# Appendix G: Noise Modeling

## Attenuation Calculations for Stationary Noise Sources

**KEY:** Orange cells are for input.
Grey cells are intermediate calculations performed by the model.
Green cells are data to present in a written analysis (output).

**STEP 1: Identify the noise source and enter the reference noise level (dBA and distance).**

**STEP 2: Select the ground type (hard or soft), and enter the source and receiver heights.**

**STEP 3: Select the distance to the receiver.**

| Noise Source/ID | Reference Noise Level | | | Attenuation Characteristics | | | | Attenuated Noise Level at Receptor | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | noise level (dBA) | @ | distance (ft) | Ground Type (soft/hard) | Source Height (ft) | Receiver Height (ft) | Ground Factor | noise level (dBA) | @ | distance (ft) |
| HVAC leq (day) | 70.0 | @ | 3 | hard | 6 | 5 | 0.00 | 64.0 | @ | 6 |
| HVAC Leq (night) | 70.0 | @ | 3 | hard | 6 | 5 | 0.00 | 44.9 | @ | 54 |

Notes:

Estimates of attenuated noise levels do not account for reductions from intervening barriers, including walls, trees, vegetation, or structures of any type.

Computation of the attenuated noise level is based on the equation presented on pg. 176 and 177 of FTA 2018.

Computation of the ground factor is based on the equation presentd in Table 4-26 on pg. 86 of FTA 2018, where the distance of the reference noise leve can be adjusted and the usage factor is not applied (i.e., the usage factor is equal to 1).

Sources:

Federal Transit Association (FTA). 2018 (September). Transit Noise and Vibration Impact Assessment. Washington, D.C. Available: <http://www.transit.dot.gov/sites/fta.dot.gov/files/docs/research-innovation/118131/transit-noise-and-vibration-impact-assessment-manual-fta-report-no-0123_0.pdf>Accessed: March 5, 2020.

| Construction Phase | Construction Equipment | Noise Level at 50 feet (Leq) |
|---|---|---|
| Site Preparation | Dozer, Tractor, Backhoe | 84.3 |
| Grading | Grader, Backhoe, Scraper | 84.7 |
| Building Construction | Dozer, welder/torch, Front end loader | 82.6 |
| Paving | Paver, roller, tractor | 85.1 |
| Architectural Coating | Air compressor | 76.0 |

## Site Preparation - Leq

| Location | Distance to Nearest Receptor in feet | Combined Predicted Noise Level ($L_{eq}$ dBA) |
|---|---|---|
| FTA daytime residential threshold | 26 | 90.0 |
| FTA residential nighttime threshold | 82 | 80.0 |
| SR 1 | 401 | 66.2 |
| SR 2 | 217 | 71.5 |
| SR 3 | 367 | 67.0 |
| SR 4 | 614 | 62.5 |
| SR 5 | 222 | 71.3 |

| Equipment | Reference Emission Noise Levels ($L_{max}$) at 50 feet[1] | Usage Factor[1] |
|---|---|---|
| **Dozer** | 85 | 0.4 |
| **Tractor** | 84 | 0.4 |
| **Backhoe** | 80 | 0.4 |
| | | #VALUE! |

| | |
|---|---|
| **Ground Type** | hard |
| **Source Height** | 8 |
| **Receiver Height** | 5 |
| **Ground Factor[2]** | 0.00 |

| Predicted Noise Level [3] | $L_{eq}$ dBA at 50 feet[3] |
|---|---|
| **Dozer** | 81.0 |
| **Tractor** | 80.0 |
| **Backhoe** | 76.0 |

| Combined Predicted Noise Level ($L_{eq}$ dBA at 50 feet) |
|---|
| 84.3 |

Sources:

[1] Obtained from the FHWA Roadway Construction Noise Model, January 2006. Table 1.

[2] Based on Figure 6-5 from the Federal Transit Noise and Vibration Impact Assessment, 2006 (pg 6-23).

[3] Based on the following from the Federal Transit Noise and Vibration Impact Assessment, 2006 (pg 12-3).

$L_{eq}(equip) = E.L.+10*\log(U.F.) - 20*\log(D/50) - 10*G*\log(D/50)$

Where: E.L. = Emission Level;

U.F.= Usage Factor;

G = Constant that accounts for topography and ground effects (FTA 2006: pg 6-23); and

D = Distance from source to receiver.

## Grading Phase - Leq

| Location | Distance to Nearest Receptor in feet | Combined Predicted Noise Level ($L_{eq}$ dBA) |
|---|---|---|
| FTA daytime residential threshol | 27 | 90.0 |
| A residential nighttime thresl | 86 | 80.0 |
| SR 1 | 401 | 66.6 |
| SR 2 | 217 | 71.9 |
| SR 3 | 367 | 67.4 |
| SR 4 | 614 | 62.9 |
| SR 5 | 222 | 71.7 |

| Equipment | Reference Emission Noise Levels ($L_{max}$) at 50 feet[1] | Usage Factor[1] |
|---|---|---|
| Grader | 85 | 0.4 |
| Backhoe | 80 | 0.4 |
| Scraper | 85 | 0.4 |
| | | #VALUE! |
| | | #VALUE! |
| | | #VALUE! |
| | | #VALUE! |

| | |
|---|---|
| Ground Type | hard |
| Source Height | 8 |
| Receiver Height | 5 |
| Ground Factor[2] | 0.00 |

| Predicted Noise Level [3] | $L_{eq}$ dBA at 50 feet[3] |
|---|---|
| Grader | 81.0 |
| Backhoe | 76.0 |
| Scraper | 81.0 |

| Combined Predicted Noise Level ($L_{eq}$ dBA at 50 feet) |
|---|
| 84.7 |

Sources:

[1] Obtained from the FHWA Roadway Construction Noise Model, January 2006. Table 1.

[2] Based on Figure 6-5 from the Federal Transit Noise and Vibration Impact Assessment, 2006 (pg 6-23).

[3] Based on the following from the Federal Transit Noise and Vibration Impact Assessment, 2006 (pg 12-3).

$L_{eq}(equip) = E.L.+10*\log(U.F.) - 20*\log(D/50) - 10*G*\log(D/50)$

Where: E.L. = Emission Level;

U.F.= Usage Factor;

G = Constant that accounts for topography and ground effects (FTA 2006: pg 6-23); and

D = Distance from source to receiver.

## Building Phase - Leq

| Location | Distance to Nearest Receptor in feet | Combined Predicted Noise Level ($L_{eq}$ dBA) |
|---|---|---|
| FTA daytime residential threshol | 21 | 90.0 |
| A residential nighttime thresl | 68 | 80.0 |
| SR 1 | 401 | 64.5 |
| SR 2 | 217 | 69.9 |
| SR 3 | 367 | 65.3 |
| SR 4 | 614 | 60.8 |
| SR 5 | 222 | 69.7 |

| Equipment | Reference Emission Noise Levels ($L_{max}$) at 50 feet[1] | Usage Factor[1] |
|---|---|---|
| Dozer | 85 | 0.4 |
| Welder / Torch | 85 | 0.05 |
| Front End Loader | 80 | 0.4 |

| | |
|---|---|
| Ground Type | hard |
| Source Height | 8 |
| Receiver Height | 5 |
| Ground Factor[2] | 0.00 |

| Predicted Noise Level [3] | $L_{eq}$ dBA at 50 feet[3] |
|---|---|
| Dozer | 81.0 |
| Welder / Torch | 72.0 |
| Front End Loader | 76.0 |

| Combined Predicted Noise Level ($L_{eq}$ dBA at 50 feet) |
|---|
| 82.6 |

Sources:

[1] Obtained from the FHWA Roadway Construction Noise Model, January 2006. Table 1.

[2] Based on Figure 6-5 from the Federal Transit Noise and Vibration Impact Assessment, 2006 (pg 6-23).

[3] Based on the following from the Federal Transit Noise and Vibration Impact Assessment, 2006 (pg 12-3).

$L_{eq}(equip) = E.L.+10*\log(U.F.) - 20*\log(D/50) - 10*G*\log(D/50)$

Where: E.L. = Emission Level;

U.F.= Usage Factor;

G = Constant that accounts for topography and ground effects (FTA 2006: pg 6-23); and

D = Distance from source to receiver.

## Paving Phase - Leq

| Location | Distance to Nearest Receptor in feet | Combined Predicted Noise Level ($L_{eq}$ dBA) |
|---|---|---|
| FTA daytime residential threshol | 28 | 90.0 |
| A residential nighttime thresl | 90 | 80.0 |
| | | |
| | | |
| SR 1 | 401 | 67.0 |
| SR 2 | 217 | 72.3 |
| SR 3 | 367 | 67.8 |
| SR 4 | 614 | 63.3 |
| SR 5 | 222 | 72.1 |

| Equipment | Reference Emission Noise Levels ($L_{max}$) at 50 feet[1] | Usage Factor[1] |
|---|---|---|
| **Paver** | 85 | 0.5 |
| **Roller** | 85 | 0.2 |
| **Tractor** | 84 | 0.4 |
| | | #VALUE! |
| | | #VALUE! |

| | |
|---|---|
| **Ground Type** | hard |
| **Source Height** | 8 |
| **Receiver Height** | 5 |
| **Ground Factor[2]** | 0.00 |

| Predicted Noise Level [3] | $L_{eq}$ dBA at 50 feet[3] |
|---|---|
| **Paver** | 82.0 |
| **Roller** | 78.0 |
| **Tractor** | 80.0 |

| Combined Predicted Noise Level ($L_{eq}$ dBA at 50 feet) |
|---|
| 85.1 |

Sources:

[1] Obtained from the FHWA Roadway Construction Noise Model, January 2006. Table 1.

[2] Based on Figure 6-5 from the Federal Transit Noise and Vibration Impact Assessment, 2006 (pg 6-23).

[3] Based on the following from the Federal Transit Noise and Vibration Impact Assessment, 2006 (pg 12-3).

$L_{eq}(equip) = E.L.+10*\log(U.F.) - 20*\log(D/50) - 10*G*\log(D/50)$

Where: E.L. = Emission Level;

U.F.= Usage Factor;

G = Constant that accounts for topography and ground effects (FTA 2006: pg 6-23); and

D = Distance from source to receiver.

## Architectural Coating Phase - Leq

| Location | Distance to Nearest Receptor in feet | Combined Predicted Noise Level ($L_{eq}$ dBA) |
|---|---|---|
| FTA daytime residential threshol | 10 | 90.0 |
| A residential nighttime thresh | 32 | 80.0 |
| SR 1 | 401 | 57.9 |
| SR 2 | 217 | 63.3 |
| SR 3 | 367 | 58.7 |
| SR 4 | 614 | 54.2 |
| SR 5 | 222 | 63.1 |

| Equipment | Reference Emission Noise Levels ($L_{max}$) at 50 feet[1] | Usage Factor[1] |
|---|---|---|
| Compressor (air) | 80 | 0.4 |
| | | #VALUE! |
| | | #VALUE! |

| | |
|---|---|
| **Ground Type** | hard |
| **Source Height** | 8 |
| **Receiver Height** | 5 |
| **Ground Factor[2]** | 0.00 |

| Predicted Noise Level [3] | $L_{eq}$ dBA at 50 feet[3] |
|---|---|
| Compressor (air) | 76.0 |

| Combined Predicted Noise Level ($L_{eq}$ dBA at 50 feet) |
|---|
| 76.0 |

Sources:

[1] Obtained from the FHWA Roadway Construction Noise Model, January 2006. Table 1.

[2] Based on Figure 6-5 from the Federal Transit Noise and Vibration Impact Assessment, 2006 (pg 6-23).

[3] Based on the following from the Federal Transit Noise and Vibration Impact Assessment, 2006 (pg 12-3).

$L_{eq}(equip) = E.L.+10*\log(U.F.) - 20*\log(D/50) - 10*G*\log(D/50)$

Where: E.L. = Emission Level;

U.F.= Usage Factor;

G = Constant that accounts for topography and ground effects (FTA 2006: pg 6-23); and

D = Distance from source to receiver.

| Equipment Description | Acoustical Usage Factor (%) | Spec 721.560 Lmax @ 50ft (dBA slow) | Actual Measured Lmax @ 50ft (dBA slow) | No. of Actual Data Samples (count) | Spec 721.560 LmaxCalc | Spec 721.560 Leq | Distance | Actual Measured LmaxCalc | Actual Measured Leq |
|---|---|---|---|---|---|---|---|---|---|
| Auger Drill Rig | 20 | 85 | 84 | 36 | 79.0 | 72.0 | 100 | 78.0 | 71.0 |
| Backhoe | 40 | 80 | 78 | 372 | 74.0 | 70.0 | 100 | 72.0 | 68.0 |
| Bar Bender | 20 | 80 | na | 0 | 74.0 | 67.0 | 100 | | |
| Blasting | na | 94 | na | 0 | 88.0 | | 100 | | |
| Boring Jack Power Unit | 50 | 80 | 83 | 1 | 74.0 | 71.0 | 100 | 77.0 | 74.0 |
| Chain Saw | 20 | 85 | 84 | 46 | 79.0 | 72.0 | 100 | 78.0 | 71.0 |
| Clam Shovel (dropping) | 20 | 93 | 87 | 4 | 87.0 | 80.0 | 100 | 81.0 | 74.0 |
| Compactor (ground) | 20 | 80 | 83 | 57 | 74.0 | 67.0 | 100 | 77.0 | 70.0 |
| Compressor (air) | 40 | 80 | 78 | 18 | 74.0 | 70.0 | 100 | 72.0 | 68.0 |
| Concrete Batch Plant | 15 | 83 | na | 0 | 77.0 | 68.7 | 100 | | |
| Concrete Mixer Truck | 40 | 85 | 79 | 40 | 79.0 | 75.0 | 100 | 73.0 | 69.0 |
| Concrete Pump Truck | 20 | 82 | 81 | 30 | 76.0 | 69.0 | 100 | 75.0 | 68.0 |
| Concrete Saw | 20 | 90 | 90 | 55 | 84.0 | 77.0 | 100 | 84.0 | 77.0 |
| Crane | 16 | 85 | 81 | 405 | 79.0 | 71.0 | 100 | 75.0 | 67.0 |
| Dozer | 40 | 85 | 82 | 55 | 79.0 | 75.0 | 100 | 76.0 | 72.0 |
| Drill Rig Truck | 20 | 84 | 79 | 22 | 78.0 | 71.0 | 100 | 73.0 | 66.0 |
| Drum Mixer | 50 | 80 | 80 | 1 | 74.0 | 71.0 | 100 | 74.0 | 71.0 |
| Dump Truck | 40 | 84 | 76 | 31 | 78.0 | 74.0 | 100 | 70.0 | 66.0 |
| Excavator | 40 | 85 | 81 | 170 | 79.0 | 75.0 | 100 | 75.0 | 71.0 |
| Flat Bed Truck | 40 | 84 | 74 | 4 | 78.0 | 74.0 | 100 | 68.0 | 64.0 |
| Front End Loader | 40 | 80 | 79 | 96 | 74.0 | 70.0 | 100 | 73.0 | 69.0 |
| Generator | 50 | 82 | 81 | 19 | 76.0 | 73.0 | 100 | 75.0 | 72.0 |
| Generator (<25KVA, VMS s | 50 | 70 | 73 | 74 | 64.0 | 61.0 | 100 | 67.0 | 64.0 |
| Gradall | 40 | 85 | 83 | 70 | 79.0 | 75.0 | 100 | 77.0 | 73.0 |
| Grader | 40 | 85 | na | 0 | 79.0 | 75.0 | 100 | | |
| Grapple (on Backhoe) | 40 | 85 | 87 | 1 | 79.0 | 75.0 | 100 | 81.0 | 77.0 |
| Horizontal Boring Hydr. Jac | 25 | 80 | 82 | 6 | 74.0 | 68.0 | 100 | 76.0 | 70.0 |
| Hydra Break Ram | 10 | 90 | na | 0 | 84.0 | 74.0 | 100 | | |
| Impact Pile Driver | 20 | 95 | 101 | 11 | 89.0 | 82.0 | 100 | 95.0 | 88.0 |
| Jackhammer | 20 | 85 | 89 | 133 | 79.0 | 72.0 | 100 | 83.0 | 76.0 |
| Man Lift | 20 | 85 | 75 | 23 | 79.0 | 72.0 | 100 | 69.0 | 62.0 |
| Mounted Impact Hammer | 20 | 90 | 90 | 212 | 84.0 | 77.0 | 100 | 84.0 | 77.0 |
| Pavement Scarafier | 20 | 85 | 90 | 2 | 79.0 | 72.0 | 100 | 84.0 | 77.0 |
| Paver | 50 | 85 | 77 | 9 | 79.0 | 76.0 | 100 | 71.0 | 68.0 |
| Pickup Truck | 40 | 55 | 75 | 1 | 49.0 | 45.0 | 100 | 69.0 | 65.0 |
| Pneumatic Tools | 50 | 85 | 85 | 90 | 79.0 | 76.0 | 100 | 79.0 | 76.0 |
| Pumps | 50 | 77 | 81 | 17 | 71.0 | 68.0 | 100 | 75.0 | 72.0 |
| Refrigerator Unit | 100 | 82 | 73 | 3 | 76.0 | 76.0 | 100 | 67.0 | 67.0 |
| Rivit Buster/chipping gun | 20 | 85 | 79 | 19 | 79.0 | 72.0 | 100 | 73.0 | 66.0 |
| Rock Drill | 20 | 85 | 81 | 3 | 79.0 | 72.0 | 100 | 75.0 | 68.0 |
| Roller | 20 | 85 | 80 | 16 | 79.0 | 72.0 | 100 | 74.0 | 67.0 |
| Sand Blasting (Single Nozzl | 20 | 85 | 96 | 9 | 79.0 | 72.0 | 100 | 90.0 | 83.0 |
| Scraper | 40 | 85 | 84 | 12 | 79.0 | 75.0 | 100 | 78.0 | 74.0 |
| Shears (on backhoe) | 40 | 85 | 96 | 5 | 79.0 | 75.0 | 100 | 90.0 | 86.0 |
| Slurry Plant | 100 | 78 | 78 | 1 | 72.0 | 72.0 | 100 | 72.0 | 72.0 |
| Slurry Trenching Machine | 50 | 82 | 80 | 75 | 76.0 | 73.0 | 100 | 74.0 | 71.0 |
| Soil Mix Drill Rig | 50 | 80 | na | 0 | 74.0 | 71.0 | 100 | | |
| Tractor | 40 | 84 | na | 0 | 78.0 | 74.0 | 100 | | |
| Tugboat | 40 | 87 | 74 | 4 | 81.0 | 77.0 | 100 | 68.0 | 64.0 |
| Vacuum Excavator (Vac-tru | 40 | 85 | 85 | 149 | 79.0 | 75.0 | 100 | 79.0 | 75.0 |
| Vacuum Street Sweeper | 10 | 80 | 82 | 19 | 74.0 | 64.0 | 100 | 76.0 | 66.0 |
| Ventilation Fan | 100 | 85 | 79 | 13 | 79.0 | 79.0 | 100 | 73.0 | 73.0 |
| Vibrating Hopper | 50 | 85 | 87 | 1 | 79.0 | 76.0 | 100 | 81.0 | 78.0 |
| Vibratory Concrete Mixer | 20 | 80 | 80 | 1 | 74.0 | 67.0 | 100 | 74.0 | 67.0 |
| Vibratory Pile Driver | 20 | 95 | 101 | 44 | 89.0 | 82.0 | 100 | 95.0 | 88.0 |
| Warning Horn | 5 | 85 | 83 | 12 | 79.0 | 66.0 | 100 | 77.0 | 64.0 |
| Workboat | 40 | 72 | 74 | 4 | 66.0 | 62.0 | 100 | 68.0 | 64.0 |
| Welder / Torch | 40 | 73 | 74 | 5 | 67.0 | 63.0 | 100 | 68.0 | 64.0 |

Source:
FHWA Roadway Construction Noise Model, January 2006. Table 9.1
U.S. Department of Transportation
CA/T Construction Spec. 721.560

# Distance Propagation Calculations for Stationary Sources of Ground Vibration

**KEY:** Orange cells are for input.

Grey cells are intermediate calculations performed by the model.

Green cells are data to present in a written analysis (output).

## STEP 1: Determine units in which to perform calculation.

— If vibration decibels (VdB), then use Table A and proceed to Steps 2A and 3A.

— If peak particle velocity (PPV), then use Table B and proceed to Steps 2B and 3B.

## STEP 2A: Identify the vibration source and enter the reference vibration level (VdB) and distance.

## STEP 3A: Select the distance to the receiver.

**Table A. Propagation of vibration decibels (VdB) with distance**

| Noise Source/ID | Reference Noise Level | | | Attenuated Noise Level at Receptor | | |
|---|---|---|---|---|---|---|
| | vibration level (VdB) | @ | distance (ft) | vibration level (VdB) | @ | distance (ft) |
| Vibratory Roller | 94 | @ | 25 | 80.0 | @ | 73 |
| Large bulldozer | 87.0 | @ | 25 | 79.9 | @ | 43 |

The Lv metric (VdB) is used to assess the likelihood for vibration to result in human annoyance.

## STEP 2B: Identify the vibration source and enter the reference peak particle velocity (PPV) and distance.

## STEP 3B: Select the distance to the receiver.

**Table B. Propagation of peak particle velocity (PPV) with distance**

| Noise Source/ID | Reference Noise Level | | | Attenuated Noise Level at Receptor | | |
|---|---|---|---|---|---|---|
| | vibration level (PPV) | @ | distance (ft) | vibration level (PPV) | @ | distance (ft) |
| Vibratory Roller | 0.210 | @ | 25 | 0.198 | @ | 26 |
| Large bulldozer | 0.089 | @ | 25 | 0.191 | @ | 15 |

The PPV metric (in/sec) is used for assessing the likelihood for the potential of structural damage.

Notes:

Computation of propagated vibration levels is based on the equations presented on pg. 185 of FTA 2018. Estimates of attenuated vibration levels do not account for reductions from intervening underground barriers or other underground structures of any type, or changes in soil type.

Federal Transit Association (FTA). 2018 (September). Transit Noise and Vibration Impact Assessment Manual. FTA Report No. 0123. Washington, D.C. Accessed: December 20, 2020. Page Available:

https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/research-innovation/118131/transit-noise-and-vibration-impact-assessment-manual-fta-report-no-0123_0.pdf

## Traffic Noise Spreadsheet Calculator

**Project:** Garbani North Residential Project Tentative Tract Map

| Number | Name | Segment Description and Location From | To | Existing Conditions | Existing + Project Conditions | Δ Existing – Existing + Project |
|---|---|---|---|---|---|---|
| **Summary of Net Changes** | | | | | | |
| 1 | Tupelo Road | Bradley Road | Sherman Road | 52.1 | 52.5 | 0.4 |

*All modeling assumes average pavement, level roadways (less than 1.5% grade), constant traffic flow and does not account for shielding of any type or finite roadway adjustments. All levels are reported as A-weighted noise levels.

## Existing Traffic Noise Spreadsheet Calculator

**Project:** Garbani North Residential Project Tentative Tract Map

**Noise Level Descriptor:** CNEL
**Site Conditions:** Hard
**Traffic Input:** ADT
**Traffic K-Factor:**

| | | Segment Description and Location | | Input | | | | | | | | | | Output | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Distance to Directional Centerline, (feet)[4] | | Traffic Distribution Characteristics | | | | | | | Distance to Contour, (feet)[3] | | | |
| Number | Name | From | To | ADT | Speed (mph) | Near | Far | % Auto | % Medium | % Heavy | % Day | % Eve | % Night | CNEL, (dBA)[5,6,7] | 75 dBA | 70 dBA | 65 dBA | 60 dBA |
| **Existing Conditions** | | | | | | | | | | | | | | | | | | |
| 1 | Tupelo Road | Bradley Road | Sherman Road | 2,600 | 25 | 100 | 100 | 97.0% | 1.8% | 0.7% | 80.0% | 15.0% | 5.0% | 52.1 | 1 | 2 | 5 | 16 |

*All modeling assumes average pavement, level roadways (less than 1.5% grade), constant traffic flow and does not account for shielding of any type or finite roadway adjustments. All levels are reported as A-weighted noise levels.

## Existing + Project Traffic Noise Spreadsheet Calculator

**Project:** Garbani North Residential Project Tentative Tract Map

**Noise Level Descriptor:** CNEL
**Site Conditions:** Hard
**Traffic Input:** ADT
**Traffic K-Factor:**

| Number | Segment Description and Location: Name | From | To | Input: ADT | Speed (mph) | Distance to Directional Centerline, (feet)[4]: Near | Far | Traffic Distribution Characteristics: % Auto | % Medium | % Heavy | % Day | % Eve | % Night | Output: CNEL, (dBA)[5,6,7] | Distance to Contour, (feet)[3]: 70 dBA | 65 dBA | 60 dBA | 55 dBA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Existing + Project Conditions** | | | | | | | | | | | | | | | | | | |
| 1 | Tupelo Road | Bradley Road | Sherman Road | 2,968 | 25 | 100 | 100 | 97.0% | 1.8% | 0.7% | 80.0% | 15.0% | 5.0% | 52.5 | 2 | 6 | 18 | 56 |

*All modeling assumes average pavement, level roadways (less than 1.5% grade), constant traffic flow and does not account for shielding of any type or finite roadway adjustments. All levels are reported as A-weighted noise levels.

| Noise Level Descriptor | Site Conditions | Traffic Input |
|---|---|---|
| Leq | Soft | Peak |
| Ldn | Hard | ADT |
| CNEL | | |

TNM REMEL Constants [1]

| | A | B | C |
|---|---|---|---|
| Autos | 41.740807 | 1.148546 | 50.128316 |
| Medium Trucks | 33.918713 | 20.591046 | 68.002978 |
| Heavy Trucks | 35.87985 | 21.019665 | 74.298135 |

Separate DEN Traffic Percentages

| Day | | | Evening | | | Night | | |
|---|---|---|---|---|---|---|---|---|
| A | MT | HT | A | MT | HT | A | MT | HT |
| | | | | | | | | |

TNM Baseline REMELs [2]

| Auto | Med. Trucks | Hvy. Trucks |
|---|---|---|
| 59.975 | 71.015 | 76.023 |

| Attenuation[3] | Gα $D1_3$ | Gα $D2_3$ | $D_E$ |
|---|---|---|---|
| 1 | -3.01 | -3.01 | 100.00 |

Traffic Flow Adjustment[8,9,10,11,12,13,14]

| Near CL | Far CL |
|---|---|
| -32.39 | -32.39 |

Peak Hour Traffic Volumes

| Auto | MT | HT | Total |
|---|---|---|---|
| 0.0 | 0.0 | 0.0 | |

| Auto |
|---|
| 2303.0 |

| ADT Temporal Distribution | | | | | | | | | | | | Weighted Traffic | | | | Noise Level by Vehicle Type, CNEL (dBA) | | | Total Noise Level, CNEL (dBA) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Daytime | | | Evening | | | | Nighttime | | | | | | | | | | | | |
| MT | HT | Total | Auto | MT | HT | Total | Auto | MT | HT | Total | Error Chk | Auto | MT | HT | Total | Auto | MT | HT | |
| 43.7 | 17.6 | 2364.2 | 431.8 | 8.2 | 3.3 | 443.3 | 143.9 | 2.7 | 1.1 | 147.8 | 2955 | 209.9 | 4.0 | 1.6 | 215.5 | 50.8 | 44.6 | 44.6 | 52.5 |
| | | 0.0 | | | | 0.0 | | | | 0.0 | 0 | | | | 0.0 | | | | |
| | | 0.0 | | | | 0.0 | | | | 0.0 | 0 | | | | 0.0 | | | | |
| | | 0.0 | | | | 0.0 | | | | 0.0 | 0 | | | | 0.0 | | | | |
| | | 0.0 | | | | 0.0 | | | | 0.0 | 0 | | | | 0.0 | | | | |
| | | 0.0 | | | | 0.0 | | | | 0.0 | 0 | | | | 0.0 | | | | |
| | | 0.0 | | | | 0.0 | | | | 0.0 | 0 | | | | 0.0 | | | | |
| | | 0.0 | | | | 0.0 | | | | 0.0 | 0 | | | | 0.0 | | | | |
| | | 0.0 | | | | 0.0 | | | | 0.0 | 0 | | | | 0.0 | | | | |
| | | 0.0 | | | | 0.0 | | | | 0.0 | 0 | | | | 0.0 | | | | |
| | | 0.0 | | | | 0.0 | | | | 0.0 | 0 | | | | 0.0 | | | | |
| | | 0.0 | | | | 0.0 | | | | 0.0 | 0 | | | | 0.0 | | | | |
| | | 0.0 | | | | 0.0 | | | | 0.0 | 0 | | | | 0.0 | | | | |
| | | 0.0 | | | | 0.0 | | | | 0.0 | 0 | | | | 0.0 | | | | |
| | | 0.0 | | | | 0.0 | | | | 0.0 | 0 | | | | 0.0 | | | | |
| | | 0.0 | | | | 0.0 | | | | 0.0 | 0 | | | | 0.0 | | | | |
| | | 0.0 | | | | 0.0 | | | | 0.0 | 0 | | | | 0.0 | | | | |
| | | 0.0 | | | | 0.0 | | | | 0.0 | 0 | | | | 0.0 | | | | |
| | | 0.0 | | | | 0.0 | | | | 0.0 | 0 | | | | 0.0 | | | | |
| | | 0.0 | | | | 0.0 | | | | 0.0 | 0 | | | | 0.0 | | | | |
| | | 0.0 | | | | 0.0 | | | | 0.0 | 0 | | | | 0.0 | | | | |
| | | 0.0 | | | | 0.0 | | | | 0.0 | 0 | | | | 0.0 | | | | |
| | | 0.0 | | | | 0.0 | | | | 0.0 | 0 | | | | 0.0 | | | | |
| | | 0.0 | | | | 0.0 | | | | 0.0 | 0 | | | | 0.0 | | | | |
| | | 0.0 | | | | 0.0 | | | | 0.0 | 0 | | | | 0.0 | | | | |
| | | 0.0 | | | | 0.0 | | | | 0.0 | 0 | | | | 0.0 | | | | |
| | | 0.0 | | | | 0.0 | | | | 0.0 | 0 | | | | 0.0 | | | | |
| | | 0.0 | | | | 0.0 | | | | 0.0 | 0 | | | | 0.0 | | | | |
| | | 0.0 | | | | 0.0 | | | | 0.0 | 0 | | | | 0.0 | | | | |
| | | 0.0 | | | | 0.0 | | | | 0.0 | 0 | | | | 0.0 | | | | |

## ITE Trip Generation Rates

| Land Use | Units | ITE Code | AM | | | PM | | | Daily |
|---|---|---|---|---|---|---|---|---|---|
| | | | In | Out | Total | In | Out | Total | |
| Single Family Homes | Dwelling Units | 210 | 0.18 | 0.52 | 0.7 | 0.59 | 0.35 | 0.94 | **9.43** |

## Project Trip Generation Rates

| Land Use | Quantity | Units | AM | | | PM | | | Daily |
|---|---|---|---|---|---|---|---|---|---|
| | | | In | Out | Total | In | Out | Total | |
| Single Family Homes | 39 | Dwelling units | 7 | 20 | 27 | 23 | 14 | 37 | **368** |

Source: 2021 ITE Trip Generation Manual (11th Edition)

| Citation # | Citations | |
|---|---|---|
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| 2 | Caltrans Technical Noise Supplement. 2009 (November). Equation (5-26), Pg 5-60. | Caltrans Technical Noise Supplement. 2013 (September). Equation (4-5), Pg 4-17. |
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| 14 | Federal Highway Administration Traffic Noise Model Technical Manual. Report No. FHWA-PD-96-010. 1998 (January). Equation (20), Pg 69 | |
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