IV Pipe Organ Placement and Acoustics

The placement of the pipe organ is crucial to the ability to project sound well. Since the room is the resonating space for a pipe organ, acoustics play a key role in its success.

Tonal egress is the path sound has to follow to project in the room. Following some simple rules will help assure the pipe organ and the organ builder can provide the best results for the space. The pipe organ should have straight line egress, and it is preferred the egress should be aligned with the long axis of the room. Pipe organs do not speak well around corners or placed behind walls. Consider the fact that you would not expect a speaker or clergy to speak or preach from the hall or alcove around a corner due to problems with projection. The same theories apply to the pipe organ. In order to ensure consistent blend of the singer and the pipe organ, they should be located in the same area. This avoids time delays for the director and the organist. It is also important that the pipe organ should be located above the listening audience or congregation. It is best suited at the middle height of the building.

One additional item of note is the presence of defining arches used in church designs to separate choir, chancel, transepts and nave spaces. While these provide visual benefits, arches are serious encumbrances to the projection of sound. An arch extension of just one or two feet around the opening of the space can impact the projection of sound (pipe organ and/or choir) by as much as 30% -- thus the reason choirs are sometimes moved to the steps of a chancel in front of an arch opening for concert purposes.

The acoustics of the space can be a very complicated matter, but some simple basics presented here should help provide a tremendous insight into that understanding. The pipe organ can generate basic foundation frequencies ranging from 10Hz (vibrations per second) to over 10,000Hz not counting overtones or articulation nuances.

Bass frequencies are usually omni-directional, allowing more options for placement. Bass frequencies also generate a large amount of energy that requires surfaces of dense mass for good reflection. Thus surfaces such as stone or masonry walls provide a good substructure for the reflective surface for bass frequencies. It should be noted, though, that rough or textured surfaces are common with such structures. Rough or porous surfaces should be polished or plastered to create a refined surface for reflection. Materials such as beaded board or plywood do not provide good density support for bass reflection. Drywall or gypsum board can suffer the same problems of reflection unless applied directly to masonry walls or unless extra support is provided. Multiple layers of drywall or gypsum board can be installed with better results. Additional options of construction are available with consultation by the organ builder, acoustician and structural engineer.

Treble frequencies are directional by nature and easily reflected by hard surfaces. Any surface with a hard smooth or polished finish will usually support good treble reflection. The organbuilder will also manage controlled placement of treble pipes, depending on the brightness or clarity they wish to obtain for the sound or ensemble.

When evaluating the room, the optimal space will have an even reverberation time across the spectrum of bass to treble frequencies. Reverberation is a sustained sound vibration in a given area. Reverberation time is the measured sustained tone after the tone source stops playing and

before the final reflection decays. As music has a complex series of overtones, the sustained overtones assist in weaving the fabric of the music the listener hears. An even reverberation time should not be confused with the problem of echo. Echo is a reflection of a sound with clear and concise separation of tone or tones. Echo is very troublesome to the musician and the listener. Echo creates problems with tempos for the musician, because the listener becomes confused with which downbeat or tone to follow. In a good acoustical environment, musicians will desire to have a 2 to 4 second reverberation time. Since the spoken word is also an important part of a worship space, 2 to 4 seconds of reverberation time is a very comfortable window for managing the spoken word.

The benefits of a good acoustical environment enhance the ability of the listener to hear the music equally in any place in the room. This also equates to a less forced sound for singers, instrumentalists, and the pipe organ. The sound flows more naturally and usually does not require excessive volume from each organ pipe to push or force the sound throughout the room. The end result is that the listener in the back of the hall or nave hears the organ and choir as well as a listener in the front of the hall or nave.

Likewise, the spoken word will not require amplification in a live space. The support from a public address system can then focus on intelligibility of the spoken word more than volume amplification. Our firm has worked with a number of companies that have designed public address systems that achieved superior results with the spoken word in a live acoustical setting, so excellent results are quite possible.

The structure and shape of the room will have impact on the time and effects of reverberation. Earlier we discussed density of walls and reflective surfaces. An organ builder should be involved with the design of a new space when possible or should be provided complete information on an existing space when considering the design of a new pipe organ. In a room with thin walls but a highly reflective surface, the room will favor the treble frequencies while absorbing the bass frequencies. The result to the listener is a room that creates a very bright sound with no foundation. Unsupported bright or tinny sound can be very irritating and tiring to the listener. Sometimes the opposite is true and the room may have masonry construction with dense walls and rough reflecting surfaces in which a room will favor bass response and absorb the treble frequencies. This would create a dull, dark and heavy tone environment. This setting creates the illusion of unclear tone or, even worse, just a wall of noise or sound. The listener then becomes disconnected and uninterested in the music. Good acoustical architecture design will address structure and surfaces as different but inter-related components. A good pipe organ builder will be able to compensate for some variations.
Understanding the relationship of the space and the pipe organ will help in the decisions for a good organ installation.