



U.S. Department of Transportation
Federal Highway Administration

SEPTEMBER 2021

Sound Sample Demonstration Tool

INSTRUCTIONS

FHWA-HEP-22-003
FEDERAL HIGHWAY ADMINISTRATION
OFFICE OF NATURAL ENVIRONMENT
Washington, D.C.



Installation

Database and Tool

Installation

Part 1 – MATLAB Runtime

- Download the MATLAB Runtime R2020b (9.9) for Windows
- <https://www.mathworks.com/products/compiler/matlab-runtime.html>

Release (MATLAB Runtime Version#)	Windows	Linux	Mac
R2021a (9.10)	64-bit	64-bit	Intel 64-bit
R2020b (9.9)	64-bit	64-bit	Intel 64-bit
R2020a (9.8)	64-bit	64-bit	Intel 64-bit
R2019b (9.7)	64-bit	64-bit	Intel 64-bit

- Extract Zip File
 - Run setup.exe
- 
- Accept default settings and follow instructions in the Installer

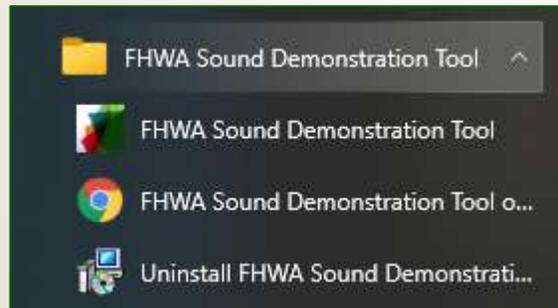
Installation

Part 2 – FHWA Sound Sample Demonstration Tool

- Download FHWA_SDT_Installer.exe



- https://www.fhwa.dot.gov/environment/noise/traffic_noise_model/
- Accept default settings and follow instructions in the Installer
- The tool can be launched using the short cut in the start menu





Getting Started

Introduction and Calibration

NOISE



- This is the Federal Highway Administrations Sound Sample Demonstration Tool (FHWA SSdT)
- The purpose of this tool is to:
 - Illustrate key features in the perception and quantification of highway-related noise
- The tool can be used by:
 - Clicking on the tabs on the left hand side of the tool to navigate to a specific topic area.
 - Selecting desired settings for the specific panel.
 - Playing the demonstration sounds in the panel.
 - Reviewing the panel outputs, such as noise levels.
 - It is recommended that, before selecting any other tabs, the Calibration tab be used to calibrate your system.
- Note on Sound Samples:
 - For some demonstrations, a steady traffic will be used.
 - For some demonstrations, the steady traffic is replaced by noise with the same spectral shape but with the temporal variation removed.
 - This is done to make hearing key points easier.
 - To hear examples of steady traffic, and noise with the same spectral shape, press the buttons below.

Play Steady Traffic

Play Shaped Noise

- Additional resources are available at:
 - [The FHWA Noise Website](#)
 - The FHWA SSdT User's Guide
 - [The NHI Training Course](#)
- For help using this tool please contact:
 - TNMHelp@dot.gov

Note: The SSdT is for illustrative purposes only:

- It **should not** be used for predicting noise levels or determining feasible and reasonable mitigation
- Shaped noise is **based on results from the FHWA Traffic Noise Model (TNM)**
- **Headphones provide the optimal listening experience,** but speakers are also acceptable

NOISE

Calibration

Playback Method

- Speakers
 Headphones

Calibration Method

- Absolute (SLM)
 Relative (Subjective)



Calibration Signal

Pink Noise

Target Level (dBA)

75

Left Channel Gain (dB)



Play Left Channel

Stop Left Channel

0

Gain (dB)

1

Gain (Linear)

Right Channel Gain (dB)



Play Right Channel

Stop Right Channel

0

Gain (dB)

1

Gain (Linear)

Purpose:

Calibrate the tool such that the intended noise levels are accurate

Process:

1. Choose the appropriate "Playback Method"
2. Choose your preferred "Calibration Signal"
 - ▶ If you will use an SLM with speakers, choose "Absolute" for the Calibration Method
 - Click "Play Left Channel" and adjust the Left Channel Gain slider until the SLM reads 75 dBA
 - Repeat for the right channel
 - ▶ If you will not be using an SLM, choose "Relative" for the Calibration Method
 - Click "Play Left Channel" and adjust the Left Channel Gain slider until you are just barely able to hear the signal
 - Repeat for the right channel



Using the Tool

Typical Sound Levels and Sound Level Differences

NOISE



Typical Levels And Perceived Sound Level Differences

Left Channel

Sound Source:

Base Level (dBA): Increment (dB):

Final Level (dBA):

Right Channel

Sound Source:

Base Level (dBA): Increment (dB):

Final Level (dBA):

Combined Level, dBA:

Purpose:

Compare a single sound source at different levels

Process:

1. Select a "Sound Source" in only one channel
 - Press "Play" to hear the sound at 30 dBA
 - **Note:** This may be inaudible.
2. Use the left dial to adjust the "Base Level" to 40 dBA
 - Press "Play" to hear the sound at 40 dBA
3. Repeat steps 1 and 2 until 80 dBA "Base Level" is reached
 - **Note:** 80 dBA may be intolerable for long durations

NOISE



Typical Levels And Perceived Sound Level Differences

Left Channel

Sound Source
White Noise

Base Level (dBA) Increment (dB)

Final Level (dBA)

Play Stop

Right Channel

Sound Source
White Noise

Base Level (dBA) Increment (dB)

Final Level (dBA)

Play Stop

Combined Level, dBA

Purpose:

Compare different sound sources at the same level

Process:

1. Select the "White Noise" Sound Source in only one channel
 - Press "Play"
 - While listening, use the left dial to select a comfortable "Base Level"
2. Select the "Pink Noise" Sound Source
 - Press "Play"
 - **Note:** the sound character differences between white and pink noise at the same sound level
3. Repeat steps 1-3 with the three pure tone Sound Sources, **noting the sound character differences between each frequency at the same sound level**

NOISE



Typical Levels And Perceived Sound Level Differences

Left Channel

Sound Source

50 60
40 70
30 80

Base Level (dBA)

4 5 6 7
3 2 1 0
8 9 10

Increment (dB)

Final Level (dBA)

Right Channel

Sound Source

50 60
40 70
30 80

Base Level (dBA)

4 5 6 7
3 2 1 0
8 9 10

Increment (dB)

Final Level (dBA)

Combined Level, dBA

Purpose:

Relate small sound level changes to perceived loudness changes

Process:

1. Select a "Sound Source" in only one channel
 - Press "Play"
 - Press "Stop"
2. Use the left dial to select a "Base Level"
 - Press "Play"
 - Press "Stop"
3. Adjust the right dial to an "Increment" of 1 dB
 - Press "Play"
 - Press "Stop"
 - **Note:** You may not be able to notice a 1 dB sound level increase
4. Return the right dial to an "Increment" of 0 dB
 - Press "Play"
 - Press "Stop"
5. Adjust the right dial to an "Increment" of 3 dB
 - Press "Play"
 - Press "Stop"
 - **Note:** You should barely be able to notice a 3 dB sound level increase
6. Repeat Step 4
7. Adjust the right dial to an "Increment" of 5 dB
 - Press "Play"
 - **Note:** You should easily be able to notice a 5 dB sound level increase

NOISE



Typical Levels And Perceived Sound Level Differences

Left Channel

Sound Source

50 60
40 70
30 80

Base Level (dBA)

4 5 6 7
3 2 1 0
8 9 10

Increment (dB)

Final Level (dBA)

Right Channel

Sound Source

50 60
40 70
30 80

Base Level (dBA)

4 5 6 7
3 2 1 0
8 9 10

Increment (dB)

Final Level (dBA)

Combined Level, dBA

Purpose:

Perceive the combination of two similar sound sources

Process:

1. Select the "White Noise" Sound Source in the left channel
 - Press "Play"
 - Use the left dial to select a comfortable "Base Level"
 - Press "Stop"
2. Select the "Pink Noise" Sound Source in the right channel
 - Press "Play"
 - Use the left dial to select a comfortable "Base Level"
 - Press "Stop"
3. Press "Play" on both channels
 - **Note:** The "Combined Level" is not an arithmetic sum of the two noise levels



Using the Tool

Combining Sounds, Frequency Content of Sounds, and Noise Metrics for Sounds

NOISE



Combining Levels of Uncorrelated Similar Sources



Sound Source

Fan ▼

Play

Stop

Combined Sound Level (dBA)

One Source

N Sources

This Demo Plays Sound Only From The Left Channel

Purpose:

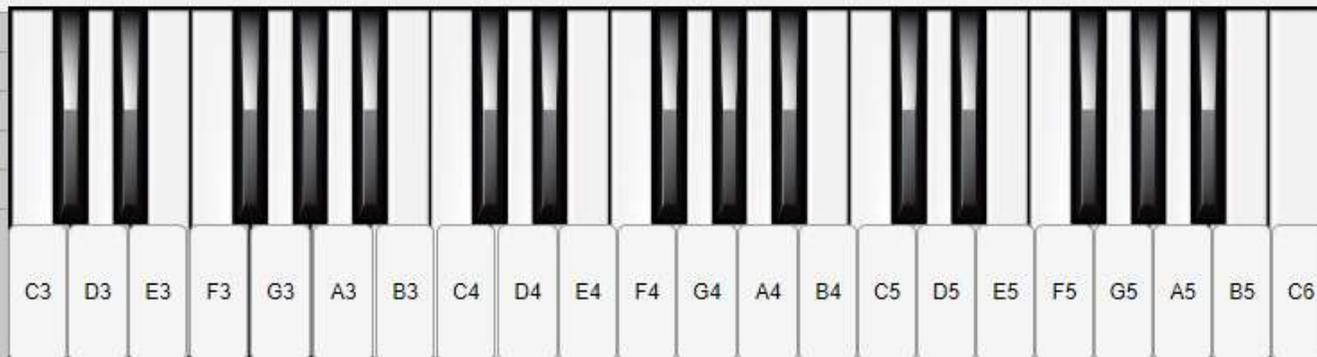
Perceive the combination of multiple sound sources of the same type

Process:

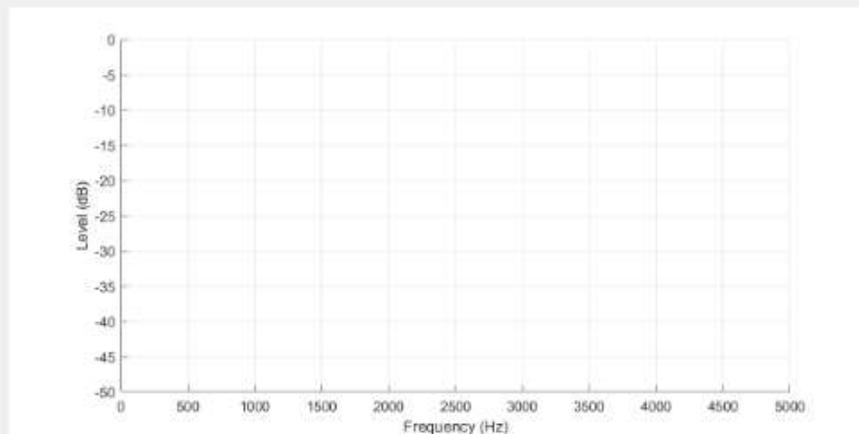
1. Select the "Fan" Sound Source
2. Use the dial to select 1 source
 - Press "Play"
3. Use the dial to select 2 sources
 - Press "Play"
 - **Note:** The combination of two similar sound sources is not perceived to be "twice as loud" as a single source
 - **Note:** The combined level (N Sources) is 3 dB greater than the level of the single source.
 - **Recall:** 3 dB is a barely perceptible sound level increase
4. Use the dial to select 3 sources
 - Press "Play"
 - **Note:** The combined level (N Sources) is about 5 dB greater than the level of the single source.
 - **Recall:** 5 dB is an easily perceptible sound level increase

- Introduction
- Calibration
- Typical Levels
- Combining Levels
- Frequency Content
- Metrics
- Sound Propagation
- Vehicle Levels
- Construction Noise
- Interior / Exterior Levels

NOISE



Spectrum



Sound Source

Piano



Sound Level (dB)

Sound Level (dB)

Sound Level (dBA)

Stop

Purpose:

Understand how frequency impacts the perception of sound

Process:

1. Select the "Pure Tone" Sound Source
2. Select any marked key on the keyboard
3. Use the "Sound Level" dial to select a comfortable level
 - **Note:** The pure tone spectrum consists of a single vertical line at a particular frequency
 - **Note:** Adjusting the sound level does not change the frequency (pitch) of the note
4. Select the "Piano" Sound Source
5. Select the same marked key from Step 2
 - **Note:** The maximum level occurs at the same frequency as the pure tone
 - **Note:** The piano spectrum consists of several local peaks across many frequencies. Your brain perceives this unique pattern of local peaks to recognize the sound character of a piano
6. Select other marked keys on the keyboard
 - **Note:** The peak frequency increases as you move from left to right across the piano
7. Select the highest and lowest notes on the keyboard
 - **Note:** The sound level in dBA is much closer to the sound level in dB for the highest note than the lowest note

Introduction

Calibration

Typical Levels

Combining Levels

Frequency Content

Metrics

Sound Propagation

Vehicle Levels

Construction Noise

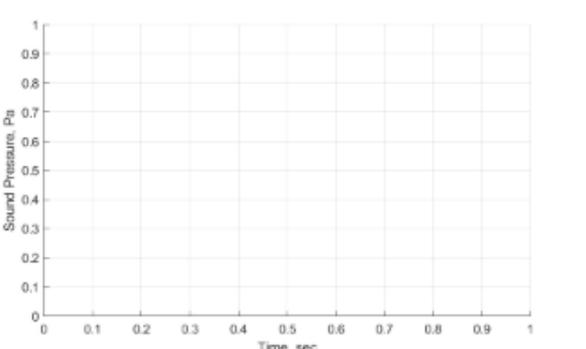
Interior / Exterior Levels

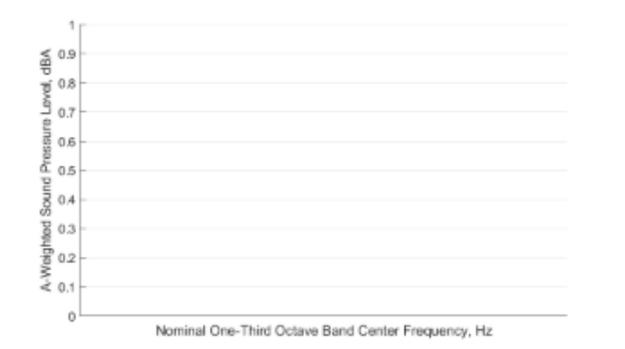
NOISE



Sound Source

Single Pa... ▼ Play Stop





A-Weighted Metrics

LAeq, 1-min (dBA)	LAeq, 10-sec (dBA)	L50 (dBA)	L10 (dBA)	Lmax (dBA)
<input style="width: 60px; height: 20px;" type="text"/>				

Un-Weighted Metrics

Leq, 1-min (dB)	Leq, 10-sec (dB)	L50 (dB)	L10 (dB)	Lmax (dB)
<input style="width: 60px; height: 20px;" type="text"/>				

Purpose:

View sound level descriptors associated with traffic noise

Process:

1. Select the "Single Passby" Sound Source
 - Press "Play"
 - **Note:** All sound pressure is condensed into a few seconds in the left plot
 - **Note:** All A-weighted metrics are lower than the un-weighted counterpart
 - **Note:** The 1-minute LAeq is much lower than the 10-second LAeq, and the percentile metrics (L10, L50) are much lower than the maximum sound level (Lmax) due to the short noise event duration
2. Select the "Heavy Traffic" Sound Source
 - Press "Play"
 - **Note:** It is difficult to ascertain distinct passby events in the left plot.
 - **Note:** The 1-minute LAeq, 10-second LAeq, and the L50 are all relatively similar due to the near-constant nature of the source noise
3. Select the "Steady State Equivalent" Sound Source
 - Press "Play"
 - **Note:** There is very little variation in the left plot.
 - **Note:** The 1-minute LAeq, 10-second LAeq, and the L50 are all identical, and the L10 is similar due to consistency of the source



Using the Tool

Sound Propagation

NOISE

Barrier 30 feet from near lane, Cars traveling at 55 mph

Ground Type	L _{Aeq} , 1-Hr (without Barrier) (dBA)		Play
Pavement (...)			
Rec Distance (ft)	L _{Aeq} , 1-Hr (with Barrier) (dBA)		Stop
50			
Barrier Height (ft)	IL (dB)		
0			
Traffic Volume			
2250 cars / hr			

Purpose:

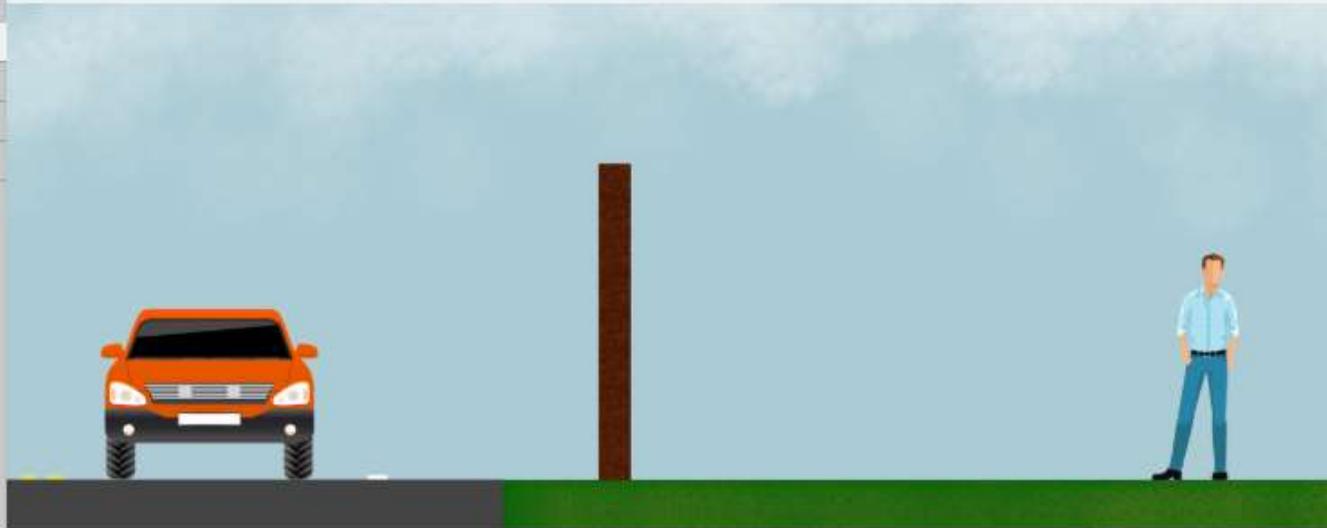
Perceive the difference between propagation over soft and hard ground

Process:

1. Select the "Pavement (Hard)" Ground Type
 - Press "Play"
2. Select the "Lawn (Soft)" Ground Type
 - Press "Play"
 - **Note:** At the same receiver distance, the same source noise measures a much lower L_{Aeq} when propagated over soft ground than over hard ground
 - **Note:** The ground type changes **both** the sound level **and** the sound character of the same source noise

- Introduction
- Calibration
- Typical Levels
- Combining Levels
- Frequency Content
- Metrics
- Sound Propagation
- Vehicle Levels
- Construction Noise
- Interior / Exterior Levels

NOISE



Barrier 30 feet from near lane, Cars traveling at 55 mph

Ground Type

Pavement (... ▼)

L_{Aeq}, 1-Hr (without Barrier) (dBA)

Play

Rec Distance (ft)

50 ▼

L_{Aeq}, 1-Hr (with Barrier) (dBA)

Stop

Barrier Height (ft)

0 ▼

IL (dB)

Traffic Volume

2250 cars / hr ▼

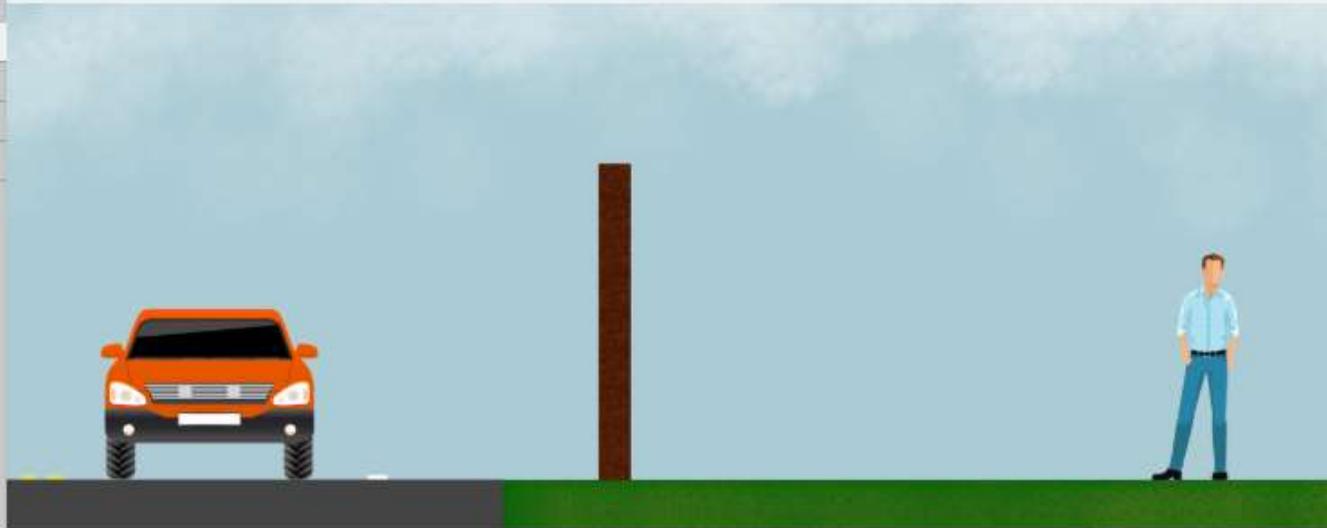
Purpose:

Perceive the impact of barrier height

Process:

1. Select the "Pavement (Hard)" Ground Type
2. Select a "Rec Distance" of 50 ft
3. Select a "Barrier Height" of 0 ft
 - ▶ Press "Play"
4. Select a "Barrier Height" of 2 ft
 - ▶ Press "Play"
 - ▶ **Note:** This barrier height has no impact on the perception or L_{Aeq} of the noise
5. Repeat Step 3
6. Select a "Barrier Height" of 4 ft
 - ▶ Press "Play"
 - ▶ **Note:** This barrier height has a small impact on the perception and L_{Aeq} of the noise, with an insertion loss of 4.1 dB
7. Repeat Step 3
8. Select a "Barrier Height" of 6 ft
 - ▶ Press "Play"
 - ▶ **Note:** This barrier height has a noticeable impact on the perception and sound level of the noise, with an insertion loss of 9 dB
9. Repeat Step 3
10. Select a "Barrier Height" of 8 ft
 - ▶ Press "Play"
 - ▶ **Note:** This barrier height has some additional reduction, with an insertion loss of 11.5 dB
 - ▶ **Note:** The relationship between barrier height increment and insertion loss is not linear

NOISE



Barrier 30 feet from near lane, Cars traveling at 55 mph

Ground Type
Pavement (... ▼)

L_{Aeq}, 1-Hr (without Barrier) (dBA)

Play

Rec Distance (ft)
50 ▼

L_{Aeq}, 1-Hr (with Barrier) (dBA)

Stop

Barrier Height (ft)
0 ▼

IL (dB)

Traffic Volume
2250 cars / hr ▼

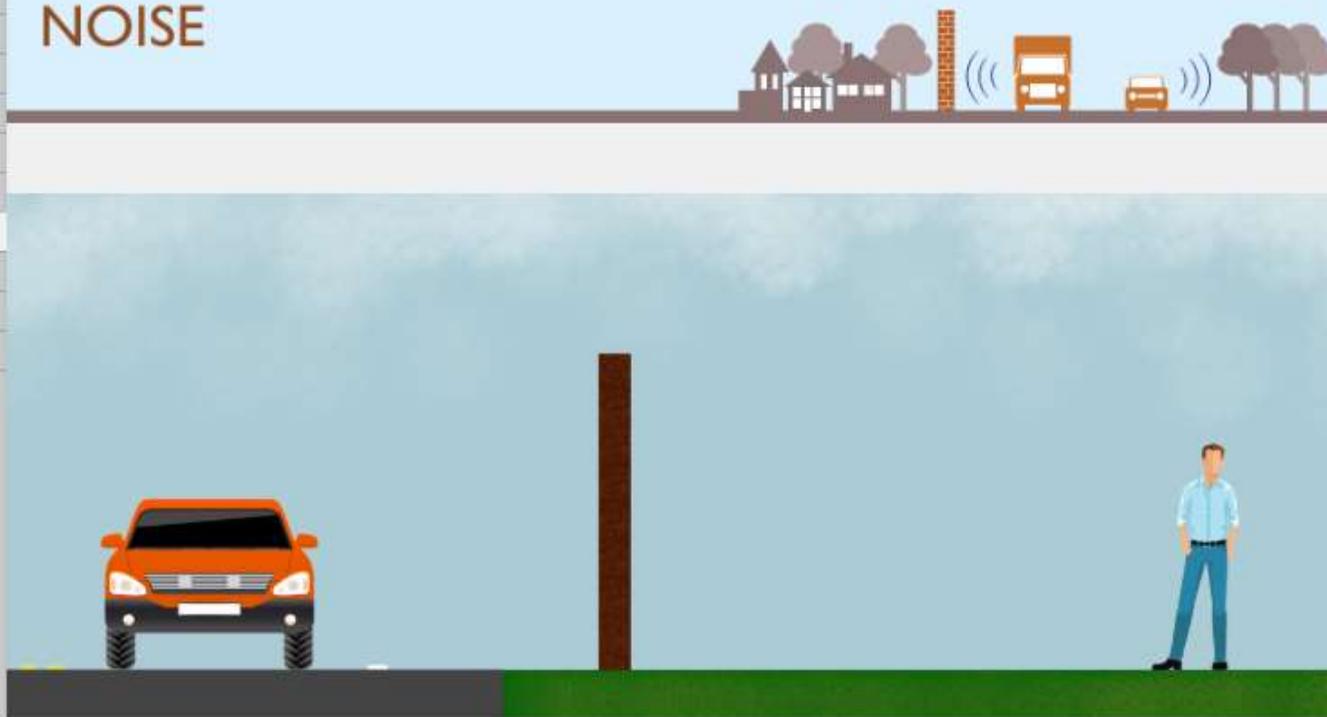
Purpose:

Perceive the impact of barrier height at various ground types

Process:

1. Select the "Pavement (Hard)" Ground Type
 - ▶ Select a "Barrier Height" of 10 ft
 - ▶ Press "Play"
2. Select the "Lawn (Soft)" Ground Type
 - ▶ Press "Play"
 - ▶ **Note:** The same barrier height does not result in the same insertion loss with different ground types
 - ▶ **Note:** Hard ground results in a higher "with Barrier" L_{Aeq}, despite higher barrier insertion loss
 - ▶ **Note:** The impact of ground attenuation is greater than the impact of insertion loss
3. Select the "Pavement (Hard)" Ground Type
 - ▶ Select a "Barrier Height" of 20 ft
 - ▶ Press "Play"
4. Select the "Lawn (Soft)" Ground Type
 - ▶ Select a "Barrier Height" of 14ft
 - ▶ Press "Play"
 - ▶ **Note:** Soft ground adds additional attenuation, resulting in a lower barrier required to achieve a similar "with Barrier" L_{Aeq}

NOISE



Barrier 30 feet from near lane, Cars traveling at 55 mph

Ground Type
Pavement (... ▼)

L_{Aeq}, 1-Hr (without Barrier) (dBA)

Play

Rec Distance (ft)
50 ▼

L_{Aeq}, 1-Hr (with Barrier) (dBA)

Stop

Barrier Height (ft)
0 ▼

IL (dB)

Traffic Volume
2250 cars / hr ▼

Purpose:

Perceive the impact of barrier height at various receiver distances

Process:

1. Select the "Pavement (Hard)" Ground Type
 - Select a "Rec Distance" of 50 ft
 - Select a "Barrier Height" of 10 ft
 - Press "Play"
2. Select a "Rec Distance" of 400 ft
 - Press "Play"
 - **Note:** Barriers are less important (have lower insertion loss) at farther distances from the roadway
3. Select a "Rec Distance" of 50 ft
 - Select a "Barrier Height" of 20 ft
 - Press "Play"
4. Select a "Rec Distance" of 400 ft
 - Select a "Barrier Height" of 8 ft
 - Press "Play"
 - **Note:** A lower barrier is required to achieve a similar "with Barrier" L_{Aeq} at further distances from roadway due to ground attenuation

NOISE

Barrier 30 feet from near lane, Cars traveling at 55 mph

Ground Type
Pavement (Hard)

Rec Distance (ft)
50

Barrier Height (ft)
0

Traffic Volume
2250 cars / hr

LAeq, 1-Hr (without Barrier) (dBA)

LAeq, 1-Hr (with Barrier) (dBA)

IL (dB)

Play

Stop

Purpose:

Perceive the impact of barrier height at various traffic volumes

Process:

1. Select the "Pavement (Hard)" Ground Type
2. Select a "Rec Distance" of 50 ft
 - ▶ Select a "Barrier Height" of 10 ft
 - ▶ Select a "Traffic Volume" of 2250 cars/hr
 - ▶ Press "Play"
3. Select a "Barrier Height" of 20 ft
 - ▶ Select a "Traffic Volume" of 6750 cars/hr
 - ▶ Press "Play"
 - ▶ **Note:** A taller barrier is required to achieve the same "with Barrier" LAeq at heavier traffic volumes



Using the Tool

Vehicle Sound Levels

Using TNM vehicle classifications

- Introduction
- Calibration
- Typical Levels
- Combining Levels
- Frequency Content
- Metrics
- Sound Propagation
- Vehicle Levels
- Construction Noise
- Interior / Exterior Levels

NOISE



Selected	Source				
<input type="checkbox"/>		Speed (mph)	35	L _{Amax} (dBA)	L _{Aeq} , 1-Hr (dBA)
		Vehicles / Hr	0	<input type="text"/>	<input type="text"/>
<input type="checkbox"/>		Speed (mph)	35	L _{Amax} (dBA)	L _{Aeq} , 1-Hr (dBA)
		Vehicles / Hr	0	<input type="text"/>	<input type="text"/>
<input type="checkbox"/>		Speed (mph)	35	L _{Amax} (dBA)	L _{Aeq} , 1-Hr (dBA)
		Vehicles / Hr	0	<input type="text"/>	<input type="text"/>
<input type="checkbox"/>		Speed (mph)	35	L _{Amax} (dBA)	L _{Aeq} , 1-Hr (dBA)
		Vehicles / Hr	0	<input type="text"/>	<input type="text"/>
<input type="checkbox"/>		Speed (mph)	35	L _{Amax} (dBA)	L _{Aeq} , 1-Hr (dBA)
		Vehicles / Hr	0	<input type="text"/>	<input type="text"/>
	Rec Distance (ft)			Combined L _{Aeq} , 1-hr (dBA)	
	50	<input type="button" value="Play"/>	<input type="button" value="Stop"/>	<input type="text"/>	

Purpose:

Perceive the noise contribution of each vehicle type in a typical highway fleet

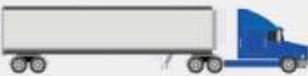
Process:

1. Select a "Speed" of 55 mph for all vehicle types
2. Select 100 "Vehicles/Hr" of cars
 - Press "Play"
3. Select 0 "Vehicles/Hr" of cars
4. Select 100 "Vehicles/Hr" of medium trucks
 - Press "Play"
5. Repeat steps 2-4 to hear the sound of 100 Vehicles/Hr of a single vehicle type at a time
 - **Note:** For the same number of vehicles traveling at the same speed, the heavy truck is the loudest, and is therefore the largest contributor to the overall "Combined L_{Aeq}"
6. Select 100 "Vehicles/Hr" for all vehicle types
 - Select a "Rec Distance" of 400 ft
 - Press "Play"
 - **Note:** At farther distances from the roadway, the aforementioned effect is even more pronounced

- Introduction
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NOISE



Selected	Source				
<input type="checkbox"/>		Speed (mph)	35 ▼	L _{Amax} (dBA)	L _{Aeq} , 1-Hr (dBA)
		Vehicles / Hr	0 ▼	<input type="text"/>	<input type="text"/>
<input type="checkbox"/>		Speed (mph)	35 ▼	L _{Amax} (dBA)	L _{Aeq} , 1-Hr (dBA)
		Vehicles / Hr	0 ▼	<input type="text"/>	<input type="text"/>
<input type="checkbox"/>		Speed (mph)	35 ▼	L _{Amax} (dBA)	L _{Aeq} , 1-Hr (dBA)
		Vehicles / Hr	0 ▼	<input type="text"/>	<input type="text"/>
<input type="checkbox"/>		Speed (mph)	35 ▼	L _{Amax} (dBA)	L _{Aeq} , 1-Hr (dBA)
		Vehicles / Hr	0 ▼	<input type="text"/>	<input type="text"/>
<input type="checkbox"/>		Speed (mph)	35 ▼	L _{Amax} (dBA)	L _{Aeq} , 1-Hr (dBA)
		Vehicles / Hr	0 ▼	<input type="text"/>	<input type="text"/>
	Rec Distance (ft)			Combined L _{Aeq} , 1-hr (dBA)	
	50 ▼		<input type="button" value="Play"/>	<input type="button" value="Stop"/>	<input type="text"/>

Purpose:

Perceive the impact of traffic volume on the sound level

Process:

1. Select a "Speed" of 65 mph for all vehicle types
 - Select 2000 "Vehicles/Hr" of cars
 - Select 200 "Vehicles/Hr" of heavy trucks
 - Select 0 "Vehicles/Hr" of all other vehicle types
 - Select a "Rec Distance" of 50 ft
 - Press "Play"
 - **Note:** Fewer trucks are required to produce a similar "L_{Aeq}" as more cars traveling at the same speed
2. Select 200 "Vehicles/Hr" of medium trucks
 - Select 20 "Vehicles/Hr" of busses
 - Select 50 "Vehicles/Hr" of motorcycles
 - Press "Play"
3. Select 50 "Vehicles/Hr" of medium and heavy trucks
 - Press "Play"
 - **Note:** Reducing the truck volume is somewhat effective in decreasing the "Combined L_{Aeq}"

NOISE



Selected	Source	Speed (mph)	Vehicles / Hr	L _{Amax} (dBA)	L _{Aeq, 1-Hr} (dBA)
<input type="checkbox"/>		35	0		
<input type="checkbox"/>		35	0		
<input type="checkbox"/>		35	0		
<input type="checkbox"/>		35	0		
<input type="checkbox"/>		35	0		

Rec Distance (ft)
50

Play Stop Combined L_{Aeq, 1-hr} (dBA)

Purpose:

Perceive the impact of speed on the sound level

Process:

- Select a "Speed" of 55 mph for all vehicle types
 - Select 2000 "Vehicles/Hr" of cars
 - Select 200 "Vehicles/Hr" of medium trucks
 - Select 0 "Vehicles/Hr" of all other vehicle types
 - Select a "Rec Distance" of 50 ft
 - Press "Play"
- Select a "Speed" of 65 mph for all vehicle types
 - Select 1000 "Vehicles/Hr" of cars
 - Select 100 "Vehicles/Hr" of medium and heavy trucks
 - Press "Play"
 - Note:** Fewer vehicles traveling faster are required to produce a similar "L_{Aeq}" as more vehicles traveling slower.
- Select a "Speed" of 45 mph for all vehicle types
 - Press "Play"
 - Note:** Reducing the speed limit is somewhat effective in decreasing the "Combined L_{Aeq}"



Using the Tool

Construction Noise Levels and Interior/Exterior Noise Levels

NOISE



Selected

Source

Selected	Source	Usage Factor (%)	L _{Amax} (dBA)	L _{Aeq} , 1-Hr (dBA)
<input type="checkbox"/>		0		
<input type="checkbox"/>		0		
<input type="checkbox"/>		0		
<input type="checkbox"/>		0		
<input type="checkbox"/>		0		
		Play	Stop	Combined L _{Aeq} , 1-hr (dBA)

Purpose:

Perceive typical construction noise examples

Process:

- Select a "Usage Factor" of 50% for the first vehicle
 - Press "Play"
- Select a "Usage Factor" of 0% for the first vehicle
- Select a "Usage Factor" of 50% for the next vehicle
 - Press "Play"
- Repeat steps 1-3 to listen to all the vehicles individually
- Select a "Usage Factor" of 50% for all vehicles
 - Press "Play"
 - Note:** Some vehicles measure a large difference between their L_{Amax} and L_{Aeq} values, due to their transience (fluctuation in noise level over time)

NOISE



Play Outside

Play Inside

Wall Type

8x8 ft Wall... ▼

LAeq (dBA)

LAeq (dBA)

Stop

Purpose:

Perceive interior vs. exterior noise levels with open and closed windows

Process:

1. Press "Play Outside"
2. Select the "Wall Type" with a closed window
 - ▶ Press "Play Inside"
3. Select the "Wall Type" with an open window
 - ▶ Press "Play Inside"
 - ▶ **Note:** The direct line of sight for noise to travel through an open window reduces the insertion loss of a typical home construction by about 25 dB