

An Introduction to Solomon's Temple and Modern Day Church Acoustics

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The big question is what does Solomon's Temple have to do with Modern Church Acoustics? Is there a correlation between what Solomon did and the learning experiences most churches go through today? Would it surprise you that there is a plan for modern day church acoustics lifted directly from the design of the temple?

What happens if we take the scriptures of 1 Kings Chapter 6 and apply it literally? What does the bible have to say about large room acoustics? Does the chronological order of 1 Kings give us a roadmap to modern day acoustics? Let's see what happens.

Here are some things to consider about Solomon's temple.

The temple took 7 years to build.
 The walls and floors were made of stone.
 The ceilings were made of beams and boards of cedar.
 There were two main rooms.
 The Holy Place and the Holy of Holies.
 The Holy Place was a rectangle.
 The Holy of Holies was a perfect cube.

At this stage the walls of both rooms are totally flat.
 Can you imagine how the two rooms would have sounded?
 The Holy of Holies would have kept ringing for over 10 seconds.
 The Holy Place would have kept ringing over 12 seconds. This is how most churches will sound like at this stage of construction. Sound Familiar?

Background on Acoustics

The reflections of a person's voice in the temple before any acoustical treatment was used would have been so loud that it was impossible for two people to talk to each other more than 6 ft apart. Early reflections are called noise. There are two parts to noise. Its strength, which is measured in Decibels. The second part is Frequency which is measured in vibrations per second.

To hear speech clearly, you have to be +15 to +25dB above the noise. Again, reflections that interfere with speech and hearing are called "noise." This is not to be confused with Reverberation or Echoes.

- Reverberation is noise that has decayed 20 to 25dB rapidly but lingers to complement words of speech or to give musical notes some color.
- Echoes are reflections after the sound has traveled over a distance of 150 ft and has lost about 6 to 12dB of energy. You can hear complete syllables indoors. Outdoors you can hear complete words.



- Flutter echoes are rapid reflections that happen really close together. They are usually mid and mid high frequencies. Usually they happen faster than you can clap your hands in a cheerful response – like a clicking or ping pong effect.
- Wherever you hear flutter echoes, there is almost always a bass problem masked by the flutters. Fixing a flutter problem almost always unmasks bass problems. Flutters or reflections off a balcony face almost always points to an excess bass problem on stage.

I have been in rooms that very much behaved as Solomon's temple would have sounded before Solomon applied any acoustical treatment. What! What do you mean applied acoustical treatment? What acoustical treatment!

The First Attempt

When the walls of Solomon's temple were up and the ceiling was installed all of the walls and floor were bare stone. The noisy reflections would have been so strong that any conversation beyond 5 ft would have been marginal and at 8 ft impossible. Sure, you might understand a word here and there but nothing intelligible.

Let's put some numbers to this. This is not exact but it is to illustrate the point. To form most words, you need a dynamic range of sound energy. To say the word "bell" you need a sound pressure level range of about 4dB. To say the word "airplane" you need about 12dB of range. Those "P" sounds produce a lot of power and dynamic - hence the need for pop filters. The larger the word or the harder the consonant sound are, the greater range you need to form the words. The maximum is about 15dB. Then there is the range of how someone talks. If you read out loud a full page of the bible, your volume range can vary up to 10dB. This happens in day to day conversation. If you take the dynamic range of speech and the fact that people will change the volume they speak, you need a dynamic range of 25dB or in other words, from the quietest to the loudest part of the spoken words, the volume changes up to 25dB. To hear everything that is being said, you have to be 20 to 25dB above all noise.

In the Holy of Holies – the square room - the signal to noise ratio at 10 ft would have been +3dB. You would not be able to understand anything said. It would be just noise no matter how loud you spoke. Just walking across the floor with leather shoes would create too much noise.

In the larger Holy place, the signal to noise ratio would have been about the same +4dB at 10 ft. This is too much noise to understand anything.

Hearing God is not an option

This detail is important because when a prophet or high priest went into the Holy of Holies, he went to hear God speak either as a voice from God or through an Angel. I've heard a couple of ministers preaching on this subject and they suggested that the listener heard an audible voice in the Holy of holies. Some scholars said the listener heard an audible voice and some say a spiritual voice. Some even believe that the Ark of the Covenant was also a communication device. For this article, I will go along saying an audible voice coming from the direction of the Ark.

Now when the Priest or Prophet entered the Holy of Holies, he would have stood anywhere from 4 to 7 cubits from the Ark. That would have been 6 to 10 ft. At that distance, there is no way for the Prophet to have understood an audible voice. For many Christians who have visited a church construction site, this should sound familiar.

Wisdom of the Builder

If you have been through a church construction site and been in the sanctuary before any furnishings, seating (chairs or pews) and floor covering (wood, tile, terrazzo or carpet) is applied, then you will have experienced what Solomon's temple would have sounded like. It would have been a very noisy space. The ringing would seem to go on forever. 1 kings 6:7 says no iron tools were used to assemble the temple on site. With a room this noisy, you couldn't use them. The sound of such tools in the temple would have been deafening. People would have had permanent hearing damage. The workers would have to wait minutes for the room to quiet down in order to hear instructions. If iron tools were used, the assembly of the temple could have take years longer. These days when a building is under such conditions it is a safety issue. When you have a large space finished in Stone or Drywall and the room is clear and empty, at 5 ft hearing the other person talk is very hard and almost impossible when the humidity is over 80%. You are often asking people to repeat things or you have to get closer. Close enough to know if the other person is using a breath mint or needs one.

It is at this point every church has one of two choices. This is when you can make the church sound great or do nothing and allow the room to sound awful. This is the last chance at making the room sound great. Now is when you must change the signal to noise ratio from +3 to +25. Yes, because of the sizes of our modern churches and use of sound systems, you need a signal to noise ratio of 25dB. (Read my article on Signal to Noise.)

1 Kings 6:14. So Solomon built the house and finished it.

I believe that this is when Solomon did his first attempt at fixing the acoustics of the Temple.

1Ki 6:15 And he built the walls of the house within with boards of cedar, both the floor of the house, and the walls of the ceiling: and he covered them on the inside with wood, and covered the floor of the house with planks of fir.

The walls, floors and ceiling were covered in Cedar. This would not have changed the sound of the two rooms much. Next, the floor was covered in Fir. If this is a chronological description, I suggest that this was another attempt at changing the room acoustics. You have Fir on top of cedar on the floor.

Then in **1Ki 6:18 "And the cedar of the house within was carved with knops and open flowers: all was cedar; there was no stone seen."**

This was a complete covering of wood. Then it was all covered in gold.

From my point of view, this looks like a first attempt at treating the room acoustics. I would also speculate that this attempt failed and was not enough.

If this is indeed the order of how the temple was assembled, then what happens next makes great sense.

The acoustics in Solomon's temple was still unforgiving. Hearing speech would have been a horrible experience. It had to be. God gave us the laws of physics and those laws would have been applied equally in the temple.

Otherwise it would have been mentioned as a miracle and none has been mentioned yet.

1Ki 6:23 And within the oracle he made two cherubims of olive tree, each ten cubits high.

If a cubit is 18 inches, then the two cherubs were 15 ft or about 4.5 meters tall. When the two Cherubim's were built and installed in the Holy of Holies or the Oracle room, these statues would have been high. 15 ft high with 7.5 ft wings. The cherubs were so big that they changed the sound of the room. How much of a change? An educated guess would suggest that speech intelligibility changed from 3 ft to about 10 ft. An improvement, but not a big enough change – but a change that Solomon may have noticed.

In **1Ki 6:28 And he overlaid the cherubims with gold.**

A new plan that works

Between verse 28 and verse 29 of 1 Kings Chapter 6, something happened. Where the inspiration came from, the bible doesn't say. Out of nowhere come carvings of Cherubs and Palm Trees on all the walls. This one obscure and often overlooked verse unlocks a key that gave Solomon satisfaction. It says **"And he carved all the walls of the house roundabout with carved figures of cherubims and palm trees and open flowers, within and without."** Soon as these carvings were mounted on the walls - all of the walls, it would have changed how Solomon's temple would have sounded. It had to have.

The carvings of the Cherubs we understand. These refer to angels, protectors of the Ark, protectors of God's Words and the Commandments and so on. What do palm trees have to do with spiritual matters? There are some references to palms later in the bible but there is nothing that would explain its use inside Solomon's temple. Lining the inside of the holiest place in Israel with palm trees doesn't make any sense. The most likely reason for the Palm Trees is to solve a BIG problem.



I speculate that Solomon heard the acoustical problems inside the temple and desperately wanted to do something about it. Their first attempt at fixing the acoustics failed. Solomon also wanted something that could be put on the walls and never have to be cleaned or maintained. Once the temple was blessed and open for worship, no one would be allowed into the Holy of Holies and I can't imagine a cleaning bee happening in the Holy Place either.

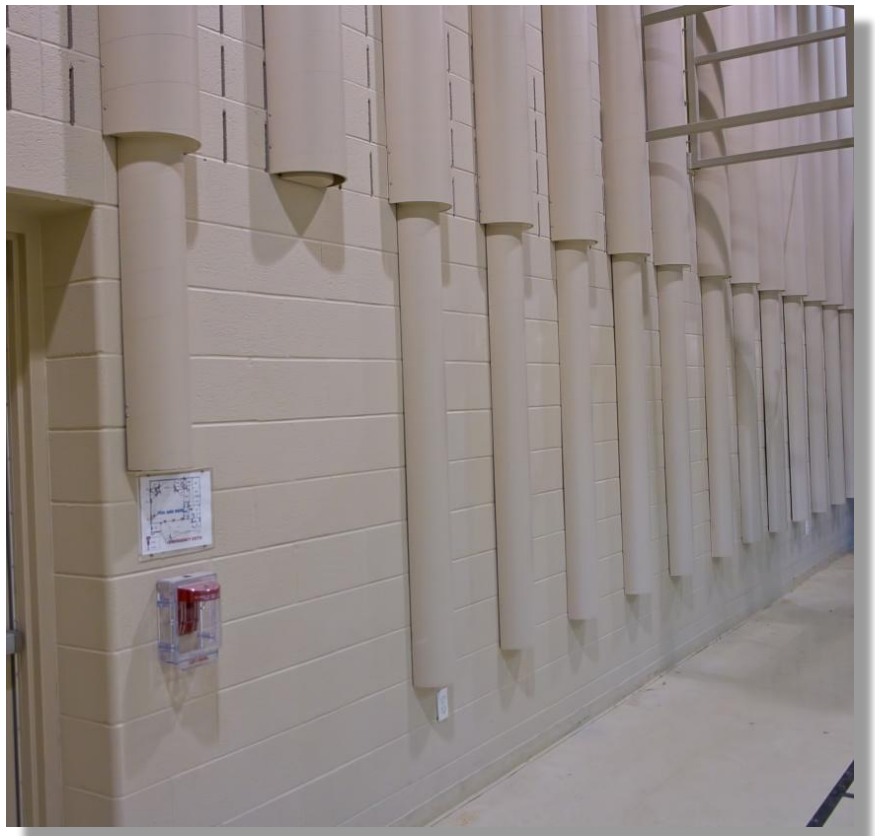
The Perfect Shape

This is when I wish I could say that God told Solomon what to do but the Bible does not say that. However, out of nowhere, the perfect solution comes up. A half round shape in various sizes. The Cherubs were one size and the Palm trees another. Somehow Solomon discovered that diffusion is the most effective way to control sound in the speech and musical range. The half round shape is the most efficient. How this miraculous discovery was made, no one knows but one thing is for sure, it works! How well does it work?

After reading about this over 20 years ago, I started experimenting with various types of diffusers. After reviewing and testing a number of excellent products, nothing out there seemed to be affordable for most churches. Then I was inspired to build a model of Solomon's temple. It was to one inch scale. Then I used the core of paper towel rolls to represent the Cherubs and Palm trees. Here just a few nuggets of what I learned.

- For a classic sounding space, you have padded seating, not carpet on the floor and leave the room bare of most absorbing materials.
- For a contemporary worship space you add padded seating and carpet the floor.
- To control the signal to noise, you change the spacing of the tubes.
- To control the frequency, you change the sizes.
- By combining the sizes and spacing, you can target specific frequencies to improve the performance of the sound system and to control architectural design mistakes made when the church was originally designed.
- This diffuser system seems to be universal for any worship style and any room shape.

I went beyond the model and used several hundred tubes in various churches and church gyms. We experimented with the most common tube sizes that were also the most affordable for most churches to buy. From that work I created a Data Base of layouts with the most effective means of performance a church needs. In the end, it was clear that by following King Solomon's example in God's temple, he gave us an example for fixing or preventing poor acoustics in a church that was and is also affordable for any church. Who knew that Solomon would give us a roadmap to modern day church acoustics and sound?



Where is the proof?

To prove that this was not a false meaning to this interpretation of the scriptures, I set out to prove that this system worked. First I tested this in a few churches with temporary diffusers. After testing this in about 10 churches, I started telling churches to do this instead of traditional flat panel treatment. Every time it was installed, it worked flawlessly. Later I learned that for new churches, you can build larger outround diffusers out of Drywall, brick, blocks and any building material before

the church was built. This system also worked. For new churches, this acoustical planning virtually added no cost to the church except for the cost of the information.

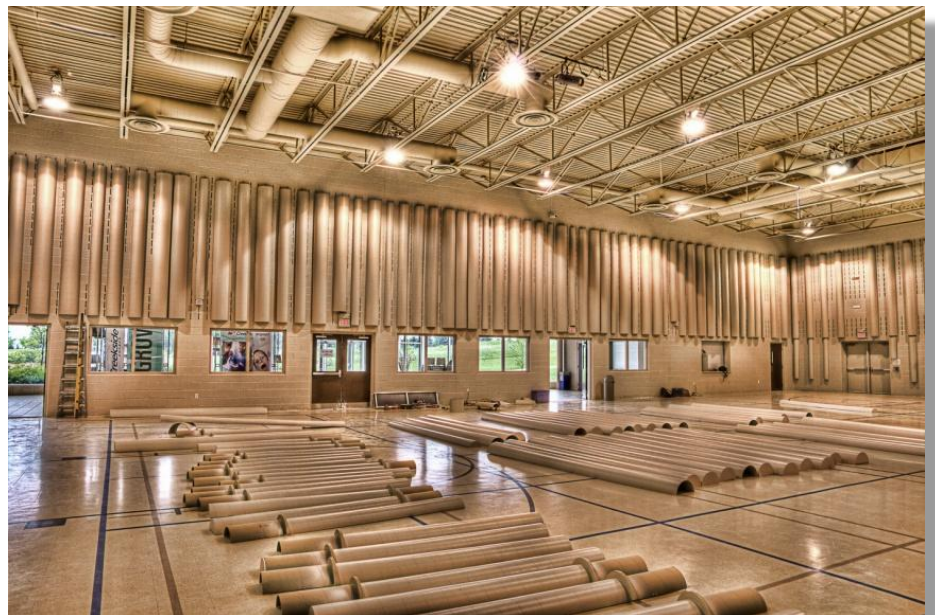
After studying all of this and today having hundreds of churches install or build a diffuser system similar to what Solomon did, it would be safe to say that God did indeed have something to do with this. It would also be fair to say the experiment is over and the most effective, most affordable and the most versatile acoustical system is what I call the "Solomon Sound Management System."

What can you use instead of Palm trees and Cherubim's. You can use anything. Cardboard Tubes, metal tubes, plaster, plastic, wood, drywall, plywood and much more. There is no limit as long as you have the right depth, lengths and sizes. They can be solid or hollow. They can be put into wooden frames and covered with cloth to make them look like flat panels. Once you know the sizes that you need, there is no limit in how to finish them in any church- even in modern and old Cathedrals, super churches and mega churches. Churches over 5000 seating have already experienced the benefits of this system.

The "Solomon Sound Management System"

The Solomon Sound Management System (SSMS) acoustical system affects every part of a church's worship program regardless of the denomination, worship style, the room shape and more. This system is not an excuse for Architects to suddenly ignore acoustical planning (more about that later.) If anything, it proves that acoustical planning works and no church should be built without it. This includes free standing churches, shopping mall churches, and warehouse churches and so on.

After careful studying of the scriptures, the Bible doesn't say that Solomon was told by God how to finish the inside walls of the Temple. Solomon did have a number of visits from God or God's angels. Perhaps it was during one of those visits where God gave Solomon specific instructions. That is something we will never know here on earth. However, I do think God lead Solomon to that discovery. The fact that the events of Solomon's temple construction is detailed so much, it does lead me to conclude that God wanted us to know and use this acoustical system.



Modern Church Acoustics

Acoustical problems in a church always come in layers. Solve one problem and you find another. Fix the second problems and the first problem comes back and a third problem shows it's face. Some of these layers can be 6 to 10 steps deep. For today's modern churches with the most modern and advanced sound systems, the SSMS is the only system that fixes all of these problems in one step. In fact, many churches that don't have the kind of acoustics the Solomon system offers, they are being held back.

What other acoustical system is there that is affordable for any church and any size that can give the following benefits? The following are paraphrased descriptions from church members and leaders.

- Great congregational singing
- No Deadspots in the room with or without the sound systems
- The praise and worship team are able to hear themselves, their monitors and the congregation singing. That means you're not forced to use IEM's.
- the stage noise is greatly reduced

- improve the sound of the choir with or without the sound system
- Assisting the minister/preacher to hear themselves better while giving the sermon which in turn allows the minister to concentrate more on what they are saying rather than worrying if they even heard the message.
- hearing speech without a sound system to a larger area of the room without the sound system (up to 80 ft in most rooms or 800 seating in a rectangle space)
- People with hearing aids are able to hear further without assistance. If you can hear normal conversation well at 10 ft in a quiet room, the church acoustics should be just as good. (Depending on the type of hearing loss you may have.)
- Any acoustical performances such as the piano, the pipe organ or digital organ, guitars and orchestra instruments will sound excellent, even when amplified.
- Improving the bass response for all musical instruments and amplified bass by being able to play an extra octave lower.
- Get up to 6dB more volume out of existing sub woofers
- For drum kits reducing or eliminating the need for drum shields.
- Tremendous gain before feedback out of the sound system.
- Less or no distortion from the sound system.
- And the list goes on and on....

Church sound doesn't have to be expensive, a mystery or a guessing game. How many times have I warned churches of the final outcome of how badly their church will sound while in the blue print stage, when the foundations are poured, when the framing of the building is finished, when the walls are ready to be painted and the day before the church opens? Or the common response most church leaders give when pressed to do something mid construction – "let's wait and see what happens. It won't be that bad...." From what Solomon shows us, there is no reason to doubt the final outcome of a room void of acoustical planning. Solomon also shows us what to do to prevent acoustical nightmares.

Modern-day Church acoustics started 3,000 years ago

This is only scratching the surface of what Solomon's acoustical system can do. So far, every room this system has been tried on, the results have been successful. I don't think that this is some new interpretation of the bible that is out in left field. This is a system that has been recommended in over 800 churches. 400 of them installed the system and the results proved and support this interpretation of the scriptures. Without such proof it would be meaningless.

There is other proof too that this works. There are a handful of 15th and 16th century Cathedrals that have similar acoustical features as in Solomon's temple and they sound amazing. Today those features would be too expensive to build, but between the pillars, life size statues, life size Stations of the Cross, angled window frames, stone edging and so on, there was indeed a great deal of acoustical planning in the past. Sadly, that information was never copied over from one generation to the next. Perhaps this is because no was around long enough to pass on the learned knowledge and to explain what the physical features were for and left out as being too excessive.

Many people quote the scriptures where it says "faith comes by hearing." Well, the faithful will come no matter what but the visitors, the strangers and those seeking God can't get much faith if they can't understand. Do the right thing and follow God's words and examples. Every church should sound great.

How do we know if we need this system?

Any church that exhibits any of the problems mentioned above needs acoustical help. You may think you have great acoustics but if the people on stage or at the altar are having problems hearing each other or themselves, you need help. When the floor monitors are as loud as the main speakers in the first 5 rows of audience seating, you need help. If your minister feels tired preaching after 20 minutes of a 30 minute sermon, you need help. Any church that is absent of any acoustical diffusion will have acoustical problems that should be address. Physics doesn't change because you're a church.

If your church is struggling, do an experiment. Cardboard tubes are cheap. Find a room in your church that can seat about 30 to 50 people. Make sure that the room is carpeted. Get enough tubes to cover 70% of the room's height and get enough tubes to be spaced around the room 3 feet apart. That should make enough of a change that everyone should notice a significant improvement. In the photo below, this church was thought to have the best acoustics in the area. When the tubes were placed in the room as shown, everyone in the church was shocked at how much of a difference the change was. The minister said it was effortless to preach. The upright piano had

more bass and the mid range notes were as clear as a larger grand piano. The Organ sounded bigger, grander, louder and quieter. (That is what the organist said.) Even the sound system which was the wrong design for the room, the gain before feedback or working distance of the mic changed from inches to feet.

You don't need expert help to do a generic fix for most small and medium sized churches. In my travels I have found many churches that have already done their own acoustics. Many churches that don't have money to spare will do their own acoustical fixes no matter what. Most smaller sized churches can't afford to hire expert help many of them never will. If you're not happy with those flat panels then this is something you can afford to do. Knowing that you can get better results and great performance copying what was done in Solomon's temple is easy to do.

Finally, I often tell churches that this is not my plan or something new. This is a system I have been using in churches that hire me for 20 years. There are others that use this system but keep the information to themselves as if it is some kind of precious secret. I'm no scientist but how many churches do you have to do before you can say it is a proven system that works 100% of the time? The solution to great sound in a church has always been with us. I like to think of it as God's plan and God used Solomon to teach us about acoustics and about worship. Worship should be a joyous experience and this plan from the Living Word does bring the joy back to worship.



How do they work?

There are many types of diffusers. The basic principles of how they work are all about the same. Sound hits object or surface. The surface is designed to scatter the sound. As the random frequencies of sound scatter and intersect the frequencies either sum together when they are in phases and cancel when they are out of phase. There is only 1 degree of the sounds summing together to increase the sound levels +3dB but there are 179 degrees from that point where the sound cancels. At -90 degrees out of phase the sound reduces 3dB. At -135 degrees the sound reduces 6dB. At -157.5 degrees the sound drops 12dB. At -168.75 degrees the sound energy drops 24dB. At -174.37 degrees the sound drops 48dB and at -180 degrees the sound is 100% absorbed or cancelled.

The other principles involve includes distance and air. The more reflections a sound has to make before it falls into the area of the room where people are listening, the more the air – which is an absorber – can reduce the energy. This is why diffusion alone in a church is not enough. You have to plan the sequence of reflection to get more performance out of your diffusers. You need to know the sizes, spacing and sequence pattern to get the best performance out of diffusers.

Are All Diffusers the same?

Some of the many diffuser designs includes: Phase Gradient Diffuser (Made famous by RPG) Ring or donut diffusers, Pyramid diffusers, Barrel diffusers, art work diffusers, accordion diffusers and so on. There are good and bad points to all of them. Most of them have good points. Personally, I find that they all work well in churches but, in many churches, there is isn't enough wall spaces for them to do the right job.

Considering that most of the acoustical issues churches run into are from 80 to 1200 hertz, we measure these frequencies in feet, not inches. Most of these acoustical systems do control these lower frequencies but, they don't reduce it enough. If you have a reflection of only -3dB from a nearby wall or within the first 40 to 50miliseconds, you will want to reduce that reflection another 22dB for a target value of -25dB. If that reflection is at 200 hertz, then the diffuser or system has to attack wave lengths that are 5 ft long. Most of the conventional diffusers will do

around 9 to 15dB of reduction. To get more reduction you have to increase the size of the diffusers or develop a system that can increase the performance of the diffusers. The half round diffusers in the 8 inch to 16 inch sizes spaced at variable distances can achieve an acoustical performance that seems impossible if measured in sabin per square ft or meters.

Just keep this in mind. If you have acoustical issue below 1000 hertz, there is no flat panel that I know of that can reduce sound energy more than 20dB that is less than the thickness of the wave length. Wave length is equal to the speed of sound divided by the frequency (Vibrations per second.) Speed of sound is 1130 ft per second. 1000 hertz is 11.3 inches long. You need a panel 11.3 inches thick for 20dB reduction. Most acoustical problems for churches are between 80 to 800 hertz. Often you need up to 22dB of reduction in the 180 to 400 hertz range and 16 inch half rounds can provide that kind of help.

Is there anything better?

As a single unit a half round diffuser doesn't seem to do much. Two half round diffusers spaced less than 2 feet apart from edge to edge does a little more but nothing spectacular. When you have 3 or more diffusers - that changes everything. The performance becomes exponential up to around -30dB at various frequencies. That seems to be the maximum.

How is that possible?

The first part of the diffusers performance is about phase as mentioned already. The next item is distance, time and air working together. There is one more element that seems to be often overlooked. It's the wall itself. The amount of flat space is much smaller when a diffuser is over it. Therefore the amount of reflected energy that can be created in the first place is reduced. Also, the surface area of a half round is 50% greater than the surface it occupies. An 8 inch half round has a 12 inch surface area. Since sound hits the surfaces at all angles, the surface area and the profile of the diffuser reduces the flat surface exposure. You can vary the percentage to achieve the amount of reduction needed by changing the gap between the diffusers.

There is also an extra benefit when using half round diffusers. In most cases there is no need for corner bass traps. When a church is about 200 seating and larger (this works in 10,000 seat spaces too) and the walls are properly diffused, there is not enough bass energy accumulated on the flat surfaces for the bass energy to travel down the walls and be amplified by the corners. When you look at cost plus performance, half round diffusers are the most effective tool and about the only tool that really does meet a church's needs for all aspects of worship.

Another property of diffusion is the wall space.

When using a flat panel, the longer wave lengths go through the panel and reflect back out. Only the higher frequencies are trapped or reduced in energy - frequencies that are less than a 1/4 of the thickness of the panel. As an example, a 4 inch panel with 2 inches of airspace does 3dB at 2,100 hertz, 6dB of control at 4,200 hertz and 9dB of control at 8,400 hertz. Most of this affects music, not speech. If anything, the energy that is left is all bass which hurts speech and music intelligibility.

At longer wave length the 6 inch panel does work to lower frequencies but at a fraction of the energy reduction. Since only about 5% of the sounds launched from a person or sound system hits the wall panels at a right angle, you do get additional attenuation down to 500 hertz as the angle of the sound changes. But, when you need 6 or 10dB of reduction, you need larger flat panels to control the sound. As a result, when you see flat panel installation, they cover large wall areas to get the best performance out of flat panels. With the half round diffuser, it is very different.

When you have a half round diffuser in a vertical position, the diffuser materials and shape does not let any of the sound go through it. The diffuser that occupies the flat wall prevents sound from reaching it. As a result, you're reducing the amount of flat wall for sounds to reflect off of. You could say you're making the wall smaller. So before the diffuser starts working, it has already done something the flat panel cannot do and that is to reduce sound at all frequencies.

Next is the surface area of the diffuser. Where the diffuser is a half round, you are increasing the surface area for a reaction to sound by 50%.

- An 8" half round has 12" of surface area,
- a 10" half round has 15",
- a 12" half round has 18 inches and
- a 16" half round has 24 inches of surface area.

This gives us more area to direct sound into different directions. With that much more surface area, you can scatter sound to a lower frequency. 12 inches is around 1100 hertz, 15 inches is around 900 hertz, 18 inches is around 800 hertz and 24 inches is around 550 hertz.

When these diffusers are by themselves, you only see about 3 to 6dB of control. When you start to combine these diffusers, the performance explodes.

- 3 units of 8" half round longer the 3 feet are combined, you have the combined surface area of a 36 inch panel or control down to 370 hertz.
- 3 units of 10" half rounds is 45 inches of combined surface area which controls sound down to around 300 hertz.
- 3 units of 12" half rounds is 54 inches of combined surface area which controls sound down to around 250 hertz
- 3 units of 16" half rounds is 72 inches of combined surface area which controls sound down to around 180 hertz.

We get all of this performance before we start with the phase cancellation of sound energy. To increase the control of sound to lower frequencies and at a higher rate of control, you start changing the distances between the diffuser and change the sizes. When you know the frequency you want to control and the rate, you start with – as an example – 8 – 8 – 12 – 8 – 16 – 8 – 16 – 12 and repeat. With these combinations you can increase the performance of the diffuser up to 30dB of control when you have enough wall space to create such sequences. Every inch difference in spacing between diffusers also changes frequency and rate of attenuation.

The flat spaces between the diffusers do a very important role. It provides feedback to the people on stage and to the audience. It also is part of the phase cancellation process of lower frequencies. Changing sizes, amount of flat spaces and the spacing between diffusers provide a very powerful and effective way of getting all the control needed in a church as you often need that much energy management. Don't forget that reducing the wall space or reflective surface area is also part of that 30dB of control.

There are three ways for a church to buy acoustical treatment

The first is to apply enough acoustical treatment for the sound system to work better. Flat panel acoustical solutions are often used to get more performance out of a sound system. Yes, there is some improvement of the sound system performance when this method is applied but the end results is a room that often degrades the congregational singing further. Any confined space that has no planned acoustical treatment often has less than an ideal space for congregational singing. When you add flat panels which can only attack the mid and high frequencies, it makes the room duller or darker which in turn reduces the "sing-ability" of the space further. Also the amount of sound system performance is also much less than what it could be. For example, before treatment everyone had to be within 3 inches of an open microphone. After the flat panels are installed you can now move out to 10 inches from an open mic. For some, this improvement seem to be a huge step but the reality is, you could get 24 inches of gain to a single open mic and in some spaces 48 inches of gain when using half round diffusers.

The second is to fix a specific acoustical problem such as an echo. Like the first step, churches often are recommended a flat panel or if diffusion is suggested, I have often seen accordion type of diffusers. Again, the flat panels' exchanges one set of problems for another as acoustical problems come in layers. Fix only problem and you expose another and the problem you expose can be as bad as or worse than what you started with. With the accordion type fix, it is better than a flat panel but you wind up with places around the room where a few people hear these annoying reflections. You could also add a hard backboard to a flat panel and place them in an accordion layout but this is not a real solution. (Some even direct the sound to the floor or ceiling. Again, these create other problems.)

In my travels, I have been exposed to all kinds of worship spaces and I have sat in on many styles of worship. As a result, I know what great congregational singing sounds like. I know what it is like to experience high quality hearing and understand of a person preaching 60 ft away without the sound system on. I know what it takes to amplify a child's voice from a mic 4 ft away for the parents – the share holders of the church – to hear their son or daughter doing a song or play in front of the church. I know what a great choir or praise and worship team should sound like and when I say that, it is in the context of the choir or praise and worship team inspiring the congregation to sing better and singing out more. Is it possible to have a room that can do all of that? Yes. This brings up to the third method of how churches buy acoustical treatment.

The third is to fix all aspects of a worship service in one step. This is what the Solomon Sound System is all about. It is an acoustical system that solves all of the main issues once and for all. As mentioned before, if you think your church has only one acoustical problem, think again. There are always layers of problems. If we could go back 3000

years to Solomon temple and if we were allowed inside, the sound of the temple with all of the Cherub and Palm tree would have given us a wonderful worship experience regardless of the style of worship you practice today. (ok... carpet on the floor and padded pews for contemporary worship.) The Solomon solution fixes everything in one step leaving the church idea for a wonderful worship experience. You could call this the Swiss army knife of large room acoustics.

Churches have told me that after they completed their church acoustics, it was like getting a whole new church. In my way of thinking, a church without acoustical treatment is a church that hasn't finished their construction. It is a space that limits worship and reduces the ability to understand speech, which can divide the people. I sometime wonder if there would be fewer church splits if churches had better acoustics. Sadly most church members and church leaders have never experienced all of positive effects of good acoustical events in a single space and it is almost impossible to tell someone what the changes will sound like in their space and for them to imagine it and know what they are getting. How can people imagine a church that they have been worshipping in for 50, 100, 200 or more years and then being told their church is not completed yet?

What is also true is that bible colleges in all of the denominations do not teach acoustics nor do they teach future ministers how to take advantage of a church with good acoustics. Choirs and music directors are not taught how to take advantage of a good room. Most Organists don't know how to play in a good room. Instead, these people spend a life time dreaming up ways to work around the acoustical problems and when someone like me comes around, they fight to keep what they have.

The ambient noise factor

This acoustical solution also has another benefit. When there is air handling system, road noises or other mechanical noises in the room, this system also reduces the ambient noise up to 12dB. So if you're looking for that extra 3 to 9dB of headroom in the sound system, if you're trying to get more level out of a headset mic or pulpit mic, and the room noise is above 45dB, then the Solomon fix will give you more gain out of the sound system. Most mechanical sounds are below 1000 hertz. The power range of a person's voice is below 1000 hertz. Mechanical noises are almost always omni directional. A person's voice is very direction with or without a sound system. The same benefits of the diffusion and the canceling of standing waves and bass sounds, it will affect the mechanical noises the same way. That then allows the direct sound from the person talking, singing or playing an instrument to give a better experience when compared to no treatment or a flat panel treatment.



Are there Alternatives for New Churches?

So far we have been talking about existing churches and fixing what has already been built. The good news is, new churches can have acoustical features included in the assembly of the new church. That means that if your interior wall is brick or block, how you build the wall can make the difference between a wall that helps the acoustics and a wall that creates acoustical problems. The neat part is, the cost difference between the two walls is \$0.00. If your walls are drywall, the cost difference between a good wall and a bad wall is \$0.00. This also goes for classrooms, fellowship halls and chapels. The key here is to get the information and implement changes before the blueprints are finalized. If you can do that, then your acoustical system can be free – ok, there may be a consulting fee but that cost is far less than hiring a consultant and then adding acoustical treatment to a finished room.

Experience has taught me something else. Whenever a church hire consultants such as myself, the aesthetic finish of the church is often better than what was hoped for. It seems that by adding acoustical planning at the very beginning of the planning stage, it engages the Architect, the builder and the church building committee to work out a better plan of the worship space. In most cases, churches are discovering that a flat wall costs the same as an acoustical wall. Architects are often surprised to learn this too. This is possible by taking the lesson learned in Solomon's temple and then adding variations of the same acoustical system.

Summary

If we take the lessons learned in Solomon's temple and then apply them to modern day churches, it is possible to have excellent acoustics every time a church is ready to build or when fixing an existing space. We exercise our faith in obeying the scriptures. The example of Solomon's should be a common exercise in faith regardless of what others would suggest.

Disclaimer. There are some churches with poor room shapes or dimension ratio's or churches will glass walls that hamper the ability to make the space perform to meet all church needs. In such cases, all that can be done is to make the hearing of speech ideal and to have a passing intelligibility score. This alone is worth all of effort of change.

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The term "Solomon Sound Management System" is registered as a public domain term which cannot be trademarked in 1991.

All scripture verses are from the King James Version of the Bible.