User’s Guide: Traffic Noise Model
TxDOT User’s Guide: Traffic Noise Model (TNM)
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INTRODUCTION

This guide is intended for use by analysts with both technical and non-technical backgrounds.

All information in this guide is presented in a WYSIWYG, 11x8½ landscape format and emphasizes the manual (stubby-pencil) approach. However, the use/importing of MicroStation files can greatly enhance the overall process and is also addressed.

Most of the required tasks in TNM may be accomplished in a number of different ways. Therefore, a variety of techniques are presented in this guide to provide the analyst with a range of choices - although every possible technique is not addressed.

Read all steps on each page before performing the first step on each page.

Each step is identified by two numbers: one number (1, 2, 3, etc.) to describe the step in text form and one number (1, 2, 3, etc.) to locate the step in the appropriate TNM window.

This guide emphasizes the use of the mouse rather than shortcut keys - although shortcut keys may be used.

= single click of the left mouse button
= double click of the left mouse button

NOTE: the best way to learn TNM is through repetition of the various, required tasks. Although this guide affords the opportunity to repeat various tasks, it will be necessary for the analyst to use TNM on several additional practice or actual projects to become proficient.

Each district will identify a single focal point for all TNM issues. Provide all TNM comments and questions to the district focal point for review and forwarding, if necessary, to the Environmental Affairs Division.

Additional TNM references:
- FHWA User’s Guide
- FHWA tutorial on CD
- TxDOT/ENV web site (to be developed)
HARDWARE/SOFTWARE REQUIREMENTS

HARDWARE

- Monitor
  - Size: 21” recommended (multiple windows)
  - Display
    - Resolution: 1024 x 768 (or greater)
    - Font size: Small Fonts
    - Colors: 16 (or greater)
- CPU: fastest available (to minimize run times)
- CD ROM drive
- Memory: 32MB RAM (or more)

SOFTWARE

- WINDOWS Operating System (including XP)

Any lower resolution…some program functions will not be visible/available.

Installation: consult with your district focal point for TNM or automation personnel before attempting to install TNM.
FHWA TNM 2.5

Version 2.5 is required for all new traffic noise analyses initiated on or after May 2, 2005.

The TNM program is copyright protected. State DOTs may make copies for internal use only. All other users must purchase their own copy.
NOTE: Place the cursor over an icon and read its function in the Status Bar at the bottom of the main window.
FREQUENTLY USED TOOLS (1 of 2)

- **Move the View of Objects in the Plan View**
  - move in the direction you want to see

- **Change the Size of the View in the Plan View**
  - **Recommended Method**
    - Zoom In/Zoom Out
  - **Alternate Method**
    - Zoom In  ..........  
      draw box around segments/objects to be enlarged
    - Zoom Out  ..........  
      reduces segments/objects in Plan View by 25%

- **Maximize the Size of the View of All Objects in the Plan View**
FREQUENTLY USED TOOLS (2 of 2)

- **Select Segment(s) and Objects**
  - select one segment
  - select multiple segments
  - select entire object
  - select everything in a box

- **Move Segments**
  - moving segment or object

- **Move Points**
  - moving one point
SENDING/RECEIVING TNM RUNS

It is possible to send/receive files associated with TNM runs as attachments in GroupWise.

**Sending** TNM runs: send all **files** (not folder) associated with each run. Files can be sent and received as attachments to eMail (GroupWise). Large files (over 4 MB) should be zipped, or sent during off-peak times, or sent on disk or CD by snail mail.

- Each/every TNM run (folder) creates two basic files. The names of the two files are identical for each/every run:
  1. "objects.dat"
  2. "objects.idx"
- Therefore, to avoid confusion when sending files for multiple runs, send the files for each run in separate GroupWise eMails.
- Remember to include any additional files created by the run.

**Receiving** TNM runs: create a new folder, then "Save As" both files for the run in the new folder.
STARTING a NEW RUN (1 of 2)

This procedure will create a logical directory of folders to easily manage/locate TNM runs:

1. File
2. New (opens Save Run As dialog box)
3. Select the appropriate drive (does not have to be the drive where TNM was installed)
4. TNM folder should already be open
5. Cursor should already be positioned in Run Name field - type PROJECTS
6. EXTENDED file names may be used (no longer restricted to eight characters)
7. OK button
8. A blank Plan View window appears

NOTE: File names may be used (no longer restricted to eight characters)

continued
The PROJECTS folder was only created to establish a location for multiple "project" folders …..it will remain empty/contain no data. In like manner, other empty folders may be required to create a logical path to a TNM run, as follows:

8. File
9. Save As (opens Save Run As dialog box)
10. With PROJECTS folder selected, type SH123 in the Run Name field
11. OK button …..this folder will also remain empty since you may have more than one run under this highway name
12. Repeat the above Save As steps to create two run folders 2005 and 2025 under SH123.
1. **Setup**
2. **Run Identification**
3. **Optional:** ...user’s preference (this info is displayed on tables)
4. **Optional:** When “Popup Help” box is checked, help boxes periodically appear during the operation of the program
   - Users may want to deselect this option when more familiar with the program
   - can become annoying.
5. **OK**

**File/Save**
1. Setup
2. General
3. Down Arrow
4. English (to change from Metric to English units)

NOTE: units can be changed at any time during a run

5. DO NOT change Relative Humidity or Temp
6. Default Ground Type will be Lawn for most projects

Do Not select Pavement or Water as the “Ground Default Type”

7. Line-of-Sight Check - - not used
8. OK

File/Save
OPENING/CHANGING/SAVING an “EXISTING” RUN

1. File
2. Open
3. Select the appropriate drive
4. folders until desired folder (run) is opened
- the inside of the folder will turn gray…..
5. OK button …..the Plan View window appears

Folders created in TNM will open properly. Folders created in Windows Explorer may be empty (no files) and, if so, any attempts to open them may result in the following messages:

Unlike other applications like WORD, EXCEL, etc., you must save a TNM run in a new folder BEFORE making any changes …..otherwise, the original data will be lost.
OPENING an OLD RUN (previous to v2.5)

1. File
2. Open
3. Select the appropriate drive
4. folders until desired folder (run) is opened
   - the inside of the folder will turn gray…..
5. OK button
6. Convert Run Window appears
7. Ensure Save Backup of Run is selected/checked
8. OK button
9. Notice of successful conversion + backup appears
10. OK button
NOTE: This is an artificial representation of a highway project for the purposes of this guide and specific training goals - it is not intended to represent an actual project.
NOTE: This is an artificial representation of a highway project for the purposes of this guide and specific training goals - it is not intended to represent an actual project.
Cartesian Coordinate System
- three coordinates (x, y, z) used to locate objects relative to each other in three-dimensional space
**ROADWAYS - - Basic Considerations (1 of 4)**

**Number of Roadways:** Model each lane as a separate roadway with slightly overlapping edges ..... even for simple two-lane projects.

**NOTE:** For the purposes of this guide and to limit the time required to complete this guide, each lane is not modeled as a separate roadway.

**Length:**
- Non-freeway: 500’ past last receiver
- Freeway: 1000’ past last receiver

**Model roadways in the direction of traffic.**

**New Roadways:** TNM allows input of different traffic speeds, volumes and mixes on different segments of the same roadway.

**Long projects with individual pockets of receivers should be modeled in separate short/small runs.**

**Slight horizontal curves may be modeled in straight line segments without compromising accuracy.**

**Elevation:** Slight vertical curves (≤1.5% slope) may be modeled in flat segments without compromising accuracy -- assumes the adjacent terrain (elevation of receivers) closely matches the roadway slope/elevation.

**NOTE:** Include all roadways directly associated with the proposed project ... even though no construction/improvements are planned for these “associated” roadways.
- For example, this would typically include all mainlanes, frontage roads, ramps, etc.
ROADWAYS - - Basic Considerations (2 of 4)

● 2-lane -- straight and flat (slope ≤1.5%) ●

- **Number of Roadways**: model both (2) roadways – one in each direction.
- **Overlap**: roadway edges **must** overlap ...simply increase the width of each roadway by 0.1 foot.
- **Traffic Split**: model Directional Distribution as depicted in the traffic data.
- **Width**: width of travel lanes - - it is not necessary to include the width of shoulders.
- **Elevation**: simpler to use zero (default) for all Z coordinates rather than the actual elevation.

● 4-lane undivided -- straight and flat (slope ≤1.5%) ●

- **Number of Roadways**: model all four roadways – two in each direction.
- **Overlap**: roadway edges **must** overlap ...simply increase the width of each roadway by 0.1 foot.
- **Traffic Split**: model Directional Distribution as depicted in the traffic data.
- **Width**: width of travel lanes - - it is not necessary to include the width of shoulders.
- **Elevation**: simpler to use zero (default) for all Z coordinates rather than the actual elevation.
ROADWAYS - - Basic Considerations (3 of 4)

- **4-lane divided -- straight/flat (slope ≤ 1.5%)**
  
  (divided by left turn lane or grass median)

- **Number of Roadways**: model all four roadways – two in each direction.
- **Turn Lane**: model the turn lane as a roadway with zero traffic.
- **Overlap**: roadway (including turn lane) edges **must** overlap …simply increase the width of each adjacent/abutting roadway by 0.1 foot.
- **Traffic Split**: model the Directional Distribution as depicted in the traffic data.
- **Width**: width of travel lanes - - it is not necessary to include the width of shoulders.
- **Elevation**: simpler to use zero (default) for all Z coordinates rather than the actual elevation.
- **Median**: it is not necessary to model a “grass” median as a “lawn” ground zone if the “default” ground zone the TNM run is “lawn.”
ROADWAYS - - Basic Considerations (4 of 4)

Roadways must be modeled in straight-line segments.

**Vertical Curves**

- **# Segments**: model a sufficient number of segments to adequately define the vertical curves (more segments = more accuracy). This is a judgement call that depends on the topography of the surrounding terrain, the elevation of adjacent receivers and the relationship to adjacent roadways and traffic barriers.
  - Model segments in the direction of traffic.
- **In this example**, additional segments are required.

**Horizontal Curves**

- **# Segments**: model a sufficient number of segments to adequately define the horizontal curves (more segments = more accuracy). This is a judgement call that depends on the location of adjacent receivers.
- **In this example**: if the minimum number of only four segments (defined by five points) was used to define these horizontal curves, noise levels would be slightly higher than actual at R-1 and slightly lower than actual at R-2.
The specific number and location of points and segments in a roadway are typically determined by the following:
- vertical and horizontal alignment/curves
- speed limit changes
- traffic volume changes

Note: all of the above may be changed within segments of the same roadway. Unlike STAMINA, a new/separate roadway is only required for changes in roadway widths (number of lanes).

The roadway representing the **EB Frontage** road will be divided into two segments defined by three points (due to the change in traffic volume at **South Street**).
- from west to east (in the direction of traffic)
ROADWAY INPUT: EB FRONTAGE (1 of 4)

1. Input
2. Roadways
3. in Name field and change Roadway1 to EB Frontage
4. in Width field and change default of 12.00 to 24 (2 lanes)

Blank Roadway Input window appears

5. Roadway coordinates \((X,Y,Z)\) cannot be entered until rows are created in this Roadway Input window.

For actual projects, model each lane as a separate roadway. To model additional roadways for parallel lanes, use the copy/paste procedures presented on Pages B-15 thru B-17.
ROADWAY INPUT: EB FRONTAGE (2 of 4)

The EB Frontage roadway has 2 segments defined by 3 points; therefore, create 3 rows (for 3 points) in the Roadway Input window, as follows:

1. \(\text{Edit}\)
2. Type the letter \(I\) to Insert the first row.
3. \(\text{Edit}\)
4. Type the letter \(A\) to Append (add) the second row.

Repeat steps 3. and 4. (\(\text{Edit/Type}\) the letter \(A\)) to add the third row.

**NOTE:** Insert Row adds an initial row or a new row before the previous or highlighted row.

Append Row adds a new row at the end of all rows.
### ROADWAY INPUT: EB FRONTAGE (3 of 4)

1. Ensure the **General** tab at the bottom of the **Roadway Input** window is selected.
2. Enter X, Y, Z coordinates for two segments/three points (Refer to Page B-6) ..... always enter coordinates in the direction of traffic.

**NOTE**: new inputs and changes appear in **RED** until applied ..... font does not appear in **RED** until after moving out of the cell.

3. Change **Pnt. Names** to the Station numbers for each point.
4. **Apply** (button becomes active when any changes are made).
5. Line drawing of roadway “should” appear in **Plan View** window.

**NOTE**: due to an inherent anomaly in TNM, the first object modeled may not appear in the **Plan View** or may not be able to be viewed properly in **View, Full View**. In order to properly view **EB Frontage**, it may be necessary to **Save, Close** and re-**Open** the run.
Average pavement type shall be used unless a State highway agency substantiates the use of a different type with the approval of FHWA

TxDOT has not substantiated the use of different type of pavement; therefore, unless/until notified otherwise, Average will be used for the Pavement Type for all roadways.

If you forget to Apply, one of the following types of reminders will appear.
The roadway representing the **EB Mainlanes** will initially be divided into four segments defined by five points (to define the vertical curves).
- from west to east (in the direction of traffic)
**ROADWAY INPUT: EB MAIN (1 of 3)**

1. **New**
2. in **Name** field and change default of Roadway2 to EB Main.
3. in **Width** field and change default of 12.00 to 24 (2 lanes).
4. **Insert/Append** five new rows (four segments defined by five points).
5. Enter \(X, Y, Z\) coordinates (Refer to Page B-11).
6. Change **Pnt. Names** to Station numbers.
7. **Apply**
8. Line drawing of EB Mainlane appears in **Plan View** window.

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For actual projects, model each lane as a **separate** roadway. To model additional roadways for parallel lanes, use the **copy/paste** procedures presented on Pages B-15 thru B-17.
To better define the vertical curve between the first two points (206 and 208), subdivide the first segment into two segments.

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To better define the vertical curve between the first two points (206 and 208), subdivide the first segment into two segments.

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To better define the vertical curve between the first two points (206 and 208), subdivide the first segment into two segments.

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6.  

To better define the vertical curve between the first two points (206 and 208), subdivide the first segment into two segments.
Subdivided segments are always equally divided - the new point is located at an equal distance between points 206 and 208, and at an average height between points 206 and 208. It is important to confirm that the X,Y,Z coordinates for the new point accurately define the vertical curve.

8. Change the Pnt. Name for the new point to the Station number.
9. Confirm that the X and Y coordinates are correct.
10. Adjust the Z coordinate to the correct elevation (Refer to Page B-11).
11. Note: ignore numbers in Pnt. No. column - do not be concerned that numbers are not in order - it is not necessary to “re-number” these points.
12. Apply

File/Save

Texas Department of Transportation/Environmental Affairs Division
Page B-14
**New Technique:** Data for **WB Main** will be entered by copying, pasting and adjusting information from the **EB Main Roadway Input**.

**NOTE:** This technique is intended to demonstrate the copy/paste function - especially helpful for multiple, parallel roadways with a large number of segments/points. As an alternative, **WB Main** could be created from scratch - same technique used to create **EB Main**.
1. Click and drag from EB Main Pnt. Name 206 (upper left) to the Z coordinate for Pnt. Name 216 (lower right). Ctrl +C to copy selected information.
2. Click New.

3. Click in Name field and change to WB Main.
4. Click in Width field and change to 24 (2 lanes).
5. Insert/Append six new rows (to allow sufficient space to “paste” the six rows (six points) “copied” from the EB Main roadway).
6. To paste copied information: click in first (top left) cell. Ctrl +V to paste selected information.

NOTE: Do Not Apply until the Y coordinates are properly adjusted.
7. Adjust all Y coordinates for WB Main (Refer to Page B-15)

8. Apply

9. The WB Main roadway is depicted in Plan View window

10. As indicated by the arrow, WB Main is not heading in the direction of traffic. Therefore, the final step will reverse the direction of the roadway.

For actual projects, model each lane as a separate roadway. To model additional roadways for parallel lanes, use this copy/paste procedure.
11. Make the Plan View window active (dark blue banner)
12. Ensure entire WB Main roadway is selected (gray shadow)
   - if not selected, select anywhere on roadway to select it
13. Edit
14. Reverse Direction
15. WB Main roadway is reversed in Plan View (note arrow)
16. X coordinates are reversed in the Roadway Input window
**EXERCISE**

Input **WB Frontage** roadway

**Tasks:**
1. Add new roadway
2. Name roadway
3. Specify roadway width
4. Insert/Append necessary rows
5. Enter X,Y,Z coordinates
6. Revise Pnt. Names

Scale: 1” = 100’

**Plan View**

**Profile View**
The roadway representing the **WB Frontage** should be divided into three segments defined by four points (due to the changes in traffic volumes at the **On Ramp** and **North Street**).
ROADWAY INPUT: WB FRONTAGE

1. New
2. In Name field and change to WB Frontage
3. In Width field and change to 24 (2 lanes)
4. Insert/Append four new rows (three segments defined by four points)
5. Enter X,Y,Z coordinates for three segments/four points in the direction of traffic (Refer to Page B-20)
6. Change Pnt. Names to Station numbers
7. Apply
8. Line drawing of WB Frontage appears in Plan View window

For actual projects, model each lane as a separate roadway. To model additional roadways for parallel lanes, use the copy/paste procedures presented on Pages B-15 thru B-17.
New Technique: On Ramp will be inputted using the mouse.

NOTE: This technique is intended to demonstrate a quick method for adding rows in the Roadway Input window. As an alternative, On Ramp could be inputted from scratch - - same technique used on most of the previous roadways.
Before inputting On Ramp, determine the number of points required to define the horizontal and vertical curves of On Ramp according to the following steps:

**FIRST:** determine the number of points based solely on the horizontal curves in the Plan View = five points to define four segments.

**SECOND:** transfer these four points onto the Profile View and connect with straight lines …..to determine if additional points are required to best define the vertical curves.
THIRD: add five additional points (in red) to more accurately define the vertical alignment = total of ten points to define nine segments.

Note: the number of segments/points is a judgement call that depends on the level of accuracy required for a particular project. For this project, four segments would be too few and more than nine segments would not noticeably improve the accuracy of the analysis.
New Technique: On Ramp will be inputted using the mouse.

1. ⬇️ Roadway button in the Tool Bar - - the cursor changes to ⬈️
2. Use the ⬈️ tool to ten points defining nine segments anywhere - - no need to be precise.
3. To deactivate the Roadway input tool, move the cursor away from the last point and Right Click the mouse.
4. Ten rows are created - - coordinates will be corrected on the next page.
### ROADWAY INPUT: ON RAMP

<table>
<thead>
<tr>
<th>Pnt. Name</th>
<th>Pnt. No.</th>
<th>X (ft)</th>
<th>Y (ft)</th>
<th>Z [pavement] (ft)</th>
<th>Pnt Type</th>
<th>On Struct?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20</td>
<td>900.0</td>
<td>325.0</td>
<td>33.00 Average</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>21</td>
<td>920.0</td>
<td>310.0</td>
<td>33.00 Average</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>22</td>
<td>800.0</td>
<td>310.0</td>
<td>33.00 Average</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>23</td>
<td>650.0</td>
<td>310.0</td>
<td>36.00 Average</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>24</td>
<td>565.0</td>
<td>310.0</td>
<td>40.00 Average</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>25</td>
<td>350.0</td>
<td>298.0</td>
<td>50.00 Average</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>26</td>
<td>300.0</td>
<td>298.0</td>
<td>52.00 Average</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>27</td>
<td>200.0</td>
<td>298.0</td>
<td>54.00 Average</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>28</td>
<td>100.0</td>
<td>298.0</td>
<td>56.00 Average</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>29</td>
<td>0.0</td>
<td>298.0</td>
<td>55.00 Average</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. Name the new roadway
6. Specify the roadway Width
7. Enter correct X,Y,Z coordinates (Refer to Page B-24)
8. Change Pnt. Names
9. Apply
10. On Ramp jumps to proper position in Plan View

**********continued from previous page.

**Plan View:** 2025:1

**File/Save**
There are two possible parts to a traffic noise analysis - Impact analysis and Abatement analysis.

1) **IMPACT** analysis: include only those roadways directly associated with the proposed project.

2) **ABATEMENT** analysis: if a proposed project will result in impacts, cross streets and intersecting roadways should be included if they could reduce the benefit of a noise barrier for impacted receivers.

For this project, **South Street** and **North Street** will **NOT** be modeled for the following reasons:
- they are not directly associated with the proposed project.
- their associated traffic volumes, percentage of trucks and speeds are too low to affect any associated noise barrier analysis.

**NOTE**: major intersecting roadways with high traffic volumes, high percentage of trucks and high speeds should be included in any associated noise **barrier** analysis.
INPUT CHECK

1. Input
2. Input Check (not available unless the Plan View is highlighted)
3. Program quickly examines inputs
4. Results of input check displayed
5. Close the Input Errors window
To help identify roadway segments:
1. View
2. Show/Hide (Plan View must be selected)
3. Under Show Text
   - Roadways to “Show” roadway labels
   - Receivers and Barriers - - for future use.
4. OK

NOTE: segments are defined by their starting points; therefore, end points are not labeled.
TRAFFIC DATA REQUEST FORM

DISTRICT: ______________   COUNTY: ______________   CSJ: ______________

HIGHWAY: _______________________________________________________________

LIMITS:        _______________________________________________________________

DISTRICT PRIORITY:  ______________   EST. LETTING DATE:  ______________

EXISTING NUMBER OF LANES:     __________________________________________

PROPOSED NUMBER OF LANES:     __________________________________________

DISTRICT CONTACT PERSON:       __________________________________________

TELEPHONE NUMBER:                     __________________________________________

PLEASE ATTACH A 8-1/2” X 11” LOCATION MAP

The following to be completed: (please mark information to be provided)

1. Basic Highway Traffic Data for pavement design
   (No line diagram analysis is required)
   A. Base Year/Beginning year:              2005
   B. Forecasted 20 year:                    2025
   C. Forecasted 30 year:                   ______________
   D. Directional Distribution
   E. K-factor

2. Vehicle classification for environmental studies (Air and Noise Analysis).
   both main lanes and frontage roads

3. Line Diagram Analysis (turning movements, please provide line diagram).

4. Complete Corridor Analysis (includes basic highway traffic data for pavement
   and environmental studies and detailed schematic turning movements; please
   provide detailed schematic).

NOTE: submit this request form to TxDOT/TPP as soon as possible. Traffic data is NOT provided by TxDOT/ENV.
# TRAFFIC ANALYSIS FOR HIGHWAY DESIGN

<table>
<thead>
<tr>
<th>Description of Location</th>
<th>Average Daily Traffic</th>
<th>Dir Dist %</th>
<th>K Factor</th>
<th>Percent Trucks ADT</th>
<th>DHV</th>
<th>ATHWLD</th>
<th>Percent Tandem Axles in ATHWLD</th>
<th>Flexible Pavement</th>
<th>S</th>
<th>Rigid Pavement</th>
<th>SLAB</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2005</td>
<td>2025</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SH 123 From To</td>
<td>50,000</td>
<td>75,500</td>
<td>60-40</td>
<td>10.5</td>
<td>9.0</td>
<td>7.2</td>
<td>10,200</td>
<td>615,000</td>
<td>3</td>
<td>658,000</td>
<td>8</td>
</tr>
</tbody>
</table>

The **K Factor** and **% of DHV** are the only items on this sheet that are used in the analysis. All other information is either not applicable or available on the sheet containing the turning movements.

### Data for Use in Air & Noise Analysis

<table>
<thead>
<tr>
<th>Vehicle Class</th>
<th>% of ADT</th>
<th>% of DHV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light Duty</td>
<td>91.0</td>
<td>92.8</td>
</tr>
<tr>
<td>Medium Duty</td>
<td>6.0</td>
<td>4.2</td>
</tr>
<tr>
<td>Heavy Duty</td>
<td>3.0</td>
<td>3.0</td>
</tr>
</tbody>
</table>
Projects that involve more than mainlanes and frontage roads typically with require a depiction of turning movements - from TPP.

This guide will model only 2025 traffic data - underlined numbers.

Always use % of DHV not % of ADT

Directional distribution percentages do not apply to traffic volumes on depictions of turning movements.

- Light Duty Vehicles: % of ADT = 91.0, % of DHV = 92.8
- Medium Duty Vehicles: % of ADT = 6.0, % of DHV = 4.2
- Heavy Duty Vehicles: % of ADT = 3.0, % of DHV = 3.0

Total DHV = ADT (x) K-factor

K-factor: 10.5%
AVERAGE DAILY TRAFFIC (ADT) VOLUMES

<table>
<thead>
<tr>
<th>Light Duty Vehicles</th>
<th>% of ADT</th>
<th>% of DHV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>91.0</td>
<td>92.8</td>
</tr>
<tr>
<td>Medium Duty Vehicles</td>
<td>6.0</td>
<td>4.2</td>
</tr>
<tr>
<td>Heavy Duty Vehicles</td>
<td>3.0</td>
<td>3.0</td>
</tr>
</tbody>
</table>

Frontage Roads and Streets

<table>
<thead>
<tr>
<th>% of ADT</th>
<th>% of DHV</th>
</tr>
</thead>
<tbody>
<tr>
<td>97.0</td>
<td>98.3</td>
</tr>
<tr>
<td>2.0</td>
<td>1.7</td>
</tr>
<tr>
<td>1.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

K-factor: 10.5%

DHV = ADT (x) K-factor
1. **Down Arrow**
2. **EB Frontage**
3. **LAeq1h Hourly tab**

---

4. Enter **Veh/hr** and **Speed (mph)** for Autos and Medium Trucks
   (Refer to Page C-4)

   - Compute **Veh/hr** as follows:
     
     First compute \( DHV = ADT \times K\text{-factor} \% \) 
     
     Then \( Veh/hr = DHV \times \text{Vehicle Type} \% \)

   - **Autos**: \( 3600 \times .105 = 378 \)
     
   - **Medium Trucks**: \( 378 - 372 = 6 \)

5. **Apply**
1. Ensure **Plan View** is selected.
2. **Input**
3. **Input Check**
4. Program quickly examines inputs
5. Result of input check displayed

**IS THIS RESULT CORRECT?**
The results of this check are misleading - - the information entered to this point is correct; however, it is incomplete and, therefore, the missing information must be added.

To determine which information is missing:
1. Tables
2. Highlight Sound-level Input - - these tables should be reviewed throughout the modeling process.

3. Traffic for TNM Vehicles
NOTE: be careful not to select “Traffic for User-defined Vehicles”
4. Incomplete information: no traffic has been entered for the segment defined by starting point 207.
5. Spaces are blank for point 216 - - this is correct. Segments are defined by their starting points, therefore, end points do not contain any traffic = all blank spaces.
To add traffic for Segment defined by point 207:

1. Down Arrow - to see a list of all modeled roadway segments
   - note that point 216 is not listed - as stated earlier, segments are defined by start points - 216 is not listed because it is an end point

2. Segment 207

**NOTE:** unlike STAMINA, TNM allows changes in volume and speed by segment without creating a separate, new roadway

3. Enter Veh/hr and Speed (mph) for Autos and Medium Trucks (Refer to Page C-4)

   **•** Compute Veh/hr as follows:

   First compute DHV = ADT (x) K-factor (%)  
   Then Veh/hr = DHV (x) Vehicle Type (%)  

   Autos: 3400 (x) .105 = 357  
   Medium Trucks: 357 (-) 351 = 6

4. Apply
### AVERAGE DAILY TRAFFIC (ADT) VOLUMES

#### Frontage Roads and Streets

<table>
<thead>
<tr>
<th>% of ADT</th>
<th>% of DHV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light Duty Vehicles</td>
<td>91.0</td>
</tr>
<tr>
<td>Medium Duty Vehicles</td>
<td>6.0</td>
</tr>
<tr>
<td>Heavy Duty Vehicles</td>
<td>3.0</td>
</tr>
</tbody>
</table>

#### Mainlanes

<table>
<thead>
<tr>
<th>% of ADT</th>
<th>% of DHV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light Duty Vehicles</td>
<td>97.0</td>
</tr>
<tr>
<td>Medium Duty Vehicles</td>
<td>2.0</td>
</tr>
<tr>
<td>Heavy Duty Vehicles</td>
<td>1.0</td>
</tr>
</tbody>
</table>

**K-factor:** 10.5%

DHV = ADT \( \times \) K-factor

---

**LEGEND**

1000 - 2005 ADT

<table>
<thead>
<tr>
<th>K-factor:</th>
<th>1000 - 2025 ADT</th>
</tr>
</thead>
<tbody>
<tr>
<td>65</td>
<td>40</td>
</tr>
<tr>
<td>SPEED LIMIT</td>
<td>SPEED LIMIT</td>
</tr>
</tbody>
</table>

Texas Department of Transportation/Environmental Affairs Division
1. Select **EB Main**

2. Enter **Veh/hr** and **Speed (mph)** for Autos, Medium Trucks, and Heavy Trucks (Refer to Page C-9)

   - Compute DHV and Veh/hr as follows:

   \[
   \text{DHV} = \text{ADT} \times \text{K-factor} (\%) = 31800 \times 0.105 = 3339 \\
   \text{Veh/hr} = \text{DHV} \times \text{Vehicle Type} (\%) \\
   \text{Autos: } 3339 \times 0.928 = 3099 \\
   \text{Medium Trucks: } 3339 \times 0.042 = 140 \\
   \text{Heavy Trucks: } 3339 - 3099 - 140 = 100
   \]

3. **Copy All** - - since all segments of **EB Main** contain the same Veh/hr and Speeds

4. **Yes** - - to confirm you wish to automatically copy all traffic data from Segment 206 to all other segments of **EB Main**

5. **Apply**

---

The **Copy All** button will not be visible if the display resolution is not 1024 x 768 (or greater) with “Small Fonts.”
TRAFFIC INPUT: EB MAIN (2 of 2)

1. Tables
2. Highlight Sound-level Input - these tables should be reviewed throughout the modeling process
3. Traffic for TNM Vehicles
   NOTE: be careful not to select “Traffic for User-defined Vehicles”
4. Information was correctly/completely copied to all segments
5. Spaces are blank for point 216 for both roadways - this is correct - end points do not define segments; therefore, end points should not contain any traffic = all blank spaces
This number is not used because the On Ramp traffic (1300) is contained in a separate lane that continues through the entire length of the project.
1. Select WB Main
2. Enter Veh/hr and Speed (mph) for Autos, Medium Trucks, and Heavy Trucks (Refer to Page C-12)
   - Compute DHV and Veh/hr as follows:
     \[
     DHV = \text{ADT} \times \text{K-factor} \%
     \]
     \[
     \text{Veh/hr} = \text{DHV} \times \text{Vehicle Type} \%
     \]
3. Copy All - since all segments of WB Main contain the same Veh/hr and Speeds
4. Yes - to confirm you wish to automatically copy all traffic data from Segment 216 to all other segments of WB Main
5. Apply
### Average Daily Traffic (ADT) Volumes

#### Frontage Roads and Streets

<table>
<thead>
<tr>
<th>% of ADT</th>
<th>% of DHV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light Duty Vehicles</td>
<td>91.0</td>
</tr>
<tr>
<td>Medium Duty Vehicles</td>
<td>6.0</td>
</tr>
<tr>
<td>Heavy Duty Vehicles</td>
<td>3.0</td>
</tr>
</tbody>
</table>

#### Mainlanes

<table>
<thead>
<tr>
<th>% of ADT</th>
<th>% of DHV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light Duty Vehicles</td>
<td>97.0</td>
</tr>
<tr>
<td>Medium Duty Vehicles</td>
<td>2.0</td>
</tr>
<tr>
<td>Heavy Duty Vehicles</td>
<td>1.0</td>
</tr>
</tbody>
</table>

**K-factor:** 10.5%

DHV = ADT (x) K-factor

---

**On Ramp**

- SH 123
- 31800
- 21700
- 33900
- 22600

**Mainlanes**

- 35200
- 23500
- 31800
- 23500

**Frontage Roads and Streets**

- 3600
- 1600
- 3400
- 1500

---

**Legend**

- 1000 - 2005 ADT
- 1000 - 2025 ADT

**Texas Department of Transportation/Environmental Affairs Division**  
**Page C-14**
1. Select **On Ramp**
2. Enter **Veh/hr** and **Speed (mph)** for Autos and Medium Trucks
   - use mainlane speed
3. ![Copy All] - since all segments of **On Ramp** contain the same Veh/hr and Speeds
4. ![Yes] - to confirm you wish to automatically copy all traffic data from Segment 215 to all other segments of **On Ramp**
5. ![Apply]
TRAFFIC INPUT: ON RAMP (2 of 2)

1. Flow Control tab
2. Down Arrow to see the list of possible Control Devices
3. Onramp
4. In Speed Constraint field and enter frontage speed of 40
   NOTE: the speed constraint is the speed at the beginning of the control device - the final speed is the speed previously entered under traffic data (LAeq1h Hourly tab)
5. Leave Vehicles Affected (%) at 100
6. Apply

<table>
<thead>
<tr>
<th>Pnt. Name</th>
<th>Pnt. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>215</td>
</tr>
<tr>
<td>2</td>
<td>214+20</td>
</tr>
<tr>
<td>3</td>
<td>214</td>
</tr>
<tr>
<td>4</td>
<td>212+50</td>
</tr>
<tr>
<td>5</td>
<td>211+65</td>
</tr>
<tr>
<td>6</td>
<td>209+50</td>
</tr>
<tr>
<td>7</td>
<td>209</td>
</tr>
<tr>
<td>8</td>
<td>200</td>
</tr>
<tr>
<td>9</td>
<td>207</td>
</tr>
<tr>
<td>10</td>
<td>206</td>
</tr>
</tbody>
</table>

NOTE: the speed constraint is the speed at the beginning of the control device - the final speed is the speed previously entered under traffic data (LAeq1h Hourly tab)
**AVERAGE DAILY TRAFFIC (ADT) VOLUMES**

**LEGEND**
- 1000 - 2005 ADT
- 1000 - 2025 ADT

<table>
<thead>
<tr>
<th>% of ADT</th>
<th>% of DHV</th>
</tr>
</thead>
<tbody>
<tr>
<td>91.0</td>
<td>92.8</td>
</tr>
<tr>
<td>6.0</td>
<td>4.2</td>
</tr>
<tr>
<td>3.0</td>
<td>3.0</td>
</tr>
</tbody>
</table>

**EXERCISE**

Input Traffic Data for **WB Frontage**

**Tasks:**
1. Compute DHV
2. Compute Veh/hr
3. Enter Veh/hr and Speeds
4. Check Input Table

<table>
<thead>
<tr>
<th>Mainlanes</th>
<th>Frontage Roads and Streets</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of ADT</td>
<td>% of DHV</td>
</tr>
<tr>
<td>91.0</td>
<td>92.8</td>
</tr>
<tr>
<td>6.0</td>
<td>4.2</td>
</tr>
<tr>
<td>3.0</td>
<td>3.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>% of ADT</th>
<th>% of DHV</th>
</tr>
</thead>
<tbody>
<tr>
<td>97.0</td>
<td>98.3</td>
</tr>
<tr>
<td>2.0</td>
<td>1.7</td>
</tr>
<tr>
<td>1.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

K-factor: 10.5%

**DHV = ADT (x) K-factor**
### AVERAGE DAILY TRAFFIC (ADT) VOLUMES

**SH 123**

<table>
<thead>
<tr>
<th></th>
<th>% of ADT</th>
<th>% of DHV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light Duty Vehicles</td>
<td>91.0</td>
<td>92.8</td>
</tr>
<tr>
<td>Medium Duty Vehicles</td>
<td>6.0</td>
<td>4.2</td>
</tr>
<tr>
<td>Heavy Duty Vehicles</td>
<td>3.0</td>
<td>3.0</td>
</tr>
</tbody>
</table>

**Light Duty Vehicles**  
**Medium Duty Vehicles**  
**Heavy Duty Vehicles**

**Mainlanes**

**65 SPEED LIMIT**

**Frontage Roads and Streets**

**40 SPEED LIMIT**

<table>
<thead>
<tr>
<th></th>
<th>% of ADT</th>
<th>% of DHV</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADT</td>
<td>97.0</td>
<td>98.3</td>
</tr>
<tr>
<td>DHV</td>
<td>2.0</td>
<td>1.7</td>
</tr>
</tbody>
</table>

**K-factor:** 10.5%

**DHV = ADT (x) K-factor**

---

**Legend**

- 1000 - 2000 ADT
- 1000 - 2020 ADT

**Texas Department of Transportation/Environmental Affairs Division**

Page C-18
TRAFFIC INPUT: WB FRONTAGE

1. Select **WB Frontage** - - Segment 216
2. Enter **Veh/hr** and **Speed (mph)** for Autos and Medium Trucks (Refer to Page C-15)
3. ➕ **Apply**

4. Select Segment 215
5. Enter **Veh/hr** and **Speed (mph)** for Autos and Medium Trucks (Refer to Page C-15)
6. ➕ **Apply**

7. Select Segment 207
8. Enter **Veh/hr** and **Speed (mph)** for Autos and Medium Trucks (Refer to Page C-15)
9. ➕ **Apply**

**General**  |  **LAEq1h Hourly**  |  **Flow Control**  |  **Notes**
---|---|---|---

### Roadway Input : 2025:2

<table>
<thead>
<tr>
<th>Vehicle Type</th>
<th>Veh/hr</th>
<th>Speed (mph)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auto</td>
<td>640</td>
<td>40.00</td>
</tr>
<tr>
<td>Medium Truck</td>
<td>11</td>
<td>40.00</td>
</tr>
<tr>
<td>Heavy Truck</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>Buses</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>Motorcycle</td>
<td>0</td>
<td>0.00</td>
</tr>
</tbody>
</table>

### Roadway Input : 2020:2

<table>
<thead>
<tr>
<th>Vehicle Type</th>
<th>Veh/hr</th>
<th>Speed (mph)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auto</td>
<td>506</td>
<td>40.00</td>
</tr>
<tr>
<td>Medium Truck</td>
<td>9</td>
<td>40.00</td>
</tr>
<tr>
<td>Heavy Truck</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>Buses</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>Motorcycle</td>
<td>0</td>
<td>0.00</td>
</tr>
</tbody>
</table>

### Roadway Input : 2025:2

<table>
<thead>
<tr>
<th>Vehicle Type</th>
<th>Veh/hr</th>
<th>Speed (mph)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auto</td>
<td>486</td>
<td>40.00</td>
</tr>
<tr>
<td>Medium Truck</td>
<td>8</td>
<td>40.00</td>
</tr>
<tr>
<td>Heavy Truck</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>Buses</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>Motorcycle</td>
<td>0</td>
<td>0.00</td>
</tr>
</tbody>
</table>
Typically, the number of receivers is limited to representative locations; however, for the purpose of this guide - - for practice, all receiver locations will be included in the analysis.

- Receiver locations are selected based on **ALL** of the following:
  1. Exterior/outdoor locations frequently used by humans
  2. Locations that might be impacted
  3. Locations that may benefit from feasible and reasonable noise abatement

**NOTE:** interior locations are used if exterior locations are physically shielded from the roadway, or if there is little or no human activity in exterior locations adjacent to the roadway.
Blank **Receiver Input** window appears
1. Ensure the **General** tab at the bottom of the Receiver Input window is selected
2. Enter a default in **Height Above Ground (ft)** field and change the **Default Setting** to 5.

   Setting this default will automatically change the **Height Above Ground** for all new/subsequent receivers to 5.

3. **Apply**

4. Select the **Levels/Criteria** tab at the bottom of the Receiver Input window.
5. Enter a default in **Noise Reduction Goal (db)** field and change the **Default Setting** to 5.
6. The numbers in the **Existing Level (dBA)**, **Impact Criteria Level (dBA)** and the **Substantial Increase (db)** fields are used by the computer to automatically determine when an impact will occur under the Absolute and Relative Impact Criteria. However, it is recommended that impacts be determined manually by the analyst. Therefore, it is not necessary to input numbers in these fields for each receiver.

   Setting these defaults will automatically change these inputs for all new/subsequent receivers.

7. **Apply**
1. Reselect the **General** tab at the bottom of the **Receiver Input** window.
2. **New**
3. Enter X, Y, Z coordinates for **Receiver1** (Refer to Page D-2)
4. **Apply**
5. **Receiver1** appears on the Plan View.

Repeat steps 2 thru 5 above for the remaining 15 (16 total) receivers.
1. Long Receiver Names can be difficult to read on the Plan View.
2. Shorten the names of all receivers to R-1, R-2, R-3, etc.
3. Apply
1. Change the number of Dwelling Units for R-8 and R-9 to 2 (apartments).
2. Apply

To see a Full View of the project in the Plan View window:...

View/Full View
1. Select Levels/Criteria tab.
2. Change the Impact Crit.Level to 51 (interior) for R-8 and R-9 (apartments), and R-10 (business)
3. Apply
1. Select **Notes** tab.
2. Leave all receivers **Active** = sound levels will be calculated for all receivers.
3. Enter a Note for **R-8, R-9** and **R-10** to indicate that **25 dBA** will be subtracted from the calculated sound level....to account for the interior adjustment for masonry construction.
4. **Apply**.
At this point in the analysis, it is important to identify and model any existing elements in the propagation path between the traffic and receivers that could serve to reduce noise levels at the receivers. For this project, the only additional design element that will be modeled is the solid concrete traffic barriers (CTB) on the elevated sections of the project.

**NOTE:** consult with the project engineer to determine the exact location and length of CTBs, especially in regard to sight distance on/near ramps.

Although wooden privacy fences may also act as a barrier to noise by providing some noise reduction that should be subtracted from modeled noise levels at associated receivers, due to the elevated geometry of the mainlanes in this project, these privacy fences provide no noise reduction for these residences/receivers. **NOTE:** masonry privacy fences/walls can be modeled in TNM (as barriers) while wooden privacy fences cannot (due to sound transmission between the wood slats).

**NOTE:** CTBs are an integral part of the design of the project and, as such, are not considered to be noise barriers even though they can serve to reduce noise levels by as much as 2-3 dBA. Because of this, solid CTBs should be considered on elevated sections of roadways adjacent to residential areas in lieu of fences or guardrails or any other non-solid traffic barriers that provide no reduction in noise levels.
The EB CTB is divided into four segments defined by five points (to follow the geometry of the EB Main roadway).

The first four segments (five points) will be copied from the EB Main roadway input.

- The Y coordinate will need to be adjusted for all five points to offset the EB CTB to the edge of pavement of EB Main.
- The X and Z coordinates will only need to be adjusted for the last/fifth point.

NOTE: It is important that CTBs be aligned/modeled as closely as possible to their adjoining roadways. For this reason, points for CTBs should be aligned as closely as possible with points for adjoining roadways.

- Enter coordinates in the direction of traffic (recommended but not required).
EXISTING BARRIER INPUT: EB CTB (1 of 4)

1. Input
2. Barriers

Blank Barrier Input window appears

3. in Name field and change Barrier1 to EB CTB
EXISTING BARRIER INPUT: EB CTB (2 of 4)

1. Minimize the Plan View
2. Open the Roadway Input window and select EB Main.

To copy information from EB Main:
3.  and drag from Pnt. Name 206 (upper left) to the Z coordinate for 215+25.
   Ctrl +C to copy selected information

4. Insert/Append a total of five new rows in the Barrier Input window (to allow sufficient space to “paste” the four rows (four points) “copied” from the EB Main roadway).

5. To paste copied information in EB CTB:
   in first (top left) cell
   Ctrl +V to “paste” selected information

NOTE: Do Not Apply until the data for all five points is properly adjusted.

continued
EXISTING BARRIER INPUT: EB CTB (3 of 4)

6. Adjust all Y coordinates (Refer to Page E-2)
7. Adjust the Pnt. Name and the X and Z coordinates for the fifth point (Refer to Page E-2)
8. Enter Height (ft) of a T-501 CTB (2'-8" = 2.67')
9. Apply
10. Line drawing of EB CTB appears (in red) in Plan View window

```
<table>
<thead>
<tr>
<th>Pnt. Name</th>
<th>Pnt. No</th>
<th>X (ft)</th>
<th>Y (ft)</th>
<th>Z (bottom) (ft)</th>
<th>Height (ft)</th>
<th>Increment (ft)</th>
<th>#Up</th>
<th>#Dn</th>
</tr>
</thead>
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<tr>
<td>1 206</td>
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<td>205.0</td>
<td>55.0</td>
<td>2.67</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2 207</td>
<td>2</td>
<td>100.0</td>
<td>205.0</td>
<td>56.0</td>
<td>2.67</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3 208</td>
<td>3</td>
<td>200.0</td>
<td>205.0</td>
<td>54.0</td>
<td>2.67</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4 209</td>
<td>4</td>
<td>300.0</td>
<td>205.0</td>
<td>52.0</td>
<td>2.67</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5 215</td>
<td>5</td>
<td>900.0</td>
<td>205.0</td>
<td>36.0</td>
<td>2.67</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
```

………continued from previous page.

- Close the Roadway Input window

![Window/Tile Horizontal](Image)

- Line drawing of EB CTB appears (in red) in Plan View window

![File/Save](Image)
ADDITIONAL NOTES:

1. It is not necessary to complete any information in this section of the **Barrier Input** window -- complete only if this barrier is to be set as the default for subsequent barriers -- not recommended for most projects.

2. Because a CTB is a fixed-height barrier that is integral to the highway design, all numbers in this section should remain at zero. With all numbers at zero, the **Sound-level Results** table will show the same levels in both the **No Barrier** and **With Barrier** columns.

**NOTE**: If it is important to know the noise level reduction attributable to the CTB, ensure there are no other “barriers” in the run and simply add a non-zero number such as **1** in the **Increment (ft)** column for each point.
EXISTING BARRIER: Median CTB

EXERCISE

Input Median CTB (4'-0" Single Slope)

Tasks:
1. Copy EB Main information
2. Add new barrier
3. Insert/Append necessary rows
4. Paste EB Main information
5. Name new barrier
6. Adjust Y coordinates & Heights

Scale: 1" = 100'

Texas Department of Transportation/Environmental Affairs Division
The **Median CTB** should be divided into five segments defined by six points (to follow the geometry of the **EB & WB Main** roadways).

All segments (five points) should be copied from the **EB Main** roadway input (the X and Z coordinates are accurate but the Y coordinates will need to be adjusted to offset the **Median CTB** to the edge of pavement of **EB Main**).
EXISTING BARRIER INPUT: Median CTB (1 of 2)

1. Minimize the Plan View
2. Open the Roadway Input window and select EB Main.

- Window/Tile Horizontal

To copy information from EB Main:
3. Drag and drop from Pnt. Name 206 (upper left) to the Z coordinate for Pnt. Name 216 (sixth row).
4. Ctrl +C to copy selected information
5. New (Barrier Input)
6. Insert/Append a total of six new rows in the Barrier Input window (to allow sufficient space to "paste" the six rows "copied" from the EB Main roadway).
7. To paste copied information in EB CTB:
   - in first (top left) cell
   - Ctrl +V to "paste" selected information
8. Name and change to Median CTB

NOTE: Do Not Apply until the Y coordinates and Heights are properly adjusted.
EXISTING BARRIER INPUT: Median CTB (2 of 2)

7. Adjust all Y coordinates (Refer to Page E-8)
8. Enter Height (ft) of a Single Slope CTB (4'-0" = 4)
9. Apply
10. Line drawing of EB CTB appears (in red) in Plan View window
It is important to align the elevation of a CTB with its adjoining roadway. This is best accomplished by matching the elevation of points on a CTB with nearby points on the adjoining roadway. Since there is no point on WB Main that is near the west end of WB CTB, one additional point will be added to WB Main before inputting WB CTB.

- The WB CTB will be inputted using the mouse.
Minimize the Barrier Input window.

Open the Roadway Input window and select the WB Main roadway.

1. Ensure the Plan View window is active (dark blue banner).
2. Select anywhere on Segment 215+25 of WB Main to select it (gray shadow along segment).
3. Select Edit
4. Select Add Point within Segment.
5. A new point, point 32, is added in the middle of Segment 215+25.

NOTE: The new point (point 32) is located at an equal distance and average height between points 215+25 and 209. Therefore, the X and Z coordinates will need to be adjusted.
**EXISTING BARRIER INPUT: WB CTB (2 of 4)**

6. Change the **Pnt. Name** for the new point to the Station number.
7. Adjust the **X** and **Z** coordinates (Refer to Page E-11).
8. **Note**: ignore numbers in **Pnt. No.** column - do not be concerned that numbers are not in order - it is not necessary to “re-number” these points.
9. **Apply**
10. New point 211 shifts to the correct position in the **Plan View**.

---

![Image of software interface](image)

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EXISTING BARRIER INPUT: WB CTB (3 of 4)

- Close the Roadway Input window.
- Restore the Barrier Input window.

1. <Barrel> button in the Tool Bar - the cursor changes to.
2. Use the <Tool> tool to define two points defining one segment anywhere in the general vicinity of WB CTB - no need to be precise.
3. To deactivate the Roadway input tool, move the cursor away from the last point and <Right Click> the mouse or deselect the button in the Tool Bar.
4. Two rows are created - coordinates will be corrected on the next page.

continued
5. **Name** the new barrier
6. Change **Pnt. Names**
7. Adjust all X, Y, Z coordinates for **WB CTB** (Refer to Page E-11)
8. Enter **Height** (ft) of a T-501 CTB (2'-8" = 2.67)
9. **Apply**
10. **WB CTB** jumps to correct position in the **Plan View**
As stated previously in this guide, it is important to horizontally (X,Y) and vertically (Z) align CTBs as closely as possible to the edge of adjoining roadways. There are essentially three different techniques that could be used to accomplish this task.

1. **From Scratch**: enter all coordinates for a CTB from the project schematic/grid.
2. **Copy/Paste**: copy info from an adjoining roadway, paste copied info in a new barrier input window and adjust the Y coordinates to the proper horizontal/vertical alignment.
3. **Mouse**: add points in the Plan View and input table by using the mouse.

**New Technique:**
4. **Mouse** and **Snap** tool: snap on adjoining roadway points which automatically inserts X,Y,Z coordinates in a new barrier input window - - then manually adjust Y coordinates to achieve the proper offset.

- Techniques 1 thru 3 have been previously addressed in this guide - - the **Ramp CTB** will be inputted using Technique #4.
EXISTING BARRIER INPUT: Ramp CTB (1 of 2)

1. Deselect Show Text for Barriers (to minimize clutter)
2. Use the tool and (snap to) all eight points of the Ramp roadway beginning with 214 and ending with 206
3. To deactivate the Barrier and Snap input tools, move the cursor away from the last point and Right Click the mouse or deselect both buttons in the Tool Bar.

NOTE: X,Y,Z coordinates are automatically inserted in the Barrier Input window for a new barrier (Barrier4) and the barrier is drawn on top of the Ramp roadway in the Plan View. The Names, Y coordinates and Heights will be adjusted on the next page.
EXISTING BARRIER INPUT: Ramp CTB (2 of 2)

3. In Name field and change to Ramp CTB
4. Add 12 feet to all Y coordinates to properly offset the Ramp CTB from the On-Ramp roadway
5. Enter the Height of a T-501 CTB (2'-8" = 2.67')
6. Change Pnt. Names to station numbers for each point
   - Reselect Show Text for Barriers
7. Apply
8. Line drawing of Ramp CTB jumps to correct position in the Plan View
A **Building Row** is used to define non-continuous structures (20-80% coverage) that shield receivers from traffic noise. If structures that shield receivers are solid/continuous (greater than 80% coverage), they are modeled as existing barriers.

**NOTE**: For most traffic noise analyses, it would not be necessary to model building rows since it is typically not necessary to model receivers such as R-13 that are behind the adjacent row.

For the purpose of this guide, the commercial property (R-10) and residential properties (R-11, R-12) will be modeled as a **Building Row** shielding R-13 from traffic noise.
The Building Row will be modeled as one segment defined by two points and will be inputted using the mouse.
BUILDING ROW INPUT (1 of 3)

Blank **Building Row Input** window appears
BUILDING ROW INPUT (2 of 3)

1. Building Row button in the Tool Bar - the cursor changes to the building icon.
2. Use the tool to define two points anywhere in the general vicinity of the building row - no need to be precise.
3. To deactivate the Building Row input tool, move the cursor away from the last point and Right Click the mouse or deselect the button in the Tool Bar.
4. Two rows are created - coordinates will be corrected on the next page.

continued
5. In **Name** field and change **Building2** to **R-10,11,12**

6. In **Avg. Height** field and change to 15 (estimated)

7. In **Building Percentage** field and change from default of 20 to 79

8. Enter correct **X**, **Y**, **Z** coordinates (Refer to Page F-2)

9. **Apply**

10. **Building Row** jumps to correct position in **Plan View**

**NOTE:** there are no **Pnt. Names** for **Building Rows**; therefore, use **Show/Hide** and select **Point Numbers** for **Building Rows**

---

Width of structures minus gaps (170) = 79%

Total width of structures and gaps (215)

**NOTE:** minimum percentage allowed is 20
maximum percentage allowed is 80
(model structures >80 as existing barriers)
Curved lines, such as those defining Terrain Lines, must be defined by a series of straight line segments. The number of segments is determined (judgement) by the amount of precision required to properly define the curve.

- smaller number of segments = less precision
- larger number of segments = greater precision

NOTE: for this project, it is only necessary to model the two Terrain Lines that identify the highest (top) and lowest (bottom) elevations. The remaining Terrain Lines have no affect on resultant noise levels.
The Terrain Line for the top of the hill will be modeled in four segments defined by five points and will be inputted using the mouse.
Blank Terrain Line Input window appears
1. **Terrain Line** button in the Tool Bar -- cursor =

2. Use the tool to place five points defining four segments anywhere in the general vicinity of the terrain line at the top of the hill -- no need to be precise.

3. To deactivate the **Terrain Line** input tool, move the cursor away from the last point and **Right Click** the mouse or deselect the button in the Tool Bar.

4. Five rows are created -- coordinates will be corrected on the next page.

---

1. **Terrain Line** button in the Tool Bar -- cursor =

2. Use the tool to place five points defining four segments anywhere in the general vicinity of the terrain line at the top of the hill -- no need to be precise.

3. To deactivate the **Terrain Line** input tool, move the cursor away from the last point and **Right Click** the mouse or deselect the button in the Tool Bar.

4. Five rows are created -- coordinates will be corrected on the next page.

---

1. **Terrain Line** button in the Tool Bar -- cursor =

2. Use the tool to place five points defining four segments anywhere in the general vicinity of the terrain line at the top of the hill -- no need to be precise.

3. To deactivate the **Terrain Line** input tool, move the cursor away from the last point and **Right Click** the mouse or deselect the button in the Tool Bar.

4. Five rows are created -- coordinates will be corrected on the next page.

---

1. **Terrain Line** button in the Tool Bar -- cursor =

2. Use the tool to place five points defining four segments anywhere in the general vicinity of the terrain line at the top of the hill -- no need to be precise.

3. To deactivate the **Terrain Line** input tool, move the cursor away from the last point and **Right Click** the mouse or deselect the button in the Tool Bar.

4. Five rows are created -- coordinates will be corrected on the next page.
5. Click in Name field and change Terrain Line 2 to Top of hill

6. Enter correct X, Y, Z coordinates (Refer to Page G-2)

7. Click Apply

8. Terrain Line jumps to proper position in Plan View

**NOTE:** there are no Pnt. Names for Building Rows; therefore, use Show/Hide and select Point Numbers for Terrain Lines

……………continued from previous page.
Use **Skew View** to check the geometry of the terrain line
- recommend maximizing the plan view

1. **View**
2. Highlight **New View**
3. **Skew Section**
4. **Skew View** Popup Help window appears
   - press Space Bar to remove Help - - cursor =
5. Use the tool to draw a line perpendicular to the roadways as shown - - the skew view will be distorted if the line is not drawn perpendicular to the roadways

**NOTE**: to turn off the help feature, deselect **Popup Help** under **Setup/Run Identification**

**Skew View** will only show objects with a complete segment in the **Plan View**
- - may need to **Zoom Out** to view the entire segment.

---

**Creating a Skew View**

To create a Skew View you must create a line which defines the cross section of the objects that you wish to view in skew.
To do this, click the left mouse button and then drag the line to the desired location, click the left mouse button a second time to complete the line.

(Press Space Bar to Continue)
1. Modeled Terrain Line
   - additional terrain lines are automatically drawn from the edge of pavement to bottom of barriers to bottom of receivers to modeled terrain lines, etc.

2. Roadway (width) three circles represent source heights

3. Concrete Traffic Barrier

4. Receiver

5. Dimensions (where cursor is placed)
   - H = horizontal distance (not the Y coordinate)
   - Z = height (Z coordinate)

NOT an accurate alignment of the slope of the hill

Objects Shown: H: 239.8 ft Z: 43.9
EXERCISE

Input Terrain Line for the **bottom** of the hill

**Task:** Add new Terrain Line using the mouse
The curved Terrain Line should be modeled in four straight line segments defined by five points.
1. Terrain Line icon in the Tool Bar - - cursor =
   - Use the tool to place five points defining four segments slightly below the terrain line previously modeled for the top of the hill - - no need to be precise.
   - Deactivate the Terrain Line input tool - - move the cursor away from the last point and Right Click the mouse or deselect the icon in the Tool Bar
2. Five rows are created
3. in Name field and change Terrain Line 3 to Bottom of hill
4. Enter correct X,Y,Z coordinates (Refer to Page G-9)
5. Apply
6. Terrain Line jumps to proper position in Plan View
TERRAIN LINE INPUT: Bottom of Hill (2 of 3)

Use Skew View to check the geometry of the terrain lines
- recommend maximizing the plan view
1. View
2. Highlight New View
3. Skew Section
4. Skew View Popup Help window appears
   - press Space Bar to remove Help - - cursor =
5. Use the tool to draw a line perpendicular to the roadways as shown - - the skew view will be distorted if the line is not drawn perpendicular to the roadways

NOTE: to turn off the help feature, deselect Popup Help under Setup/Run Identification

Skew View will only show objects with a complete segment in the Plan View - - may need to Zoom Out to view the entire segment.
Skew View/Cross Section

More accurate alignment of the slope of the hill
Curved lines, such as those defining **Ground Zones**, must be defined by a series of straight line segments. The number of segments is determined (judgement) by the amount of precision required to properly define the curve.

- smaller number of segments = less precision
- larger number of segments = greater precision

**Ground Zones** are modeled for features between the roadways and receivers which are different from the **Ground Default Type (Lawn)** specified in Setup. Small ground zones (e.g., less than 20% of the surface between the roadway and a receiver) have no effect on resultant noise levels and do not need to be included in a traffic noise analysis.

**NOTE**: the Pond occupies approximately 45% of the surface between the **WB Frontage** and R-14.
The Pond Ground Zone will be modeled in six segments defined by six points (same number of segments and points because Ground Zones are self-enclosing objects).
GROUND ZONE INPUT: Pond (1 of 3)

1. Input
2. Ground Zones

Blank Ground Zone Input window appears
GROUND ZONE INPUT: Pond (2 of 3)

Ensure the Plan View window is active (dark blue banner)
1. Ground Zone icon in the Tool Bar - the cursor changes to
2. Use the tool to place six points defining six segments anywhere in the general vicinity of the pond - no need to be precise.
3. To deactivate the Ground Zone input tool, move the cursor away from the last point and Right Click the mouse
4. Six rows are created - coordinates will be adjusted on the next page.

Enlarge Plan View: use Arrow and Page Up (magnify) keys
5. In **Name** field and change **Ground Zone 2** to **Pond Surface**
6. Click **down arrow** in the **Type** field and select **Water**
7. **Flow Resistivity** changes automatically with the ground **Type**
8. Enter correct **X**, **Y** coordinates (Refer to Page H-2)

**NOTE**: there are no **Z** coordinates for **Ground Zones** since they are automatically placed on the surface of surrounding terrain
9. Apply
10. **Ground Zone** jumps to proper position in **Plan View**

**NOTE**: there are no **Pnt. Names** for **Ground Zones**; therefore, use **Show/Hide** and select **Point Numbers** for **Ground Zones**.

**NOTE**: since **Z** coordinates are not used for **Ground Zones**, without any further steps, the elevation of the surface of the pond would be the same as the surface of the surrounding terrain (30'). Therefore, two terrain lines will be modeled around the pond to define the elevation of the surface of the pond (25') and the top of the embankment (30').
1. **Input**
2. **Terrain Lines**

Blank **Terrain Line Input** window appears
1. Terrain Line icon in the Tool Bar - - cursor =
   - Use the tool to seven points defining six segments slightly outside the surface of the pond ground zone - - no need to be precise - - will adjust/move later.
   - Deactivate the Terrain Line input tool - - move the cursor away from the last point and Right Click the mouse or deselect the icon in the Tool Bar
2. Seven rows are created
3. in Name field and change Terrain Line 4 to Pond Surface
4. Change all Z coordinates to 25 (surface of pond)
5. Apply

Do Not attempt to connect the last point to the first point - - this will create an error - - leave a small gap
Use the mouse to manually move all seven terrain line points to a position closer to **BUT NOT TOUCHING** the pond, as follows:

6. $\mathbf{\checkmark}$ individual segments one at a time then, while holding down the Ctrl key, $\mathbf{\checkmark}$ the mouse to move each point closer to the pond

7. $X,Y$ coordinates are automatically updated in the Terrain Line Input window

8. $\mathbf{\checkmark}$ Apply

---

<table>
<thead>
<tr>
<th>Pt. #</th>
<th>X [ft]</th>
<th>Y [ft]</th>
<th>Z [ft]</th>
</tr>
</thead>
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<td>1</td>
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<td>415.7</td>
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<tr>
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</tr>
<tr>
<td>7</td>
<td>17</td>
<td>480.5</td>
<td>442.4</td>
</tr>
</tbody>
</table>

---

Leave a small gap between the points.

Do Not allow any lines to intersect/cross.
Use Skew View to check the geometry of the terrain lines
- recommend maximizing the plan view
1. View
2. Highlight New View
3. Skew Section
4. Skew View Popup Help window appears
   - press Space Bar to remove Help - cursor =
5. Use the tool to draw a line perpendicular to the roadways as shown - the skew view will be distorted if the line is not drawn perpendicular to the roadways

NOTE: to turn off the help feature, deselect Popup Help under Setup/Run Identification

Skew View will only show objects with a complete segment in the Plan View
- may need to Zoom Out to view the entire segment.
1. Modeled Terrain Lines
   - additional terrain lines are automatically drawn from the receiver and the edge of pavement
2. Ground Zone lines (no Z coordinate - defined by elevation of surrounding terrain)

3. Roadway (width) three circles represent source heights
4. Receiver
5. Dimensions (where cursor is placed)
   - H = horizontal distance (not the Y coordinate)
   - Z = height (Z coordinate)

NOT an accurate alignment of the slope to the pond
TERRAIN LINE INPUT: Embankment (1 of 3)

1. **Terrain Line** icon in the **Tool Bar** - cursor =
   - Use the **tool** to place seven points defining six segments slightly outside the Terrain Line for the Pond Surface - no need to be precise - will adjust/move later.
   - **Deactivate** the **Terrain Line** input tool - move the cursor away from the last point and **Right Click** the mouse or deselect the icon in the **Tool Bar**
2. Seven rows are created
3. **Name** field and change **Terrain Line 5** to **Embankment**
4. Change all **Z** coordinates to **30** (surrounding terrain)
5. **Apply**

Use the mouse to move points as necessary to create a 5’ wide embankment.

---

**Notes:**
- Do Not allow any lines to intersect/cross
- Leave a small gap
- File/Save
- FHWA Traffic Noise Model (TNM v2.5) User’s Guide 2005
Use Skew View to check the geometry of the terrain lines - recommend maximizing the plan view

1. View
2. Highlight New View
3. Skew Section
4. Skew View Popup Help window appears - press Space Bar to remove Help - cursor =
5. Use the tool to draw a line perpendicular to the roadways as shown - the skew view will be distorted if the line is not drawn perpendicular to the roadways

NOTE: to turn off the help feature, deselect Popup Help under Setup/Run Identification

Skew View will only show objects with a complete segment in the Plan View - may need to Zoom Out to view the entire segment.
1. Modeled Terrain Lines
   - additional terrain lines are automatically drawn from the receiver and the edge of pavement
2. Ground Zone lines (no Z coordinate - defined by elevation of surrounding terrain)
3. Roadway (width) three circles represent source heights
4. Receiver
5. Dimensions (where cursor is placed)
   - H = horizontal distance (not the Y coordinate)
   - Z = height (Z coordinate)

Skew View/Cross Section

More accurate alignment of the slope to the pond
COMPLETED PROJECT (WITHOUT ABATEMENT)
CALCULATE SOUND LEVELS (1 of 3)

Before calculating **Sound Levels**, perform the following checks to ensure the accuracy of the input data:
- Check input tables for all modeled objects
- Check **View/New View/Skew View** at several locations along the project to ensure the accuracy of the overall geometry of all modeled objects
- Check **View/New View/Perspective** - also to check overall project geometry

**NOTE**: an **Input Check** runs automatically when **Calculate/Sound Levels** is selected

**continued**
1. **Calculate**
2. **Current Run/All Receivers**
3. An Input Check runs automatically
4. Status window indicates progress of calculations
   - indicates R-1 thru R-8 complete
   - currently calculating R-9
   - the blue ribbon confirms that calculations are approximately ½ complete
5. For longer runs, the time to go (50 sec to go) will not be accurate

Total run time: 1-2 minutes

**NOTE**: calculations may be canceled anytime without losing the levels already calculated. Calculations may be restarted (where left off) even after the run is closed and reopened.

It is possible to operate other applications (WORD, EXCEL, etc.) while TNM is calculating sound levels; **HOWEVER**, all applications will operate much slower than normal.
### CALCULATE SOUND LEVELS (3 of 3)

1. **Table**
2. Highlight **Sound-level Results**
3. **Sound Levels** (the table is only partially displayed)
4. **Maximize the table**

#### Sound-Level Results

<table>
<thead>
<tr>
<th>Receiver</th>
<th>Name</th>
<th>No.</th>
<th>#DUs</th>
<th>Existing L&amp;Ep1h</th>
<th>No B</th>
<th>LA&amp;Ep1h Calculated</th>
<th>Crit’n</th>
<th>Increase over existing LA&amp;Ep1h Calculated</th>
<th>Crit’n Sub’l Inc</th>
<th>Type</th>
<th>Impact</th>
</tr>
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</table>

- **CALCULATE SOUND LEVELS (3 of 3)**
- **FHWA TNM 2.5**
- **2 May 2005**
- **TNM 2.5 Calculated with TNM 2.5**

**Note:**
- The table is only partially displayed.
- Click the blue banner to maximize the table.
# SOUND LEVEL RESULTS (1 of 2)

<table>
<thead>
<tr>
<th>#DU's</th>
<th>Existing L(\text{A}_{eq})h</th>
<th>No Barrier</th>
<th>Increase over existing</th>
<th>Type</th>
<th>With Barrier</th>
<th>Calculated L(\text{A}_{eq})h</th>
<th>Noise Reduction</th>
<th>Calculated minus Goal</th>
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<td></td>
<td>dBA</td>
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<td>dB</td>
<td></td>
<td>dBA</td>
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<td>Snd Lvl</td>
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<td>Snd Lvl</td>
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<td>Snd Lvl</td>
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<td>Snd Lvl</td>
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<td>R-16</td>
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<td>72.1</td>
<td>66</td>
<td>72.1</td>
<td>Snd Lvl</td>
<td>72.1</td>
<td>0.0</td>
</tr>
</tbody>
</table>

## Dwelling Units

<table>
<thead>
<tr>
<th># DUs</th>
<th>Noise Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min</td>
</tr>
<tr>
<td>dB</td>
<td>dB</td>
</tr>
</tbody>
</table>

- **All Selected**: 18 dB, 0.0 dB, 0.0 dB
- **All Impacted**: 16 dB, 0.0 dB, 0.0 dB
- **All that meet NR Goal**: 0 dB, 0.0 dB, 0.0 dB
### SOUND LEVEL RESULTS (2 of 2)

**Impact Assessment**

- **Ignore impacts automatically calculated by the program.**
- **Determine all impacts by manual calculation only.**

#### Receiver Information

- **No.**
- **# DUs**
- **Existent L_Aeq**
- **Added L_Aeq**
- **Type Impact**
- **With Barrier Calculated L_Aeq**
- **Noise Reduction Goal**
- **Calculated minus Goal**

<table>
<thead>
<tr>
<th>Receiver</th>
<th>No.</th>
<th># DUs</th>
<th>Existent L_Aeq</th>
<th>Added L_Aeq</th>
<th>Type Impact</th>
<th>With Barrier Calculated L_Aeq</th>
<th>Noise Reduction Goal</th>
<th>Calculated minus Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-1</td>
<td>1</td>
<td>1</td>
<td>66.2</td>
<td>66.2</td>
<td>Impact</td>
<td>Snd Lvl 66.2</td>
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<td>5</td>
</tr>
<tr>
<td>R-2</td>
<td>2</td>
<td>1</td>
<td>66.5</td>
<td>66.5</td>
<td>Impact</td>
<td>Snd Lvl 66.5</td>
<td>0.0</td>
<td>5</td>
</tr>
<tr>
<td>R-3</td>
<td>3</td>
<td>1</td>
<td>66.7</td>
<td>66.7</td>
<td>Impact</td>
<td>Snd Lvl 66.7</td>
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<td>5</td>
</tr>
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<td>R-4</td>
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</tr>
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<td>R-5</td>
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<td>67.3</td>
<td>67.3</td>
<td>Impact</td>
<td>Snd Lvl 67.3</td>
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<td>R-6</td>
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<td>Impact</td>
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<td>5</td>
</tr>
<tr>
<td>R-7</td>
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<td>67.8</td>
<td>67.8</td>
<td>Impact</td>
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</tr>
<tr>
<td>R-8</td>
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<td>0</td>
<td>68.0</td>
<td>68.0</td>
<td>Impact</td>
<td>Snd Lvl 68.0</td>
<td>0.0</td>
<td>5</td>
</tr>
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<td>R-9</td>
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<td>68.4</td>
<td>Impact</td>
<td>Snd Lvl 68.4</td>
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<td>5</td>
</tr>
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<td>R-10</td>
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<td>65.2</td>
<td>65.2</td>
<td>Impact</td>
<td>Snd Lvl 65.2</td>
<td>0.0</td>
<td>5</td>
</tr>
<tr>
<td>R-11</td>
<td>11</td>
<td>0</td>
<td>66.4</td>
<td>66.4</td>
<td>Impact</td>
<td>Snd Lvl 66.4</td>
<td>0.0</td>
<td>5</td>
</tr>
<tr>
<td>R-12</td>
<td>12</td>
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<td>66.8</td>
<td>66.8</td>
<td>Impact</td>
<td>Snd Lvl 66.8</td>
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</tr>
<tr>
<td>R-13</td>
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<td>64.0</td>
<td>64.0</td>
<td>Impact</td>
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<td>Impact</td>
<td>Snd Lvl 72.1</td>
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</tr>
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</table>

#### Noise Reduction

<table>
<thead>
<tr>
<th>Dwelling Units</th>
<th># DUs</th>
<th>Noise Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Min</td>
</tr>
<tr>
<td>All Selected</td>
<td>18</td>
<td>0.0</td>
</tr>
<tr>
<td>All Impacted</td>
<td>16</td>
<td>0.0</td>
</tr>
<tr>
<td>All that meet NR Goal</td>
<td>0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

**Impact Type**

- **Snd Lvl** = Absolute Impact Criterion
- **Increase** = Relative Impact Criterion
- **Both** = Both Impact Criteria

**No reductions since the CTBs are fixed-height traffic barriers not noise barriers.**

---

**Ignore impacts automatically calculated by the program. Determine all impacts by manual calculation only.**

- **Drop the number after the decimal point.**
- **Do not round to the nearest whole number.**

---

**Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.**

---

**Ignore impacts automatically calculated by the program. Determine all impacts by manual calculation only.**

- **Drop the number after the decimal point.**
- **Do not round to the nearest whole number.**

---

**Ignore impacts automatically calculated by the program. Determine all impacts by manual calculation only.**

- **Drop the number after the decimal point.**
- **Do not round to the nearest whole number.**
CTB NOISE LEVEL REDUCTION

EXERCISE

You want to show the project engineer the noise level reduction that would result from solid CTBs rather than guard rails or fences.

**Task:** Determine the **Calculated Noise Reduction** of all CTBs combined.

### Exercise Table

<table>
<thead>
<tr>
<th>Receiver Name</th>
<th>No.</th>
<th># DUs</th>
<th>Existing L\text{\text{Aeq}}\text{h}</th>
<th>No Barrier L\text{\text{Aeq}}\text{h}</th>
<th>Increase over existing calculated</th>
<th>Crit’n Sub’l Inc</th>
<th>Type Impact</th>
<th>With Barrier L\text{\text{Aeq}}\text{h}</th>
<th>Calculated Noise Reduction Goal</th>
<th>Calculated Noise Reduction minus Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-1</td>
<td>1</td>
<td>1</td>
<td>0.0</td>
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<td>66.2</td>
<td>11</td>
<td>Snd Lvl</td>
<td>66.2</td>
<td>0.0</td>
<td>5</td>
</tr>
<tr>
<td>R-2</td>
<td>2</td>
<td>1</td>
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<td>66.5</td>
<td>66.5</td>
<td>11</td>
<td>Snd Lvl</td>
<td>66.5</td>
<td>0.0</td>
<td>5</td>
</tr>
<tr>
<td>R-3</td>
<td>3</td>
<td>1</td>
<td>0.0</td>
<td>66.7</td>
<td>66.7</td>
<td>11</td>
<td>Snd Lvl</td>
<td>66.7</td>
<td>0.0</td>
<td>5</td>
</tr>
<tr>
<td>R-4</td>
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<td>67.0</td>
<td>67.0</td>
<td>11</td>
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<td>67.5</td>
<td>0.0</td>
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<tr>
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<td>67.8</td>
<td>67.8</td>
<td>11</td>
<td>Snd Lvl</td>
<td>67.8</td>
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<td>5</td>
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<td>69.0</td>
<td>11</td>
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<td>0.0</td>
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<td>69.4</td>
<td>11</td>
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<td>Snd Lvl</td>
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<td>66.8</td>
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<td>0.0</td>
<td>5</td>
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<tr>
<td>R-13</td>
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<td>64.0</td>
<td>64.0</td>
<td>11</td>
<td>—</td>
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<td>0.0</td>
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<td>66.2</td>
<td>11</td>
<td>Snd Lvl</td>
<td>66.2</td>
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<td>71.0</td>
<td>71.0</td>
<td>11</td>
<td>Snd Lvl</td>
<td>71.0</td>
<td>0.0</td>
<td>5</td>
</tr>
<tr>
<td>R-16</td>
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<td>72.1</td>
<td>11</td>
<td>Snd Lvl</td>
<td>72.1</td>
<td>0.0</td>
<td>5</td>
</tr>
</tbody>
</table>

### Impact Summary

<table>
<thead>
<tr>
<th>Dwelling Units</th>
<th># DUs</th>
<th>Noise Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Min  Avg  Max</td>
</tr>
<tr>
<td>All Selected</td>
<td>18</td>
<td>0.0  0.0  0.0</td>
</tr>
<tr>
<td>All Impacted</td>
<td>16</td>
<td>0.0  0.0  0.0</td>
</tr>
<tr>
<td>All that meet NR Goal</td>
<td>0</td>
<td>0.0  0.0  0.0</td>
</tr>
</tbody>
</table>

Before making any changes to this run, save the run under a different name using File/Save As ..... 2025CTB.
CTB NOISE LEVEL REDUCTION (1 of 3)

1. Open the **Barrier Input** window
2. Select **EB CTB**
3. Change the Increment for all points to **1**
4. Select each of the three remaining CTBs individually and change the Increment for all points in each CTB to **1**
5. **Apply** after changing each CTB
CTB NOISE LEVEL REDUCTION (2 of 3)

1. **Calculate**
2. **Current Run/All Receivers**

When calculations are complete (2-3 minutes):

3. **Tables**
4. Highlight **Sound-level Results**
5. **Sound Levels** (the table is only partially displayed)
6. **Maximize the table**
### CTB NOISE LEVEL REDUCTION (3 of 3)

**RESULTS: SOUND LEVELS**

- **Project/Contract:** CSJ: 123-45-6789
- **Run:** SH123 [2025]
- **Barrier Design:** INPUT HEIGHTS

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

```
<table>
<thead>
<tr>
<th>Name</th>
<th>No.</th>
<th>#DUs</th>
<th>Existing L_Aeq1h</th>
<th>No Barrier L_Aeq1h</th>
<th>Increase over existing Type Impact</th>
<th>With Barrier L_Aeq1h</th>
<th>Calculated Noise Reduction</th>
<th>Calculated minus Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>dBA</td>
<td>dBA</td>
<td>Calculated</td>
<td>Calculated</td>
<td>Goal</td>
<td></td>
</tr>
<tr>
<td>R-1</td>
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<td>2.2</td>
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</tbody>
</table>
```

**Noise Reductions** attributable to the CTBs. For some projects, they may be sufficient to avoid impacts.

**Dwelling Units**

- **# DUs:** Noise Reduction
  - Min: 1.7
  - Avg: 2.2
  - Max: 3.5

- **All Selected:**
  - 18 dB
  - 1.7 dB
  - 2.2 dB
  - 3.5 dB

- **All Impacted:**
  - 18 dB
  - 1.7 dB
  - 2.2 dB
  - 3.5 dB

- **All that meet NR Goal:**
  - 0 dB
  - 0 dB
  - 0 dB
  - 0 dB
Considerations for Noise Barrier location: (consult with the Project Engineer)

1. Locate barriers within the ROW (for the purposes of this guide, the noise barriers will be located on the ROW line)
2. Consider a barrier wrap for end receivers if there is sufficient space within the ROW
3. Adjust length of barrier to allow sufficient sight distance near side streets and driveways
4. Do not cross commercial property lines

NOTE: When sound levels are calculated for noise barriers, TNM calculates sound levels for all possible combinations of barrier segment heights for all receivers. The amount of time TNM takes to complete the calculations is directly proportional to the number of segments in a noise barrier and the number of Up and Dn increments. Therefore, the number of Up and Dn increments should be kept to a minimum for the initial run to avoid excessive run times.

- In multiple barrier situations (such as CTBs/noise barriers or multiple noise barriers), TNM will calculate the net effect for the most effective pair of barriers.
It is important that noise barriers be properly aligned with the adjacent roadway/terrain. Since the ROW (location of noise barriers) is level/flat, the South Noise Barrier will initially be modeled in two segments defined by three points, and in the direction of the eastbound traffic.

Scale: 1" = 100'
NOISE BARRIER INPUT: SOUTH NOISE BARRIER (1 of 8)

- Close the CTB run from the previous Exercise.
- Open the 2025 run and the Barrier Input window.
  1. New (blank Barrier Input window appears)
  2. in Name field and change to South Noise Barrier
  3. Use Edit/Insert and Edit/Append to add three new rows
  4. Enter X,Y,Z coordinates for two segments and three points (Refer to Page J-2)
   **NOTE:** enter points in the direction of eastbound traffic
  5. Apply
  6. Line drawing of South Noise Barrier appears in Plan View
In order to best analyze the noise level reduction that may be achieved at each receiver, it is necessary to divide the barrier into a number of segments. For the purpose of this guide, subdivide the second segment of the barrier into seven segments.

1. Edit the second segment of the barrier
2. Edit
3. Subdivide Segment
4. Number of Segments field and change default of 2 to 7
5. OK
### NOISE BARRIER INPUT: SOUTH NOISE BARRIER (3 of 8)

**Plan View**

- Seven new equally divided segments are displayed.
- Six new lines/points are added in the **Barrier Input** window.
- Change **Pnt. Names** to 1 thru 9.
- **Apply**

**Barrier Input**

<table>
<thead>
<tr>
<th>Pnt. Name</th>
<th>Pnt. No.</th>
<th>X (ft)</th>
<th>Y (ft)</th>
<th>Z (bottom) (ft)</th>
<th>Height (ft)</th>
<th>Increment (ft)</th>
<th>#Up</th>
<th>#Dn</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 2</td>
<td>22</td>
<td>140.0</td>
<td>130.0</td>
<td>30.00</td>
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<td>0.00</td>
<td>0</td>
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<tr>
<td>2 3</td>
<td>23</td>
<td>150.0</td>
<td>150.0</td>
<td>30.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3 4</td>
<td>25</td>
<td>212.9</td>
<td>150.0</td>
<td>30.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4 5</td>
<td>26</td>
<td>275.7</td>
<td>150.0</td>
<td>30.00</td>
<td>0.00</td>
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<td>30.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6 7</td>
<td>28</td>
<td>401.4</td>
<td>150.0</td>
<td>30.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7 8</td>
<td>29</td>
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<td>150.0</td>
<td>30.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>8 9</td>
<td>30</td>
<td>527.1</td>
<td>150.0</td>
<td>30.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>9</td>
<td>24</td>
<td>590.0</td>
<td>150.0</td>
<td>30.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

---

This top section of the **Barrier Input** window is not used.

---
The following are initial “best guess” estimates.

1. Change the **Height (ft)** for all segments to **12**
2. Change the **Increment (ft)** for all segments to **1**
3. Change the **#Up** increments for all segments to **4**
4. Change the **#Dn** increments for all segments to **1**
5. **Apply**

**Definitions:**

- **Height**: the reference height
- **Increment**: the amount of change in height (ft) for each Up and Dn increment
- **#Up/#Dn**: the number of height changes (increments) from the reference height

Based on these height and increment inputs, TNM will calculate sound levels for the following barrier heights:

- 11’ 1 (and only) increment Dn from the reference height: 12-(1x1)=11
- 12’ reference height (widest line)
- 13’ first of 4 increments Up from the reference height: 12+(1x1)=13
- 14’ second of 4 increments Up from the reference height: 12+(2x1)=14
- 15’ third of 4 increments Up from the reference height: 12+(3x1)=15
- 16’ fourth of 4 increments Up from the reference height: 12+(4x1)=16
EXERCISE

Task: Draw a Skew Section through the following objects:
- EB Main
- EB CTB
- EB Frontage
- South Noise Barrier
- R-4
Creating a Skew View

To create a Skew View you must create a line which defines the cross section of the objects that you wish to view in skew.
To do this, click the left mouse button and then drag the line to the desired location, click the left mouse button a second time to complete the line.

NOTE: to turn off the help feature, deselect Popup Help under Setup/Run Identification

Skew View will only show objects with a complete segment in the Plan View - - may need to Zoom Out to view the entire segment.
NOISE BARRIER INPUT: SOUTH NOISE BARRIER (7 of 8)

Skew View/Cross Section

EB Main
EB CTB
EB Frontage
South Noise Barrier

16'
15'
14'
13'
12' reference
11'

R-4

Reference:

- EB Main
- EB CTB
- EB Frontage
- South Noise Barrier

Objects Shown: H: 239.3 Z: 43.9 ft
NOISE BARRIER INPUT: SOUTH NOISE BARRIER (8 of 8)

1. More tab at the bottom of the window
2. Cost ($/sq ft) field and enter 18
3. Apply

4. Reflections tab at the bottom of the window
5. The Reflections feature is currently not active
6. NRC (Noise Reduction Coefficients) would primarily be modeled for absorptive treatment on the roadway side (Lside) of the barrier. The NRC would be provided by the vendor. For this barrier, do not enter any NRC value = non absorptive.
The North Noise Barrier will be modeled in seven segments defined by eight points, and in the direction of westbound traffic. The points were located to essentially “bracket” the impacted receivers in order to best analyze the noise level reduction that may be achieved at each receiver.
NOISE BARRIER INPUT: NORTH NOISE BARRIER (1 of 3)

1. New (blank Barrier Input window appears)
2. in Name field and change to North Noise Barrier
3. Use Edit/Insert and Edit/Append to add eight new rows
4. Enter X, Y, Z coordinates for seven segments and eight points (Refer to Page J-11)
   NOTE: enter points in the direction of westbound traffic
6. Apply
7. Line drawing of North Noise Barrier appears in Plan View
NOISE BARRIER INPUT: NORTH NOISE BARRIER (2 of 3)

The following are initial “best guess” estimates.

1. Change the **Height (ft)** for all segments to **16**
2. Change the **Increment (ft)** for all segments to **2**
3. Change the **#Up** increments for all segments to **3**
4. Leave the **#Dn** increments for all segments at **0**
5. **Apply**

**Definitions:**

- **Height**: the reference height
- **Increment**: the amount of change in height (ft) for each Up and Dn increment
- **#Up/#Dn**: the number of height changes (increments) from the reference height

Based on these height and increment inputs, TNM will calculate sound levels for the following barrier heights:

- **16’ reference height** (widest line)
- **18’** first of four increments **Up** from the reference height: 16+(1x2)=18
- **20’** second of four increments **Up** from the reference height: 16+(2x2)=20
- **22’** third of four increments **Up** from the reference height: 16+(3x2)=22

---

**File/Save**
NOISE BARRIER INPUT: NORTH NOISE BARRIER (3 of 3)

1. More tab at the bottom of the window
2. Cost ($/sq ft) field and enter 18
3. Apply

1. More tab at the bottom of the window
2. Cost ($/sq ft) field and enter 18
3. Apply

4. Reflections tab at the bottom of the window
5. The Reflections? feature is currently not active
6. NRC (Noise Reduction Coefficient) would primarily be modeled for absorptive treatment on the roadway side of the barrier. The NRC would be provided by the vendor. For this barrier, do not enter any NRC value = non absorptive.
OVERALL MODELED PROJECT (WITH NOISE BARRIERS)
CALCULATE SOUND LEVELS (WITH ABATEMENT)

Before calculating Sound Levels, perform the following checks to ensure the accuracy of the input data:
- Check **Tables/Sound-level Input/Barriers**
- Check **View/New View/Skew View** at several locations along the project to ensure the accuracy of the overall geometry of all modeled object
- Check **View/New View/Perspective** - also to check overall project geometry

**NOTE:** an **Input Check** runs automatically when **Calculate/Sound Levels** is selected
CALCULATE SOUND LEVELS

1.  Calculate
2.  Current Run/All Receivers
3.  An Input Check runs automatically
4.  Status window indicates progress of calculations
   - indicates R-1 thru R-8 complete
   - currently calculating R-9
   - the blue ribbon confirms that calculations are approximately ½ complete
5.  For some runs, the time to go (7 min to go) may not be accurate

Total run time: 5-10 minutes

NOTE: calculations may be canceled anytime without losing the levels already calculated. Calculations may be restarted (where left off) even after the run is closed and reopened.

It is possible to operate other applications (WORD, EXCEL, etc.) while TNM is calculating sound levels; HOWEVER, all applications will operate much slower than normal.
### NOISE BARRIER (INITIAL) ASSESSMENT

**RESULTS: SOUND LEVELS**

**PROJECT/CONTRACT:** CSJ: 123-45-6789  
**RUN:** SH123 [2025]  
**BARRIER DESIGN:** INPUT HEIGHTS  
**ATMOSPHERICS:** 68 deg F, 50% RH

#### Noise Levels with Barrier and Noise Reductions

Noise levels with barrier and noise reductions are based on the reference heights for each noise barrier:

- **South Noise Barrier:** 12’  
- **North Noise Barrier:** 14’

**Note:** Noise reductions do not account for the CTBs since they were modeled as fixed-height traffic barriers.

#### Sound Levels

<table>
<thead>
<tr>
<th>Receiver</th>
<th>No.</th>
<th># DUs</th>
<th>Existing Lₐₑq₁₀h</th>
<th>No Barrier Lₐₑq₁₀h</th>
<th>Increase over existing Lₐₑq₁₀h</th>
<th>Type</th>
<th>Impact</th>
<th>With Barrier Lₐₑq₁₀h</th>
<th>Noise Reduction</th>
<th>Calculated Lₐₑq₁₀h</th>
<th>Goal</th>
<th>Calculated minus Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-1</td>
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<td>1</td>
<td>0.0</td>
<td>0.0</td>
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<td>65.0</td>
<td>1.3</td>
<td>5</td>
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<td>-3.5</td>
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<td>65.1</td>
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<td>5</td>
<td>-3.0</td>
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<td>5</td>
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<td>5</td>
<td>-2.2</td>
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<td>-2.8</td>
<td></td>
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<td>69.0</td>
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<td></td>
<td></td>
<td>69.4</td>
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<td>5</td>
<td>-5.0</td>
<td></td>
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<td>5</td>
<td>2.8</td>
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<td>72.2</td>
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<td>5</td>
<td>-5.0</td>
<td></td>
</tr>
</tbody>
</table>

**Dwelling Units**

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<tr>
<th># DUs</th>
<th>Noise Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min  Avg  Max</td>
</tr>
<tr>
<td></td>
<td>dB   dB   dB</td>
</tr>
<tr>
<td>All Selected</td>
<td>18  0.0  2.0  7.8</td>
</tr>
<tr>
<td>All Impacted</td>
<td>16  0.0  2.1  7.8</td>
</tr>
<tr>
<td>All that meet NR Goal</td>
<td>2   5.9  6.8  7.8</td>
</tr>
</tbody>
</table>
The Barrier Analysis is used to determine if a noise barrier will be feasible (5 dBA reduction) and reasonable (not more than $25,000 for each benefitted receiver).

1. Select the entire South Noise Barrier and impacted Receivers R-1 thru R-7 by drawing a box around them with the mouse.

NOTE: In order to perform a new noise barrier analysis, you must first select at least one Barrier and one Receiver.

2. Barrier Analysis
3. New

continued
BARRIER ANALYSIS: SOUTH NOISE BARRIER (2 of 8)

............continued from previous page.

4. **Barrier View** appears (the barrier is depicted at the reference height of 12’)
5. Minimize **Plan View**
6. With **Barrier View** highlighted, open the **Sound Level** (Results) table. Adjust the size of the windows to be able to easily view the noise levels for the seven receivers in the table as well as the **Barrier View** of the barrier and receivers.
   - **Window/Tile Horizontal** (resize windows as appropriate)
   - **View/Full View** to maximize and center the Barrier View
   - **Show/Hide/Receivers** (to show labels/text for receivers)

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Tables associated with a barrier analysis will not provide proper data unless the **Barrier View** is active/highlighted **“before”** a table is selected.
Noise level reductions are based on the reference height of 12 feet.

TNM has already pre-calculated the noise levels/noise level reductions for all heights for all barrier segments and all receivers.

The next step will be to adjust the height of each barrier segment to achieve a feasible reduction in noise levels at the impacted receivers, if possible -- to arrive at the maximum number of “benefited” receivers.

To adjust the height of barrier segments:
1. Select/adjust one segment:
   - the bottom line of one segment
   - Select/adjust all segments:
     - the bottom line of any segment
2. Use the Shift + Arrow Up/Dn keys to increase/decrease the height of the selected barrier segment(s)
3. As the height is changed, the noise levels With Barrier and Noise Reductions change immediately.
BARRIER ANALYSIS: SOUTH NOISE BARRIER (4 of 8)

Noise barrier analyses often have more than one solution ... multiple solutions that are all feasible and reasonable.

This symbol helps orient the X, Y, Z axes and is called an “axiomaticator.”

The South Noise Barrier is feasible.

The next step will be to determine the overall cost of the South Noise Barrier to determine if it is also reasonable = will not exceed $25,000 for each “benefited” receiver.
To review the total cost of the South Noise Barrier:

1. Ensure the **Barrier View** is still active
2. **Table**s
3. **Barriers**

Tables associated with a barrier analysis will not provide proper data unless the **Barrier View** is active/highlighted "before" a table is selected.
4. The **Barrier Descriptions** table provides the total length, area and cost of all eight segments of the **South Noise Barrier**.

- Adjust the size of the windows to simultaneously view all three.

**Task:** Adjust the height of the segments to reduce the overall cost while maintaining the same number of "benefited receivers."
**BARRIER ANALYSIS: SOUTH NOISE BARRIER (7 of 8)**

**Note:** under the Neighborhood Concept, even though R-6 and R-7 are not "benefited," the noise barrier should include the segment adjacent to R-6 and R-7 as long as the total cost of the noise barrier does not exceed $25,000 for each of the 5 receivers that are "benefited."

**South Noise Barrier**

- **Feasible and reasonable:**
  - Must be proposed for incorporation into the project.

**Sound Levels:**

6. **Total Cost ($117,668)** = $23,534***

7. **Benefited Receivers (5)**

---

The South Noise Barrier is feasible and reasonable and, therefore, must be proposed for incorporation into the project.
“Remember” this Barrier Design, as follows:
1. Highlight Barrier View
2. Barrier Analysis
3. Remember As
4. in Design Name field and change unsaved to SNB-fr
5. OK

“Remembering” a Barrier Design does not automatically “Save” it …you must “Remember” the Barrier Design and “Save” the run …or the Barrier Design will be lost.
BARRIER ANALYSIS: NORTH NOISE BARRIER (1 of 5)

1. Select the entire North Noise Barrier and impacted Receivers R-11, R-12 and R14 thru R16
   - any segment of the barrier (selects entire barrier)
   - Shift + select each receiver individually

2. Barrier Analysis
3. New
1. Before starting the analysis, decrease the height of the sixth segment to 0' (Shift + Arrow Dn key) to account for the gap for the driveways for Receivers R-11 and R-12. Note that noise reductions drop below “feasible” levels.
EXERCISE

Task: Adjust the height of all remaining segments of the North Noise Barrier to attempt to achieve a feasible reduction (5 dBA) in noise levels at a reasonable cost ($25,000 or less for each benefited receiver) for any or all of the selected receivers.
It is only possible to achieve a feasible reduction in noise levels at two impacted receivers (R-12 and R-14); however, the cost for this barrier ($160,920) far exceeds the $25,000 limit for each benefited receiver. The **North Noise Barrier** is not feasible and reasonable for any receivers.
Save this Barrier Design, as follows:
1. Highlight Barrier View
2. Barrier Analysis
3. Remember As
4. in Design Name field and change unsaved to NNB-nfr
5. OK
MicroStation .dgn files must be exported from MicroStation in a .dxf format before importing into TNM.

Before importing into TNM, .dxf files should be as small (in memory) as possible. Consider the following:

- hide/eliminate all information (levels) not required for a noise analysis
  - include the following information:
    - plan view of the entire project - - eliminate any profile views - - although a hard copy of the profile view is necessary to determine Z coordinates
    - centerlines or edges of pavement
      - to determine horizontal alignment
    - edge of pavement
      - to locate concrete traffic barriers (when applicable)
    - station numbers
      - to precisely determine Z coordinates (elevations) on profile view
    - outline of adjacent buildings
      - to locate receivers
    - topographic information (elevation numbers NOT contour lines)
      - to determine elevation of receivers
      - to determine elevation adjacent land features that may serve to reduce noise levels
  - hide/eliminate levels that contain multiple curved lines for features such as tree lines and/or contour lines (typically not required for a noise analysis) - - curved lines add greatly to the size/memory of a .dxf file
  - divide very large project files into multiple, smaller files
  - redraw lines (for required features such as roadways) that contain a high number of individual segments - - if not redrawn, these lines can severely complicate or even block/crash the import process
  - redefine the global origin (optional)

**NOTE:** TNM may not import all types of MicroStation elements - - see Page 28 of the TNM User’s Guide for a list of items TNM can and cannot import.
IMPORTING A MICROSTATION FILE (2 of 4)

Open/Setup a new run = blank Plan View
1. File
2. Highlight Import
3. Import DXF File
   (opens “Import DXF File” dialog box)

4. Import As Background
   If “Import As Background is not checked, the .dxf file will be imported “as objects” and the import process will take much, much longer!
5. (open) the folder (RESULTS) that contains the desired .dxf file
6. desired .dxf file = MARSTON.DXF
7. OK button (import process begins)

continued
8. Importing DXF window, with status bar, appears - the process should be complete in minutes (or less) depending on the size of the file

9. .dxf file appears in Plan View
Additional Information:

Select icons in the Tool Bar to draw objects (roadways, receivers, barriers, etc.) on top of the background view.

As these objects are drawn, their X and Y coordinates are automatically added to the appropriate input table. Select the input tables to add the remaining, required information.

After drawing objects, the background view may be hidden by deselecting DXF Background under Show/Hide.

The .dxf file/background view is not saved with the run. However, anytime the .dxf file is imported, it will properly align with any previously drawn TNM objects.