NOISE LEVELS IN PUBS AND NIGHTCLUBS IN VANCOUVER

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1. INTRODUCTION

As part of the application process for extended hours of operation, the City of Vancouver requires local pubs and nightclubs to demonstrate compliance with its Noise Control Bylaw No. 6555[1]. Since 2007, BKL Consultants Ltd. has provided this service to over 30 entertainment venues in Vancouver.

Part of the method used to establish a venue's contribution to the sound level at noise sensitive locations includes the installation of an overnight noise monitor inside the facility. Compliance with Vancouver's noise control bylaw is assessed both in terms of A-weighted and C-weighted sound levels. Measurement results in this summary paper are presented in terms of A-weighted equivalent sound levels for the purpose of comparing results with generally accepted occupational noise exposure criteria[2].

2. METHOD

Long-term noise monitoring (> 12 hour periods) was performed inside 30 entertainment venues. These venues consisted of nightclubs with live DJ's, pubs with live bands or DJ's and/or pubs playing music through a house sound-system. The primary intention of these measurements was to establish the maximum indoor sound levels received at a fixed microphone location inside a venue under test. Measurements were mostly conducted on Friday or Saturday evenings.

Safety of the measurement microphone (Brüel & Kjær Type 4189) and sound level meter (Brüel & Kjær Type 2250) often dictated the selected monitoring position inside the venues. Where possible, the measurement microphone was suspended from the ceiling above dance floors or near DJ booths.

3. RESULTS

The distribution of equivalent sound levels, L_{eq}'s, measured in all 30 entertainment venues is presented in the boxplot shown in Fig.1. Data is shown in groups of one hour periods between 20:00 – 02:00 hours. The distribution of the 8-hour equivalent sound levels ($L_{eq,8hr}$) measured in the entertainment venues is also shown in the far right group shown in Fig. 1. Median values (horizontal lines inside the boxes) range from 84 - 97 dBA. The lower quartile (Q1-lower horizontal lines) values range from 80 – 98 dBA while the upper quartile (Q3 - upper horizontal lines) values range from 90 – 102 dBA. The median $L_{eq,8hr}$ is 97 dBA. The lower and upper quartile $L_{eq,8hr}$ values range from 90 to 98 dBA, respectively.

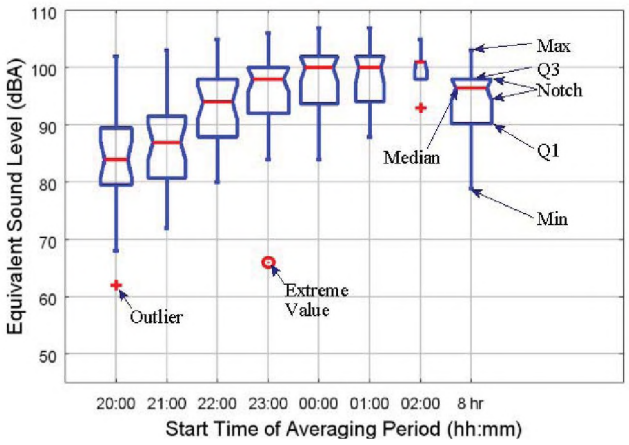

Fig. 1. Boxplot of equivalent sound levels (L_{eq}) by one hour time averaging periods between 20:00 – 02:00 hours and eight hour time averaging period (far right).

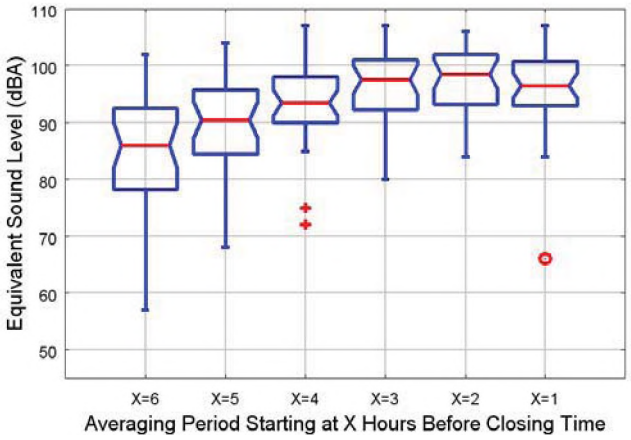

Fig. 2. Boxplot of one-hour equivalent sound levels ($L_{eq,1hr}$) by averaging periods starting at six hours before closing time continuing up to one hour before closing time.

The boxplot shown in Fig. 2 presents the distribution of equivalent sound levels for the complete data set in groups of one hour averaging time periods starting at six hours before closing time continuing up to one hour before closing time. Median values range from 86 – 99 dBA. The lower quartile and upper quartile values range from 78 – 93 dBA and 93 – 102 dBA, respectively.

4. DISCUSSION

The notches (defined by the horizontal V-shaped dips on either side of the boxes) shown in Figures 1 and 2 represent the median confidence interval. They can be used to visually assess whether the median $L_{eq,1hr}$ values between groups are significantly different (with 95% confidence). That is, if the notches between groups are not overlapping, then there is strong evidence that median values are significantly different. The notches of $L_{eq,1hr}$ values grouped at 20:00 - 21:00 hours in Fig. 1 do not overlap with the notches of groups at 22:00 – 02:00 hours. This indicates that median $L_{eq,1hr}$ values between groups at 20:00 and 21:00 hours are significantly different than median $L_{eq,1hr}$ values at later times in the evening. Further, $L_{eq,1hr}$ values grouped at 22:00 hours are significantly different than $L_{eq,1hr}$ values grouped at 00:00 hours. Given that the notches between groups at 23:00, 00:00, 01:00 and 02:00 hours are overlapping , and are barely overlapping with the notch at group 22:00, it is likely that the peak $L_{eq,1hr}$ occurs between 23:00 and 02:00 hours.

The boxplot shown in Fig.2 was presented in order to compare the distribution of measured $L_{eq,1hr}$ values accounting for different hours of operation. In comparison with Fig.1, median values in Fig. 2 are more closely placed in the centre of each box, indicating a more symmetric distribution. The median $L_{eq,1hr}$ values at groups X=6 and X=5 hours before closing time are significantly different than values at times approaching the final hour of operation. Further, $L_{eq,1hr}$ values at groups X=4 and X=2 hours before closing time are significantly different. Given that notches between groups X=3, X=2 and X=1 are overlapping, and are barely overlapping with the notch of group X=4, it is likely that the peak $L_{eq,1hr}$ occurs between one and three hours before closing time.

The boxplots in Figures 1 and 2 would indicate that median $L_{eq,1hr}$ values are tending to increase as the evening progresses. Due to the large amount of variation in this data set, it is difficult to conclude that $L_{eq,1hr}$ values between each group are significantly different from each other. The large variation in sound levels measured in the entertainment venues is likely caused by differences in the measurement microphone's distance to the sound sources, acoustic room influences on sound levels received at the microphone position, the type of audio equipment used and the venues' individual volume preference. The overall variation could have been reduced by categorizing the different types of venues. Due to the wide range of amplified activities going on at the assessed venues and the limited data set, this was not done.

The median $L_{eq,8hr}$ value of 97 dB is an indication that the potential risk for noise-induced hearing damage exists in these entertainment facilities, particularly for those who are in close proximity to DJ booths and/or nightclub dance floors for extended periods of time on a regular basis. The $L_{eq,8hr}$ presented here is not an accurate estimate of an individual's noise exposure as sound levels can vary greatly at different spatial locations inside the facilities.

REFERENCES

[1]City of Vancouver (2010). "Noise Control Bylaw No. 6555." (*vancouver.ca/**bylaws**/**6555**c.PDF)*
[2]ISO 1999:1990."Acoustics -- Determination of occupational noise exposure and estimation of noise-induced hearing impairment." (International Standards Organization, Geneva 1990)

ACKNOWLEDGEMENTS

The author would like to thank all the staff at BKL Consultants Ltd. and the open source developers of GNU Octave. Special thanks also to Ju Helen Wong, University of Manchester.

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