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U.S. Department of Transportation
Federal Highway Administration

USER'S GUIDE

TRAFFIC NOISE SCREENING TOOL 1.0

FHWA-HEP-22-005
FEDERAL HIGHWAY ADMINISTRATION
OFFICE OF NATURAL ENVIRONMENT
Washington, D.C.

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13. ABSTRACT (Maximum 200 words)

This user's guide describes the basic layout and use of the FHWA's Traffic Noise Screening Tool. The FHWA's Traffic Noise Screening Tool (Screening Tool) is a program that is intended to help the noise analyst determine if a more detailed study is needed for a given project by modeling a worst-case scenario for a given project area. The Screening Tool has been designed to evaluate noise levels for simple sites that are likely to fall below the levels that would trigger a detailed study.

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1. INTRODUCTION

1.1 SCOPE

This user's guide describes the basic layout and use of the FHWA's Traffic Noise Screening Tool[1]. The FHWA's Traffic Noise Screening Tool (Screening Tool) is a tool intended to help the noise analyst determine if a more detailed study is needed for a given project by modeling a worst-case scenario for a given project area. The Screening Tool has been designed to evaluate noise levels for simple sites that are likely to fall below the levels that would trigger a detailed study.

The Screening Tool should only be used if the site is flat with only hard ground (pavement) or soft ground (lawn) between the source and the receiver. The roads involved should be straight and have a constant gradient no more than +/- eight percent (± 8%). The Screening Tool computes noise levels using average pavement for a receiver that is five feet above the ground and at a user-defined distance from the roads. Sites that require, for example, terrain lines, barriers, multiple ground types or curved roads should use a more comprehensive tool like the FHWA's Traffic Noise Model.

1.2 OVERVIEW

The FHWA's Traffic Noise Screening Tool is divided into four sections ordered from top to bottom as shown in **Figure 1**. The first section shows an illustration of a typical site that could be modeled using the Screening Tool. The second section (***Project Settings***) provides inputs for the analyst to define various project settings. This primarily focuses on site geometry, but also includes options for selecting the format for traffic input, the Noise Abatement Criteria (NAC), and options for computation of substantial increase above an existing level. The next section (***Traffic Input***) covers traffic input. This section is sub-divided by tabs. The number of tabs will depend on the number of near and far lanes selected in the Project Settings, but there will always be at least two tabs, a Diagram and a NL1 (Near Lane 1). The first tab provides a basic diagram to illustrate the receiver distance that is entered in the ***Project Settings*** section. The additional tabs in the ***Traffic Input*** section provide for the actual traffic input on a lane-by-lane basis. The final section (***Computations and Results***) includes the final user commands to start computations and, if desired, to write a summary of the analysis. This section includes a progress bar that increments during the computations and includes five fields that summarize the results of the analysis. Each of these sections will be discussed in more detail later in the guide.

When navigating the Screening Tool's user interface, tooltips will display if the user hovers over a particular control. A tooltip example is shown in **Figure 2**.

[1] *The Traffic Noise Screening Tool supersedes and replaces the Low Volume Road Tool.*

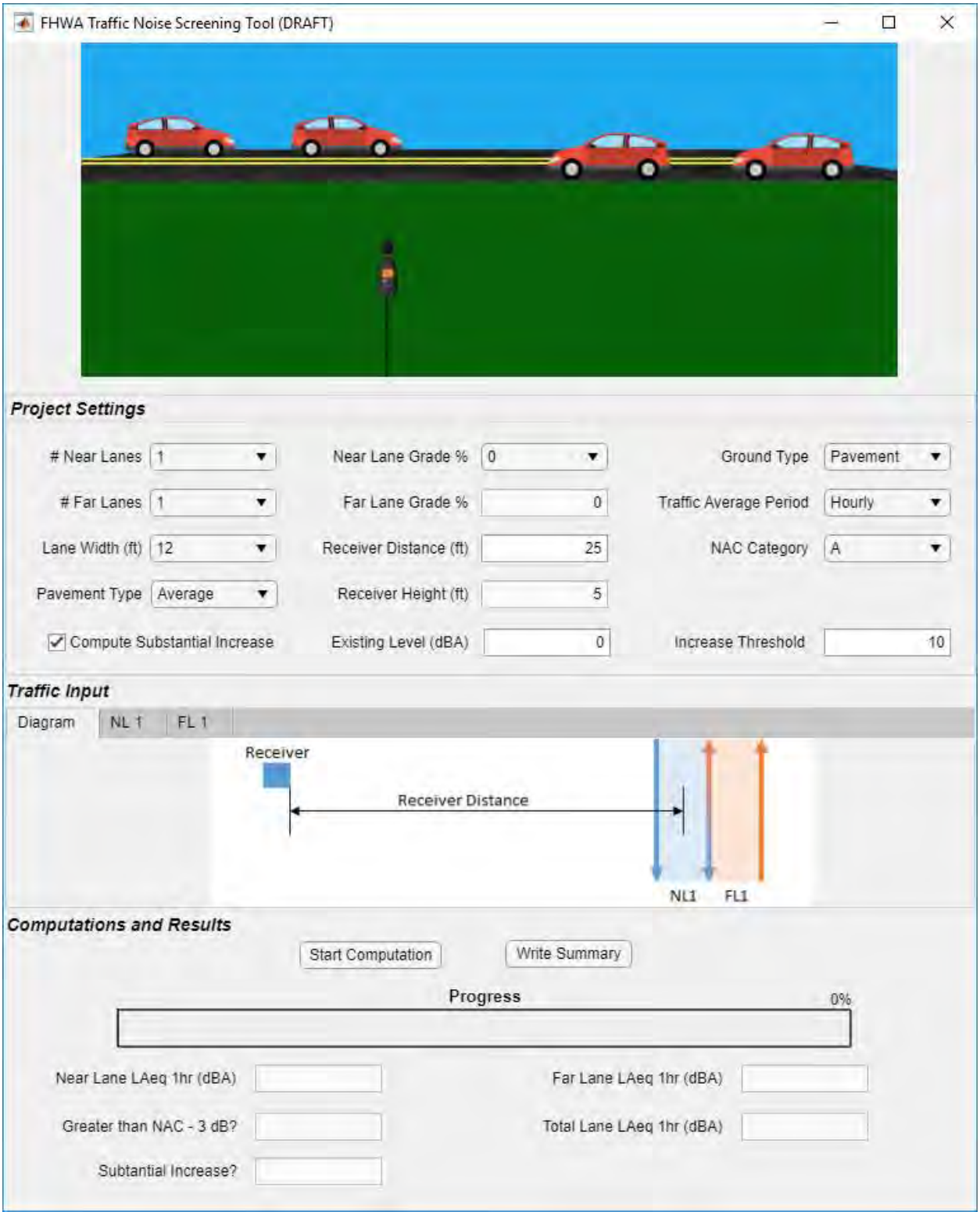

***Figure 1**: FHWA Traffic Noise Screening Tool Overview*

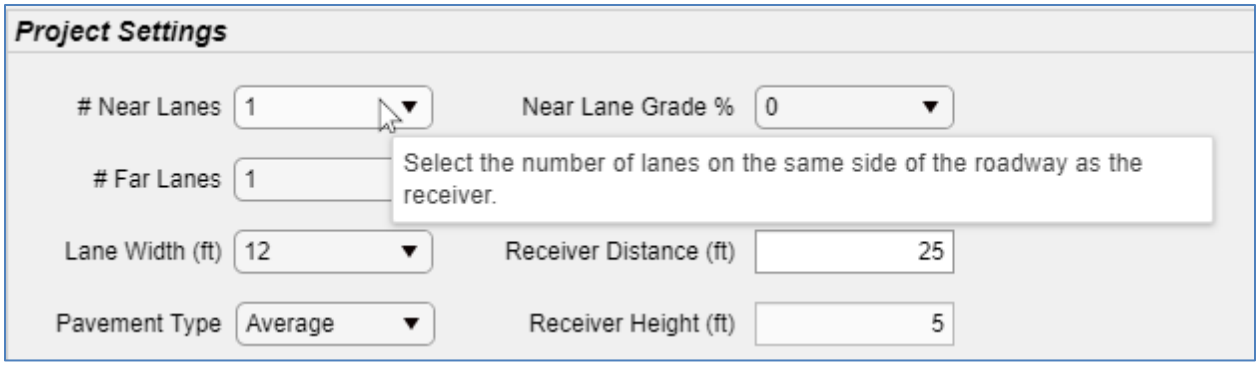

***Figure 2**: Example of Tooltip for User Input*

1.3 INSTALLATION

Two installers are required to fully install the Traffic Noise Screening Tool, one to install the Matlab Runtime Library and another to install the Traffic Noise Screening Tool itself. The use of each installer is discussed in 1.3.1 and 1.3.2.

1.3.1 MATLAB RUNTIME LIBRARY INSTALLATION

The R2020b (9.9) version of the Matlab Runtime Library is required to run the Traffic Noise Screening Tool. To install this library, please go to the Matlab Runtime webpage and download R2020b (9.9) for Windows as shown in **Figure 3**.

https://www.mathworks.com/products/compiler/matlab-runtime.html

Release (MATLAB Runtime Version#)	Windows	Linux	Mac
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
R2019a (9.6)	64-bit	64-bit	Intel 64-bit

***Figure 3**: The Traffic Noise Screening Tool Requires the R2020(9.9) Version of the Matlab Runtime Library*

Once the file has been downloaded[2]:

1) Right click the zip file MATLAB_Runtime_R2020b_win64.zip[3]
2) Select Extract All and specify your desired destination directory
3) Double click the setup file in the extracted folder to start the installation process. Note, you may need administrator privileges to install the Runtime Library

[2] These instructions are based on MATLAB's installation instructions found at https://www.mathworks.com/help/compiler/install-the-matlab-runtime.html.

[3] At the time of this writing, the current version of this zip file is: MATLAB_Runtime_R2020b_Update_5_win64.zip. Matlab may periodically update this file. Always use the latest version of the R2020b (9.9) version.

Figure 4 *The extracted 'setup.exe' icon*

4) When the MATLAB Runtime installer starts, it displays a dialog box. Read the information and then click Next to proceed with the installation.

Figure 5*: Starting Dialog for the Matlab Runtime Library Setup Program*

5) The next dialog will present the MathWorks License Agreement. This agreement needs to be accepted in order to proceed with the Matlab Runtime Library installation.

Figure 6*: License Agreement for the Matlab Runtime Library Setup Program*

6) The next dialog will indicate where the Matlab Runtime Library will be installed. To begin installation press the Install button.

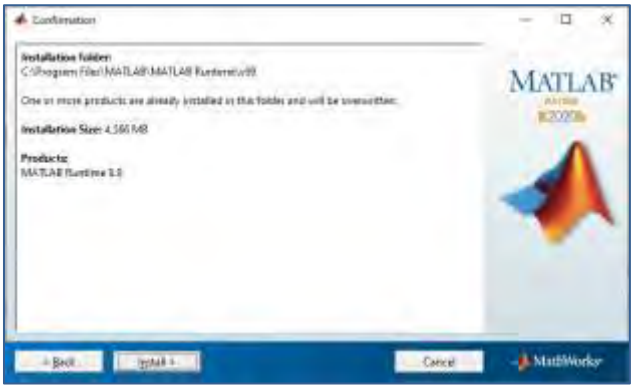

Figure 7*: Installation Folder for the Matlab Runtime Library Setup Program*

7) The next dialog will indicate the installation progress for the Matlab Runtime Library.

***Figure 8**: Installing the Matlab Runtime Library*

8) Once the installation is complete, click Finish to exit the installer.

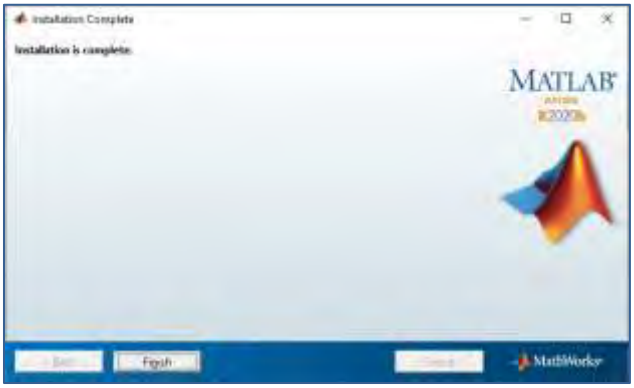

***Figure 9**: Finalizing the Matlab Runtime Library Installation*

The user does not need to run the Matlab Runtime Library. The screening tool will make use of the Matlab Runtime Library automatically.

1.3.2 Traffic Noise Screening Tool Installation

The installation of the Traffic Noise Screening Tool is accomplished via a setup file that can be downloaded from the FHWA website. Generally, administrator privileges are not required to install the software because it will install to the C:\Users*UserName*\AppData\Local\ folder, which is owned by the user. In some instances, a user's IT policy may still restrict installation. In such cases, please consult your IT department for assistance in installing.

To install the Traffic Noise Screening Tool:

1. Download the setup file located at the link below:
   https://www.fhwa.dot.gov/environment/noise/
2. Navigate to the download folder and find the setup_FHWA_TNST.exe

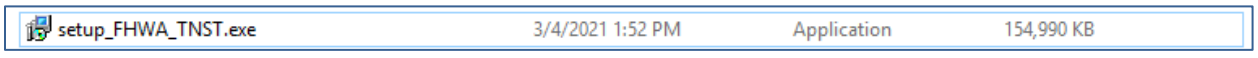

***Figure 10**: Traffic Noise Screening Tool Setup File as it is Shown in the Windows File Explorer*

3. Double click this file to start the installation process. The setup program will show the following dialog.

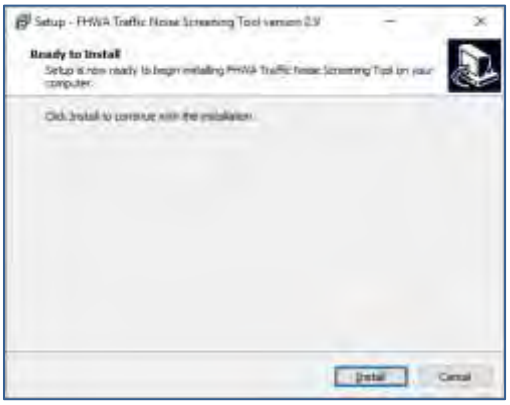

***Figure 11**: Starting Dialog for the Traffic Noise Screening Tool Setup Program*

4. Click on the install button in the dialog. The setup program will display a progress dialog.

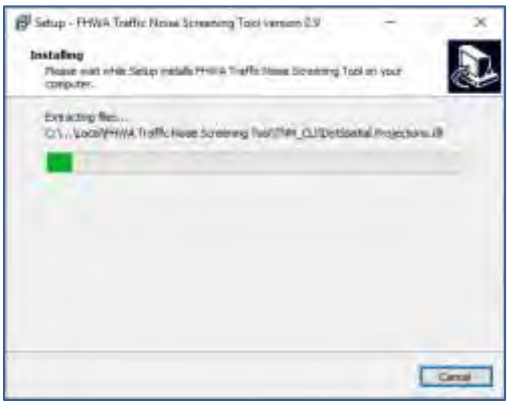

***Figure 12**: Progress Dialog for the Traffic Noise Screening Tool Setup Program*

5. When installation is complete, a final dialog will be shown giving the user an option to launch the FHWA Traffic Noise Screening Tool. If this box is checked, the setup will launch the Traffic Noise Screening Tool after clicking the Finish button (see **Figure 16**). If the box is not checked, the setup will simply complete the installation after clicking the Finish button.

***Figure 13**: Completion Dialog for the ACTS Tool Setup Program*

Once the Traffic Noise Screening Tool has been installed, it can be launched by going to the Windows Startup menu by clicking the FHWA Traffic Noise Screening Tool icon under the FHWA Traffic Noise Screening Tool folder.

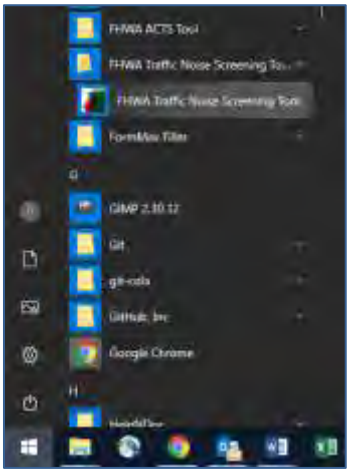

***Figure 14**: Launching the Traffic Noise Screening Tool from the Start Menu*

Note, when launching the Traffic Noise Screening Tool, Windows will start a background process to run the Matlab Runtime Library. This will be indicated by the command window shown in **Figure 15**. About a minute after this window opens, the Traffic Noise Screening Tool will be displayed.

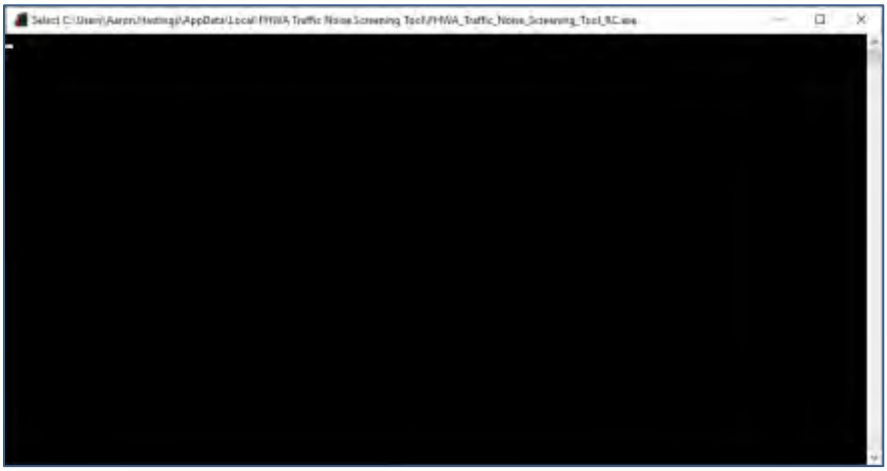

***Figure 15**: Launching the Traffic Noise Screening Tool from the Start Menu*

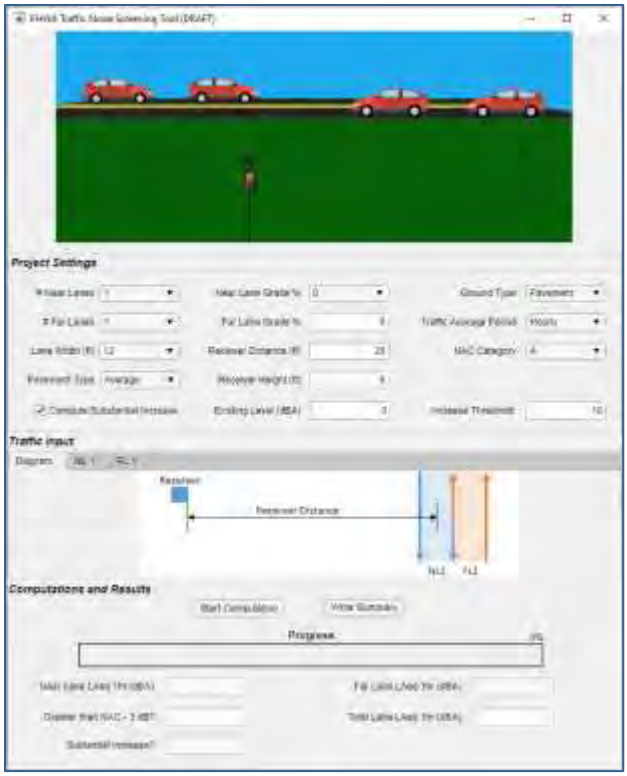

***Figure 16**: Traffic Noise Screening Tool at Startup*

1.4 Steps to use the Traffic Noise Screening Tool

Once the noise analyst has all requisite site and traffic data, the general process to conduct a screening analysis using the Screening Tool flows from the top to the bottom of the Screening Tool's user interface. Starting with the ***Project Settings*** section, the analyst selects:

- Number of near and far lanes
- Lane width (applies to all lanes)
- Grade of the near lane (far lane is automatically assigned opposite grade)
- Receiver distance from the center of the nearest lane
- Ground type between the nearest lane and receiver
- Format of traffic data
- Noise Abatement Criteria

If the analyst wishes to determine if the project produces a substantial increase, then the analyst also enters an existing level and a threshold increase.

The only pavement type currently available is average and the receiver height can only be five feet above flat ground. These fields have been included to help clarify the conditions that are being modeled by the Screening Tool.

Once the project settings are selected, the noise analyst fills in the data for the ***Traffic Input*** section. For

each lane, these data include:

- Lane speed
- AADT total traffic for the lane
- Either percent of total traffic or hourly traffic volume by vehicle type (automobile, medium truck, and heavy trucks)[4]

Once the traffic data are entered for each lane, the *Start Computation* button in the ***Computations and Results*** section can be selected to execute an input check and begin computations. As the Screening Tool progresses with the calculations, the *Progress* bar will update.

Once the computations are complete, results will be shown in the fields below the progress bar and a new icon will be displayed that indicates whether or not a detailed study is needed based on the final results and the NAC selected. If values are within 3 dB of the selected NAC, the tool will indicate the need for a more detailed analysis.

In order to document the analysis, the analyst can then press the *Write Summary* button, which will save inputs and results to a .csv file in the Screening Tool's application folder.

Sections 2 to 4 provide more details on each of the user input sections.

[4] If the project traffic contains a significant portion of buses or motorcycles, a more comprehensive tool such as the Traffic Noise Model (TNM) should be used to model and evaluate the noise results.

2. PROJECT SETTINGS

This section of the Traffic Noise Screening Tool provides inputs for the analyst to define various project settings. Inputs primarily focus on site geometry, but options for selecting the format for traffic input, the Noise Abatement Criteria (NAC), and options for computation of substantial increase above an existing level are also included. When the Tool is first launched, this section will appear with default inputs, as shown in **Figure 17**. When the Compute Substantial Increase box is checked, two optional inputs are present, Existing Level (dBA) and Increase Threshold (**Figure 17**). When the Compute Substantial Increase is not checked, these two optional inputs are not present, as in **Figure 18**. Each of the user inputs and displays in the **Project Settings** section are described in **TABLE 1**.

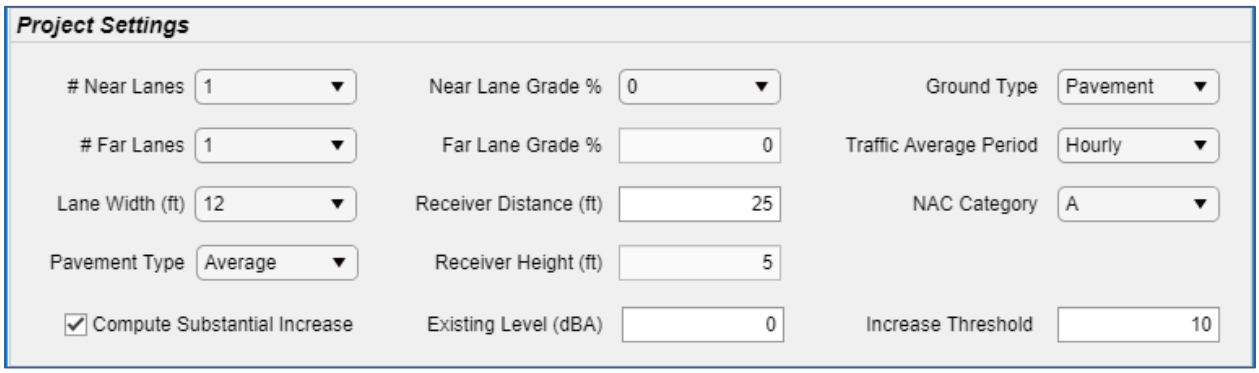

***Figure 17**: Default Appearance of Project Settings Section when Compute Substantial Increase is Checked*

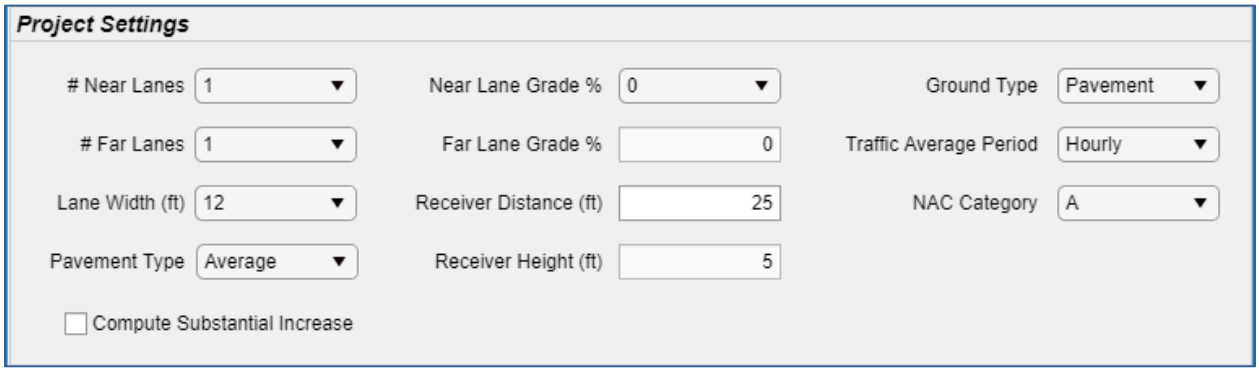

***Figure 18**: Default Appearance of Project Settings Section when Compute Substantial Increase is Not Checked*

TABLE 1: SUMMARY OF PROJECT SETTINGS SECTION INPUTS AND DISPLAYS

Input	Details
# Near Lanes	User input with dropdown for integer values between 1 and 4. Indicates the number of near lanes to be modeled.
# Far Lanes	User input with dropdown for integer values between 0 and 4. Indicates the number of far lanes to be modeled.
Lane Width (ft)	User input with dropdown for values of 10 and 12 ft, which applies to all lanes.
Pavement Type	User input with a single value of Average. Emphasizes that all lanes are modeled using Average pavement.
Compute Substantial Increase	User input checkbox. If selected, the Screening Tool will, in addition to the NAC, consider whether the project produces a substantial increase over an existing condition. Enables required inputs fields for *Existing Level (dBA)* and *Increase Threshold*.
Near Lane Grade %	User input with dropdown for integer values between -8 and 8, indicating a percentage that applies to all near lanes. Far lanes are assumed to have the opposite grade.
Far Lane Grade %	Display indicating a percentage that applies to all far lanes. Opposite of the Near Lane Grade % user input.
Receiver Distance (ft)	User input textbox that accepts integer values between 25 and 500, representing the distance in feet from the center of the nearest lane. (See **Figure 19** for illustration.)
Receiver Height (ft)	Display that indicates that the receiver height is 5 feet above flat ground.
Existing Level (dBA)	Optional user input textbox for an existing noise level. This field is only present if the *Compute Substantial Increase* checkbox is checked.
Ground Type	User input with dropdown for values of Lawn and Pavement. Indicates the ground type between the nearest lane the receiver.
Traffic Average Period	User input with dropdown for values of Hourly or Daily. Indicates traffic volume input format. If Daily is chosen then some fields in the ***Traffic Input*** section will have values divided by 24 to account for a 24-hour average.
NAC Category	User input dropdown for values of A through E that correspond to noise abatement criteria in Table 1 of 23 CFR 772.
Increase Threshold	Optional user input for the increased threshold criterion used to determine if the project produces a substantial increase over an existing level. This field is only present if the *Compute Substantial Increase* checkbox is checked.

3. TRAFFIC INPUT

This section of the Traffic Noise Screening Tool covers traffic input for each lane identified in the ***Project Settings*** section. This section is sub-divided by tabs. The number of tabs will depend on the number of near and far lanes selected in the ***Project Settings*** section, but there will always be at least two tabs, a Diagram and NL1 (Near Lane 1) tab. The first tab provides a basic diagram to illustrate the receiver distance from the nearest lane, as shown in **Figure 19**.

The Diagram tab does not change based on the number of lanes input in the *Project Setting* section. This diagram is only intended to illustrate the *Receiver Distance*, which is relative to the center of the nearest lane, and to illustrate the direction of traffic volume flow for near and far lanes.

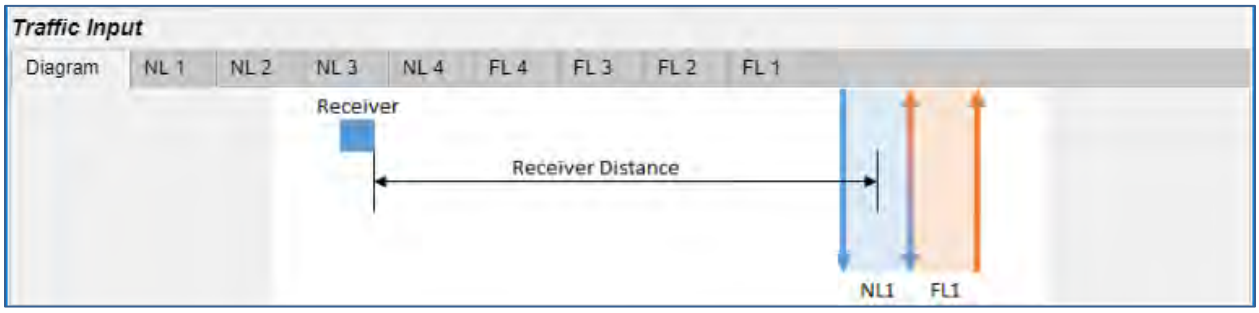

***Figure 19**: Traffic Input Section for Four Near Lane and Four Far Lane Identified in the Project Settings Section*

The tabs to the right of the Diagram tab in the **Traffic Input** section provide the user with traffic inputs for each lane identified in the **Project Settings**. **Figure 20** shows the traffic input for near lane one, or NL1. Each tab for traffic input has the same format, consisting of three columns. The leftmost column contains a Lane Speed (mph) user input, an Average Total Traffic input and an Average Hourly Traffic display. The center column contains % of Hourly Traffic inputs for automobiles, medium trucks and heavy trucks. The rightmost column contains the Hourly Traffic for automobiles, medium trucks and heavy trucks. Each of the user inputs and displays in the **Traffic Input** section are described in **TABLE 2**.

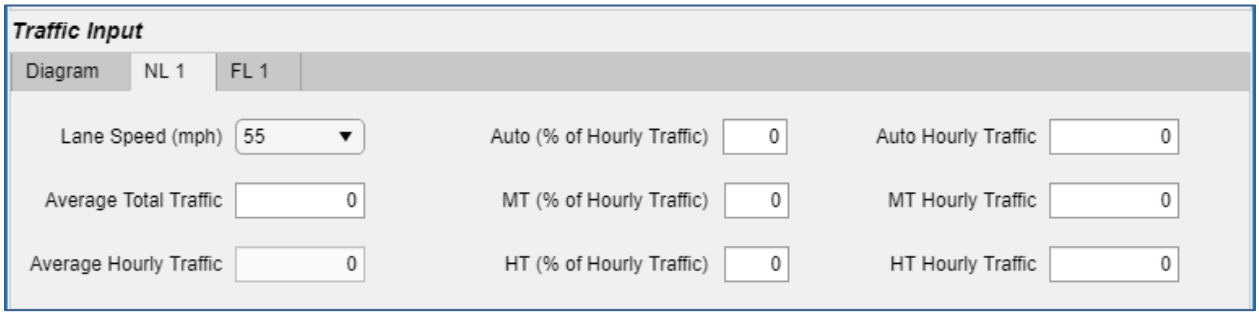

***Figure 20**: Traffic Input Tab for Near Lane 1*

TABLE 2: SUMMARY TRAFFIC INPUT SECTION INPUTS AND DISPLAYS

Input	Details
Lane Speed (mph)	User input dropdown with values between 5 and 70 mph in 5 mph increments. Indicates the speed of all vehicles traveling in the current lane.
Average Total Traffic	Integer user input for the total traffic in the current lane. If the *Time Average Period* in the ***Project Settings*** is set to Hourly, then this should be an hourly value. If the *Time Average Period* is set to Daily, this should be a Daily value.
Average Hourly Traffic	Display that shows the total hourly traffic for the current lane. If the *Time Average Period* in the ***Project Settings*** is set to Hourly, this will be the same as the *Average Total Traffic*. If the *Time Average Period* is set to Daily, then this will be the *Average Total Traffic* divided by 24.
Auto (% of Hourly Traffic)	This field can be either an input or a display. The user may enter the integer percent of hourly automobile traffic. Automatically updates to reflect *Auto Hourly Traffic* changes.
MT (% of Hourly Traffic)	This field can be either an input or a display. The user may enter the integer percent of hourly medium truck traffic. Automatically updates to reflect *MT Hourly Traffic* changes.
HT (% of Hourly Traffic)	This field can be either an input or a display. The user may enter the integer percent of hourly heavy truck traffic. Automatically updates to reflect *HT Hourly Traffic* changes.
Auto Hourly Traffic	This field can be either an input or a display. The user may enter the integer hourly automobile traffic volume. Automatically updates to reflect *Auto (% of Hourly Traffic)* changes.
MT Hourly Traffic	This field can be either an input or a display. The user may enter the integer hourly medium truck traffic volume. Automatically updates to reflect *MT (% of Hourly Traffic)* changes.
HT Hourly Traffic	This field can be either an input or a display. The user may enter the integer hourly heavy truck traffic volume. Automatically updates to reflect *HT (% of Hourly Traffic)* changes.

4. COMPUTATION AND RESULTS

The bottommost section of the Traffic Noise Screening Tool includes the final user commands to start computations and, if desired, to write a summary of the analysis. This section also includes a progress bar to display the status of the computations.[5] When complete, five fields that summarize the results of the analysis will populate. If the *Compute Substantial Increase* box is checked in the ***Project Settings*** section, the ***Computation and Results*** section will appear as shown in **Figure 21** by default. If the *Compute Substantial Increase* box is not checked in the ***Project Settings*** section, the ***Computation and Results*** section will appear as shown in **Figure 22** by default.

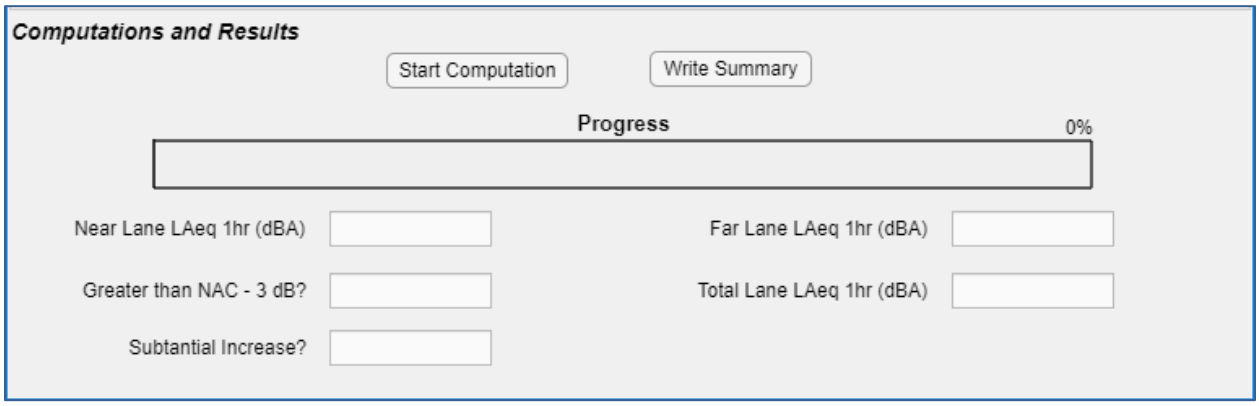

***Figure 21**: Default Appearance of Computations and Results Section when Compute Substantial Increase is Checked*

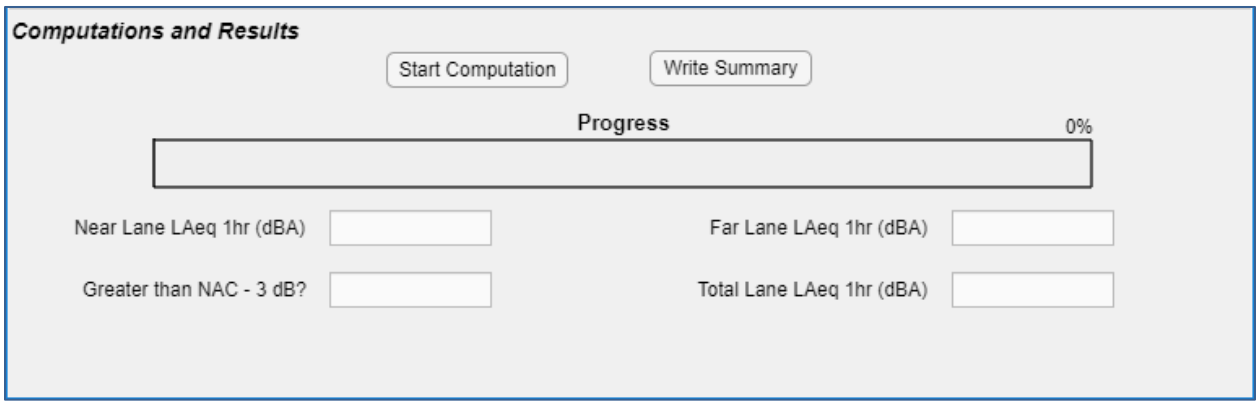

***Figure 22**: Default Appearance of Computations and Results Section when Compute Substantial Increase is Un-Checked*

Figure 23 shows the ***Computation and Results*** section mid-computation. **Figure 24** shows final results that require no additional analysis, indicated by the green icon "No Detailed Analysis Needed". Note that both *Greater than NAC – 3 dB*? and *Substantial Increase*? display NO. (If *Compute Substantial Increase* is not checked, *Substantial Increase*? will not be evaluated.) **Figure 25** shows final results that do require additional analysis, indicated by the red icon "Detailed Analysis Needed". Note that in this case the *Greater than NAC – 3 dB*? displays YES and *Substantial Increase*? displays NO. (If *Compute Substantial Increase* is not checked, then *Substantial Increase*? will not be evaluated.)

[5] *Each lane included in the **Project Settings** will linearly increase the computation time.*

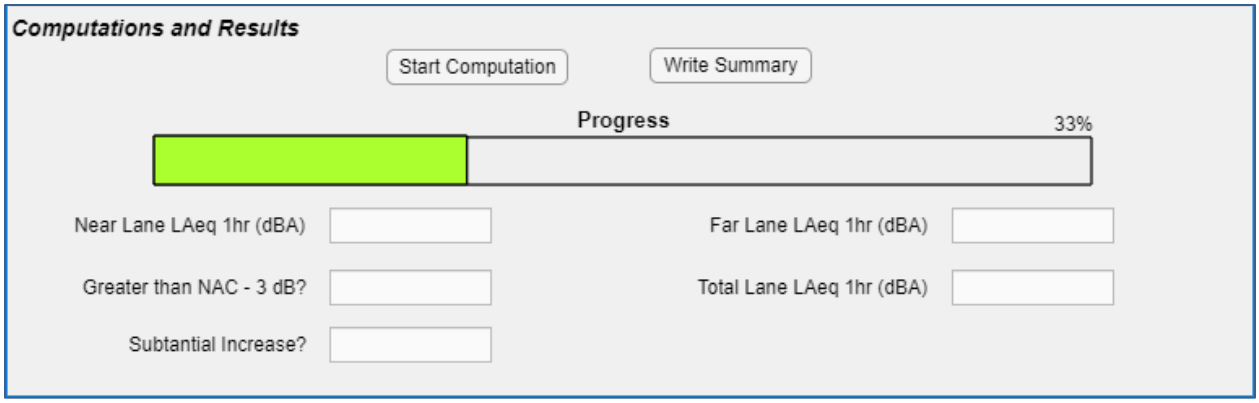

***Figure 23**: Computations and Results Section Showing Progress During a Computation*

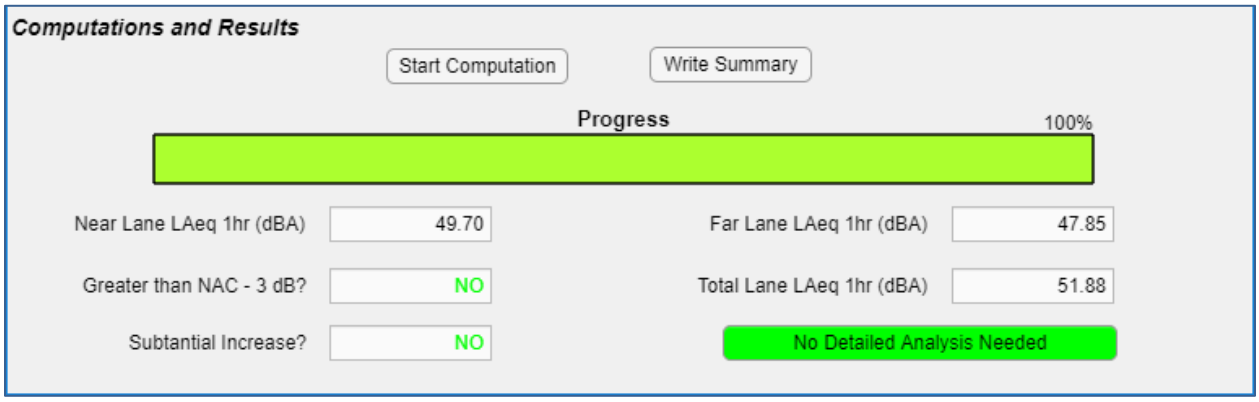

***Figure 24**: Computations and Results Section Showing Results and No Detailed Analysis Needed*

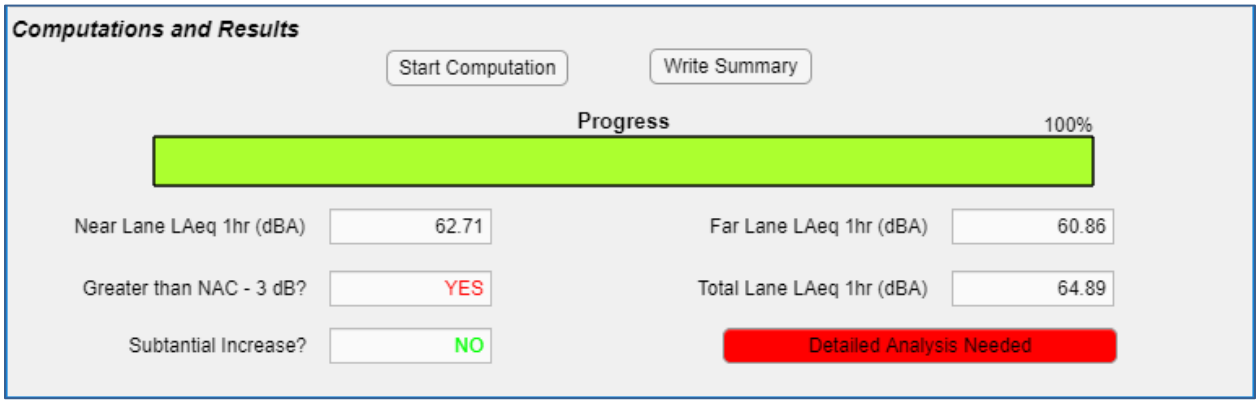

***Figure 25**: Computations and Results Section Showing Results and Detailed Analysis Needed*

Each of the user inputs and displays in the **Computations and Results** section are described in

TABLE *3*.

TABLE 3: SUMMARY OF COMPUTATIONS AND RESULTS SECTION INPUTS AND DISPLAYS

Input	Details
Start Computation	Selection will execute an input check for invalid data in the *Traffic Input* section and will then begin the computation process.
Write Summary	Selection will write the project settings, traffic inputs and results to a CSV file in the application folder.
Progress Bar	When computations are underway, the *Progress Bar* is periodically updated to show progress. Computation time is linearly related to the number of lanes.
Near Lane LAeq 1hr (dBA)	This display shows the overall A-weighted noise level computed for all traffic on the near lanes.
Greater than NAC – 3 dB?	After computation, this display will show a red YES or a green NO based on the overall level and the NAC chosen.
Substantial Increase?	If *Compute Substantial Increase* is checked this display will show a red YES or a green NO after computation depending on the overall level, the existing level, and increase threshold.
Far Lane LAeq 1hr (dBA)	This display shows the overall A-weighted noise level computed for all traffic on the far lanes.
Total Lane LAeq 1hr (dBA)	This display shows the overall A-weighted noise level computed for all traffic for all lanes. It is the energy sum of the results in *Near Lane LAeq 1hr (dBA)* and *Far Lane LAeq 1hr (dBA)*.

When comparing the computed noise level results to the NAC, the Traffic Noise Screening Tool uses a 3 dB buffer to make sure that the comparison is conservative.

When the analyst clicks on the Write Summary button, the CSV file is written to the same folder as the Traffic Noise Screening Tool application itself. The file name format of this CSV file is as follows:
Traffic_Noise_Screening_Tool_Results_DAY-MONTH-YEAR_HR-MIN-SEC.csv