



May 26, 2016

File: 0205-16B

The University of British Columbia - Vancouver Campus
CIRS Building Rm 3331, 2260 West Mall
Vancouver, BC
V6T 1Z4

Attention: Aviva Savelson, MA, MCIP, RPP, Senior Policy Planner, Campus & Community Planning

Dear Aviva:

**Re: North Campus UBC Event Noise Guidelines
Acoustical Services**

1 - Background

The University of British Columbia (UBC) has commissioned BKL Consultants Ltd (BKL) to conduct a baseline noise survey, monitor sound levels and provide a report of the findings and recommendations of events which include the playing of amplified music within the academic boundaries of the university. The noise assessment has been initiated following concerns raised by local residents at the level of event noise from three venues within academic areas on the UBC Vancouver North Campus. The events include outdoor and indoor amplified noise and it is the intention to define operating guidelines and "best practice" recommendations for event organisers and operators of the venues in order to control noise at the nearby residential, sensitive receivers.

The three venues in the study area are identified below.

Venue	Peak Frequency of Events	Typical Noise Events	
		Outdoor	Indoor
Cecil Green Park House	More than 5 weddings per week	Weddings. No amplified music outside after 9PM. Patron noise.	Amplified sound equipment.

Venue	Peak Frequency of Events	Typical Noise Events	
		Outdoor	Indoor
Koerners Pub	Venue open six days per week with outdoor events occurring in the summer months	No amplified sound equipment after 1 AM.	Typical Pub noise including in-house amplified sound equipment.
Museum of Anthropology	Once per week	Weddings Funerals, Corporate Functions etc. that use amplified sound equipment. Music turned off by 12:30 AM.	None

It is our understanding that noise from Cecil Green Park House is related to patron noise, not amplified music, and therefore this report will not comment on this particular venue.

The UBC is responsible for land use policy and planning. As such, noise bylaws from Metro Vancouver or surrounding municipalities do not apply to the campus. The University Neighbourhoods Association (UNA) has a noise bylaw that applies to properties within designated areas on campus. However, the UNA bylaw is not applicable to the North Campus venues and, as such, there are no applicable noise guidelines. This report will review neighbouring municipalities noise bylaws, and other pertinent noise bylaws or ordinances, to provide recommendations on a noise management strategy consistent with neighbourhoods of a similar character and size.

2 - General Noise Theory

Noise is defined as unwanted sound. Human ears are able to respond to sound over the frequency range of about 20 Hz to 20 kHz and over the audible range of 0 dB (the threshold of perception) to 140 dB (the threshold of pain). The ear does not respond equally to different frequencies of the same magnitude, and is more responsive to mid-frequencies than to lower or higher frequencies. To quantify noise in a manner that approximates to the response of the human ear, a weighting mechanism is used. This reduces the importance of lower and higher frequencies, in a similar manner to the human ear. To help understand the range of noise levels which may be encountered, an indication of the level of some common sounds on the dBA scale is given in the table below:

Sound Level (dBA)	Description
140	Threshold of pain
120	Jet take-off at 50 metres
100	Chain-saw at 5 metres
80	Curbside of a busy urban highway
60	Busy general office

Sound Level (dBA)	Description
40	Residential area at night
20	Background noise level in a TV studio
0	Threshold of hearing

Furthermore, the perception of noise may be determined by a number of other factors, both acoustic and non-acoustic. In general, the impact of noise depends upon its level, the margin by which it exceeds the background or underlying level, its character and its variation over a given period of time. In addition, the time of day and other acoustic features such as tonality may be important, as may the disposition of the affected individual. Any assessment of noise should give due consideration to all of these factors when assessing the significance of a noise source.

The most widely used weighting mechanism that corresponds to the response of the human ear is the A-weighting scale. This is widely used for environmental noise measurement, and the levels are denoted as dBA or L_{Aeq} , L_{Amax} etc. according to the parameter being measured.

Similarly, the C-weighting scale can also be used to measure environmental noise. It puts a higher emphasis on the low frequency content of the sound, which the A-weighting tends to discount. Therefore, the C-weighting is often used to quantify noise such as music with a distinct bass component. These levels are denoted as dBC, L_{Ceq} or L_{Cmax} etc.

The decibel scale is logarithmic rather than linear, and hence a 3 dB increase in sound level represents a doubling of the sound energy present. Judgement of sound is subjective, but as a general guide a 10 dBA increase can be taken to represent a doubling of loudness, whilst an increase in the order of 3 dBA of a steady source is generally regarded as the minimum difference needed to perceive a change.

3 - Noise Survey Procedures

In order to gain a better understanding of the background noise climate at the UBC neighbourhood, BKL performed two long-term on-site measurements at Green College, located in the North Campus area, and "The Coast" strata building, located in Chancellor Place Neighbourhood, from March 31 to April 4, 2016. The purpose of these monitoring locations was to establish the typical background noise environment during the late evening and nighttime periods when residents may be resting or sleeping and, therefore, more likely to be disturbed by noisy events. Nighttime is normally defined as the hours between 10PM and 7AM the following morning. At Green College the windows were left open in a typical manner for summer ventilation.



Figure 1: Monitoring Location in the Principal's residence at Green College

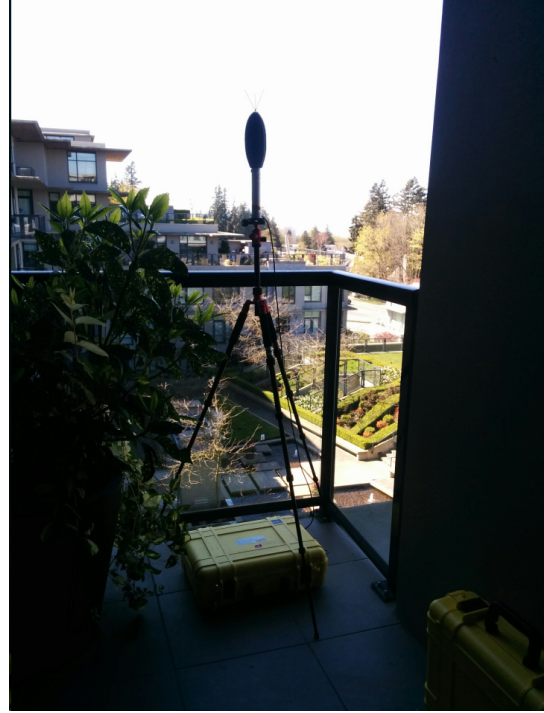


Figure 2: Monitoring Location in the Coast Strata

After setting up the long-term measurement sites, BKL undertook short-term measurements at both Koerners Pub and at the Museum of Anthropology on Thursday March 31st, 2016. A music amplification system was set up at each location that represented the typical system and location employed for outdoors events at each venue. All measurements were performed at a height of 1.5 metres above the ground using a precision sound level meter.

All noise measurements were undertaken by a consultant certified as competent in environmental noise monitoring, and, in accordance with the principles of ISO 1996-1:2003: *Acoustics - Description, measurement and assessment of environmental noise* and following the guidance given in American National Standard ANSI S1.13 - 2005 (R2010) *Measurement of Sound Pressure levels in Air*.

All acoustic measurement equipment used during the noise surveys conformed to Type 1 specification of American National Standard ANSI S1.4 - 1 - 2014, *Electroacoustics - Sound Level Meters - Part 1: Specifications*.

The meteorological conditions were considered conducive to environmental noise measurement, with warm, partially cloudy but still wind conditions throughout the survey period. The measurement locations are identified within Figure 3 below.

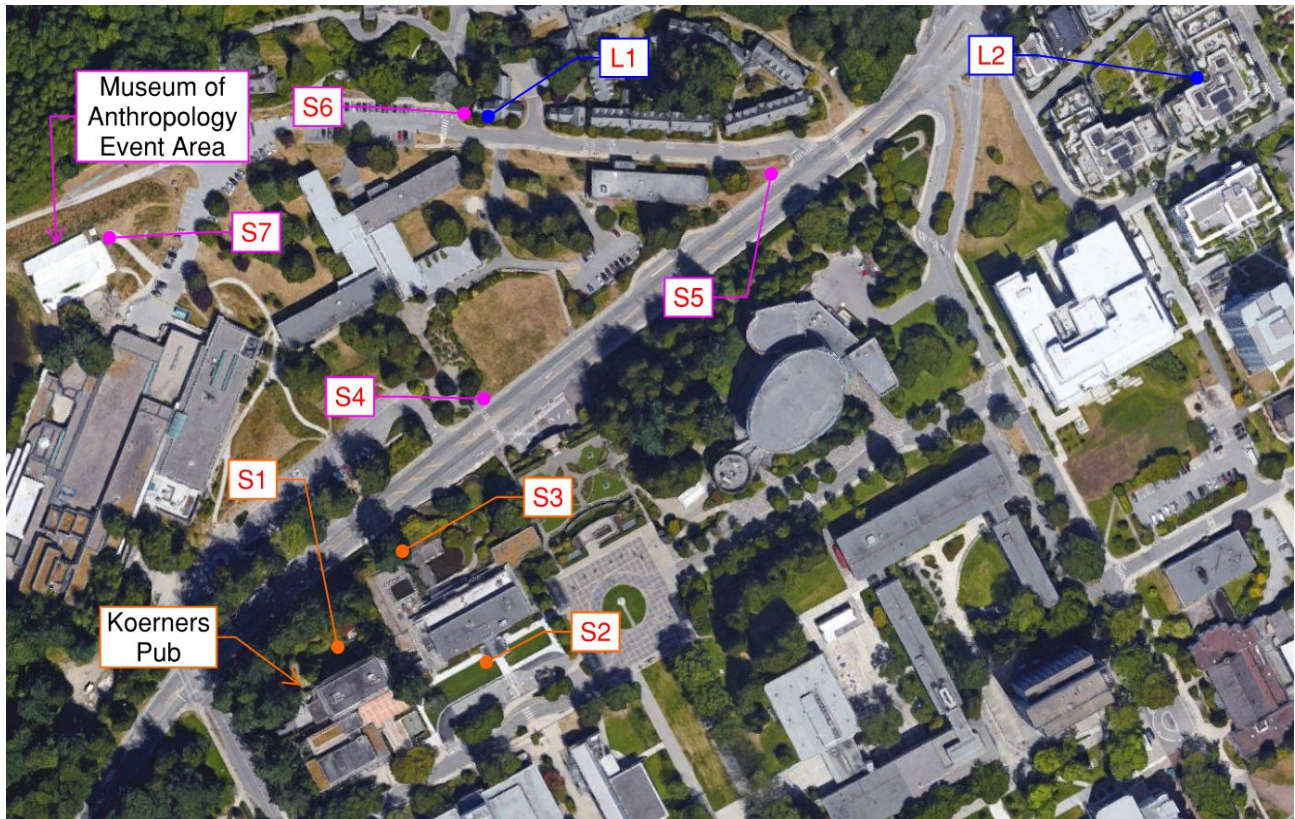


Figure 3: Noise Monitoring and Noise Event Locations

3.1 - Koerners Pub

The amplification system at Koerners Pub was positioned outside at the bottom of the patio steps pointed in, facing toward the pub façade. Measurements were made directly in front of the amplification system and at two nearby points of reception (Positions S1-S3 in the above Figure).

3.2 - Museum of Anthropology

The outdoor event area used for wedding events was equipped with an amplification system and typical base heavy music was played. Short-term measurements were made at four specific locations as shown in the above Figure (S4-S7).

4 - Measurement Results

4.1 - Long-Term Background Monitoring

The long-term monitors recorded the sound levels during the nighttime both on week days and weekends. Nighttime is normally defined as the hours between 10PM and 7AM the following day. The measurement results for the nighttime equivalent sound level (L_{eq}) on weekday and weekend are shown in the table below.

Monitoring Location	Monitoring Location	Measured Weekday Leq		Measured Weekend Leq	
		dBA	dB(C)	dBA	dB(C)
Green College	L1	34	46	32	45
The Coast	L2	48	55	47	55

Note that the monitor at the Coast was located on a balcony area outside an apartment and, therefore the relatively higher sound levels at this location are expected.

In order to evaluate the lowest nighttime noise environment at the two long-term monitoring locations, the quietest 15 min, slow time constant, equivalent sound level ($L_{Aeq,15min}$) during the weekend and weekday are presented in the table below.

Monitoring Location	Monitoring Location	Lowest Measured Weekday $L_{eq,15min}$		Lowest Measured Weekend $L_{eq,15min}$	
		dBA	dB(C)	dBA	dB(C)
Green College	L1	30	42	30	42
The Coast	L2	44	50	44	50

4.2 - Short-Term Monitoring of Event Noise

Monitoring was also performed on a short-term basis at various positions surrounding the event noise locations during the playing of amplified music. At the same time, the long-term monitors were recording at locations L1 and L2. The noise levels at the long and short-term monitoring locations during the event noise generation is shown below. For this set of measurements the speakers at the Museum of Anthropology were pointed westward, away from Green College.

Noise Event Location	Measurement Location	Microphone Position	Measured Equivalent Sound Level (Leq)	
			dBA	dBC
Koerners Pub	S1	Centre of stairs directly in front of sound system	90	101
	S2	South side of Peter Wall University Centre	57	75
	S3	North side of Peter Wall University Centre	66	84
	L1	Long-term monitor at Green College	36	52
	L2	Long-term monitor at the Coast	51*	59*
Museum of Anthropology	S4	North side of NW Marine Dr., opposite UBC Rose Garden	54	67
	S5	South walkway at intersection of Green Park Rd. and NW Marine Dr.	Not measurable	Not measurable
	S6	West of façade of principal's house at Green College	48	71
	S7	Top of gravel road at Museum fo Anthropology event area	77	91
	L1	Long-term monitor at Green College	41	56
	L2	Long-term monitor at the Coast	52*	60*

* Music was not audible upon review of measurement data

Measurement S6 and S7 were repeated twice, once with the speakers pointed westward as reported above, and once with them pointed eastward, toward Green College. The difference in sound level was louder by 6 dBA and 1 dBC when the speakers were directed toward the receiver for both monitoring locations. This difference can be applied to other monitoring positions assuming similar attenuating factors such as shielding and ground effect.

5 - Review of Noise Bylaws and Guidelines

In order to establish an understanding of the acceptability of noise from events consisting of amplified music, BKL has undertaken a review of both local and international noise bylaws, ordinances and guidelines to determine consensus opinion as to the best practical means of controlling noise to acceptable level for the general public.

Multiple noise bylaws and guidelines exist in surrounding municipalities to UBC which are presented below. These bylaws are considered to be of particular interest since they will allow greater consistency with the neighbouring municipalities within the lower mainland and will reflect similar local characteristics in both attitudes and expectations for noise control.

International standards and guidelines are also discussed as these can provide greater insight in noise assessment and other methods to manage event noise beyond the local interpretation .

Please note that the interpretation and parameters of noise intrusion vary depending on the period of the measurement, where the measurements are taken, and the time of measurement. The way in which the noise impact assessment is reported is also not agreed between municipalities, regions or countries. Consequently, BKL has necessarily adapted some of the bylaws, ordinances and guidelines to allow a greater level of comparison as part of the exercise.

5.1 - Municipal Standards and Guidance

The City of Vancouver noise bylaw (no. 6555) specifies a dual limit for noise emanating from, and received by an area depending on how the noise source and receiver are zoned. There are additional, overall limits for noise depending on the time of day and the source type (eg. an after hours night club playing bass heavy music). Some examples of the limits are shown in the table below.

The Burnaby Noise or Sound Abatement Bylaw (no. 1979) and the University Neighbourhoods Association Noise Control Bylaw also give a dual limits for continuous sound during the nighttime.

Finally, the Richmond City Noise Regulation Bylaw (no. 8856) gives very similar methods as the Vancouver City Bylaw, however it also specifies dBC noise levels that vary with the zone in which they are received.

Bylaw	Language	Notes
City of Van. Noise Bylaw (no. 6555), Clause 6A	<p>No person shall in an intermediate zone make, cause or permit to be made or caused, continuous sound, the sound level of which during the nighttime exceeds:</p> <ul style="list-style-type: none"> i) 65 on an approved sound meter when received at a point of reception within an ACTIVITY ZONE or an EVENT ZONE ii) 65 on an approved sound meter when received at a point of reception within an INTERMEDIATE ZONE iii) 50 on an approved sound meter when received at a point of reception within a QUIET ZONE 	<p>A point of reception is defined as:</p> <ul style="list-style-type: none"> (a) a point in a lane or street, adjacent to but outside of the property occupied by the recipient of the noise or sound, that represents the shortest distance between that property and the source of the noise or (b) where no lane, street, or other public property exists between the recipient and
City of Van. Noise Bylaw (no. 6555), Clause 11	<p>A person in any commercial premises must not make, cause, or permit to be made or caused continuous or non-continuous bass noise or bass sound ... whether amplified or not, the level of which... during the nighttime, exceeds a rating of 65 dBC (Leq) when measured on an approved sound meter for a period of three minutes at the point of reception.</p>	<p>the source, any point outside the property line of the real property from which the noise or sound emanates</p>

<p>Burnaby Noise or Sound Abatement Bylaw (no. 1979), Clause 6B</p>	<p>No person shall in a Commercial District, Industrial District, Comprehensive Development District, or Agricultural District make or cause or permit to be made or caused continuous noise or continuous sound, the noise or sound level of which exceeds:</p> <p>i) 60 dBA when measured at any point on the property line or within six (6) metres of the property line of the real property from which the said noise or continuous sound is emanating</p> <p>ii) 55 dBA when measured at any point on the boundary or within a Residential District, Public and Institutional District or Multiple Family Residential District</p>	
<p>University Neighbourhoods Association Noise Control Bylaw</p>	<p>No person shall Cause Continuous Sound the Sound Level of which:</p> <p>(a) during the Daytime exceeds a rating of 55 dBA or 70 dBC on an Approved Sound Meter when received at a Point of Reception; or</p> <p>(b) during the Nighttime exceeds a rating of 45 dBA or 65 dBC on an Approved Sound Meter when received at a Point of Reception.</p>	<p>A point of reception is defined as:</p> <p>(a) a point in a lane or a street, adjacent to but outside of the property occupied by the recipient of the Noise, that represents the shortest distance between that property and the source of the Noise; or</p> <p>(b) where no lane, street, or other public property exists between the recipient and the source, any point outside the property line of the real property from which the Noise emanates</p>
<p>Richmond City Noise Regulation Bylaw (no. 8856)</p>	<p>In an Intermediate Zone a person must not make, cause or permit to be made or caused any sound that has a rating level which during the nighttime exceeds:</p> <p>i) 50 dBA or 60 dBC when received at a point of reception in a Quiet Zone</p> <p>ii) 50 dBA or 60 dBC when the prescribed point of reception is outdoors or 55 dBC when the prescribed point of reception is indoors in an Intermediate Zone</p> <p>iii) 70 dBA or 80 dBC when received at a point of reception in an Activity Zone</p>	<p>A point of reception is defined as:</p> <p>A position within the property line of the real property occupied by the recipient of a sound that best represents the location at which that specific sound, emanating from another property, is received and the resulting disturbance experienced and is at least 1.2 m from the surface of the ground and any other sound reflecting surface.</p>

5.2 - International Standards and Guidance

Within the US, city and county administrations provide noise limits within ordinances (or codes) that apply on or at the boundary of complainants property. In general the approach to acceptable noise

limits follows the strategy set out in the US Environmental Protection Agency (EPA) Framework for Community Based Environmental Protection.

The City of Seattle and King County Noise Ordinance (Chapter 25.08) provides an exterior noise level limit of 47 dBA between the hours of 10PM and 9AM on weekends and legal holidays in residential areas when noise emanates from commercial areas. The Pierce County Noise Pollution Control Code (Chapter 8.76), which is applicable within the University of Washington neighbourhood, limits maximum permissible noise levels to 47 dBA between the hours of 10PM and 7AM on weekends and legal holidays in residential areas when noise emanates from commercial areas.

However, there are a few examples of ordinances, which permit higher noise limits for Friday and Saturday evenings, particularly in areas which contain a strong college presence or have "entertainment districts". The range of maximum permissible noise levels varies from 50-55 dBA in more densely populated areas or up to 60 dBA in "commercial" neighbourhoods although city ordinances predominantly maintain noise level limits of 45dBA during the nighttime period within residential areas.

Within the UK the noise guidance document sets out noise limits for facilities that play music past 11PM. This method uses a statistical analysis of the representative background noise environment above which the event noise is to not exceed. It also addresses the bass components of the event noise through a limit on the event noise between certain $\frac{1}{3}$ rd octave centre band frequencies. The limits specified are as follows:

"The L_{Aeq} of the entertainment noise should not exceed the representative background noise level LA_{90} (without entertainment noise) by more than 5 dB, and the L_{10} of the entertainment noise should not exceed the representative background noise level L_{90} (without entertainment noise) by more than 5 dB in each $\frac{1}{3}$ rd octave band between 40 Hz and 160 Hz."

This guideline also offers an alternate approach whereby the background levels (L_{Amin}) and event noise ($L_{Aeq,T}$) are measured and compared. It specifies that for venues that continue to play music beyond 11PM the difference in event noise and background level should not be greater than 1 or 2 dB.

In its "Code of Practice on Environmental Noise Control at Concerts" the Noise Council Code specifies a much more stringent criteria as follows:

"For events continuing or held between the hours of 2300 and 0900 the music noise should not be audible within noise-sensitive premises with windows open in a typical manner for ventilation."

it continues that,

"[this can be achieved] by limiting the music noise so that it is just audible outside the noise sensitive premises. When that is achieved it can be assumed that the music noise is not audible inside the noise sensitive premises."

The World Health Organization Guidelines for Community Noise (1999) state that in order to protect the majority of people from sleep disturbance, the indoor equivalent noise level for bedrooms should be no more than 30 dB L_{Aeq} for continuous noise and a maximum level (L_{Amax}) of 45 dB for single sound events. These correspond to sound pressure levels at the outside façades of the living spaces which do not exceed 45 dB L_{Aeq} and 60 dB L_{Amax} so that people may sleep with bedroom windows open. These values are obtained by assuming that the noise reduction from outside to inside with the window partly open is 15 dB

The 1999 WHO Guidelines are supplemented by the Night Noise Guidelines for Europe, which were published by the World Health Organization in 2009. The 2009 guidelines are based on a thorough review of evidence related to the effects of night-time noise on sleep and the effects of night-time noise on health.

The 2009 guidelines recommend that the population should not be exposed to a Night-time Noise Guideline (NNG) value of greater than $L_{night, outside} = 40\text{dB}$, which is the lowest observed adverse effect level determined by a consensus of experts and stakeholders (including representatives from Health Canada) necessary to protect the public, including most of the vulnerable groups such as children, the chronically ill and the elderly, from the adverse effects of night noise.

However, within the 2009 guidelines, the World Health Organization acknowledges that in some locations achieving the 40dB $L_{night, outside}$ will not be feasible and an interim target (IT) value of 55dB $L_{night, outside}$ was provided for the "short-run". The guidelines emphasize that the IT level is a feasibility based criteria for exceptional local circumstances and not a health-based limit. Consequently, the 55dB $L_{night, outside}$ will not protect the vulnerable groups.

6 - Discussion and Recommendations

6.1 - Recommended Sound Level Limits at Receiver Locations and Sound Levels at Source

Typically, the bass component of music is more noticeable over long distances and can cause disturbance or intrusion to sensitive receivers. The bass frequencies are typically between 40-160 Hz and are generally transmitted through air with low levels of sound attenuation when compared to higher frequencies. By playing music with these components we were able to measure the noise at the affected receivers in order to help quantify it and establish guidelines that meet the concerns of the residents while keeping in mind the livelihood of the facilities whose business it depends on. However, comparison of the event noise measurements against the international and municipal standards and guidelines presented above is not always wholly practicable due to the different measurement parameters, time of day and zoning interpretations.

For example, if we compare the measured music event noise levels outside Green College (S6) with the Clause 11 requirements of the Vancouver municipal noise bylaw, we can find some onerous requirements. At this location the measured dBC level was 71, whereas the bylaw states that the maximum permissible level is 65 dBC. If this standard were adopted the noise at the Museum of

Anthropology would have to be decreased to 85 dBC from the 91 dBC recorded during the survey when measured at location S7. The lowering of C-weighted sound levels by 6dB will provide music with a noticeably lower bass content than that heard during the measurement survey.

Furthermore, the dBA levels measured at location S6 (Green College) can be compared against World Health Organization standard. The measured level, 48 dBA, exceeds this criterion by 3 dB. The amplification system would therefore need to be adjusted in order to decrease the measured value at S7 to 74dBA.

The magnitude of any sound reduction is subjective and dependent on individual receivers. However, it is generally agreed that a decrease in noise of 3 dBA can be perceived as just barely noticeable, even if the effort to cause this reduction is significant. Conversely, a decrease in noise of 10 dBA can be perceived as half as loud. It is therefore important to implement noise strategies and limits that are achievable and representative of the desired experience both from the perspective of those bothered by the noise, and those enjoying it and attending the events.

As shown by the $L_{Aeq,15min}$ sound levels, the nighttime noise environment at UBC is typical of a residential, mixed use commercial zone when compared to noise levels found in other local municipalities. From the survey, it can be concluded that the UBC North Campus area is not considered to be an exceptionally quiet zone in the context of other location in the lower mainland and does not warrant unduly onerous requirements when evaluating suitable noise limits.

We therefore recommend the following set of nighttime noise limits that are suitable for the North Campus as a part of the noise management strategy. The noise limits given are when measured at a point of reception defined as:

"A position within the property line of the real property occupied by the recipient of a sound that best represents the location at which that specific sound, emanating from another property, is received and the resulting disturbance experienced and is at least 1.2 m from the surface of the ground and any other sound reflecting surface."

Day & Time	dBA (Leq, slow) 22.00 - 01.00 hrs	dBC (Leq, slow) 22.00 - 01.00 hrs	01.00 - 07.00 hrs
Weekday: Sunday to Thursday	50	60	No audible music ¹
Weekend: Friday to Saturday	55	65	No audible music ¹

This set of limits were adapted from the consensus of local municipal noise limits to provide consistency between municipal areas in the Lower Mainland. Additionally, it provides limits to accommodate event organisers on campus through varying the noise limits on weekends and

¹

For the purposes of these recommendations, the term "no audible music" shall be defined as the level at which a person with reasonable hearing cannot distinguish music above the background level at a point of reception.

weekdays. This reflects the interests of the receivers of the noise as well through accounting for the expectation of quiet during weekdays.

These noise limits also ensure that as a minimum measure the interim nighttime noise limit stated by the WHO, is maintained for the residents within the North Campus area during the first period of the nighttime with greater controls required after 1AM to reflect the sensitivity of the time of day. Venues could also consider reducing noise limits after midnight, a municipal best practice.

Even with these limits in place it is likely that the noise generating facilities would need to exercise controls to the volume of the amplification systems, regardless of the mitigation strategy used (i.e. repositioning of speakers). The following table gives estimates, based on the measurements made, of the sound levels that would need to be met to comply with the above limits. Note that measurements at the Coast did not record any event noise and, therefore, at this time we there remains some prediction uncertainties associated with noise limits relating to this particular location.

Noise Event Location	Measurement Location	Day of week	Predicted Sound Level (Leq)	
			dBA	dBC
Koerners Pub	Measured Sound Level Above Recommended Criteria at S6	Weekday	0	7
		Weekend	0	2
	Required Sound Level at S3 to Meet Criteria	Weekday	66	77
		Weekend	66	82
	Required Sound Level at S1 to Meet Criteria	Weekday	90	94
		Weekend	90	99
Museum of Anthropology	Measured Sound Level Above Recommended Criteria at S6	Weekday	0	11
		Weekend	0	6
	Required Sound Level at S7 to Meet Criteria	Weekday	77	80
		Weekend	77	85

Interpreting from the above table, we predict that the dBA levels from both venues will not exceed the limits set for the hours between 10PM and 1AM. However, the dBC levels may exceed the limits set in some cases significantly. The dBC levels are still within typical levels that we would expect for venues of this nature. During the hours of 1AM to 7AM however the proposed limits call for "no audible music". This is a contentious and difficult concept to quantify as it relies on an in-depth understanding of the background noise levels. In most cases this would relate to music levels at Koerners Pub being played at no more than background levels, and no amplified music at the Museum of Anthropology.

Additional limits where by the background levels should not be exceeded by "X" dB were also considered. However, due to the nature of noise on campus, and consistency with local municipalities these were not included. Future consideration could be given for an adoption of an above-background-noise limit after the implementation and feasibility of the above limits in conjunction with the noise management guidelines are evaluated.

6.2 - Other Means for Noise Management

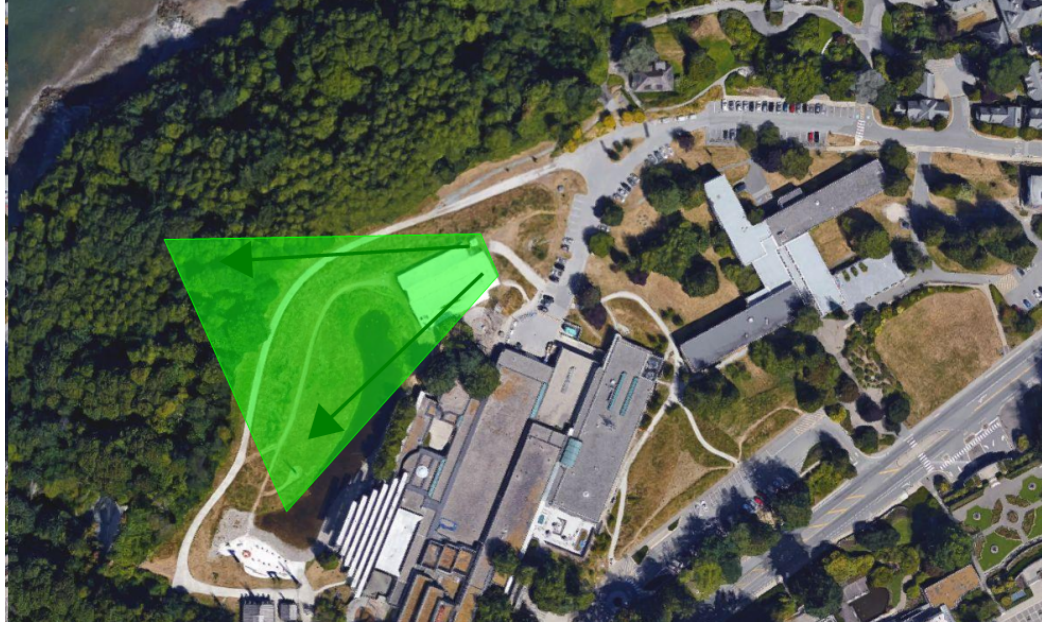
Sound reduction can be achieved using an array of methods including, but not limited to, reducing the volume on the amplification system, repositioning of the speaker orientation, adjusting the frequency content of the music being played, or the installation or use of existing physical barriers. Other means for noise abatement can be used such as management plans which can be introduced in order to facilitate mutually agreeable noise control procedures where venues can operate and a noise environment maintained in accordance with best practices at the nearby residential buildings. These methods include:

I. Communications

- A. Advanced Notification - Relationships with the noise sensitive receivers and venue managers are key to any noise management strategy. Providing regular notice of particular events where noise may be more disturbing to the noise sensitive receivers can be one effective method to public relations.
- B. Official Complaint Procedure - Residents near venues that generate noise, which may be considered disturbing, should have the resources available in order to submit an official noise complaint. Any registered complaint should include a follow up where the resident can have a forum to voice if or how corrective action was taken, and the magnitude of the disturbance. One possible method for this would be to provide the nearby residents with a phone number or email of the venue where the on-site manager can be reached and would commence an investigation. Through this method the noise issue may be resolved immediately by simple corrective actions. If the manager or a resolution cannot be reached at the time of the disturbance, a formal complaint may be made through an online form, filled out by the complainant. All noise complaints should be followed up to assess their validity, track trends in disturbances and evaluate the potential for future annoyance.

II. Sound Equipment - Outdoor Setup

- A. As the measurements showed, facing the amplification systems away from the sensitive receivers at the Museum of Anthropology can cause a distinct reduction in the A-weighted sound levels (up to 6 dBA). This method is not as effective for low frequency noise (1 to 2 dBC) which does not propagate from the speakers in the same manner as mid-high frequency sound. A figure showing the optimal speaker direction is shown below. Additionally, positioning the sound stage as far away from the sensitive receivers as possible will provide further attenuation.



- B. The outdoor music amplification system at Koerners Pub should be positioned with the speakers pointing in towards the façade of the building, consistent with the current operating procedure of the venue and with the positioning during the noise measurements.

III. Sound Monitoring

- A. Microphone Controlled Venue Noise - On-site noise monitors can be installed at set locations to warn venue managers that noise levels are exceeding established limits that correspond to the limits at the noise sensitive receivers. These systems have the advantage of working on any sound system brought into the premises. This system could be put into use at Koerners Pub where, if a sound limit is exceeded, the power to the amplification system is cut. Examples of such equipment include the Sentry Noise Controller, Cesva LRF Sound Level Limiter, SoundEar or EM2010 Wireless Environmental Noise Monitor for outdoor locations.
- B. Sound Monitoring By Event Staff - During the course of the events at MOA, staff can be equipped with sound level monitors to assess the noise and its potential to exceed the set limits. Locations such as S7 (at the top of the gravel road by the MOA) would be ideal for monitoring of this type because it is representative of the noise experienced by the residents at a further setback distance. Any sound level meter used for the purposes of monitoring music noise levels should conform to the a minimum of Class 2 requirements of ANSI S1.4. Examples of such equipment include the CEL240, Pulsar Model 82A, Cesva SC102 or Larson Davis 831 sound level meters.

- IV. Timing of Events - Depending on the type of venue and event, the timing may be managed in order to operate outside of times when noise can be more intrusive (ie. past 12 midnight).

7 - Summary

UBC has contracted BKL consultants to provide acoustical guidance on establishing guidelines and noise limits for the academic areas on north campus. Currently, no event noise management plan is in place for this area leading to differences in expectation for the noise environment between noise sensitive receivers in residential areas and venues that lie within academic areas and rely on music amplification for their businesses livelihood.

In order to inform a noise management strategy, BKL performed long-term baseline noise measurements at Green College and at the Coast Strata. Additionally, short-term monitoring was performed which measured the noise from the Museum of Anthropology and Koerners Pub. BKL reviewed local municipal and international bylaws, ordinances, and guidelines to provide context for the noise limits and guidelines proposed.

Finally, BKL used the measurement information combined with the reviewed noise information to develop recommendations for noise limits during evening hours and nighttime hours both in dBA and dBC sound levels. We recommend that these limits be implemented for the North Campus area, in addition to the noise management strategies layed out. Specifically, an official noise complaint procedure and advanced notification will assist in managing the noise environment expectations of all parties involved.

This concludes our report on noise guidelines for the North Campus. Should you require any further information or analysis we would be happy to assist you.

Sincerely,

BKL Consultants Ltd.

per:



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