G. ACOUSTICAL DESIGN NARRATIVE

Introduction

This narrative presents acoustical design criteria and recommendations for the Mary Lowell Center in Seward, Alaska. Design criteria are directed toward control of reverberant sound levels within communication spaces, and mechanical noise control to ensure appropriately low noise levels from the facility HVAC system. The design recommendations include wall types for sound isolation, sound-absorptive finishes for reverberant sound control, and open plan office recommendations to optimize the open plan acoustical environment.

Design Criteria

Reverberation Time

Reverberation time is a measure of the time required for sound to decay within an occupied space. Excessive reverberation time will produce low speech intelligibility, and a lack of clarity and intelligibility during playback of recorded program material. The recommended reverberation time for key areas are presented in Table G-1.

Table G-1
Recommended Reverberation Time (in seconds)

Room	***Reverberation Time***
Conference Rooms	0.6 to 0.8
Exhibit Hall	0.8 to 1.0
Theater/Multi-purpose Room	0.8 to 1.0
Meeting Rooms	0.8 to 1.0

Mechanical System Noise Criteria

Effective control of mechanical system noise is critical for the success of all occupied areas within the facility. Mechanical system noise levels are specified as Noise Criterion (NC) levels, which is a standard system of rating the noise level in an occupied space by comparing actual or predicted sound levels with a series of established octave-band spectra. Recommended NC levels for key areas are presented in Table G-2.

Table G-2 Recommended Noise Criteria (NC) Levels	
Room	***NC Level***
Conference Rooms	30
Offices	30
Open Plan Office Areas	35
Exhibit Hall	25-30
Theater/Multi-Purpose Room	25-30
Meeting Rooms	30

Acoustical Wall Types

Four wall assemblies are recommended for acoustical isolation performance. The acoustical walls should extend to the structure, and be caulked airtight at the base of the wall assembly. The wall types are based on wood stud construction; significantly lighter construction will be acceptable if light gauge metal studs are used rather than wood studs.

Wall Type W-5a: Moderate Isolation Wall Type 1 (100% and 90%) - This assembly is recommended for standard private offices and other areas requiring a moderate level of isolation from adjacent spaces. The wall assembly for 100% and 90% performance is as follows: staggered 4" studs on a 2"x 6" plate, with one layer of 5/8" gypsum board on one side and two layers of 5/8" gypsum board on the other side. The stud cavity should be filled with a 6"-thickness of glass fiber or cotton batt insulation. This wall has an acoustical rating of STC 52.

Wall Type W-5b: Moderate Isolation Wall Type 1 (75%) - For 75% acoustical isolation performance, the recommended assembly is staggered 4" studs on a 2"x 6" plate , with one layer of 5/8" gypsum board on each side. The stud cavity should be filled with a 6"-thickness of glass fiber or cotton batt insulation. This wall has an acoustical rating of STC 46.

Wall Type W-5c: High Isolation Wall Type 2 (100% and 90%) – This assembly is recommended for areas requiring a higher level of privacy, such as executive offices, conference rooms, interview room, and meeting rooms. The wall assembly for 100% and 90% performance is as follows: staggered 4" studs on a 2"x 6" plate, with two layers of 5/8" gypsum board on each side of the stud assembly. The stud cavity should be filled with a 6"-thickness of glass fiber or cotton batt insulation. This wall has an acoustical rating of STC 56.

Wall Type W-5d: High Isolation Wall Type 2 (75%) - For 75% performance, the recommended assembly is 4" staggered studs on a 2"x 6" plate, with two layers of 5/8" gypsum board on one side and one layer of 5/8" gypsum board on the other side. The stud cavity should be filled with a 6"-thickness of glass fiber or cotton batt insulation. This wall has an acoustical rating of STC 52.

Specific locations for each wall type are as follows:

Wall Type W-5a:

- NMFS D02/NMFS D03
- Asst Super A02/open plan B09
- Res Staff B03/Fire Ofcr B04
- Dist Ranger B01/Chief Ranger A04
- Chief Ranger A04/Chief Admin A06
- Chief Admin A06/Chief Interp A07

Wall Type W-5c:

- Evidence D09/Conference D13
- Conference D13/NMFS D04
- NMFS D04/Toilet D15
- Interview D11/USFS Law D08
- Conference C29/Rec Plan B19
- Conference C29/Asst Super A02
- Pub Srv B02/Dist Ranger B01
- Pub Srv B02/Rev Staff B03
- Conference C39/Chf Interp A07
- Conference C39/Chief Rm A03
- Meeting Rooms (if the meeting room dividers are operable partitions, the partitions should have an STC 51 rating or higher).

Multi-Purpose Room

Key acoustical considerations for the Theater/Multi-Purpose Room are sound isolation, reverberation time, mechanical noise control, and room configuration.

Reverberant Sound Control

The multipurpose room ceiling should provide a significant level of sound absorption to control reverberant sound to appropriate levels. The acoustical ceiling alternatives include lay-in acoustical ceiling; areas of continuous fabric on supporting framework backed with a 2"-thickness of glass fiber insulation board; fabric-covered acoustical

panels suspended horizontally from the deck; acoustical clouds, or acoustical baffles or banners suspended vertically from the deck.

If the ceiling is lay-in acoustical tile, the tile should be glass fiber tile with a Noise Reduction Coefficient (NRC) of 0.80 or higher. If the ceiling is acoustical clouds, the acoustical material can be standard lay-in tile with glass fiber tiles having NRC 0.80 or higher, or continuous fabric backed with a 2"-thickness of glass fiber insulation board.

If the deck above the multipurpose room is exposed, it will also be effective to treat the deck with a spray-on acoustical treatment, such as "K-13", a cellulose-based acoustical treatment manufactured by International Cellulose. The material can be black or other dark color to minimize the material visually.

Additional sound absorption may be provided by curtains used for exterior light control or, alternatively, 60 to 100 square feet of acoustical wall panel can be located on the limited wall space available for such treatment.

Meeting Rooms

Reverberant sound control in the Meeting Rooms will be provided primarily by the ceiling finish material, as there is very limited wall area available for acoustical wall panels or other treatments. Sound absorption in addition to the ceiling area may be provided by curtains used for exterior light control. The recommended options for the ceiling material are presented in the Acoustical Ceiling section below.

The Meeting Rooms are well positioned to minimize sound intrusion from adjacent spaces, and fixed wall assemblies will not require high level acoustical performance for sound isolation. Perimeter walls, however, should be filled with batt insulation to provide adequate sound isolation using a single stud assembly.

It is assumed that operable partitions will be used to divide the Meeting Rooms. The partitions should have an STC rating of 51 or higher. Recommended manufacturers are Modernfold, Hufcor, and Advanced Equipment.

Acoustical Ceilings

The recommended assemblies for acoustical ceilings are presented below:

Standard Lay-in Acoustical Ceilings (100% and 90%) - the acoustical tile should be glass fiber tile with a Noise Reduction Coefficient (NRC) of 0.80 or higher.

Standard Lay-in Acoustical Ceilings (75%) - the acoustical tile should be mineral tile with a Noise Reduction Coefficient (NRC) of 0.55 or higher.

Open Plan Office Ceilings – The recommended ceilings for open plan office areas are glass fiber acoustical "clouds", or standard lay-in acoustical ceiling. The clouds can be sections of ceiling that cover the workstation groups within the open plan areas. This arrangement can provide control of ceiling-reflected sound between work groups, and will also visually define the workgroup areas. The acoustical cloud material can be standard lay-in tile with glass fiber tiles having NRC 0.80 or higher, areas of continuous fabric on supporting framework backed with a 2"-thickness of glass fiber insulation board, fabric-covered acoustical panels suspended horizontally above the workgroup areas, or acoustical baffles or banners suspended vertically above the workgroup areas.

If the deck above the workgroup areas is exposed, it may be effective to treat the deck with a spray-on acoustical treatment, such as "K-13", a cellulose-based acoustical treatment manufactured by International Cellulose. The material can be black or other dark color to minimize the material visually, with acoustical clouds suspended above the open plan workgroups.

Multipurpose Room, Meeting Rooms, and Exhibit Hall Ceilings: The Theater, Meeting Rooms, and Exhibit Hall ceilings should provide a significant level of sound absorption to control reverberant sound to appropriate levels. If the ceilings are lay-in acoustical tile, the tile should be glass fiber tile with a Noise Reduction Coefficient (NRC) of 0.80 or higher. Other alternatives are acoustical clouds, spray-on acoustical finish, or hanging baffles or banners. These options are as described above for the open plan office areas. The selected treatment should be applied to the entire ceilings areas of the Multipurpose Room, Meeting Rooms, and Exhibit Hall.

Emergency Generator Room Floor and Ceiling: The specific assembly for emergency generator noise control will be developed when the generator noise level is provided by the equipment supplier. It is expected that the approach for the ceiling assembly in the generator room will be comparable to two layers of 5/8" gypsum board, suspended on resilient hangers, with a 6"-thickness of glass fiber batt insulation above the gypsum board ceiling. This is a very preliminary recommendation, and will be further developed as design progresses and more information is available about the equipment planned for the generator room.

Open Plan Office Acoustical Design

The key acoustical elements for acoustical privacy in open plan office areas are workstation divider height, sound-absorbent ceilings, workstation orientation, acoustical wall treatments, and background noise level. It is understood from programming documents and project plans that the preferred approach for open plan areas is to group staff members to support and maintain group identities. Measures to optimize acoustical isolation within and between work groups are presented below.

Divider Height – The key acoustical element for workstation divider height is that the dividers break line of sight between workstations. If occupants have visual contact while seated, there will be essentially no acoustical isolation between workstations. The recommended divider height is a minimum of 60 inches, which is approximately 12 inches above typical seated ear height. If visual contact between workstations must be maintained, the upper section of the dividers can be plexiglass or other transparent material. This approach will also allow natural light penetration into the workstation office areas while maintaining a higher level of sound isolation. If the surface of the divider is sound absorbent, the divider will contribute to the overall sound control between workstations by minimizing reflections.

Sound Absorbent Ceilings – Ceilings are a major sound reflection path between workstations. The recommended approach to control reflected sound is to use glass fiber lay-in acoustical tile. The tile should have a Noise Reduction Coefficient (NRC) of 0.80 or higher. The workgroups in the current project plans are shown clustered together, with staff assembled in a team approach. An effective method for controlling ceiling reflections is to suspend sections of acoustical ceiling above each workgroup using acoustical lay-in tile as specified above. The ceiling sections, or "clouds", will serve to control sound reflections between workgroups, as well as define each work group area with the individual ceiling elements. For additional sound control, the deck above the cloud areas can be treated with a spray-on acoustical treatment, such as "K-13", manufactured by International Cellulose. The material is available in black and other dark colors, to minimize visibility of the material above the ceiling lights and acoustical clouds.

Workstation Orientation – Workstation orientation is an important element for controlling line of sight, and therefore acoustical isolation, between workstations. Occupants sharing the same work areas are effectively in the same room, with no acoustical isolation between workstations. If additional privacy is required, the workstations must be oriented so that dividers isolate individuals and workstation openings are not directly in line between work spaces. In the current project plan, it appears that workgroups will be clustered in groups of two to four individuals that will effectively be in the same acoustical space. It is important to recognize that phone calls, conversation, and all other activities will be clearly audible to others within the same four-person work space. It is important to have effective divider height between the work groups, and to orient occupants to optimize isolation if a higher level of privacy is preferred.

Acoustical Wall Treatment – The most effective location for sound-absorbent wall material is directly in line with the workstation occupants while talking on the phone or speaking with co-workers. Workstation dividers that have a sound-absorbent finish should be located in workstation corners, and on other wide, flat surfaces that will otherwise reflect sound to adjacent workstations. The acoustical finishes can also provide a tackable surface, although the acoustical performance is effective only if the

acoustical surface is exposed. Workstation dividers can be obtained that include sound-absorbent finishes to optimize sound control within the workstations.

Background Noise Level – A low background noise level, although often preferred in the workplace, can be detrimental to acoustical privacy in an open plan work space. A low noise level allows all other sounds to be more easily heard, including speech and other activities in adjacent spaces.

The use of a sound masking system is an effective method for increasing the background noise level to improve acoustical privacy. The system is designed to introduce noise that is optimized to reduce distraction for neighboring office staff, and to maintain a degree of privacy in closely separated conversations. The system uses loudspeakers above a suspended ceiling, or near the deck of an open ceiling, to distribute carefully balanced and equalized broadband noise throughout the open plan area. The masking system noise is adjusted in both loudness and spectrum to avoid being intrusive or distracting in itself, while still allowing normal conversations between co-workers within the same work group.

Sound masking is a very effective method for optimizing acoustical privacy, and is recommended for consideration at the Mary Lowell Center, particularly for occupants concerned with acoustical isolation.

Mechanical System Noise Control

The primary noise sources in a conventional mechanical system are air handling units, fans, chillers and other equipment used to condition or distribute air. The proposed combination of natural ventilation and hydronic radiant heating will minimize the noise producing equipment in the system, and therefore noise control requirements will also be minimized.

The mechanical system noise control measures that are currently anticipated include the possible need for silencers on the system fans planned for the facility, boiler vibration and airborne noise isolation, and acoustically lined transfer elbows on supply registers in rooms with underfloor ventilation systems. Areas that are mechanically ventilated using ducts may require acoustically lined ductwork to control fan noise.

The mechanical system noise control will be developed as design progresses, using acoustical design criteria as indicated in Table G-2 above.

-End of Narrative-

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