

Sound Insulation Estimator User Guide

The screenshot shows the 'Sound Insulation Estimator' software window. It is divided into several sections: 'Building Characteristics' with radio buttons for Property Type (Residential, Non-Residential) and Construction Type (New Construction, Renovation), dropdowns for State, Primary Sound Source, Outdoor DNL Zone, and Indoor DNL Goal; 'Options & Settings' with a File Location field, 'Save As...' and 'Save' buttons, and a Units selection (English, Metric); 'Room Characteristics' with dropdowns for Ceiling Type, Floor Finish, and Furnishings, a Room Volume field, and checkboxes for Pull-Down Attic Stair and Gas-Fired Appliance; 'Room Elements' with a list of six elements, each with a dropdown and an 'Area' field; and 'Results' with a list of six elements, each with an 'R/U-Value' field. A 'Run' button is located on the right side. A 'Miscellaneous' section is also present with checkboxes for Pull-Down Attic Stair and Gas-Fired Appliance. An 'Acoustics & Cost Estimate' section is located at the bottom right, containing fields for Required NLR, Unmodified NLR, Modified NLR, NLR Improvement, and Cost Increase.

Prepared by:

Matt Calton, M.S.
Engineer, BRRC

J. Micah Downing, Ph.D.
Chief Scientist, BRRC

Gary Ehrlich, P.E.
Principal, Hush Acoustics

Michael Payne, AIA
Managing Principal, The Jones Payne Group

Andrew Walter, LEED AP
Principal, The Jones Payne Group

1 Software Purpose

Sound Insulation Estimator is a tool to aid in the selection of sound insulating materials and the approximate material and labor costs associated with installation. Users may input various outdoor and indoor characteristics of the room under consideration, such as primary sound sources, room dimensions, and building materials. Based on the user-selected data, the program calculates the necessary upgrades needed to achieve the target noise level reduction.

2 User Guide

Sound Insulation Estimator allows users to specify room properties for acoustic calculations and cost analysis. The Estimator uses information stored within *SoundInsulation_Database.xlsx* to obtain pricing, labor rates, and acoustic performance data for common building materials. Since the information in the database is vital to the main program's operation and stability, the Excel document is only accessible via the Sound Insulation Estimator executable.

To ensure stable program operation, Sound Insulation Estimator requires an active installation of Microsoft Excel 2010 or later. The executable requires *SoundInsulation_Database.xlsx* to be contained within the same directory.

The following section details the layout of the user interface, as well as a description of the possible user inputs and program outputs. As seen in Figure 2-1, the user interface is divided into two sections for data input and results. The input section contains panels to specify room characteristics, as well as options for program operation. The results section displays recommended upgrades to the specified room elements and the estimated cost and noise reduction for the given upgrades.

2.1 Building Characteristics

The **Building Characteristics** panel contains inputs for the general specifications of the project.

- **Property Type:** Designate the property as residential or non-residential. The user selection determines the available building components that may be selected in the Room Elements panel.
- **Construction Type:** Select the state of construction. The user selection determines the available building components that may be selected in the Room Elements panel.
- **State:** Labor rates are calculated based on the state selected from the dropdown menu.
- **Primary Sound Source:** Choose the dominant sound source at the location.
- **Outdoor DNL Zone:** Select the day-night average sound level based on the current AICUZ noise contours at the location. The DNL zones are explained in more detail below:
 - **60-65 dB:** Above 60, up to and including 65
 - **65-70 dB:** Above 65, up to and including 70
 - **70-75 dB:** Above 70, up to and including 75
 - **75-80 dB:** Above 75, up to and including 80
- **Indoor DNL Goal:** Desired indoor day-night average sound level.

2.2 Room Characteristics

The **Room Characteristics** panel allows users to specify properties of the interior space for the room under consideration, such as the finish of interior surfaces, the volume of the room, and the amount of

furnishings. The user should also complete the room attributes in the **Miscellaneous** sub-panel, as these impact acoustic transmission into the space.

- **Ceiling Type:** Choose the acoustic characteristics and coverage of the ceiling from the dropdown menu.
- **Floor Finish:** Select coverage of carpet or rugs in the room of interest.
- **Furnishings:** Choose the amount of furnishings present in the room.
- **Room Volume:** Specify room volume. Alternatively, users may input room dimensions for rectangular rooms.

Figure 2-1. Overview of the user interface for Sound Insulation Estimator.

2.3 Room Elements

The **Room Elements** panel allows users to define the elements that separate the interior from the exterior of the building. For example, a door that leads into another room within the building should not be considered, whereas an exterior wall should be defined.

A user may select up to six elements and their corresponding surface area. Available elements based on selections made in the **Building Characteristics** panel are listed in each of the six dropdown menus. These elements are grouped according to type, *e.g.* wall, roof, window, etc. Due to the number of construction materials available, the database of available elements represents the most common building materials. Therefore, if a specific element is not found within the list of room elements, users should select the closest available analogue.

If multiple elements of the same type exist in a room, enter the sum of all areas in one line. For example, two exterior walls of the same construction should be input on the same line with the combined area of both walls.

Certain room elements require additional input from the user. The additional information will appear on the current line and will require user interaction as they become visible. Figure 2-2 shows an example of the information requested for certain inputs in the Room Elements panel.

Room Elements			
1	Sliding glass door	Area: 70	sqft <input checked="" type="checkbox"/> Prefer Storm Doors <input type="checkbox"/> Existing Storm Door
2	Non-cement siding on wood studs	Area: 100	sqft
3	Fixed double pane glass (e.g., store)	Area: 25	sqft <input checked="" type="checkbox"/> Prefer Storm Windows Available Width for Secondary Window: 2" <input type="checkbox"/> Additional Ceiling Allowed
4	Shingles, wood roof deck, no ceiling	Area: 200	sqft
5	Fireplace	Area: 1	sqft
6		Area:	sqft

Figure 2-2 Example of room elements and additional information for common elements.

2.4 Options & Settings

The **Options & Settings** panel allows users to change the project units and save inputs and outputs. To save, use the 'Save As...' button to select a file name and location for the Excel spreadsheet. The 'Save' button overwrites the file displayed in the 'File Location' box.

2.5 Results

Once all required inputs have been defined, the acoustic and cost analysis can be initiated by pressing the 'Run' button. The calculation results are shown in the **Results Panel**. Any recommended upgrades will be displayed on the line corresponding with the input from the **Room Elements** panel. Thermal efficiency values associated with the recommended change are also displayed on the appropriate line.

The **Acoustics & Cost Estimate** sub-panel shows the approximate noise reduction and cost metrics for the project.

- **Required NLR:** Predicted Noise Level Reduction required to meet indoor goal set in the Building Characteristics panel.
- **Unmodified NLR:** Estimated Noise Level Reduction before any acoustic upgrades.
- **Modified NLR:** Predicted Noise Level Reduction after the recommended acoustic upgrades.
- **NLR Improvement:** Predicted Noise Level Reduction improvement after the recommended acoustic upgrades.
- **Cost Increase/Renovation Cost:** Estimated Cost for the recommended acoustic upgrades.

A typical project is shown in Figure 2-3, including program inputs and outputs.

Sound Insulation Estimator

Building Characteristics

Property Type: ☒ Residential ☐ Non-Residential
 Construction Type: ☐ New Construction ☒ Renovation
 State: NC Primary Sound Source: Military Jets
 Outdoor DNL Zone: 70-75 Indoor DNL Goal: 45 dB

Options & Settings

File Location: Select Save As... to Choose File Location
 Save As... Save
 Units: ☒ English ☐ Metric

Room Characteristics

Ceiling Type: All Sound-Absorp.
 Floor Finish: All Carpet/Rugs
 Furnishings: Moderately Furni.
 Room Volume: 2000 cu. ft. ☒ Volume ☐ Dimensions

Miscellaneous

☒ Pull-Down Attic Stair
☐ Gas-Fired Appliance

Room Elements

Element	Area	sqft	Options
1 Sliding glass door	70	sqft	<input checked="" type="checkbox"/> Prefer Storm Doors <input type="checkbox"/> Existing Storm Door
2 Non-cement siding on wood studs	100	sqft	
3 Fixed double pane glass (e.g., storef	25	sqft	<input checked="" type="checkbox"/> Prefer Storm Windows Available Width for Secondary Window: 2"
4 Shingles, wood roof deck, no ceiling	200	sqft	<input type="checkbox"/> Additional Ceiling Allowed
5 Fireplace	1	sqft	
6		sqft	

Run

Results

Result	U-Value	R-Value
1 Replace the sliding glass door with an STC 34 sliding glass door.	0.3	0
2 No change needed	0	0
3 No change needed	0	0
4 Remove the roofing, add 7/16" OSB to the roof, add 3.5" or deeper Z purlins on the OSB	2.26	0
5 Replace the fireplace with a ventless model.	0	0
6 No change needed	0	0
+ Add a cover in the attic over the pull-down stair.	0	0

Acoustics & Cost Estimate

Required NLR:	33.2 dB
Unmodified NLR:	28.2 dB
Modified NLR:	33.2 dB
NLR Improvement:	5.1 dB
Renovation Cost:	\$11,060.73

Figure 2-3 Inputs and outputs for a typical project.

3 Frequently Asked Questions (FAQ)

Why do I get an error that states "It is not feasible to meet the required NLR"?

- For some projects, the noise reduction associated with the upgrades for all selected elements may be insufficient to meet the noise level reduction goal. In this case, a user should reevaluate the room elements that were selected and adjust the indoor DNL goal if necessary. Any outputs for calculations that do not meet the required NLR goal are still valid and may be used in estimating possible noise level reductions and associated costs.

What does a Cost Savings mean?

- Some acoustic upgrades are also less expensive than standard materials typically used in new construction projects. In some cases, the desired noise level reduction can be achieved by using these less expensive products, which would yield an overall cost savings for new construction.