Residential Sound Insulation Program
Noise Audit Regulation and Guidance

ONCC Residential Committee Meeting – May 13, 2020

CDA
CHICAGO DEPARTMENT OF AVIATION

O'HARE & MIDWAY
INTERNATIONAL AIRPORTS

SUMMARY OF WHAT WAS COVERED DURING THE LAST PRESENTATION

- Defined the term Noise Audit
- Reviewed several key fundamentals of acoustics that pertain to noise audits
- Outlined the two Federal Aviation Administration (FAA) noise reduction goals
- Discussed how we perceive changes in decibel (dB) levels
- Presented the two most common methods for conducting a noise audit:
  - Overflight Noise Audit (ONA)
  - Loudspeaker Noise Audit (LNA)
- Briefly discussed highlights of each noise audit method

PART 2:
Noise Audit Regulation and Guidance

NOISE AUDIT REGULATION AND GUIDANCE

- Direct FAA regulations:
  - Airport Improvement Program (AIP) Handbook Order 5100.38D (Change 1)
  - Advisory Circular 150/5000-9A, *Guidelines for the Sound Insulation of Residences Exposed to Aircraft Operations*
    - Draft Advisory Circular 150/5000-9B (issued for public comment in 2019, but not official yet)

- FAA sponsored research that provides guidance and best practices:
  - Airport Cooperative Research Program (ACRP) Report 89, *Guidelines for Airport Sound Insulation Programs*
  - Policy, Engineering, Analysis, and Research Support (PEARS), *Study of Noise Level Reduction (NLR) Variation*
  - Airport Cooperative Research Program (ACRP) Report 152, *Evaluating Methods for Determining Interior Noise Levels Used in Airport Sound Insulation Programs*
  - HMMH Report No. 305220.008, *Review and Evaluation of Aircraft Noise Spectra used to Estimate Noise Level Reduction for Airport Sound Insulation Programs based on the Loudspeaker Test Method*
  - DOT/FAA/TC-18/15, *Investigation of ASTM E966 Adjustment Factors*
  - DOT/FAA/TC-19/34, *Noise Level Reduction Measurement Method Equalization and Normalization*

NOISE AUDIT REGULATION AND GUIDANCE

- Applicable standards and/or research studies:
  - American Society for Testing and Materials (ASTM) E966-18a, *Standard Guide for Field Measurements of Airborne Sound Attenuation of Building Facades and Facade Elements*
  - Society of Automotive Engineers (SAE) ARP 6973, *Aircraft Noise Level Reduction Measurement of Building Facades* (in development)
  - International Organization for Standardization (ISO) 16283-3:2016, *Acoustics—Field Measurement of Sound Insulation in Buildings and of Building Elements—Part 3: Facade Sound Insulation*
  - Journal of the Acoustical Society of America (JASA) **129**, 3027 (2011) Carl Hopkins, *On the efficacy of spatial sampling using manual scanning paths to determine the spatial average sound pressure level in rooms*

SELECTING THE OVERFLIGHT OR LOUDSPEAKER METHOD

Method	ONA	LNA
Conditions Needed	Overflights are needed to collect data, no rain	Data can be collected independent of flight pattern usage, no rain
Repeatability	Only w/ similar wind conditions & flight patterns	Very, follow logged notes from first test
Scheduling/ Time Commitment	Can only book day of, 2 – 4 Hours	Can be planned days/weeks in advanced, 1 – 2 Hours
Resource Commitment	1 Technician, 4 – 5 sound level meters	2 Technicians, 2 sound level meters, source equipment
Homeowner Expectations	Quiet required in selected rooms and at exterior sound level meter location for entire audit	Quiet required in one room at a time when the source noise is active
Limitations	Requires steady overflights of same type to achieve high confidence in results	Roofs & rooms above third floors are difficult to measure

An aircraft is an uncontrollable noise source, and measurements can be difficult to repeat if aircrafts fly different tracks on different days.

The LNA method was adapted from the standard ASTM E966-18a test procedure which uses an outdoor loudspeaker to simulate an aircraft noise source. The technique measures outdoor-indoor noise reduction (OINR) to find the difference in sound level between the interior and exterior of a room.

Its autonomy from reliance on flight patterns, ease of repeatability, ability to schedule far in advanced and less probability of homeowner-generated data contamination makes this method the most common approach across the industry.[1] This efficiency also makes it the RSIP's preferred approach.

1) Airport Cooperative Research Program (ACRP) Report 152

LOUDSPEAKER NOISE AUDIT – SOUND LEVEL METER REQUIREMENTS

SOUNDEXPERT LxT SPECIFICATIONS	
Averaging (Integration Method)	Linear or Exponential
Compliance	ANSI Type 1, IEC Class 1
1/1 and 1/3 Octave Filter	
1/1 Octave Filters	8 Hz to 16 kHz
1/3 Octave Filters	6.3 Hz to 20 kHz
Frequency Weighting	A, C, or Z (unweighted)
Compliance	ANSI Type 1, IEC Class 1

Type 1/Class 1 Integrating Sound Level Meter (Larson Davis LxT SoundExpert)

The current guidelines (AC 150/5000-9A), discuss using a sound level meter designed to comply with the American National Standards Institute (ANSI) Type 2 requirements when conducting an overflight noise audit. However, the new draft guidelines (AC 150/5000-9B) currently indicate that the FAA will likely be requiring Type 1/Class 1 sound level meters for a higher level of accuracy on overflight and loudspeaker audits.

The table on the left highlights some of the necessary specifications incorporated in the sound level meter used by the RSIP for loudspeaker noise audits.

LOUDSPEAKER NOISE AUDIT – SOUND LEVEL METER REQUIREMENTS GUIDANCE

ASTM E966 - 18a (11.1.1 Loudspeaker Source Method)

- "An integrating-averaging sound level meter or equivalent instrumentation that meets Type 1 requirements of ANSI S1.43 or IEC 61672 is required for the methods in Section 8 (Measurement with a Fixed Loudspeaker Source)".
  - ANSI S1.43 - Describes instruments for the measurement of frequency-weighted and time-average sound pressure levels including steady, intermittent, fluctuating and impulsive sounds.
  - IEC 61672 - Two performance categories, Class 1 and Class 2, are specified in this standard. In general, specifications for Class 1 and Class 2 sound level meters have the same design goals and differ mainly in the tolerance limits and the range of operational temperatures. Tolerance limits for Class 2 specifications are greater than, or equal to, those for Class 1 specifications.

    Note - When the new standard for sound level meters, IEC 61672, was developed, Type was replaced by Class. In terms of accuracy, Class 1 and Type 1 instrument are roughly equivalent although there are technical differences in the standards.

Draft AC 150/5000-9B

- "An integrating sound level meter with spectral analysis is required to measure spectral LEQs. SLMs must comply with the American National Standards Institute (ANSI) for Type 1 precision measurements or the equivalent international standard."

LOUDSPEAKER NOISE AUDIT – CALIBRATION REQUIREMENTS

Sound Level Meter Calibrator (Bruel & Kjaer Sound Calibrator 4231)

Calibration of the Larson Davis LxT is performed once before the beginning of the LNA using the Bruel & Kjaer 4231 calibrator and once after completion to verify the performance of the LxT sound level meter.

- Conforms to EN/IEC 60942 (2003) Class LS and Class 1, and ANSI S1.40–2006
- 94 dB sound pressure level or 114 dB sound pressure level for calibration
- 1,000 Hz calibration frequency for correct calibration level
- Calibration accuracy ±0.2 dB

Along with the calibration done for each audit, a calibration by a certified laboratory is done annually on the sound level meters, microphones and calibrators.

LOUDSPEAKER NOISE AUDIT – CALIBRATION REQUIREMENTS GUIDANCE

Standards for Calibrator Used in Noise Audit

ASTM E966 – 18a (11.3 Calibration)

- "The calibration of all measurement systems shall be verified at one frequency before (and preferably after) each series of tests at a given site using a calibrator meeting class 2 requirements of ANSI S1.40 or IEC 60942."

ANSI S1.4 – (2.12)

- "A frequency in hertz specified by the manufacturer in the nominal range from 200 to 1000 hertz. A nominal calibration frequency of 1000 hertz is preferred with a sound pressure level in decibels specified by the manufacturer to be used for calibrating the absolute sensitivity level of a sound level meter."

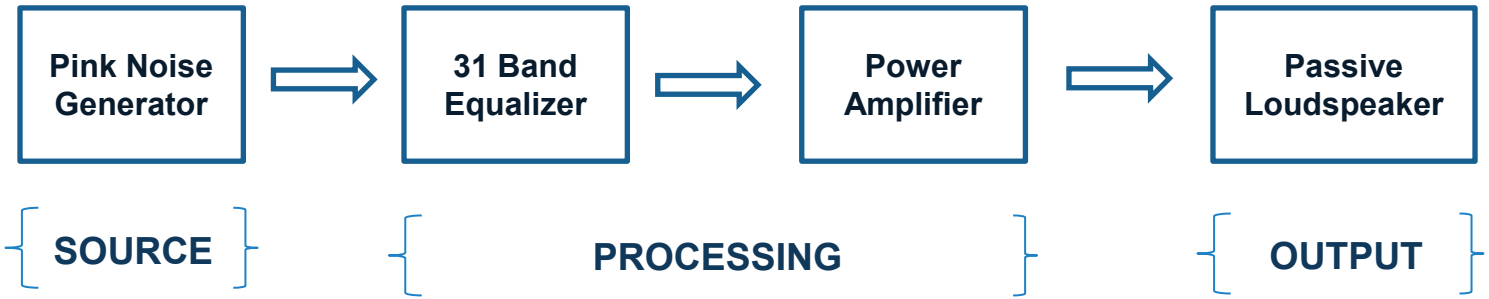
IEC 61672 (3.18 Calibration check frequency)

- "Nominal frequency in the range from 160 hertz to 1250 hertz of the sinusoidal sound pressure produced by a sound calibrator that is used in checking and adjusting a sound level meter."

LOUDSPEAKER NOISE AUDIT – NOISE SOURCE EQUIPMENT

LNAs employ an outdoor loudspeaker and various sound reinforcement equipment to simulate an aircraft noise source. There are three main components to the system as outlined below:

- **Source:** A signal generator outputs a pink noise signal, a signal the human ear perceives as “flat”. Pink noise provides equal amount of acoustical energy in each octave band.
- **Processing:** A multi-band equalizer is used to boost and/or cut specific frequency bands of the pink noise source signal in order to optimize system performance and maximize the potential sound pressure level. Any adjustments made are to ensure a strong signal-to-noise ratio which are accounted for during the analysis of the results. Via an XLR cable, the signal is sent to an amplifier to increase the overall amplitude. The output is controlled by the technician to ensure appropriate levels and safety of the test equipment.
- **Output:** A passive loudspeaker is the final stage of the equipment chain. It supplies sufficient output of the processed signal in order to be measured. It has enough power to provide a source signal that is significantly above the outdoor ambient level.



LOUDSPEAKER NOISE AUDIT – NOISE SOURCE EQUIPMENT GUIDANCE

Policy, Engineering, Analysis, and Research Support (PEARS) - (4.31)

- "L&B used a specialized field monitoring kit that includes a signal generator, amplifier, and an equalizer to produce a noise source of equal energy in each octave band (known in the acoustics field as “pink noise”). The use of pink noise lends to accurately measuring all octave bands of interest. The noise source was relayed to a loudspeaker and the amplified pink noise was directed at the room of interest."

ASTM E 966 – 18a – (8.2.2 Test Signal)

- "The electrical signal to the loudspeaker shall consist of random noise over the test frequency range. It may be necessary to filter the spectrum of the noise source to concentrate the available speaker sound power capability in a few bands to increase the receiver room sound pressure level. "

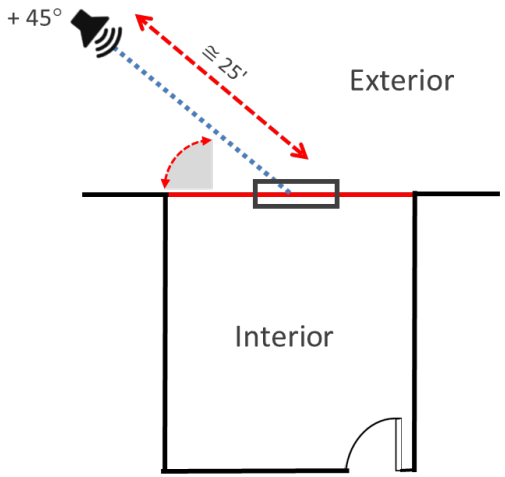
ASTM E 966 – 18a - (8.2.1 Loudspeaker Sound Emission Characteristics)

- "A single loudspeaker enclosure is preferred. Its directional characteristic should be such that at 2,000 Hz the free-field radiated sound pressure up to an angle of 45° off-axis shall not be more than 6 dB different from the on-axis sound pressure. It must supply sufficient output in all measurement bands to achieve sound levels at least 5 dB and preferably 10 dB over the background level in the receiving room over the range from 80 to 4,000 Hz. It may be necessary to add a high frequency loudspeaker in or on the enclosure to achieve sound that is reasonably distributed over the specimen area and to have the transmitted sound be above the background noise in the receiving room."

LOUDSPEAKER NOISE AUDIT – DISTANCE AND ANGLE OF INCIDENCE

- **Distance:** Preferably, the loudspeaker should be placed at **25 feet** from the center of the facade. However, under certain exterior conditions the loudspeaker's distance will have to vary.
- **Angle of incidence:** Preferably, the angle of incidence of the loudspeaker should be **45°** in any plane about a line perpendicular to the center of the facade. However, angles of incidence between **30°** and **60°** can also be used.

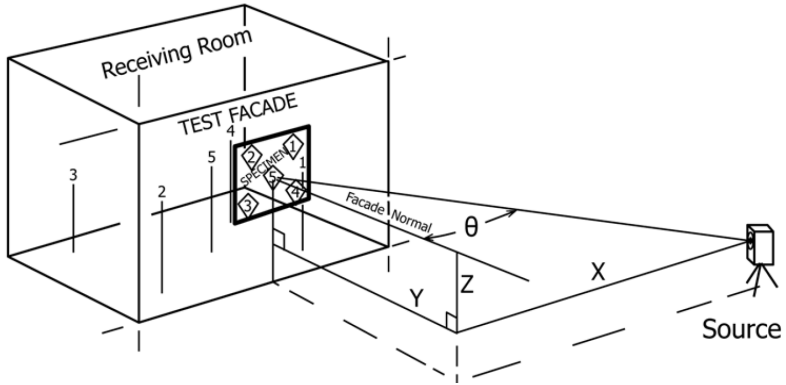
CONDITIONS	LNA
Outside Temperature	15° - 100° F
Precipitation	Not Recommended
Exterior Accessibility	Open space recommended
Interior Accessibility	N/A
Exterior Ambient	High levels possible



LOUDSPEAKER NOISE AUDIT – DISTANCE AND ANGLE OF INCIDENCE GUIDANCE

ASTM E 966 - 18a

- A single loudspeaker enclosure is preferred and the criteria for selecting the distance and angle incidence of the loudspeaker from the building surface is that the variation of sound level across the facade to be tested is not greater than **3 dB**.



Geometry of Flush Method – ASTM E966 - 18a

DOT/FAA/TC-18/15

- In order to achieve this level of sound pressure variation on the exterior facade, the loudspeaker should be placed at as large distance from the center facade as possible, preferably at least **25 feet**.

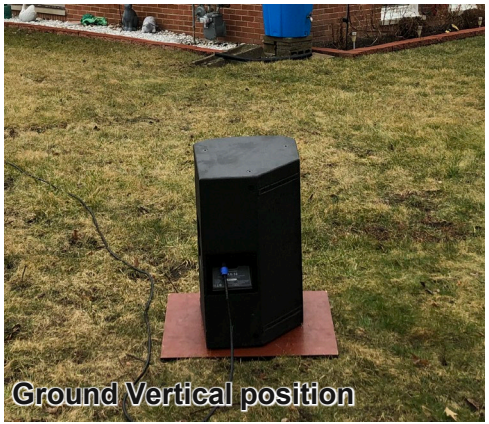
DOT/FAA/TC-19/34

- Using one single loudspeaker at a **45°** angle to the facade **can simulate the spectrum** and the incident sound wave of an aircraft overflight as it moves along its flight track.

- Angles of incidence between **30°** to **60°** can also be used if necessary due to exterior physical limitations or in order to provide the proper spatial noise level variation on the exterior facade's surface.

LOUDSPEAKER NOISE AUDIT – LOUDSPEAKER PLACEMENT VARIABLES

- In order to provide the appropriate audio signal coverage for most 1st and 2nd floor room facades, the loudspeaker should be placed at **ground level** (with mounting board) on either **vertical or horizontal** position.


Ground Vertical position

Ground Horizontal (Wedged) position

Stand and raised position (6 ft height) for 2nd and 3rd floor room facades

- While using the **ground level** position for facades located on 1st and 2nd floors and up to **24 ft** high, the front of the loudspeaker may be tilted upward as needed to improve signal spread coverage.

- The loudspeaker may also be placed on a **stand and raised** position to a height of 6 feet for microphone heights above **24 feet**. This might include exceedingly high 2nd floor room facades as well as most 3rd floor room facades.

LOUDSPEAKER NOISE AUDIT – LOUDSPEAKER PLACEMENT VARIABLES GUIDANCE

DOT/FAA/TC-19/34

- Managing unwanted ground reflections is one of the principal issues to consider during the selection of the loudspeaker placement at **ground level (0.7 ft)** or **stand and raised position (6 ft)**.
- From the combination of the typical aircraft noise spectrum and the value of the common facade noise reduction, the majority of the transmitted sound energy determining the NLR lies within the **100 to 500 Hz** frequency range.
- The table to the right indicates the frequency range affected by unwanted ground reflections in relationship to loudspeaker height and microphone height at a loudspeaker distance of **25 feet**.
- As noted by the green shaded cells, placing the loudspeaker on the ground position (0.7 ft) allows to conduct measurements with a microphone height of up to 24 ft while keeping the ground reflection interference frequency above **500 Hz**.
- As noted by the light orange shaded cells, placing the loudspeaker on the stand position (6 ft height) allows to conduct measurements with a microphone height above 24 ft while keeping the ground reflection interference frequency below **100 Hz**.

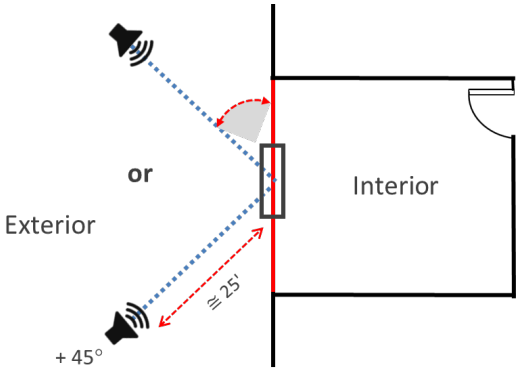
Microphone Height (ft)	Loudspeaker Source Height	
	0.7 feet	6 feet
1	10,083 Hz	1,209 Hz
3	3,384 Hz	405 Hz
6	1,727 Hz	207 Hz
8	1,322 Hz	158 Hz
10	1,085 Hz	129 Hz
12	931 Hz	111 Hz
14	825 Hz	98 Hz
18	690 Hz	81 Hz
24	582 Hz	68 Hz
30	524 Hz	61 Hz

Ground Reflection Interference Frequency as a Function of Loudspeaker and Microphone Height at a Distance of 25 ft – DOT/FAA/TC-19/34

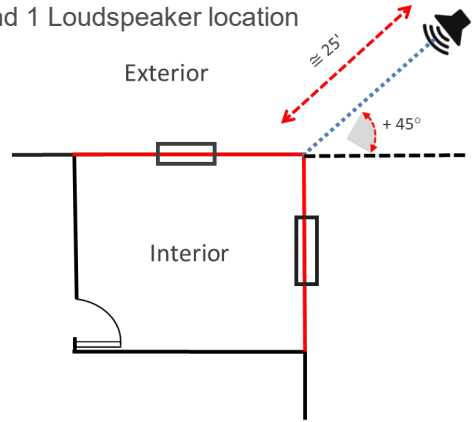
LOUDSPEAKER NOISE AUDIT – SINGLE AND MULTIPLE FACADES

- The type of LNA procedure for each home varies on a case-by-case basis. Depending on the home's layout, height and exterior physical obstructions around the property might require variations on the LNA's procedure.
- For single or one exterior facade room, the **1W** method should be used. For rooms with two exterior facades (corner rooms), either the **2W1** or **2W2** methods should be used.
- Measurements of corner rooms using a diagonal (corner) loudspeaker location or **2W1** is appropriate only where there are not any nearby reflecting surfaces. Otherwise, the **2W2** method should be used.

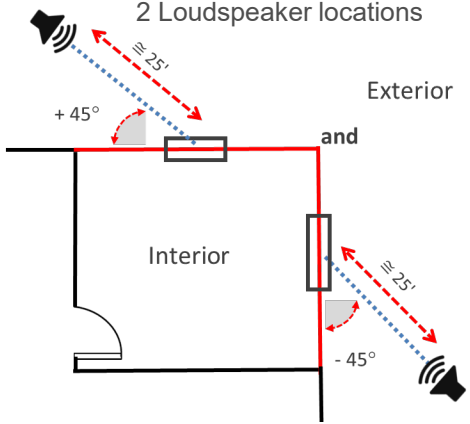
1W:
For Rooms with 1 Exterior Wall



2W1:
For Rooms with 2 Exterior Walls and 1 Loudspeaker location



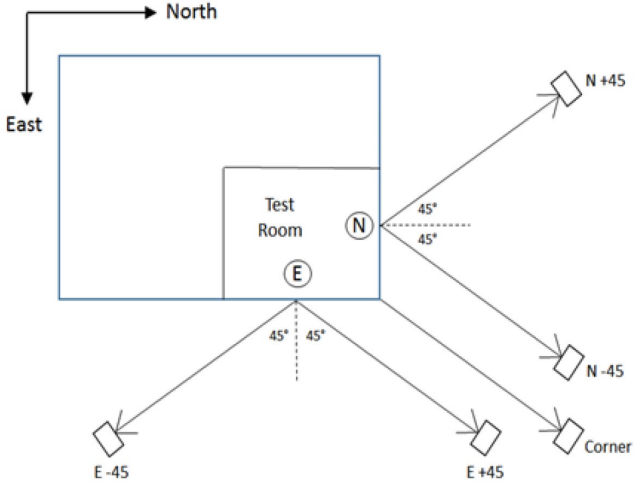
2W2:
For Rooms with 2 Exterior Walls and 2 Loudspeaker locations



LOUDSPEAKER NOISE AUDIT – SINGLE AND MULTIPLE FACADES GUIDANCE

DOT/FAA/TC-18/15 and DOT/FAA/TC-19/34

- Considering the various loudspeaker locations shown on the image to the right, the possible loudspeaker locations is determined by the number of the room's exposed facades and the exterior physical conditions around the property.



Test Configuration Diagram – DOT/FAA/TC-19/34

Single Facade Exposures:

- For rooms with single facade exposures, the two viable loudspeaker locations could be either at a **+45** or a **-45** angle of incidence (**1W**). The preference of either location will mainly depend on whether the preferable distance of **25 feet** from the center can be achieved.

Multiple Facade Exposures:

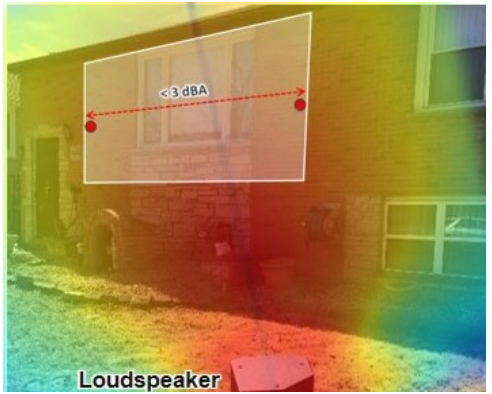
- For rooms with two facade exposures or corner rooms, the center loudspeaker location would be the preferred method as it is the most time efficient and repeatable method (**2W1**).
- However, when nearby structures prevent the preferable loudspeaker center distance of **25 feet** from being achieved, using two separate locations such as **N +45** and **E -45** should be considered (**2W2**).
- In addition, nearby structures may cause unwanted reflections during the center loudspeaker location. This will negatively affect the audio signal causing and uneven distribution between both facades. Using the **2W2** method will help to avoid this problem.

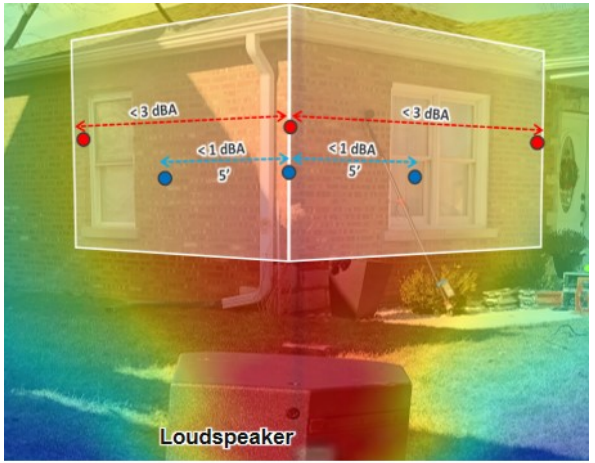
LOUDSPEAKER NOISE AUDIT – AUDIO SIGNAL SPREAD VERIFICATION

Audio signal spread is the reduction of acoustic energy measured throughout the extent of the exterior facade as the measurement location moves further away from the focal point of the signal. By verifying this level of variation, we can ensure that the entire façade is being exposed to an even distribution of acoustic energy with no unwanted concentrations.

- During the **1W** method, the audio signal variation between the opposite lateral sides of the exterior facade should be less than **3 dB** (top right image).
- During the **2W1** method, the audio signal variation between the opposite lateral sides of each exterior facade should be less than **3 dB** independently (bottom right image). In addition, the difference between the corner or intersecting point of the two facades to equal distanced opposite points on each facade should be less than **1 dB** (bottom right image).
- During the **2W2** method, the limit of **3 dB** audio signal variation requirement will need to be met on each facade independently. Since each loudspeaker position will require a separate interior measurement as well, the **2W2** method may be approached as two separate **1W** measurements.

IMPORTANT: Moving the loudspeaker to a distance greater than **25 ft** and/or slightly shifting the **angle of incidence** (direction) of the loudspeaker can help meeting these audio signal spread requirements.





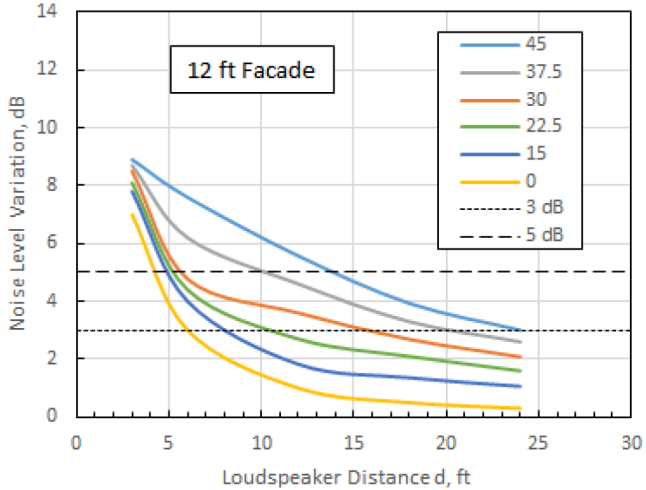
LOUDSPEAKER NOISE AUDIT – AUDIO SIGNAL SPREAD VERIFICATION GUIDANCE

ASTM E 966 – 18a and DOT/FAA/TC-18/15

- The loudspeaker axis shall be directed toward the center of the facade, favoring the more remote edge only as needed to make the sound pressure variation across the facade as small as possible, preferably within **3 dB**.
- In practice, the applied criteria for selecting the distance of the loudspeaker from the building surface should be that the variation of sound level across the facade to be tested is not greater than **3 dB**.

DOT/FAA/TC-19/34

- The spatial variation in noise level over a **12 ft** wide facade as a function of loudspeaker distance and angle of incidence is shown in the figure.
- Applying this criteria mentioned above, a loudspeaker distance of at least **25 ft** is required when the angle of incidence is **45°**. If measurements are conducted at distances less than **25 ft**, the angle of incidence must be reduced to maintain the **3 dB** variation in sound level over the facade.
- For corner rooms (two exposed facades) and to ensure equal exposure to the loudspeaker acoustical energy, a **±1 dB** variation must be measured at equal distances from the intersecting point.



Spatial Variation in Noise Level Over a 12-ft-Wide Facade as a Function of Loudspeaker Distance and Angle of Incidence – DOT/FAA/TC-19/34

LOUDSPEAKER NOISE AUDIT – AMBIENT MEASUREMENTS

- An indoor and outdoor background (ambient) noise measurement is required before the noise audit to verify there are no interfering noise sources that could affect the loudspeaker measurements.
- A 30 second Equivalent Sound Level (LEQ) measurement is taken outside the home at least 15 feet away from the facade.
- A 30 second center spatial LEQ measurement is taken on the interior of each room being audited.
- Additional ambient measurements may be necessary if different sides of the property are exposed to a louder ambient noise source (busy road highway, train, etc.).
- Redo any ambient measurements that may have been contaminated by a transient external noise event during the 30 second period. This is to ensure that we are documenting the true ambient level, excluding any irregular noise sources that could falsely influence the results of your measurements.

LOUDSPEAKER NOISE AUDIT – AMBIENT MEASUREMENTS GUIDANCE

ASTM E966 18a – (8.1.2 Site Background Noise)

- "Where possible turn off any extraneous interfering noise sources either indoors or outdoors. Measure the background sound both indoors and outdoors in the same way the test noise levels are measured with the source operating. Adjust for this background noise as required by Section 10. It may be necessary to conduct measurements during periods of low indoor and outdoor ambient noise to meet these requirements."

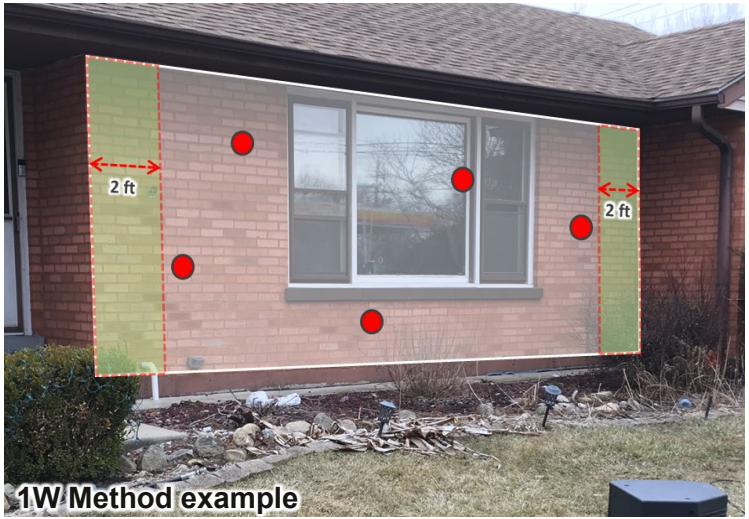
ASTM E966 18a – (10.1)

- "Verify that the outdoor and indoor levels are from the designated test source (traffic or loudspeaker) and not from some extraneous background noise source. At each measurement position, the background level should be at least 5 dB below the level of signal and background combined. Adjustments shall be made unless the background level is more than 10 dB below the combined level."

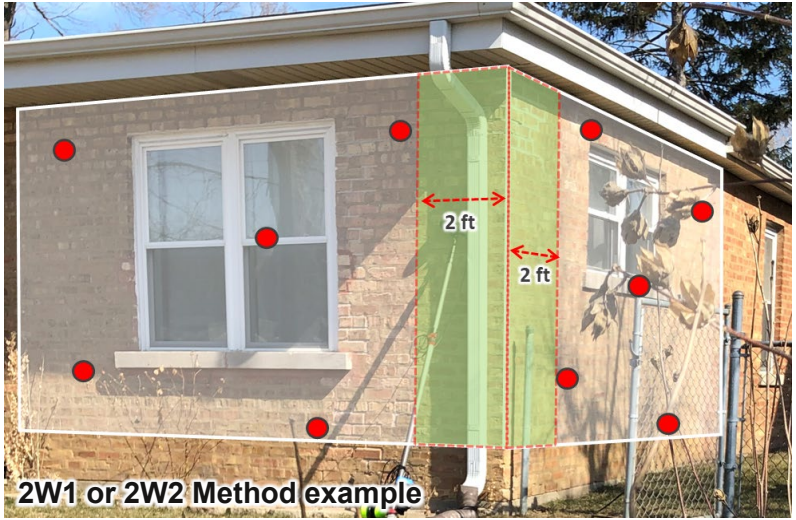
LOUDSPEAKER NOISE AUDIT – CONDUCTING EXTERIOR MEASUREMENTS

- The exterior microphone should be flush mounted at a maximum distance of 0.5” from the surface.
- 5 random flushed position measurements covering the extent of each facade should conducted, each lasting 30 seconds.
- None of the 5 measurements should focus on a specific element (Window, Door, etc.).

IMPORTANT: A distance or buffer zone of **2 feet** between any of the measurements and **90°** exterior facade corners should be maintained. Keeping this distance will help to avoid acoustical phenomena such as diffraction and/or build up.



1W Method example



2W1 or 2W2 Method example

LOUDSPEAKER NOISE AUDIT – CONDUCTING EXTERIOR MEASUREMENTS GUIDANCE

ASTM E 966 - 18a

- When compared to other loudspeaker measurement methods such as the Near-Facade Microphone and the Calibrated Source Method, the Flush Method offers the benefit of repeatability between the Pre and Post construction noise audits. In addition, the level of deviation in the measurements of frequency response are less affected by variations in distance and angle of incidence.

DOT/FAA/TC-18/15 and DOT/FAA/TC-19/34

- 5 random flushed mounted position measurements covering the extent of each facade should conducted, each lasting 30 seconds. Common practice among consultants is to measure the facade level by averaging the level of the five fixed positions for flush measurement.
- Each flush measurement should be conducted with a small condenser microphone 13 mm in diameter with a standard 3.54-in. windscreen mounted very close to the facade.

Exterior facade correction factor :

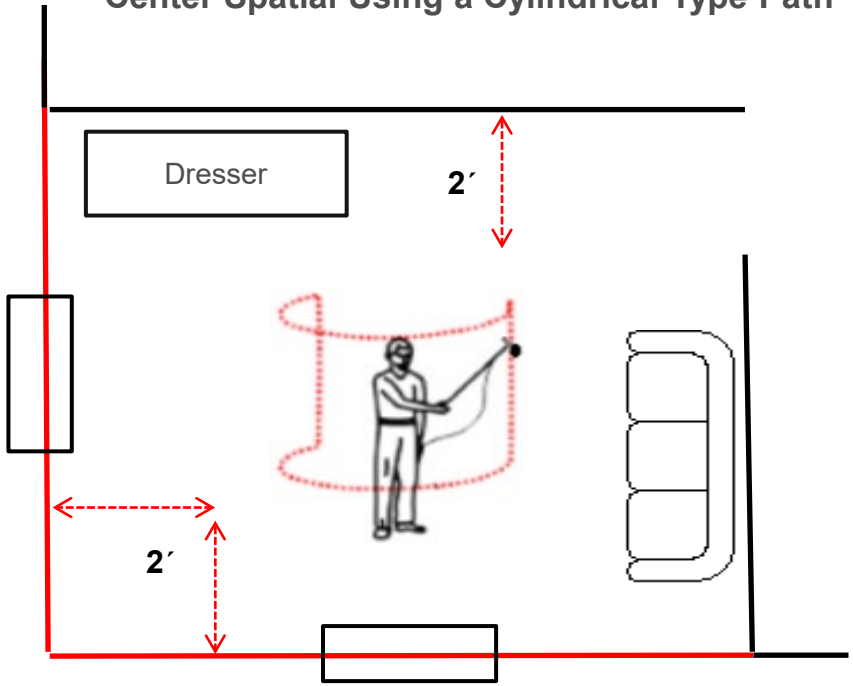
- The presence of the facade approximately quadruples the sound pressure by **6 dB**. Therefore, an adjustment factor of **– 6 dB** should be applied to the calculated Outdoor-Indoor Noise Reduction (OINR) value at an angle of incidence θ using the following equation:

$$OINR(\theta) = L_{flush} - L_{in}(\theta) - 6\ dB$$

LOUDSPEAKER NOISE AUDIT – CONDUCTING INTERIOR MEASUREMENTS

- Two 30 seconds measurement per room should be conducted.
- Extend the pole so that the microphone is at least 2 feet from your body. This 2-foot minimum distance is maintained during each measurement.
- Sweep the microphone in a half-can pattern **maintaining a constant speed of 1 foot per second** and **staying at least 2 feet away from the floor, ceiling, walls, or any hard-reflective surfaces.**

Center Spatial Using a Cylindrical Type Path



LOUDSPEAKER NOISE AUDIT – CONDUCTING INTERIOR MEASUREMENTS GUIDANCE

ASTM E966 – (8.4.1)

- "Fixed microphone positions or a single moving microphone manually swept or moving continuously along a circular path may be used while satisfying the following conditions"

ASTM E966 – (8.4.1.1)

- "No microphone position shall be closer than 1 m to the inside surface of the exterior wall or to any other boundary or extended surface, unless the room is too small to allow adequate microphone positions within this restriction in which case the microphones may be within 0.5 m of surfaces other than the specimen."

ASTM E966 – (8.4.1.4)

- "For a moving microphone use an integrating averaging sound level meter meeting the requirements of ANSI S1.43 or IEC 61672."

JASA **129**, 3034 (2011) Carl Hopkins

- Employing a walking scanning pattern for interior measurements is not efficient because of noise created by the operator. Scanning from a fixed position avoids these issues. The use of a 1 – 3 foot extension rod for the microphone and a cylindrical type path technique optimizes the number of uncorrelated samples gathered from the measurement, more so than a simple circular motion.

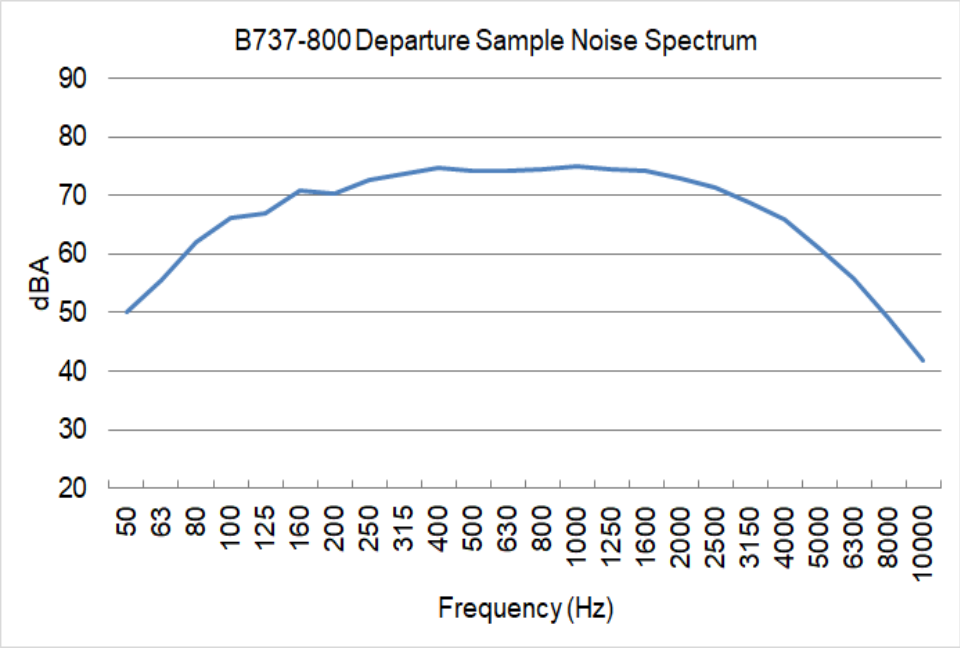
LOUDSPEAKER NOISE AUDIT – AIRCRAFT FREQUENCY SPECTRUM

An aircraft noise spectrum or “curve” was created for each community using data of the most frequently operated aircraft type for each unique runway end.

Every community has a runway whose operations affect said town. To find the appropriate spectra for each, the following steps were taken:

- The **most frequently operated aircraft** was identified for the runway associated with each town
- Spectral class IDs were provided by the FAA for each identified aircraft
- Determined the annual average percentage of arrivals to departures for each runway by reviewing past flight data
- Each spectra was weighted based on the percentage of arrivals to departures to establish a curve that represents the noise affecting each town

The spectra established became the curves we use and is the most relevant by runway end and noise audit location.



LOUDSPEAKER NOISE AUDIT – AIRCRAFT FREQUENCY SPECTRUM GUIDANCE

HMMH Report No.305220.008

- The authors found that the method, which utilizes a single aircraft spectrum, also produce reasonably accurate results, since operations at both of the study airports are largely dominated by a single INM aircraft type (e.g., Boeing737-700).

- Recommendations are based on a tiered approach for identifying an aircraft noise spectrum to use in airport SIPs. Initially, we recommend an Interim Approach at the request of FAA that uses the **most frequently operating aircraft at an airport by runway end**. This Interim Approach is relatively straight-forward and requires a low level of effort to implement. The Interim Approach yields reasonably accurate results for airports dominated by frequent commercial jet operations and may be used immediately.

FAA Draft AC 150/5000-9B – (Table 7-8 Source Spectrum Methods)

- "The **aircraft that dominates (used most frequently) at an airport by runway end** must be used as the aircraft noise spectrum. Alternative versions of this method use an approach spectrum since that best represents the dominant noise communities receive from arrivals or use a departure spectrum since they receive almost exclusively departure noise."

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