June 7, 2012

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Re: Plan B – Community Noise Study

EXECUTIVE SUMMARY

Acoustics By Design, Inc., (ABD) was retained by Plan B to complete a noise study in the surrounding community near Plan B. ABD visited the above site on May 17th and 18th, 2012. The purpose of the visit was to measure background noise levels at various property line locations during normal business hours at Plan B.

ABD completed a careful review of the City of Madison Noise Ordinance that applies at this location. Our review found that the City of Madison employs a broad general nuisance noise ordinance, as well as a quantitative noise ordinance with permissible noise limits.

We completed noise measurements at the nearby residential property lines between 7:00 PM on May 17, 2012 to 3:00 AM on May 18, 2012. We noted that the noise levels at each of the measurement locations were dominated by traffic noise. Based on the data collected, we compared the measurements of the noise levels with the City of Madison Noise Ordinance. The measurements indicate that Plan B does not exceed the City of Madison Noise Ordinance (Section 24.08(6)).

REPORT:

Introduction

Acoustics By Design, Inc., (ABD) was retained by Plan B to complete a noise study in the surrounding community near Plan B. ABD visited the above site during the evening of May 17th and 18th, 2012. The purpose of the visit was to measure background noise levels at various property line locations during normal business hours at Plan B. Based on this data, we have compared the measurements with the City of Madison Noise Ordinance.

Instrumentation

A Larson-Davis Laboratories Model 824 and 831 precision sound level meters were used for all octave band measurements reported here. These meters conform to the ANSI Standard Specifications for Sound Level Meters S1.4-1983, Type 1 (Precision), and the IEC Standard 651-1979, Sound-Level Meters, Type 1 Peak. The instrument was calibrated and is traceable to The National Institute of Standards. Evidence of traceability is on file at the Larson Davis Corporate Headquarters. The meters calibrations were field verified before and after the measurement session.

Larson-Davis Laboratories Model 703/706-RC sound meters were used for the A-weighted long term sound level measurements. These meters conform to ANSI Standard Specifications for Sound Level Meters S1.4-1983, Type 2, and the IEC 651-1979, Sound Level Meters Type 2. The instruments were calibrated and are traceable to the National Institute of Standards. Evidence of traceability is on file at the Larson Davis Corporate Headquarters. The meters were field verified before and after the measurement session.

Atmospheric Conditions

Atmospheric conditions were within the range of those specified in ANSI S12.9 and S12.18 for environmental noise measurements. The winds were calm and the temperature was cool.

Acoustical Terminology and Concepts

When dealing with sound, there is the physical quantity which is expressed as sound level and the perceived level which is expressed as loudness. Sound level is measured in units called decibels (abbreviated dB). Decibels are power ratios and are logarithmic quantities. Audible sound occurs over a wide frequency range, from approximately 20 Hertz (Hz) to 20,000 Hz. Human hearing does not respond equally to sounds at different frequencies (or pitch). Lower frequency sounds that are equally as "loud" have a much higher decibel level than high frequency sounds. To accommodate this variation in frequency sensitivity of human hearing, a frequency weighting can be applied to sound level measurements. When the weighting is applied, the resulting sound level measurements are said to be "A-weighted" and the decibel level is abbreviated dBA.

When the sound energy doubles, the decibel value increases by 3 dB. Human hearing is also logarithmic and when the perceived loudness of a sound is "doubled", the corresponding sound level increases by approximately 10 dBA. A qualified listener cannot detect a change in sound level of 1 dBA. The average listener starts to detect a change in level at 3 dBA, and a clearly noticeable change occurs at 5 dBA.

While the decibel or A-weighted decibel are the basic units used for noise measurement, other indices are also used. One common known index, the equivalent sound level, abbreviated as Leq, is commonly used to indicate the average sound level over a period of time. Leq represents the steady level of sound which would contain the same amount of sound energy as does the actual time varying sound level. Although it is an average, it is strongly influenced by the loudest events occurring during the time period because these loudest events contain most of the sound energy.

The following table lists some commonly encountered noises, their A-weighted level, and associated subjective evaluations:

Table 1: Noise Source Comparisons

Pain Threshold	140 dBA	Jet Engine (at 60 ft)
	130 dBA	"Hard Rock" Band (near stage)
	120 dBA	Thunder (nearby)
Long-term Hearing Loss	100 dBA	Auto Horn (at 9 ft)
	90 dBA	OSHA 8 Hour Noise Exposure Limit
	80 dBA	Street Corner in Busy City
Typical Daily Exposure	70 dBA	Busy Freeway (25 ft to 100 ft)
	60 dBA	
	50 dBA	Typical Office Environment
	40 dBA	
	30 dBA	Inside Average Residence
Very Quiet	20 dBA	Whisper
	10 dBA	Human Breathing
Threshold of Hearing	0 dBA	

City of Madison Noise Ordinances

The City of Madison, Wisconsin Ordinance, Section 24.04 Prohibition of Noises Disturbing the Public Peace subsection (2) states:

> *(2): It shall be unlawful for any person, firm, corporation, or other entity occupying or having charge of any building or premises, or any part thereof, to cause, suffer or allow any loud, excessive or unusual noise in the operation of any radio, stereo or other mechanical or electrical device, instrument or machine, which loud, excessive or unusual noise tends to unreasonably disturb the comfort, quiet or repose of persons therein or in the vicinity.*

This type of nuisance noise ordinance is both difficult to enforce and difficult to interpret since the basis of the ordinance addresses subjective experience. When a specific ordinance exists, the courts usually determine that it takes precedence over the general ordinance. In this case, a more specific noise ordinance exists:

According to the City of Madison, Section 24.08 Noise Control Regulation, subsection (6)

> *(6). Maximum Permissible Sound Levels.*
>
> *(a) General Limitations: Effective upon the enactment of this ordinance, in the following zoning districts (as set forth in Chapter 29, Madison General Ordinances) the sound emitted from any source of stationary noise shall not exceed the following limits at any point within a receiving zone which point is outside of the property line of the source of the stationary noise:*

Receiving Zone Classified	Source Level Zoned	Maximum dBA
Residential, Conservancy, Wetlands, PCD, PUD, Planned Community Mobile Home Park District	All zoning districts	65 dBA
Commercial (C1, C2) or Office	Residential, Conservancy, PCD, PUD, Planned Community Mobile Home Park District	65 dBA
	Commercial (C1, C2), Office	70 dBA
	Manufacturing, Agriculture, Commercial (C2, C4, C3L)	75 dBA
Commercial (C3, C4, C3L), Manufacturing or Agriculture	Residential, Conservancy, PCD, PUD, Planned Community Mobile Home Park District	65 dBA
	Commercial (C1, C2), Office	70 dBA
	Manufacturing, Agriculture, Commercial (C2, C4, C3L)	75 dBA

Noise Measurements

Noise measurements were completed at four locations as shown graphically in Figure 1:

Location 1: On the SW property line of 923 Williamson Street.

Location 2: On property line across from Plan B.

Location 3: On the property line of 940 and 936 Jenifer Street.

Location 4: On the property line of 928 Jenifer Street.

Figure 1: Test Measurement Locations

On visiting the site, we noted that the noise levels at the properties were dominated by traffic noise, specifically at Location 2 on Williamson Street. It was also noted that multiple bus lines are routed on Jenifer St. In addition, an air conditioning unit at the back of the Umami Restaurant near Location 1 had a significant impact on the noise levels at that location. The unit was running during the entire measurement period.

We completed both long term noise measurements at each location between 7:00 PM May 17, 2012, and 3:00 AM May 18, 2012. In addition, short term measurements were also taken inside Plan B at the location of the D.J. between 12:30 AM-1:00 AM on May 18, 2012. Sound levels within Plan B ranged from 94-101 dBA with an average of 97 dBA. This was considered the "typical" operating sound level.

Figure 2 below shows the measured 1 hour L_{eq} sound levels at each of the property line locations compared against the City of Madison Noise Ordinance (Section 24.08(6)) from 7:00 PM to 2:00 AM. Music was playing inside Plan B from 9:00 PM to 1:30 AM. The hourly sound levels indicated in Figure 2 include noise from all sources including traffic.

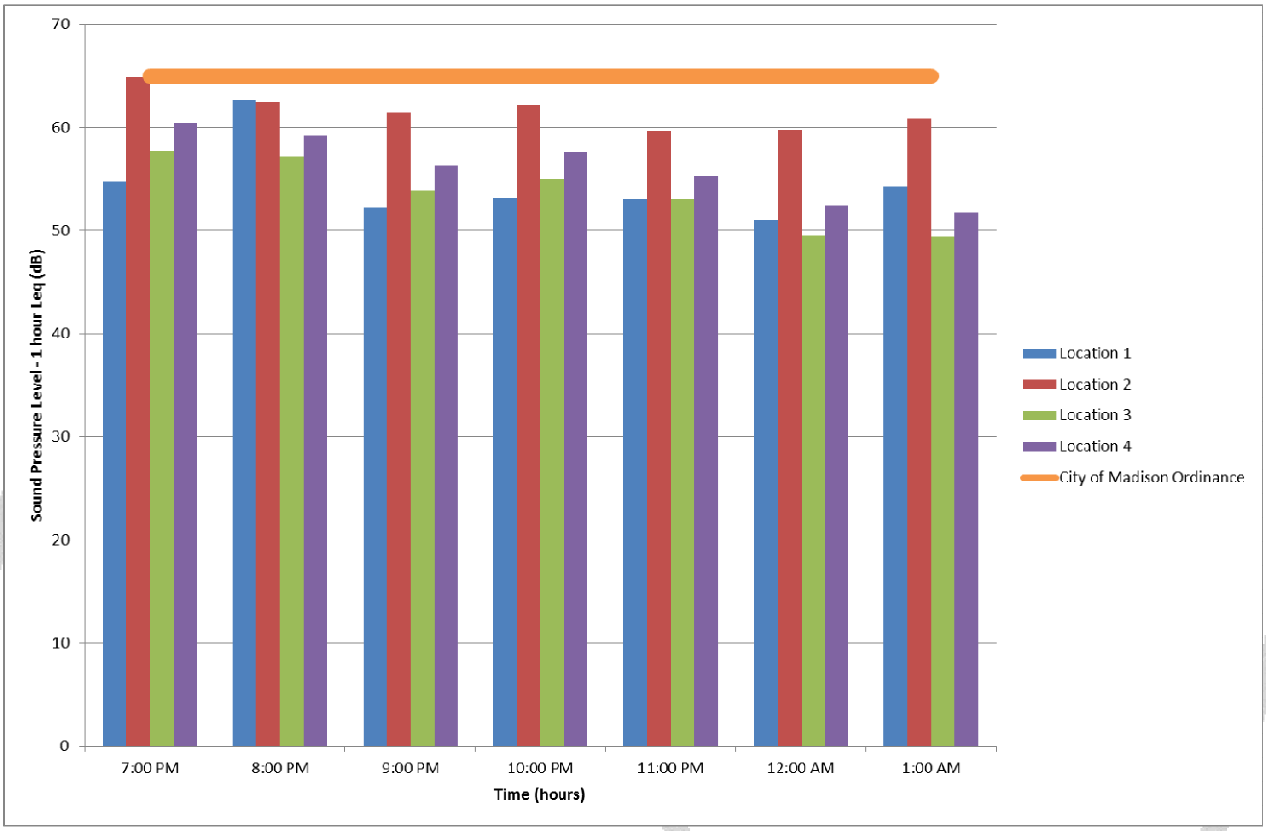

Figure 2: 1 hour L_{eq} Sound Pressure Levels (dBA)

Table 2 shows the short term sound pressure levels measured between 12:30 AM and 1:00 AM on May 18, 2012, while the music was playing at Plan B compared with the ambient measurements taken between 2:45 AM and 3:00 AM after Plan B had closed. These levels are significantly lower than the hourly average levels indicated in Figure 2 because they were taken when no vehicles were passing the measurement location. This allowed us to measure the impact of the sound levels from Plan B without the contamination of traffic noise. During this time period it was noted that the music was audible at Locations 1 and 2 with no traffic, but was somewhat masked when cars passed by specifically at Location 2 because of its proximity to Williamson Street. At Locations 3 and 4 the music was barely audible with no traffic.

Table 2: Short Term Measured Sound Pressure Levels

Location	Sound Pressure Level (dBA) Between 12:30 AM and 1:00 AM	Ambient Sound Pressure Level (dBA) Between 2:45 AM and 3:00 AM
1	51	50
2	52	50
3	41	40
4	41	40

Although the City of Madison only addresses the overall dBA maximum allowable noise levels, other municipalities sometimes also incorporate maximum octave band frequency limits. For comparative purposes, we took a typical noise control ordinance and adjusted the octave band frequency limits to match the 65 dBA overall noise level requirement of the City of Madison. These levels are shown in Figures 3 and 4 below compared to short term measurements taken between 12:30 AM and 1:00 AM on May 18, 2012, ambient measurements taken between 2:45 AM and 3:00 AM after Plan B had closed. As stated above, all short term measurements were taken when no vehicles were passing the measurement location.

Figure 4 indicates that there is no significant difference in the sound levels at Locations 3 and 4 between when Plan B had music playing and after the club had closed. In Figure 3, there is a 4-10 dB increase above ambient in the 63 Hz and 125 Hz octave bands when Plan B had music playing, however, the levels are still well below the equivalent levels for a 65 dBA overall noise level.

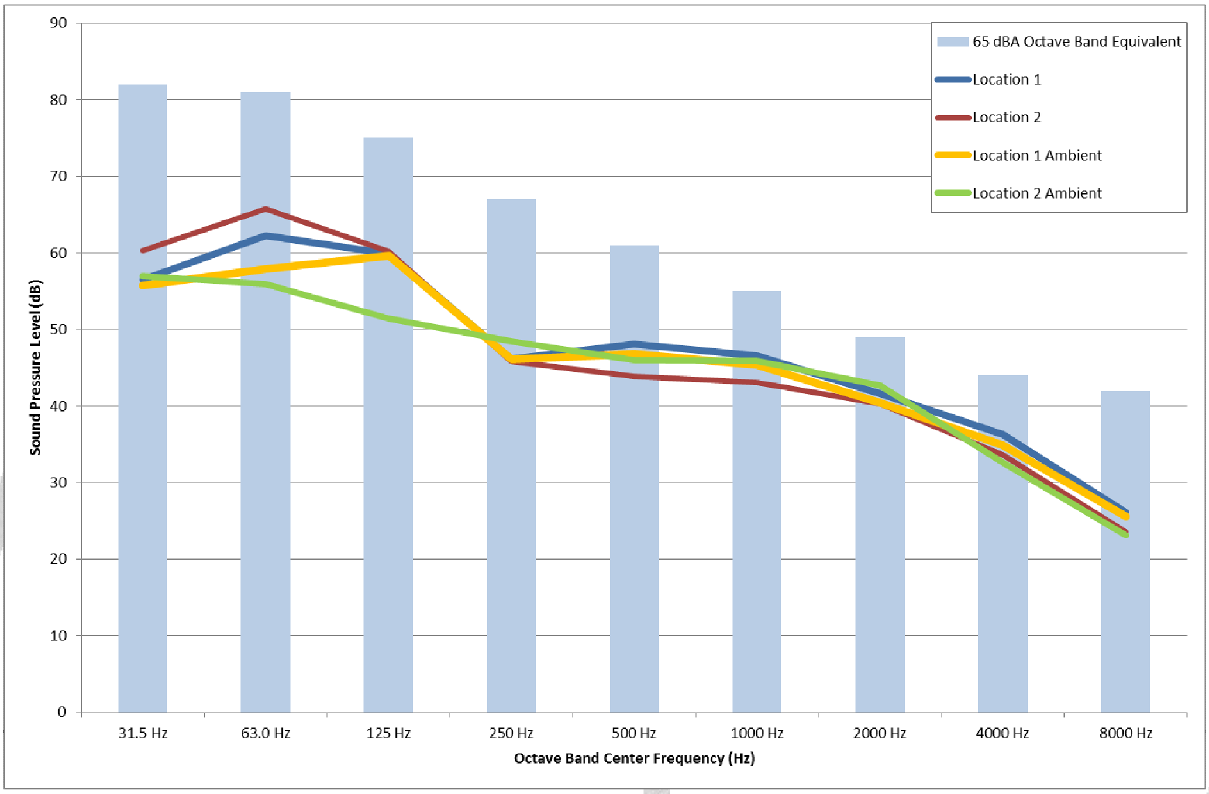

Figure 3: Octave Band Sound Pressure Levels at Property Line Locations 1 and 2

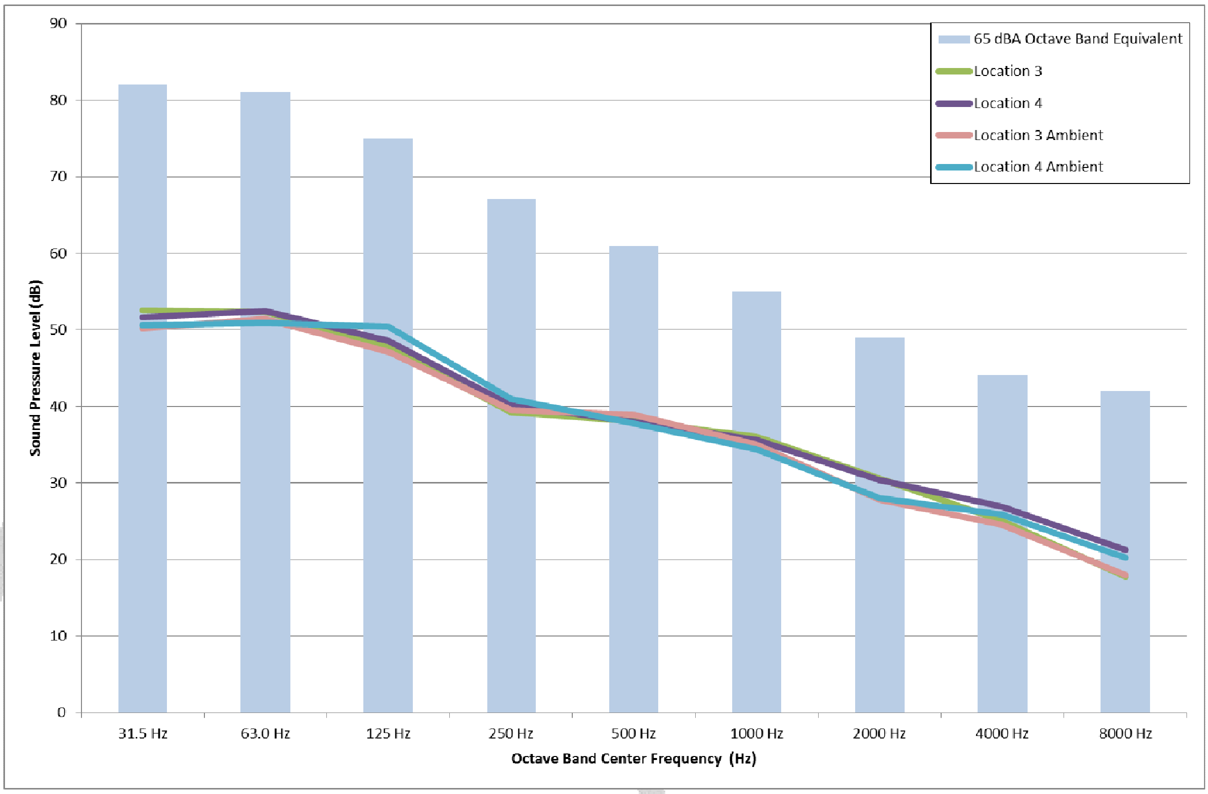

Figure 4: Octave Band Sound Pressure Levels at Property Line Locations 3 and 4

Conclusions

Acoustics By Design, Inc., (ABD) was retained by Plan B to complete a noise study in the surrounding community near Plan B. ABD visited the above site during the evening of May 17th and May 18th, 2012. The purpose of the visit was to measure background noise levels at various property line locations during normal business hours at Plan B.

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If you have any questions, please call.

Sincerely,

ACOUSTICS BY DESIGN, INC.
Per:

Kenric D. Van Wyk, PE, INCE Bd. Cert.
President

Melinda Miller
Senior Consultant

Appendix

Acoustical Terminology and Concepts - Expanded

There are two main characteristics to sound: frequency, measured in Hertz (Hz), which is perceived as pitch, and sound level, measured in decibels (dB), which is perceived as loudness. Audible sound occurs over a wide frequency range, from approximately 20 Hertz (Hz) to 20,000Hz. Any one specific sound can contain multiple frequencies at different sound levels or loudness levels. Human hearing does not respond equally to sounds at different frequencies. Lower frequency sounds that are perceived as equally “loud” as higher frequency sounds actually have a much higher decibel level. To accommodate for this variation in frequency sensitivity of human hearing, a frequency weighting can be applied to the raw sound level measurements. When this weighting is applied, the resulting sound level measurements are said to be “A-weighted” and the decibel level unit is abbreviated dBA. The A weighting system is used as the industry standard.

Additional weighting systems exist such as B, C, and Z. Usually these are not used unless very specific conditions are met or required.

Detailed noise measurements gather data on the overall sound level as a single number (in dBA) as well as the sound levels at each octave band (in dB). An octave band is defined as the sum of the sound levels across a range of frequencies that is an octave wide. For example; if someone were to refer to the 1000 Hz octave band they are referencing the overall sound level from the following frequency range: 710 Hz to 1,420 Hz. Typically, individual octave band levels are represented as un-weighted decibels or (dB).

The difference between dB and dBA is often misunderstood and usually misrepresented when laymen discuss noise levels. To get the single number, overall “A-weighted” noise level (dBA), the octave band sound levels are weighted based on human sensitivity as described above and the sound energy is added together. In order to better represent how sound at each frequency applies to the overall sound level we have prepared the following analogy:

The musical strength and diversity of an orchestra includes a broad range of instruments that are played to represent an individual piece of music. During a performance you may be able to hear groups of instruments separately within the overall piece being performed on stage. For example, the pitch or tone of a trumpet is easily distinguished from wood-woodwind instruments. Each instrument type is capable of producing sound in a specific range of frequencies, allowing for easy identification when everyone is playing on stage. At any point in time during a performance we can measure the frequency ranges of sound that are present as well as the level of sound in each individual frequency. By applying an A-weighting to the sound level from each instrument and then adding the sound levels logarithmically we are able to come up with a single number representing the sound level of the orchestra as a whole. The table below represents a hypothetical measurement of an orchestra performance which indicates the measured sound level of each individual frequency range and shows the relationship of the individual level to the overall level.

Frequency Type	Corresponding Octave Bands	Typical Instruments	Sound Level (dB)	Overall Sound Level (dBA)
High	2000 Hz to 8000 Hz	Flute and Violins	55	71
Mid-High	500 Hz to 1000 Hz	Trumpet and Viola	65	
Mid-Low	125 Hz to 250 Hz	Trombone and Cello	75	
Low	31.5 Hz to 63 Hz	Tuba and String Bass	85	

Mathematically, when the sound energy doubles, the total decibel value increases by 3 dB from the original value (i.e. the combined sound level of two violinists playing at 55 dB each will be measured as 58 dB total). A qualified listener cannot detect a change in sound level of 1 dBA. The average listener starts to detect a change in level at 3 dBA, and a clearly noticeable change occurs at 5 dBA. When the perceived loudness of a sound is “doubled”, the corresponding sound level increases by approximately 10 dBA. For example, in using our above orchestra example; if we increase the overall level to 81 dBA rather than 71 dBA, the audience would perceive this change as twice as loud as before.

While the decibel or A-weighted decibel are the basic units used for noise measurement, other indices are also used. One such common known index, the equivalent sound level, abbreviated as Leq, is commonly used to indicate the average sound level over a period of time. Leq represents the steady level of sound which would contain the same amount of sound energy as does the actual time varying sound level. Although it is an average, it is strongly influenced by the loudest events occurring during the time period because these loudest events contain most of the sound energy.