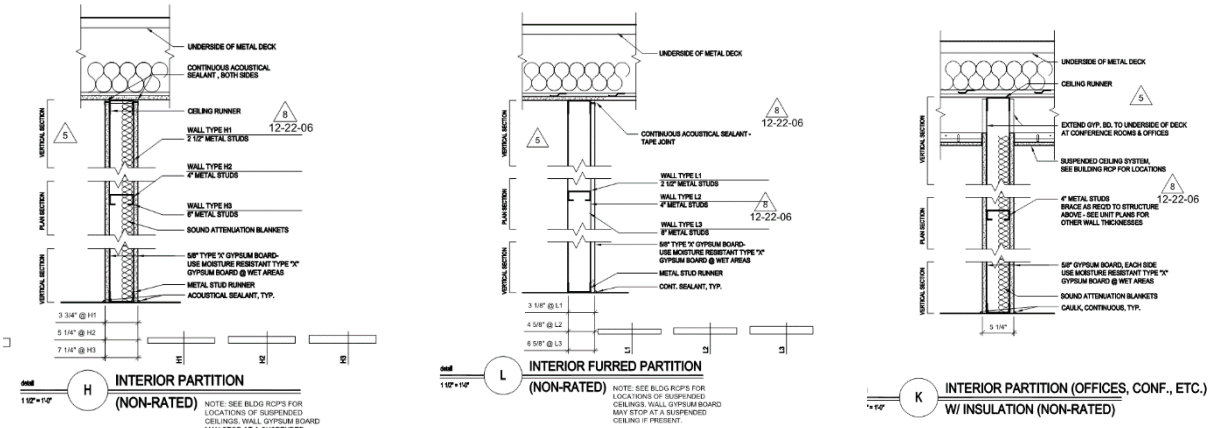


*Figure 4:* Expanded plansets for each wall-type that's typical for the walls used throughout Poly Canyon Village

## Results

The information is now laid out to make an attempt for the renovation project proposal. Typical materials are presented that have been used in other music studio rooms that have been consistently used that can be applied. Acoustical damping methods and materials have been presented that can further soundproof the room on top of what is already laid out in the plans.

For the renovation project, stripping down the gypsum walls already in place is the first thing that should be done. This will be replaced with materials similar to the QuietRock EZ-Snap panels spread out on top. L1 walls will need to have acoustic batts installed for the insulation to further help damp the sound source within the room, along with having the K and H3 walls replace their acoustic batts with brand new ones. Underneath will need to have a layer of mass-loaded vinyl completely flatten out to add more resistance of sound of leaking through the walls. Between the studs and the applied gypsum panels will have several resilient metal channels installed to lay the panels on. Panels

will also replace the ones in the ceiling along with the provided insulation spread out above to add protection through the 2nd floor. All of these will contribute to a higher STC which is something that is highly recommended for the music room.

With a small team of workers, the soundproofing process should last between one to two weeks, depending on the hours worked each day and the amount of freedom to bring in the tools and materials necessary. Because there are students living above, it is highly recommended that the construction phase takes place during vacation time where there are less complaints and clashes.

Once soundproofing the walls are complete, turning the music room into more of an actual studio room can be applied along with acoustic damping methods on top of the process. Finding the right balance between a live-end and a dead-end will come down to experimenting with the materials that are able to be installed on top of the walls and ceilings. Have panel absorbers installed on top of the gypsum boards all around for the low-mid frequencies, and have bass traps on the corners of the room, particularly on the bottom side depending on the source of the sound. The schedule of this process can vary depending on how much experiment can be done and usually this can be by some with a good hearing for acoustics, not just construction laborers.

## Conclusion and Future Research

Acoustical damping can be applied by means of both soundproofing and through controlling the sound energy that results in a higher STC rating. As proposed, this paper is meant to be a stepping stone for the PCV music room renovation project. The topics learned in this research is not something too heavily talked about, especially in the residential and commercial classes in the construction management program. This is merely scratching the surface of the endless possibilities that can be done as a particular construction focus. Using the information provided, the renovation plan can be approved on, especially deciding on what specific materials that can be used for each type, where they can be installed, and creating the proposed plansets with the given materials installed. If possible, this paper can be referenced on to further explore on the idea that is acoustical damping. I do personally see this happening in the near future that can be done for another senior project by students that's in the construction field and has an ear for music and sound quality. Plus, having a room in Poly Canyon Village dedicated to being a music studio room that can rival other high quality music studio rooms can open up possibilities for students that are into musicians to be able to live that experience. As a musician myself, it is one thing to being able to play the music you want. The quality has to also show in the music that can be pleasant to the human ear. Plus, having it soundproof means you can go as hard as you can without having to worry too much about noise complaints as I used to worry about when I was a part of Tin Kitty. As stated before, this research is a stepping stone that can lead to a potential change in the PCV music room, or as a bonus, a subject in residential or commercial classes.

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