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Infrastructure Issues for Videoconferencing and AV Presentation Environments

Creating an effective environment for conferencing and presentations requires careful coordination of both the technical systems and the physical space that contains them. A compromise in the form or functionality in either of these two components, or a lack of complementary constructive coordination between them, will result in a space that will fail to support its intended program.

Fortunately, many of these issues can be summarized in a logical and systematic format such as the following document so that all the design team members may become aware of their importance and interdependence.

As a general scope of work, most of these items are documented by the architect based upon input from the technical presentation systems integrator. These infrastructure items are also generally provided by trades other than the technical presentation systems integrator and usually fall under "base building" budgets.

Finally, the issues here are addressed in very general terms & bullet points, and specific technical details particular to each project can be addressed under separate cover.

As videoconferencing is similar to TV broadcasting and has certain "show business" aspects, we are using TV analogies in this document.

Quiet On the Set! Keep the Noise Out... ...and In.

Excessive noise from mechanical systems, adjacent interior spaces and exterior environments is one of the most serious impediments to any conference or presentation, but especially to a videoconference environment. Besides interfering with speech between the participants within a room, noise in a conference space can potentially be picked up by the sensitive microphones required for conferencing and be transmitted to the remote site where it is amplified and mixed with noise originating at that site.

Conversely, an environment that is poorly isolated from exterior noise can potentially allow sensitive conversations generated within the room to be overheard in those same adjacent areas, significantly compromising confidentiality. Therefore videoconferencing and presentation spaces must be carefully designed to keep outside sound out and inside sound in.

1. All perimeter wall construction must be rated for >54dB STC (**S**ound **T**ransmission **C**oefficient).
   STC is a weighted speech-band average of how much reduction (in decibels, or dB) in the sound pressure level of sound on one side of a partition through to the other side. The higher the number STC, the greater the reduction of sound is provided by the wall.

2. Party walls between acoustically sensitive areas and known noisy areas, where unavoidable, should have STC ratings of >57.

3. All perimeter wall construction must be **very** carefully constructed in accordance with the guidelines published by the various wall material manufacturer's handbooks (such as the US Gypsum handbooks) and must be carefully monitored and inspected during and after construction to verify that the construction guidelines are adhered to.

4. All perimeter wall penetrations for utilities such as HVAC, sprinklers, plumbing, electrical raceways and exposed low-voltage cables must be **very** carefully sealed with non-hardening acoustical caulk (or other materials as required) in accordance with the guidelines published by the wall material manufacturers handbooks. These penetrations must be carefully monitored and inspected during and after construction to verify that the construction guidelines are adhered to.

5. HVAC systems must be designed for a **N**oise **C**riteria (NC) of no more than NC30. Most mechanical engineers use the A.S.H.R.A.E. **R**oom **C**riteria of RC30N and this is also acceptable. Refer to the A.S.H.R.A.E. Applications handbook for additional details.

6. Heat loads are generally not excessive for typical small conference room presentation systems, though some nominal additional capacity (500-1000 BTU) is required for the displays (large screen TV's, plasmas, projectors).

7. Exterior glazing, where unavoidable, should have a STC of >45dB. Very careful attention should be paid to potential nose flanking paths through and around the mullions, knee walls and headers.

8. Exit/entry doors should be solid wood or insulated hollow metal construction with metal jambs carefully secured to the adjacent structure. Cavities behind the jambs should be carefully filled with insulating materials and caulked. Acoustically rated "sound doors" are generally not required and, fortunately, simple acoustical hardware such as perimeter smoke gaskets, door shoes and ADA-compliant thresholds can be provided to provide an acceptable level of sound isolation at considerable cost savings.

Quiet On the Set, Part Two! Control The Sound That Remains.

The most important issues are the reduction (or diffusion) of acoustical energy repeatedly bouncing between parallel surfaces (so-called flutter echo) and reduction (or diffusion) of strong, distinctive reflections from surfaces that are significantly large and planer.

Therefore a proper balance of the three basic types of acoustical surfaces (absorptive, reflective and diffusive) in both quantity and location is important.

And, as noted previously, the microphones required for conferencing may not properly distinguish between speech and echoes and will transmit both to the far site, with compromised intelligibility.

1. Generally the acoustical wall treatments for these spaces are the very generic 1 inch thick semi-rigid fiberglass panels faced with an acoustically transparent fabric such as the Guilford of Maine FR-series. Panels may be either pre-made and secured to the wall substrate with a variety of fastening methods, or may be the type that are fabricated on-site with a perimeter frame attached directly to the wall then in-filled and covered.
2. Provide absorbent wall materials behind the room's participants (rear wall) and on at least one sidewall. Absorbent materials in front of the room's participants (front wall) are generally not required.

   Absorbent wall materials are generally not required from floor to ceiling to be effective. Typically, a 48 inch high, horizontal band, with the bottom near chair rail height, is all that is generally required in smaller spaces. Wall surfaces above or below this band may be reflective, such as wood or gypsum wall board (GWB). Additional acoustical treatments, such as a full wall height panel, if required for decorative or aesthetic reasons, are acceptable.
3. Where possible, provide irregular wall surfaces such as small alcoves, non-parallel walls, soffits and other irregularities that break-up large planer surfaces. This can be beneficial as they provide a diffuse and irregular acoustical character.
4. Where possible, provide a reflective surface for the center section of the ceiling, as it provides natural speech reinforcement to the participants within the room, potentially alleviating some need for a separate sound reinforcement system. Acoustically absorbent ceiling materials should be provided along the perimeter of the ceiling.
5. Note that *providing large amounts of acoustically absorbent materials within a room does not soundproof it;* only the rigorous wall constructions and details noted above can provide this function. Also, rooms with significant amounts of acoustically absorbent materials are *not* good spaces for conferencing or presentations because they lack the "ambience" and "ensemble" that participants expect in a normal meeting environment.

Places, Everyone!

Key to successful videoconferencing is a sense of "presence" and "connectivity" between both ends of the conference. This requires a clear unobstructed view of the participants from the camera location at the front of the room. Traditional boardroom furniture designs using rectangular table's position participants so that they may be obscured or not properly facing the camera. This results in a poor sense of "face to face" communication.

1. A trapezoidal table is strongly preferred for videoconferencing. With the wide end at the front of the room, all of the participants can both BE seen by the far end and have better sight lines to see the far end on the video monitors. This has the caveat of allowing better sight lines to a local presenter should there be a lectern or podium at the front of the room.
2. Local presenters should be located at stage right (the audience's left) as studies have indicated that our eyes tend to initially focus at the left of our viewing field.
3. Seating or gallery areas for participants not at the primary conference table location should be elevated if possible so that they may have a more clear view of the presentation images and may be seen more clearly by the cameras.

Lights!

Lighting for both presentation and for the participants for videoconferencing is much simpler than is generally perceived, with selection of the proper fixtures, dimming and zoning focused on creating the proper amount of full and relatively shadow-less lighting on the participants and a general wash on the backgrounds. Elaborate theatrical lighting is generally not required, though careful attention must be paid to the lighting around the image presentation areas in the front of the room.

1. In many small and mid-size rooms (<650 square feet), an eight zone dimming system can provide sufficient lighting control for both presentation and videoconferencing. In small dedicated videoconference rooms, two or four zones of lighting may be sufficient.
2. Avoid inexpensive manual wall dimmers due to their potential to create electrical "noise" that may interfere with the technical presentation systems. Small commercial dimming systems, such as the Lutron GraphicEye 4000 series, are very cost competitive when compared to numerous manual wall dimmers, both in parts and installation labor.

   Additionally, commercial dimming systems generally provide a higher noise filtering capability and have the added feature of allowing remote control by the technical presentation systems.

3. In general, lighting levels of 35-40 foot candles (fc) are sufficient for the video conference participants; this should include a significant horizontal component. 25-35 fc is sufficient for background and perimeter surfaces.
4. For front projection applications, lighting *must* be carefully controlled to allow no more than 3-6 foot candles on the screen to maintain minimum contrast. The current generation of bright LCD and DLP projectors cannot overcome excessive ambient light on a front projection surface.
5. For videoconferencing, avoid lights that direct the majority of their energy downward towards the floor or work surface: this includes the typical down-light can, track-lights that are aimed toward the floor or desktop surface and recessed fluorescent troffers that have divided lenses.
6. For videoconferencing, use lights that direct the majority of their energy at an angle towards the participants and/or provide a significant amount of up-lamp wash against the ceiling.
7. Wall wash fixtures should be linear types to provide a smooth distribution on the wall from both top/bottom and laterally. Avoid down lights or any fixture that provides a scalloped pattern.
8. Dimmable florescent lamps, if used, must be the 1% type; 5% and 10% are not acceptable.
9. Fluorescent fixtures must use 3200 degree Kelvin lamps where available.
10. As a general rule, don't mix incandescent and fluorescent fixtures due to their color temperature differences that will be more pronounced on video cameras than perceived by the local participants.

Camera!

Camera placement is also critical for the sense of "presence" and "connectivity" between the far end and the local participants, as noted previously.

1. The camera must be horizontally located at the image that presents the far site participants; ideally it should be centered with this image, but may be offset to the side of the image. The camera may *not* be located beyond the side of the far site image.

   If the camera is offset too far to one side of the far site image, local participants will be perceived by the far site as looking "away" or "off-camera" when speaking, a very counterproductive process that disrupts effective communication.
2. Auxiliary wall mounted cameras located in the rear of the room (to capture a presenter) are generally mandated by building codes to be at least 80 inches above the finished floor (AFF / local requirements may vary).

Action!

This section addresses extraneous activity that can distract from the primary focus of face to face communications.

1. Avoid exit or entry doors within the view of the cameras (e.g.: the rear or rear sides or the room.
2. Avoid exit or entry doors behind the local presenter at the front of the room.
3. Where possible, locate furniture or casework that participants access during a meeting toward the side of the room or out of the primary camera view. Activity of shuffling papers/ binders, getting water/ drinks/ food, opening/ closing drawers, using fixed computers can be very distracting to the far site participants and these functions should be located off-camera.

Mind Those P's & Q's - Power & Quality.

Technical presentation systems have the following specific though not overly rigorous power and power quality issues.

1. Power for technical presentation systems should be dedicated to those systems and not shared with other building systems or general purpose circuits.
2. An isolated ground system is preferred for new construction to assist in minimizing interference from other building systems.
3. UPS power is generally not required for the technical presentation systems but can assure that the AV system does not power down during a brief power outage.

Raceway

There is no such thing as too much raceway for the technical presentation systems! ☺

1. A floor box for the technical presentation systems should be provided at any conference table or free standing lectern location and a segregated wire path for the technical systems cabling must be provided to minimize interference from high voltage and other low voltage systems.

   There are several effective multi-trade floor boxes that can provide for proper segregation of power, voice/data and technical systems. In new construction, these can be included in the floor slab, or in renovation projects these can be cut into the existing slab.
2. Wall boxes for technical presentation systems can be both "gang-type" or standard NEMA "J-box" type (as specified by the technical presentation systems integrator) and must be located in careful coordination with related services such as power and voice / data.

3. Raceway and wire paths to connect the technical presentation systems to many of the other systems noted in this document (dimming systems, motorized shades & drapes, etc.) must be carefully coordinated. Fortunately, these coordination requirements are neither rigorous, nor complex, and are covered in separate documents that are provided by the technical presentation systems integrator.

Architectural Finishes

1. Wall finishes should have a **L**ight **R**eflectance **V**alue (LRV) of approximately 50% regardless of material (wood, painted, fabric). Wood or painted finishes should be low or no-gloss. Avoid shiny metal surfaces such as natural brushed steel, aluminum, brass, bronze, copper, etc.

b) Similarly, work or table surfaces should have finishes with a LRV of approximately 40- 50% regardless of material (wood, painted, laminate

a) It is especially important that the horizontal finishes of the tables and work surfaces about which the conference participants gather be low or no-gloss. Avoid wood grains with high-contrast grains or stains.

b) Any metal or plastic surfaces such as cable management systems, decorative trim or protective mats should feature a low or no-gloss finish that not contrast either in color or texture with the surrounding body of the table. .

3. Colors should be low-saturation and tend toward blue-grays, green-grays or warm grays. Avoid highly saturated colors, especially reds, whites, pinks, oranges; avoid dark colors such as black, dark blue, dark wood tones or chocolate

4. Walls and all other surfaces regularly seen by the camera should not have any discernable pattern more than 36" from the naked eye. As a reference, the patterns in the typical Guilford of Maine fabrics used on acoustical wall panels are acceptable, patterns more noticeable than these should be avoided.

5. Ceilings should be traditional "ceiling white" with no tints or other architectural details that are significantly different from white or off-white. Most acoustical ceiling tile that is designated "white", "ceiling white", "near white" or similar is acceptable, regardless of its surface texture.

Other Light Control Issues

Exterior windows within the view of the camera must be controlled for several reasons: technically, the brightness of daylight can be significantly overpowering to the camera causing it to close its iris and causing the local participants to appear as silhouettes; and the color temperature of daylight is much higher (more blue) than typical artificial lighting, resulting in disconcerting color anomalies in the video image. Also, exterior activity can be very distracting to the far site viewers.

1. Exterior windows within the view of the camera should be covered with blackout shades or motorized curtains, Shades are preferred over curtains because they have less vertical patterns than extended drapes.
2. Shear shades (<5%) are acceptable for non-videoconference uses and may be combined in double-roller shade systems.
3. Avoid window tints that have any color, only neutral gray is acceptable.