

ACOUSTIC CHALLENGES FOR THE PACIFIC AUTISM FAMILY CENTRE

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1 Introduction

Autism Spectrum Disorder (ASD), a neurodevelopmental condition impacting brain development, occurs in one in 68 children [1,2]. It is characterized by difficulties in communication (verbal and non-verbal), impaired social interactions, and restricted or repetitive behaviours [1,2]. The purpose of the Pacific Autism Family Centre is to provide a single location where children and young adults can access the wide range of medical personnel and service providers required, and their families can find support. It is also meant to provide support to people researching ASD. This paper discusses the acoustic design of this facility, and compares some of the differences with more standard schools and healthcare facilities.

2 Project description

This building is foremost for children, teenagers and young adults, however, it is also meant to provide support to families of children with ASD, as well as provide space to further ASD research. The floor area of the building is approximately 5500 square meters, which is split over three levels. It is located ~500m from the end of the south runway at the Vancouver International Airport, with the courtyards / play areas backing onto the Fraser River.

A large range of rooms are provided, including:

- educational spaces, e.g. group learning, music rooms, library, cafeteria and a gym/multipurpose room;
- healthcare spaces, e.g. assessment and consulting rooms, dental rooms;
- life skill spaces, e.g. activity areas, social lounge, 'digital' classroom, life skills living area (similar to an apartment, with living room, kitchen and washroom); and
- research spaces, offices, and observation rooms.

There are also a number of rooms provided specifically for people with ASD. Some examples are provided in Section 5, including 'Calm/Meeting' rooms. These are typically smaller rooms (~8 m²), meant for meetings with children and parents (sometimes with privacy requirements), and also as spaces where children can 'escape' to if they become over stimulated.

3 Project requirements

Specific acoustic criteria did not form part of the project requirements, rather, more broadly, the facility was to

incorporate sound absorbing finishes, have acoustically lined mechanical systems, and be acoustically insulated to avoid issues arising internally from aircraft noise.

Following discussions with the project team, certain rooms-spaces were identified as 'critical' (e.g. requiring a high level of sound isolation) from an acoustic perspective. A range of criteria were proposed to provide a sufficient level of sound isolation, and also to limit the internal ambient noise level and reverberation time based on these discussions, while considering the standards set out in standard school and healthcare guidelines (e.g. ANSI S12.60, UK Building Bulletin 93, The Facility Guidelines Institute Guidelines for Design and Construction of Hospitals and Outpatient Facilities).



Figure 1: The Pacific Autism Family Centre is located ~500m from the Vancouver International Airport.

4 Design approach

4.1 Controlling external noise

Noise measurements carried out at the project site confirmed the expectation that aircraft noise would dominate the exterior noise environment. It was observed that there was an increase of ~20 dB when an aircraft flew over the site. While the frequency of these events varied, during daytime hours, there typically was an event every 3 minutes, with a duration of approximately 30 seconds. The loudest hour was from 1PM – 2PM, when the outdoor L_{Aeq} was 70 dBA. The spectrum indicated a significant portion of the sound energy was at low frequencies, as expected for aircraft noise.

Multi-layer assemblies were selected for the roof and facades to provide a high level of sound isolation, particularly at lower frequencies, however, the overall performance was limited by the numerous windows throughout the building (Figure 1). A moderate-high performance glazing was selected for most spaces (6L-13-6L, STC42/OITC33). For spaces considered to be very

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noise sensitive (e.g. the calm rooms), a high performance glazing was selected (8L – 16 – 12L, STC48/OITC38). This particular glazing was also selected as it provided a good performance at the lower frequencies that dominated the external noise climate at this site.

It was challenging to accommodate this higher performance glazing since most window frames can only accommodate windows that are up to 25 mm deep (there is a limit on the low-frequency performance at this depth). Also, we learned during tendering that although the curtain wall framing selected for this project was able to accept the thicker acoustic glass (i.e. 36 mm), the doors and the opening windows could not and certain sections had to be downgraded to the STC42 option.

4.2 Reverberation control

Sound absorbing finishes were included throughout the building. Typically, they were in the form of acoustic t-bar ceilings, and carpeted floors. In keeping with the project requirements to limit stimulation and maintain a quiet and calm interior, where additional absorption was required, it was included more subtly, for example, by backing perforated and slotted wood with absorption (Figure 2 and Figure 3).

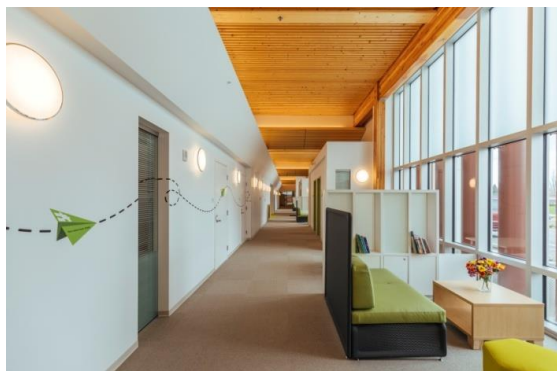


Figure 2: Slotted wood ceiling along corridor is backed with duct liner to provide acoustic absorption.



Figure 3: Perforated wood panels backed with duct liner on walls provide additional absorption in multi-purpose room.

4.3 Internal sound isolation

One of the primary drivers for internal sound isolation in this building was to ensure a reasonable level of privacy

between spaces. Areas requiring low, moderate, and high levels of sound isolation were identified at the beginning of the design, and recommendations were provided to meet these objectives. By having this information and being able to provide input early on in the project, later reviews were very simple and straightforward.

Unlike some hospital projects where it is not possible to have drop-down seals due to cleaning requirements, all clinical spaces that required privacy could have full door seals.

5 Spaces unique to PAFC

5.1 Calm rooms

Six Calm/Meeting Rooms are located throughout the building. One of the primary purposes of these rooms is to provide an escape for children, where they can retreat should they become agitated or upset. An example of a situation where this room could be used may be if a child is very upset and screaming, which could in turn upset other children: a teacher or assistant may accompany this child to a calm room where they take a moment on their own to relax. The calm rooms were also used for meetings, e.g. with parents. The driving acoustical requirements were therefore high sound isolation to i) provide a private room for the children to express themselves as they need to, and ii) have confidential discussions. Vision panels (a project requirement), doors, and walls were selected to provide the required sound isolation.

5.2 Apartment, life skills area

One goal of PAFC is to help teens and young adults transition to independent living. To assist with this, there is a Life Skills Living area, which is similar to an apartment (it includes a living area, kitchen, laundry, and full washroom/bath area). These spaces were designed to be similar to those found in a typical home. Following from this, a limited amount of acoustic treatment was provided to approximate more typical living conditions (e.g. carpeted floors and soft furnishings, but minimal ceiling treatment).

6 Conclusions

It was critical to understand the uses and purposes of the various spaces in this building to ensure appropriate acoustic environments were provided. This project had the additional challenge of being located close to a busy airport. Early feedback has indicated that the end users are pleased with the acoustic design.

References

- [1] Autism BC website <https://www.autismbc.ca/info/> [July 26, 2017]
- [2] Pacific Autism Family Centre website <http://pacificautismfamily.com/about-asd/> [July 26, 2017]