

APPLICATION OF DOW-QUASH TO LIMITING COMMUNITY NOISE

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1 INTRODUCTION

Annoyance with community noise occurs in all degrees of severity and in all contexts (rural, urban, etc). The degree of annoyance can usually be anticipated based on familiarity with “average hearing” of the “typical” human listener. Yet there are occasions where an individual claims, for example, sleep disturbance when experience suggests that there is no obvious reason for this to be occurring. With regard to potential noise mitigation the task is then first to assess the disturbance claim, and, if deemed valid, develop feasible solutions. This paper outlines the application of a relatively new noise control product to provide a “path”-based solution (as opposed to treating the noise “at-source” or “at-receiver”).

In the current study the human noise disturbance issue was complicated by the presence of a peregrine falcon: the falcon’s nest was in the immediate proximity of where one of the most-feasible noise mitigation options would normally be installed. Noise was not deemed a concern with regard to the falcon: the falcon had been returning annually to this location immediately adjacent to the offending noise source for many years and had regularly produced offspring without any apparent detrimental effect due to noise. Of great concern was whether relocating the falcon’s nest would upset its behavioral patterns, including producing offspring. (The peregrine falcon is considered an endangered species and as such is protected by law.)

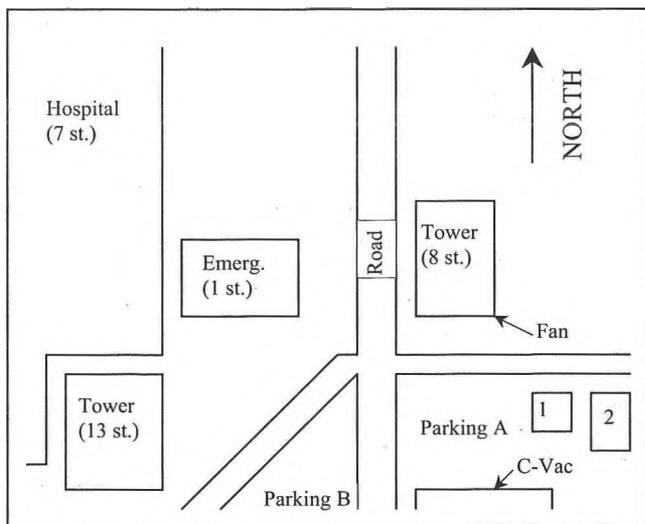


Figure 1 – Area Plot Plan

Figure 1 shows a macroscopic view of the study area. Of note are the large teaching Hospital, the 13-storey research tower with mechanical penthouse, a central-vacuum outlet recessed in a loading dock in close proximity to the noise-affected Residence and the restaurant exhaust fan. In the quietest night-time hours traffic flows on the Roadway typically reduced to one vehicle pass-by every minute or so. The Hospital had a major roof-mounted noise source (exhaust unit) on its south wing which was significantly shielded from the noise-affected Residence (Fig. 1, “2”) by the Research Tower. The Hospital also had numerous additional ventilation intakes and outlets on the upper storey of its east face as well as its Emergency ward at grade on the east side. The central vacuum system of the south high-rise did not stop at the same time each night; it had a generally low-frequency signal that was clearly audible across the Parking Lot. The Restaurant exhaust fan on the north high-rise was mounted at essentially the height of the second floor and initially ran continuously.

Figure 2 indicates the position of the falcon’s nest relative to the Research Tower’s exhaust-fan outlet louvres.

2 MEASUREMENT PROGRAM, RESULTS

Three separate sets of night-time measurements were conducted. The first involved logging the 1/3-octave and broadband sound levels in 30-second intervals for an entire night-time. In addition, localized spot measurements were conducted at other nearby noise sources. This effectively verified that the primary noise offender was a series of east-facing exhaust fans atop the Research Tower, all other candidate noise sources being masked by other area noise sources. Surprisingly, while the central-vacuum was intuitively suspected as a key noise-offender, the Complainant ruled this out: it had been suspected that the *cessation* of this noise source was resulting in a change of noise climate to the degree of waking the Complainant.

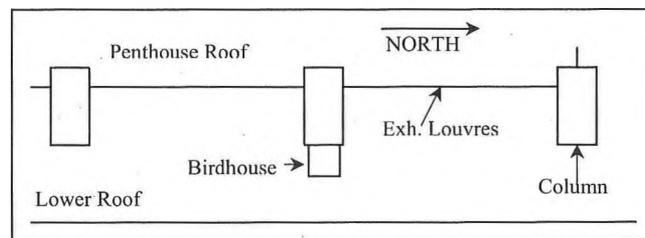


Figure 2 – Penthouse Area (Plan)

The second and third measurement sets involved short-term 1/3-octave sound level logging while ALL penthouse noise sources atop the Research Tower were progressively shut off and returned to normal operation. One such round was measured on the upper-most level of Parking "B" (Figure 1), the final set being measured near the eastern edge of Parking "A". The measurements atop Parking "B" confirmed the Penthouse noise sources as the primary noise offender, while those on Parking "A" were done to assess the noise impact relative to the City Noise Bylaw. These latter measurements indicated a resultant sound level of 51 dBA while all penthouse noise sources were running and a nominal 47 dBA with all Penthouse noise source shut off. Given the relative distances involved, it was determined that the Penthouse noise sources just met the City Bylaw allowable sound level of 50 dBA at the residential property line. Thus the options available to the Owner of the Research Tower were to (a) indicate to the noise-affected Resident that further action was not required or (b) implement some degree of noise mitigation despite not being required by law. The latter was chosen.

The upper (solid) line on Figure 3 indicates the 1/3-octave spectrum measured immediately near the Penthouse exhaust systems on the Research Tower. There is a local maximum centered on the 800Hz and 1000Hz bands. The second trace (dashed) on Figure 3 is the combined effect of all Penthouse noise sources in operation, as measured on Parking "A". It is evident that the local maximum was still evident. The lowest (dotted) trace is the spectrum with all Penthouse noise sources off.

3 NOISE-CONTROL TREATMENT

The optional treatments were (1) mitigation at source by means of re-configuring the ductwork, introducing silencers and possibly obtaining a lower-noise type of exhaust fan and (2) constructing a noise shield externally in front of the set of exhaust louvres.

Several considerations covering relative costs, relative effectiveness for noise reduction, and the impact on the falcon played into the decision-making. It was considered that re-configuring the ductwork-and-exhaust-fans within the Penthouse could run as much as two-to-three times the expense of constructing a noise-shield. The advantage of re-configuring the exhaust systems was that it potentially could avoid any interference with the falcon and thus could be implemented without time restrictions. For the noise shield, while likely being less labor-intensive than the ductwork option, it would likely require relocating the bird-house or somehow integrating the birdhouse into the noise shield. There was concern that the "change-of-scenery" in the immediate vicinity of the bird-house could adversely affect the falcon in its nesting, feeding and parenting habits. Also,

it was deemed necessary to have a noise shield completed by 15-March, the usual time the falcon could be expected back. A relatively minor concern was that of visually integrating any new construction into older architecture directly exposed to public view. From the standpoint of noise control, it was deemed that either solution could provide the necessary degree of attenuation.

Mainly for reasons of cost, the Owner favored the noise-shield option. Therefore, a meeting was called between Building-staff, the acoustical consultant and a Provincial Wildlife biologist. It was determined that introduction of the noise shield and relocation of the bird-house would very likely *not* adversely affect the falcon. A detailed design for the wall was developed, submitted for approvals and subsequently built.

In this instance it would be quite feasible to construct a noise shield that provides barrier-type noise attenuation and forego any sound-absorbing lining. However, given the sensitivity that precipitated the study and the relatively small cost of adding the lining, it was decided to include a liner directly facing the exhaust-fan louvres. Traditionally, one would automatically opt for fibrous-based core material, usually wrapped in thin plastic to withstand effects of wind, water and winter and protected by expanded-metal mesh or, at minimum, wire mesh. However, since DOW-QUASH, a relatively new poly-ethylene based cellular product that provided maximum sound attenuation in the preferred frequency range, can be left directly exposed, it was determined to be the liner-of-choice.

Upon completion a follow-up visual inspection of the wall was done and a few spot measurements taken at grade. The noise reduction realized was a decrease for the "all systems on" condition by 4 dBA (from 51 to 47 dBA); thus the net sound level had been reduced to the "penthouse off" condition measured during earlier measurements. Subjectively, at Parking "A" it was necessary to listen intently to distinguish the exhaust-fans sound. Indications are that the falcon has continued its usual life-cycle patterns as though nothing has changed.

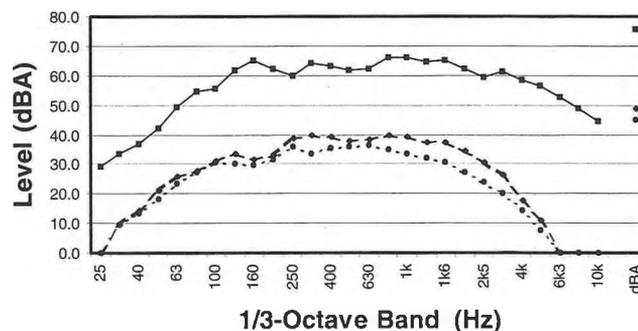


Figure 3 - 1/3-Octave Spectra