

## Résumé

Spécialisée dans les domaines architectural, environnemental et les vibrations, Atelier 7hz se fixe deux objectifs : l'excellence de son expertise et la fourniture de recommandations utiles et claires. Nous sommes en recherche permanente d'approfondissement à travers de nouvelles méthodes de mesure et de calcul mais aussi en recherche de nouveaux matériaux et de solutions innovantes.

**Mots clefs :** Architecture, Environnement, Vibrations, Acoustique des salles, Bruit solidien, Ferroviaire, Bruit des machines

## Abstract

In the environmental domain, Atelier 7hz is particularly specialized in acoustic impact studies for urban planning, structure-borne noise in buildings, vibrations transmission in the ground and railways. In architecture, we have extensive experience in building studies as a whole and room acoustics optimization. We also design solutions to control industrial noise and mechanical equipment. Already backed by our multiple experiences, we are constantly looking to deepen our knowledge through new methods of measurement and calculation but also looking for new quality materials and innovative solutions. Atelier 7hz set two goals: excellence in expertise and providing useful and clear recommendations.

**Keywords:** Architecture, Environment, Vibrations, Room Acoustics, Structure-borne Noise, Railway, Equipment Noise

## 1 The company

### 1.1 Excellence in expertise

Our experts developed their expertise over multiple experiences in several business sectors. Interacting with other related specialties and the desire to provide an excellent service for our customers enables us to adapt to all types of projects and work organization. Our acoustic and vibration recommendations are designed to reach the original objectives set-up in the beginning of the project with the client. The solutions we present are always combined with a predictable acoustic performance and a cost-estimate. We are renowned for the clarity of our recommendations through understandable and ergonomic detailed reports and explanatory diagrams and sketches.

### 1.2 Method

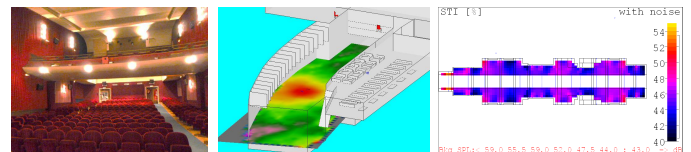
To ensure that our clients and our team have the same level of information, we offer the creation of a web interface dedicated to each project. Project monitoring is facilitated and it is possible at any time to inquire about its progress. We can join work teams, integrate design or intervene at the client's request in any projects. The satisfaction of our customers is then systematically achieved. Our extensive experience of the different instrumentations available allows us to choose adapted measurement tools for each project. We also use the latest simulation software, calculation codes and develop our own software tools (Scilab). If needed, we partner with other acoustic firms to pool our tools and resources.

## 2 Expertise

### 2.1 Architecture

Our experience in architectural projects allows us to consider all acoustic and vibration components based on the type of comfort desired by the client. We recommend studying the project as a whole to avoid heavy and expensive countermeasures after the project's end. We also offer a systematic program of inspections during construction to verify compliance with our recommendations but also acoustic and vibration performance measurements after construction (AHC, ASTC, NC).

**Institutional and Cultural Projects:** This type of project often involves large interior spaces where room acoustics is a major issue. The shape, size and organization of space and materials must be defined at first in agreement with the other disciplines involved in the project. Then, various acoustic criteria (TR60, H%, EDT, D50, C80, STI, G, LEV, etc.) are selected to be optimized.



**Figure 1:** Room acoustic study and PA system design

The analyzing methods we use to design the room acoustics of auditoriums and theaters are based on our experts' experience helped by numerical calculations and 3D modeling of acoustic spaces. Noise control of mechanical

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and stage equipment and sound insulation between different areas also require careful study.

**Residential and commercial projects:** We offer the study of residential and commercial projects through four optimization phases: interior insulation, building envelope acoustic insulation, noise and vibration of mechanical equipment, plumbing and electricity. Thus, every detail of the project is taken into account. We work during scoping meetings in consultation with project's stakeholders but also using drawings, plans and layouts of the different disciplines. Mechanical equipment noise is also assessed to ensure noise comfort.



Figure 2: Residential projects

**Open plan offices:** Controlling acoustics in open plan offices constantly requires a compromise between noise level and reverberation time in the area. A balance between acoustic comfort and acoustic privacy must be found. Sound masking devices can be implemented if found appropriate.

## 2.2 Transportation and Environment

**Transportation:** Our expertise in the field of environmental noise is not limited to the design of noise barriers, buffer zones and facade acoustic insulation recommendations to protect sensitive areas. Although these solutions are effective, we still prefer, if possible, a comprehensive approach to urban planning and infrastructure buildings.

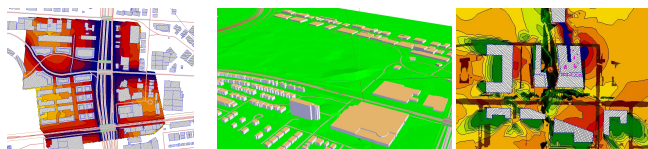


Figure 3: Environmental acoustic study

**Construction works:** We can deliver Noise Management Programs as requested by various Departments of the State. Because some activities can be very noisy and emit a lot of vibration (foundations pile driving, steamroller, trucks, etc.), monitoring levels during construction works can also be carried out for noise and vibration.

## 2.3 Industrial sites and Noise exposure at work

Controlling noise machines is crucial to limit the environmental noise pollution and noise exposure at work. Thus, our experts can design specific solutions based on the characterization of measures to reduce engine noise (enclosure, walls, acoustic treatment, etc.) and fans (acoustic louvers, silencers, etc.). In workshops, the respect of noise exposure limits is essential to ensure the good hearing health of workers.

## 3 In-depth studies

**Railway structureborne noise:** We have extensive experience in the railway field. We can for example perform

acoustic and vibration impact studies and participate in the design of the railway track type to limit vibration transmission and structureborne noise emission. We can also work on the rolling noise reduction (rail roughness, dynamic absorbers, etc.).

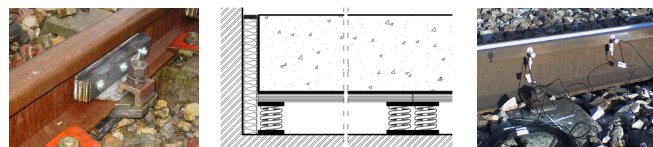


Figure 4: Railway noise and vibration mitigation

**Groundborne vibrations:** To be able to predict in advance vibration levels emitted in the environment, it is important to characterize the vibration sources (trains, construction equipment, etc.). We use the inverse method to measure the force injected into the ground by vibration sources. Thus, vibration measurements are taken at different distances from the real source and with a calibrated source of vibration. We also assess the vibration level decreasing in the ground at a particular site taking into account the soil composition. Assessing the transfer function of foundation vibration levels and structure-borne sound is useful predict the audible structure-borne noise in a building.

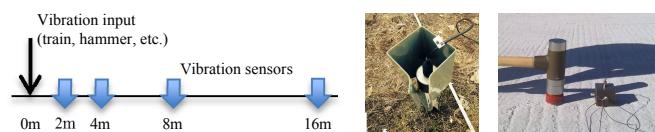


Figure 4: Ground-borne vibration decrease

**Soundscape and auralization:** We have developed our own tool for creating soundscape to offer our customers a comparative listening of the foreseeable impact of the various proposed solutions. This decision support tool is very useful and often saves valuable time.

**Simplified measurement tool development:** Our constant search for efficiency and an effort to reduce costs regularly brings us to question our methods. In particular, some measurement campaigns require the use of heavy and bulky equipment often difficult and expensive to implement. Thus, using new technologies and increasingly sophisticated tools available to the general public enables a reinvention and a simplification of our measurement methods.

## 4 Company and team projects

**Company projects:** Sciences complex, Outremont Campus, University of Montreal, Peterson Condominiums, Coopérative Griffin, "La Presse" press room, Wentworth Nord Biathlon Club, Provigo Claremont-Groupe Maurice combined project, Le Beaumont Condominiums, City Hall of Montreal, Auditorium of Air Canada head office, Montreal « Bain St-Michel » theater, St-Amable Hotel.

**Teams past projects:** Urban planning of the former Montreal's racetrack (Blue Bonnets), Jean Coutu head office, Campus Agropur, East line of Algiers tramway (acoustic et vibration impact), Line 8 of Paris Metro (acoustic et vibration impact), RATP bus workshop.