

# DOWNTOWN MONTREAL NOISE CONTROL – CHALLENGES ON THE RISE WITH MIXITY AND URBAN DENSITY

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## 1. INTRODUCTION

Cities consist of a large urban mix where different human activities coexist. Housing can be found next to stores and transports, schools and hospitals, industrial facilities and service firms, leisure and tourism activities. During the day and at night, part of the city is sleeping while the other works or relaxes. Keeping harmonious local noise situations is beneficial to all inhabitants. Today, the accumulation of different ways of life leads local authorities to elaborate new policies for the management of noise pollution. Also, a new concept relative to the measurement of sound levels in several synchronized points has come out. Adapting metrology to this concept leads to innovative quantifying of urban noise events, for a better knowledge of the noise situation. For a very concrete illustration of the various operating steps addressed in this approach, this paper presents typical situations in the Ville Marie borough of the city of Montreal (all dB levels expressed are in Leq fast, i.e. RMS averages).

## 2. INNER CITY NOISECONTROL

### 2.1 Caseload overview

Bedrooms only 40m away from massive air conditioning units blaring 90 dBA each, resulting in 65 dBA exposure versus an authorized 40 dBA limit; sub bass from an outdoor party traversing brick and stone walls into a condo 200m away; business owners buying overly powerful and noisy ventilation systems from sellers unaware of noise limits; another bedroom 50m away from a 100 000 Watt sound system inside an after-hours nightclub; an entire touristic neighbourhood haunted by a fluctuating whistle tone coming from a dust filled muffler half a kilometre away, etc. All these problems are solvable once the noisy party has been shown clear evidence they're above municipally authorized limits.

### 2.1 Helped by technology

With the evolution of integrating sound level meters and spectrum analyzers we can pinpoint which frequency range needs to be reduced by how many decibels instead of simply divulging global levels. Firms like Acoustilog in New York City have inspired us to equip ourselves with high quality calibrated wave recorders that we can use for proof in court.

All-in-one devices have started to appear, such as DUO smart noise monitoring which has the calibrated recording feature, as well as a GPS and modem for remote control. One of the big differences to other systems is that 01dB designed DUO for unattended noise measurement outdoor, including a number of very unique features like waterproof microphone, automated system check (based on the CIC principle) and full compliance with the IEC 61672-1 standard for class 1 sound level meter, on both 0° and 90° of source incidence [1].

## 3. EXAMPLES OF PRACTICE

### 3.1 More fear than harm

A plaintiff was certain that his upstairs neighbours were using a rotating press machine all night because a bass tone was audible and structurally transmitted in the wall. Finally it was a dryer on four legs with a tool case over it that was backed to the wall, transmitting the frequency of 63 Hz all the way down to the plaintiff's apartment.

Another such case involved a tabletop ventilator placed on a wobbly wood table about 1' by 2' with two foldable U-shaped legs. Two tones at 31.5 and 100 Hz were transmitted into the apartment downstairs and although the plaintiffs urged the Ville Marie noise control department to call the police and emit warnings by bailiff, a technician went upstairs and sat the shaky table on a 1 inch thick Styrofoam baseplate and the problem was instantly solved. The reduction was 15 dBZ at 31.5 Hz and 23 dBZ at 100 Hz.

### 3.2 Discotheque soundproof diagnostics

The borough was asked by the police department to confirm soundproofing of a new 3000 person capacity nightclub before the liquor board could deliver its alcohol permit. It is located 200 m away from existing and proposed condo buildings. Before the club completed soundproofing we measured 15 dBZ emergences at 63 Hz (i.e. kick drum or boom frequency), even after attenuating the 18 cardioid subwoofers which had rendered the sound quality mediocre.

Even though there was only 1 dBA emergence at 180 m away, the musical thump was still audible and we measured an 8 dBC emergence (74.7 dBC with music and 66.8 without). Every time a bus or train passed the level at 50Hz shot up to 86 dBZ from 56 dBZ so care was taken to not integrate these.

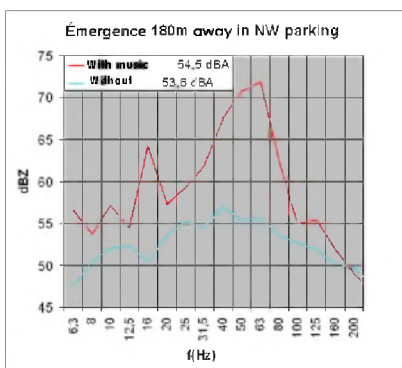


Figure 1. Bass emergence levels 180m away from club (95 dBA global and 106 dBZ at 63 Hz inside)

We monitored inner and outer noise levels with two DUO systems on six channels: dBA, lin and third octaves 40, 50, 63 and 80 Hz, while repeating the same house music loop. Then further soundproofing was done and emergence levels dropped to 0 dBZ at 60 Hz with a remaining 10 dBZ at 50 Hz that was inaudible. No variations in dBA were observed with music on or off, and only 3 dBC varied:

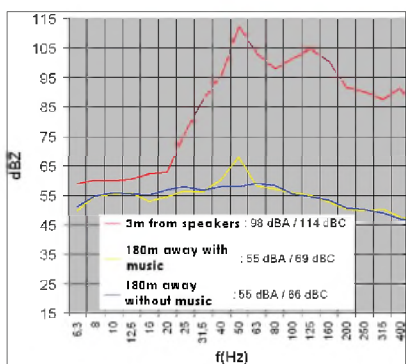


Figure 2. Emergence levels after final soundproofing

The club's sound system has been set to Montreal's 98 dBA noise limit at minimum 3m from speakers or musical instruments. No noise complaints have ever been registered towards the nightclub after several months of operation.

### 3.3 Outdoor music festival monitoring

We have put the DUO technology to good use by placing several instruments in strategic positions between dwellings and festival sites involving amplified music and pyrotechnics. Standalone remote controlled waterproof units with modems, GPS, manual and triggered wave recording, direct audio and SMS warnings thus greatly helped efficiently collecting & processing all relevant information.

The department received a complaint about bass tones from an outdoor dance party that were infiltrating a condo unit. The meters used by the sound and lighting company had no spectrum analyzers and from what their sound technicians and engineers could measure, levels were within the 80 dBA

/ 100 dBC authorized limits at 35m from speakers. However when a noise control technician did a spectrum analysis between the speakers and the plaintiff's residence west of them, he noticed as much energy at 50Hz (100 dBZ) as directly in front of the speakers, although the global level was 9 dBA lower (79 vs 88). He reported this to the sound engineer who realized that the vertical subwoofers had been laid to the side, thus sending off the bass tones laterally.

During a summer festival, one of the neighbouring residents complained about bass pulses reaching his bedroom, where the energy level in the 63 Hz octave was 5 dBZ over NR curve 55 that covered the rest of the spectrum. The Ville Marie noise control department had that reduced by the sound engineer without any audible difference at the site of the party. The department also saw much variation in the high frequencies, due to insufficient compression or limiting of a percussive instrument. The sound engineer quickly remedied this problem as well. The department's actions increased the quality of the sound instead of simply lowering the master volume and frustrating the organisers and clients. Everyone was happy, especially the plaintiff.

## 4. DISCUSSION AND CONCLUSIONS

Although the limits are expressed in dBA, pure tones between 22 and 11 314 Hz warrant a 5 dBA penalty as do impulsivity and speech transmission. In some cases emergences are calculated with L95% levels in order to eliminate parasite noises like traffic and animal noises (especially dogs and birds). And even though technology helps (definitely DUO smart noise monitors bring much more flexibility than any other classical instruments previously used in similar situations), a lot of what the Ville Marie noise control department does involves mediation and dealing with human tolerance, perception and expectations.

## REFERENCES & ACKNOWLEDGEMENTS

- [1] IEC 61672-1 2002-05 "Electroacoustics-sound level meters – part 1: Specifications"
- [2] 01dB, a brand of ACOEM: "DUO Brochure - COM1002 Rev B" – May 2012
- [3] Certificat d'examen de type LNE-21674 (21 juillet 2011) delivered by LNE (Laboratoire National d'Essais), France
- [4] PTB-1.63-4052726 delivered the 6th February 2012 by PTB (Physikalisch-Technische Bundesanstalt), Germany
- [5] Zulassungszertifikat CH-A3-12096-00 (20<sup>th</sup> February 2012) by Bundesamt für Metrologie METAS, Switzerland.
- [6] Ordonnance nr.2 – Règlement 4996 sur le Bruit « Ordonnance sur le Bruit dans les lieux habités », 8 Juin 1977, Montréal

*DUO is the first and single sound level meter approved in France [3], in Germany [4] and in Switzerland [5] with both reference directions 0° and 90°.*