



Cross-Spectrum Acoustics Inc.

Massachusetts

Utah

California

September 4, 2025

Dr. Michael Klemens  
Chair, Planning & Zoning Commission  
Town of Salisbury  
PO Box 548  
27 Main Street  
Salisbury, CT 06068

Project Reference: J2025-1540 – Wake Robin Inn Noise Study / Response to Commissioner Cockerline Questions

Dear Dr. Klemens:

This letter provides responses to a set of questions submitted to Cross-Spectrum Acoustics (CSA) by Commissioner Cockerline. The Commissioner's questions and our responses are listed below. Questions are shown in italics.

**Question:** *Regarding the distinction of audible sound vs dBA;*

*A. Is no audible sound an attainable goal given that measurable sound already exists? Salisbury P&Z recently issued a special permit to 75 Sharon Rd. for complete demolition of one home and construction of another with no restriction on construction noise. Should the same standard apply to this application?*

**Response:** In my professional opinion “no audible sound” *ever* is not attainable or practical. Also note that in recommending criteria “based on audibility” we did not state or intend that the limit should be based on absolute audibility. I do believe “no regularly bothersome audible sound” is attainable, consistent with the Planning and Zoning Commission Regulations, and represented by the  $L_{90} + 5$  dB criteria I recommended previously.

While I do not know the exact details of the special permit granted to 75 Sharon Road, it is my opinion as a consultant that noise requirements for planning purposes should be uniform across a jurisdiction. Going forward, the Planning & Zoning Commission should determine specific goals regarding noise control and update their requirements and/or guidance accordingly (to the extent the Commission has the ability to do so). Construction noise should at least be subject to time of day/day of week restrictions.

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**Question:** *B. Is dBC something we need to consider. How and when is it applied?*

**Response:** By way of background - Sound is a vibrational disturbance that manifests as rapid air pressure fluctuations at the ear. The human ear responds very well to mid-frequency vibration (human speech, guitar, and horns) but we do not hear low frequency sounds (thunder, drums) or high-frequency sounds (cymbals, cricket sounds) as well as mid-frequencies.

Sound levels are quantified using “decibels” (abbreviated ‘dB’ see attachment). An unweighted decibel (“dBZ”) quantifies the sound level without regard to whether a human can perceive the

level. For example, a dBZ sound level measurement of a dog whistle may provide a very high value on a sound level meter but is inaudible to humans.

The A-weighting scale filters sound collected by sound meters to reduce the influence of low and high-frequency sounds while accentuating mid-frequency sounds. The resulting A-weighted decibel (“dBA”) better represents sound levels as perceived by humans. The A-weighted decibel is the quantity that is generally used to assess human response to noise.

The C-weighting scale (“dBC”) is similar to the A-weighting scale in that it reduces the level of high and low frequencies, but not as much as A-weighting. C-weighted sound levels are often used to characterize sound levels with strong low-frequency content such as bass-heavy music or heavy machinery.

I understand that the community is concerned about music from the project and in that context, a noise assessment based on C-weighted (dBC) sound levels is a reasonable request. The applicant’s noise consultant, Cavanaugh Tocci (CTA) almost certainly has the data and expertise to produce the assessment. The complicating factor is determining appropriate sound level limits that can be applied to the assessment. While there are C-weighted noise criteria used by a variety of jurisdictions around the country, it is not as ubiquitous or well-supported as A-weighted criteria. By comparison, the State of Connecticut noise limits are based on a study produced by the Environmental Protection Agency (EPA) and is regularly referenced by jurisdictions across the United States. The  $L_{90} + 5$  dB criteria I recommended (and developed by CTA) has been used successfully by communities across the United States, including recently in Colorado and rural Montana.

The Planning & Zoning Commission would need to select appropriate dBC criteria that protects the community and is compatible with current town activities. The process of selection such criteria could take a few weeks.

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**Question:** *The applicant has committed to complete control of sound system in event space. Can low Hertz frequencies be targeted for electronic control. Are these frequencies as easily controlled and/or monitored as dBA?*

**Response:** Amplified low frequency music sounds (produced by DJ equipment, electric bass, or amplified drums) can be controlled electronically using specialized equipment in the audio/amplifier signal chain. Unamplified low-frequency music sounds (unamplified drums, tuba, etc.), cannot be controlled electrically, but will be generally quieter than amplified low-frequency music.

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**Question:** *Are there effective sound barriers that could be used for parking area and mechanical systems that would further reduce measurable sound? By how much? Also specific recommendations for these barriers.*

**Response:** Sound barriers (or berms) can be used to reduce construction noise if they are placed close to the construction activity. The amount of reduction would be dependent on the specific construction activity, the height of the barrier, and the position of the barrier relative to the construction activity and adjacent homes. I would expect reductions to be in the 3 to 8 decibel range, but detailed calculations would be required to find exact values. Temporary and

moveable/portable noise barriers, including noise curtains<sup>1</sup>, are used for heavy construction projects (the Boston Central/Artery Tunnel “Big Dig” project or New York City 2<sup>nd</sup> Avenue subway project for example) but are generally not used in small scale construction projects. Noise mitigation recommendations for small (1-4 months) projects usually consist of time-of-day restrictions and community notification obligations.

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**Question:** Explain soundscape analysis. Would this be helpful in this application?

**Response:** Soundscape analysis does not have a precise definition, but in this context, it refers to an analysis that looks at the relationships between an existing sound environment and the community. A soundscape analysis may also look at how future sound sources would fit into the community. Reduction of overall sound levels or specific sound sources are not necessarily the objective - for example, the sound of a bell at a landmark church might be considered “loud” but could be accepted by a community for historic reasons.

A soundscape analysis is not nearly as straightforward as a typical noise impact assessment - a soundscape analysis would involve multiple disciplines (sound experts, statisticians, community survey experts) and require identifications of all notable sound sources in the area, under various conditions and seasons. Measurements at multiple locations would follow, along with surveys of the community. A sound scape analysis by itself is essentially a research project along the lines of a Master Plan study. In my opinion, a soundscape analysis is not appropriate for a redevelopment project. If a soundscape analysis were requested, I would expect the study to take roughly 12 to 18 months to complete.

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Please note that these responses are not meant to undervalue community concerns. There will be activities at the proposed project that will be audible at abutting properties at times. However, in my professional opinion, the activities as analyzed by CTA will meet relevant acoustical limits.

If you have any questions or comments, please feel free to call me at (413) 315-5770 ext. 701, or email [hsingleton@csacoustics.com](mailto:hsingleton@csacoustics.com).

Sincerely,



Herbert Singleton Jr, PE (Massachusetts), INCE Bd. Cert.  
President  
Cross-Spectrum Acoustics, Inc.

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<sup>1</sup> Example of a noise curtain product commonly used on construction sites is available at <https://www.soundseal.com/industrial/products/exterior-sound-curtains/bbc-exterior>



**Sound** is a vibrational disturbance that propagates through the air in a predictable manner and can be detected by human hearing organs. Sound can be mathematically expressed as rapid changes in air pressure that travel from a vibrating source (speaker diaphragm, mouth, etc) to a receiver.

**Vibration** is the mechanical oscillation of a solid or fluid object about an equilibrium or rest position. Vibration is typically described in terms of displacement (inches or meters), velocity (inches per second or meters per second) or acceleration (inches per second squared or meters per second squared)

**Noise** is unwanted sound that may interfere with communications or disturb a person. There is no mathematical or scientific distinction between noise and sound, the only difference is how they are perceived by humans.

**Decibel** (abbreviation “dB”) is a mathematical expression used for expressing the magnitude of sound levels. The human ear is capable of hearing pressure variations from 0.00002 Pascals to 20 Pascals. Decibels are used to compress this large range of values to a more manageable range that varies from about 0 to 120. A decibel is defined as  $10 \log_{10} \left( \frac{P_{ref}^2}{P_{ref}^2} \right)$  “p” is the sound pressure magnitude generated by a source, and “P<sup>2</sup><sub>ref</sub>” is a reference pressure of 20 microPascals (μPa). Note that decibels are logarithmic quantities. Therefore, 60 dB + 60 dB = 63 dB, not 120 dB

**Frequency** is the number of cyclical variations in sound pressure that occur over one second. Humans perceive a change in frequency as a change in pitch. For example, a low frequency sound (“bass”) will be perceived as having a low pitch, and a high frequency sound (“treble”) will be perceived as having a high pitch. Frequency is expressed in units of Hertz, abbreviated as Hz.

**Octave** (or octave band) is a range of frequencies where the upper frequency limit is twice the lower frequency limit. For example, the frequency range of 25 Hz to 50 Hz is one octave. Octave bands are identified by their “center” frequencies.



**A-Weighting** simulates the response of the human ear to sound by attenuating low and high frequencies, and amplifying the midrange frequencies. A-weighted sound levels are abbreviated as “dBA.” The following gives an indication of how A-weighted sound levels are perceived by humans under normal conditions:

- A 1 decibel difference in sound level can only be detected in carefully controlled laboratory experiments.
- A 3 decibel change is the minimum difference in noise level that is perceptible to humans outside of controlled testing environments
- A change of at least 5 decibels is required before a community would perceive a significant change in the noise environment.
- A 10 decibel change in sound level is usually perceived as a doubling in the loudness of sound.

The following table gives common A-weighted sound levels:

Typical Noise Source dBA Levels	
Noise from rustling leaves	20 dBA
Room in a quiet dwelling at night	32 dBA
Soft Whisper at five feet	34 dBA
Room with window air conditioner	55 dBA
Passenger car at 50 ft	69 dBA
Television at full volume at 5 ft	70 dBA
Bulldozer at 50 ft	87 dBA
Jackhammer at 50 ft	88 dBA
Heavy diesel propelled vehicle at 25 ft	92 dBA
Home lawn mower	98 dBA
Jet aircraft at 500 ft overhead	115 dBA
Human pain threshold	120 dBA

**L<sub>90</sub>** is the sound level that is exceeded 90% of the time during the measurement period. **L<sub>90</sub>** is the metric commonly associated with the background noise, and is used by several agencies and municipalities to assess background noise.

**L<sub>eq</sub>** is the level of steady sound that has the same energy as a fluctuating sound measured over the same time period. **L<sub>eq</sub>** is indicative of the average sound level during the measurement period.

**L<sub>max</sub>** is the maximum sound pressure level of an event. **L<sub>max</sub>** is often used to characterize the loudness of a single event

Reference: Martin Hirschorn, *Noise Control Reference Handbook*, Industrial Acoustics Company, New York, NY, 1989.