

# ACOUSTICAL CONSIDERATIONS FOR DESIGN-BUILD MENTAL AND BEHAVIOURAL HEALTHCARE FACILITIES

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## 1 Introduction

The links between acoustics and the health and wellbeing of the general population in hospital are well known. Evidence suggests that acoustical conditions play an important role in patient health, such that positive “soundscapes” assist with the recovery process (healing and therapeutic) while poor acoustical conditions can cause irritability, anxiety, stress-related conditions as well as lower immune systems.

However, mental or behavioural healthcare has a varied occurrence, with patients that exhibit a range of conditions, capabilities, healthcare requirements and experiences usually not seen in mainstream healthcare. These symptoms do not always necessarily equate to the “norm” and the patient population is typically very vulnerable, with a low tolerance to stressors. Depression, anxiety, behavioral or personality disorders as well as abusive or chaotic tendencies factor into their healthcare requirements. In some cases, noise or even particular sounds may play some role or act as a trigger to some symptoms.

At this time, typical healthcare acoustic design standards for more mainstream facilities in Canada include CSA Z8000<sup>[1]</sup>, the FGI Guidelines for Health Care Facilities<sup>[2]</sup> or the ASHRAE Handbook<sup>[3]</sup>. These design standards or guidelines establish requirements for sound isolation, both for respite care and patient privacy, acoustical comfort and the underlying background sound levels. In general, the design standards can be considered appropriate for the promotion of health and well-being in mainstream healthcare buildings, ensuring patients can recover from or be treated for any serious illnesses without the risk of undue disturbance.

However, within mental or behavioural healthcare facilities, unduly quiet acoustical conditions can lead to a feeling of isolation or loneliness. Similarly, high levels of sound isolation can lead to patient agitation or healthcare staff not being able to adequately hear patients who are in a state of distress or self-harming. Patient responses within mental or behavioural healthcare facilities can be very different to those in mainstream healthcare facilities and the potential heightened response to various triggers, as well as the low tolerance of external conditions can be challenging to the usual well-rehearsed acoustical treatments, acousticians are accustomed to.

## 2 Treatment Spaces and Acoustical Needs

The acoustical needs for mental or behavioural healthcare facilities need to include a wide range of acoustical

treatments, all of which have different solutions. Examples of the various units and treatments include the following:

### 2.1 Emergency or Crisis Treatment Units

Emergency psychiatric units are inherently noisy and active places. They often include high stress situations with high intensity activities and raised voices. The requirement for abuse-resistant finishes within common and private spaces is an over-arching design feature, but the units also typically include secure-rooms, de-escalation spaces, nurse care stations and consultation rooms, where the control of reverberant sound enables a more calming acoustic environment and patient privacy.

The surface weight of abuse-resistant (or high-core density) drywall assemblies often results in the need for loadbearing steel stud arrangements. While 18-20ga steel studs offer increased load capabilities, the reduction in sound isolation characteristics can result in both increased costs and loss of floor space in order to accommodate additional gypsum board linings or the inclusion of resilient channels to achieve acoustical separation. However, the use of wide flange or stiffened ridge stud systems, such as the Bailey Platinum steel stud systems, can offer increased load capacities without unduly compromising the sound isolation characteristics offered by non-loadbearing studs.

The control reverberant sound, both in open and cellular spaces relies on durability as well as absorption properties. Slatted-wood or wood-wool panels with concealed fibreglass or non-fibrous duct liners offer cost-effective alternatives to backloaded or security-locked drop-in ceiling panels. The use of recycled PET felt panels are also a cost-affective alternate to absorptive compressed fibreglass wall panels.

The use of secure rooms is routine in such units and maintaining high levels of sound isolation is often a requirement, so that other patients do not become disrupted by the noises emanating from the room. The use of double-leaf masonry walls or concrete wall constructions with an independently furred drywall lining with batt insulation, resilient floors and ceiling assemblies, with padded wall linings are commonplace, with access through a lobbied door anteroom with a fully gasketed outer door to maintain acoustical privacy to adjacencies and corridors.

### 2.2 Child and Adolescent Mental Health Units

Child and Adolescent units consist of many different uses, from individual to group counselling rooms, recreational and sporting activities, study and work rooms as well as residential bedrooms and welfare spaces. The acoustic requirements often dictate enhanced levels of sound isolation, promotion of calming spaces and a careful mix of low

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background levels in some spaces with higher sound levels in other areas to maintain speech privacy by sound masking.

During a recent project, healthcare staff within a proposed adolescent unit indicated that the main safety concerns related to both concealment, either of prescription medication or items that could be used for self-harming, and patients barricading themselves into room-spaces.

While a number of the acoustical treatments are readily replicated from Emergency and Crisis units, the design of residential bedrooms, nurse stations and activity rooms require further consideration to avoid the safety concerns.

Project specifications typically require standard speech privacy between circulation spaces and residential bedrooms. Additionally, bedrooms have to incorporate a 2-way door mechanism to prevent barricading with ligature-free fixtures. While “wicket door” systems offer many advantages, the relative cost per door is high. Also, some Health Authorities express a desire to have secondary narrow door mounted within the same frame in a double-egress configuration to allow for two-person intervention entries into bedrooms.

This configuration allows for a door stop so that standard bulb gasketing, albeit ligature-free with tear perforations, can be employed on the main door slab. However, due to issues with durability, door bottoms are not available with ligature free perforations and, therefore, traditional concealed mortised drop seals are required to maintain speech privacy.

While the ceilings will necessarily be formed from non-accessible gypsum, acoustical absorption can be provided by perforated gypsum panel systems with a textured spray finish, such as the CGC Ensemble, or from recycled PET felt panels, mounted as tack-boards as required.

Protective glazed nurse stations require a delicate balance of speech privacy so staff can discuss patient treatments or interventions, while allowing both visual and audio monitoring of the adjacencies. Wall mounted concealed microphones, can offer electronic audio connection to the adjacencies without adversely affecting staff privacy or unduly altering patients to the surveillance.

### 2.3 Continuing Care for Seniors

Residential care facilities for seniors often include integrated units for patients with dementia related symptoms, such as anxiety, confusion and disorientation, difficulty with communication and paranoia.

Sound, along with light, perception is known to be affected by dementia and can impair a patient’s ability to orientate themselves in any environment. High noise levels readily lead to stress reactions including confusion, increased heart rate and fatigue from over-stimulation. While, natural sounds, such as birdsong or water sounds, or familiar music can provide a helpful stimulation and facilitate recall.

In general, the control of background noise levels in Continuing Care facilities is important with an emphasis placed on minimizing the impact from medical emergency alarms, paging systems and mechanical systems. Water features within entry lobbies or centralized gardens off bedrooms can be used to offer useful masking sounds.

Acoustical design for seniors within the general population often underplays issues related to presbycusis, the cumulative effect of aging on hearing, which can change the patient’s ability to understand speech. However, it is even more important in dementia facilities, where reducing the impact of intruding noise allows for better comprehension, thus aiding understanding, and also improving privacy during treatments.

Common or dayrooms are often used for group activities that encourage participation with others through activities such as keep-fit, arts and crafts, group singing or dancing, and movie presentations. Reverberation control using both ceiling and wall treatments should be encouraged to achieve a reverberation time of less than a second wherever practicable in order to improve speech intelligibility and, thereby, inclusion into the group.

Patient bedrooms may also require specialist equipment for palliative or bariatric care. In such cases, the rooms typically require a higher density of penetrations for building or piped services, which can unduly affect the integrity of sound isolating assemblies or limit the incorporation of absorptive treatments. Careful detailing and selection of patient hoists is required to minimize noisy events which may agitate patients both in the room and within adjoining spaces.

As with adolescent care, double door-sets are often required in Continuing Care facilities for patient interventions. Such doors limit the potential for gasketing to provide adequate sound privacy. However, slightly increasing the sound levels within the corridors with colored noise to maintain steady background sound conditions helps to mask noisy activities and, thereby, minimize awakenings.

## 3 Conclusion

While solutions for acoustical treatment in mainstream healthcare are well-rehearsed and typically adequate for the patient population, the treatment of patients with mental or behavioural conditions often requires greater care and detailed consideration.

The welfare and safety of both patients and healthcare providers is critical in such facilities and treatments for sound isolation or reverberation control have to be selected not only for their acoustic adequacy but also to reflect patient needs or characteristics. Acousticians and other design professionals must engage with the healthcare providers to understand the needs and controls that are key to the success of a mental or behavioural healthcare facility so that they may include innovative and robust treatments to the benefit of the patients.

## References

- [1] CSA Z8000: Canadian Health Care Facilities – Planning, Design and Construction.
- [2] The Facility Guidelines Institute Sound & Vibration Design Guidelines for Health Care Facilities.
- [3] The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Handbook 2019 – HVAC Applications, Chapter 49: Noise and Vibration Control.