Dove Mountain Boulevard Sound Assessment

Workshop Presentation

April 17, 2024 | 2–3 pm

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Please sign in and pick up questionnaire and handouts

Questionnaire, Map, and Handouts

Questionnaire: Contact information (optional) or general location, instructions, assessment objectives, some important definitions, and 17 questions to help define the sound and noise issues and details.

11" x 17" Color Map: Gives you the opportunity to mark your location and line out the areas that are causing you (the receptor) issues.

Handouts: Provide you with information about sound and noise. Two are from the Arizona Department of Transportation (ADOT) and the other is a compilation of information from the Federal Highway Administration (FHWA) National Highway Institute (NHI).

Please Fill Out the Questionnaire and Map: This is a key aspect of this assessment, as it will help us know what and where your issues are.

Authorities on Street Traffic Sound and Noise – Local

Local Law: The Town of Marana does have a noise ordinance (Chapter 11-5. Noise), but it applies to stationary noise sources. Traffic sound and noise are a line source that is moving, so it does not apply.

Local Law: Pima County also has a noise ordinance (Chapter 9.30, Regulation of Excessive, Unnecessary and Annoying Noises), that includes Section 9.30.060, Vehicular Noise.

9.30.060 Vehicular noise.

A. It shall be unlawful for any person within any residential area of this county to repair, rebuild or test any motor vehicle between the hours of 10:00 p.m. of one day and 7:00 a.m. of the next day in such a manner as to create an excessive, unnecessary or offensive noise that a reasonable person of normal sensitivity residing in the area is caused discomfort or annoyance.

B. No person shall operate or cause to operate any motor vehicle unless the exhaust system of such vehicle:

1. Is free from defects which may cause sound level magnification,

2. Is equipped with a muffler,

3. Has not been modified in such a manner which will amplify or increase the sound level emitted by the motor of such vehicle above that emitted by a muffler originally installed on the vehicle as manufactured for initial sale.

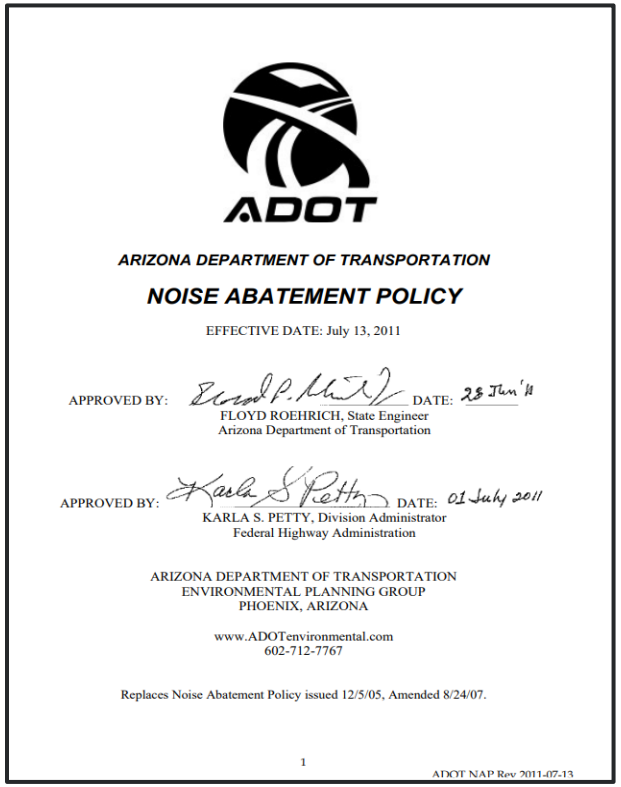
C. No person shall operate a motor vehicle in such a manner which creates the squealing of tires in the roadway.

(Ord. 1999-61 § 1 (part), 1999)

Authorities on Street Traffic Sound and Noise – State and Federal

State Law: Arizona Revised Statutes (ARS) Section 28-955 is targeted mostly at excessive noise a motor vehicle might emit via its exhaust system.

Federal Laws: The National Environmental Policy Act (NEPA) of 1969, Federal Aid Highway Act of 1970, and Noise Control Act of 1972 initiated methods to research, study, and mitigate noise, especially caused by vehicles. The NEPA and Highway Acts have targeted noise issues related to federal aid projects. Each state department of transportation must adopt a noise abatement policy.



ADOT

ARIZONA DEPARTMENT OF TRANSPORTATION

NOISE ABATEMENT POLICY

EFFECTIVE DATE: July 13, 2011

APPROVED BY: DATE: 28 Jun '11
FLOYD ROEHRICH, State Engineer
Arizona Department of Transportation

APPROVED BY: DATE: 01 July 2011
KARLA S. PETTY, Division Administrator
Federal Highway Administration

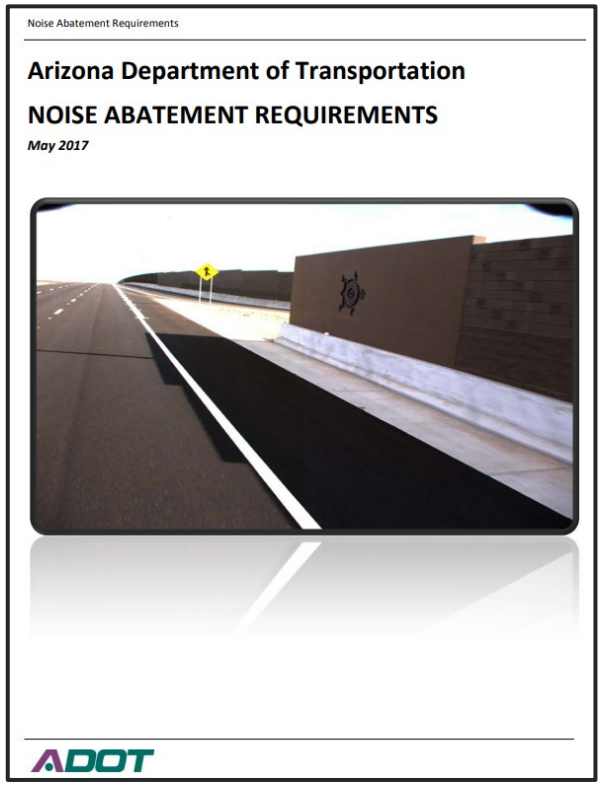
ARIZONA DEPARTMENT OF TRANSPORTATION
ENVIRONMENTAL PLANNING GROUP
PHOENIX, ARIZONA

www.ADOTenvironmental.com
602-712-7767

Replaces Noise Abatement Policy issued 12/5/05, Amended 8/24/07.

1

ADOT NAP Rev 2011-07-13



Noise Abatement Requirements

Arizona Department of Transportation

NOISE ABATEMENT REQUIREMENTS

May 2017

ADOT

ADOT Noise Abatement Requirements

Chapter 6

Reasonableness

There are three reasonableness factors or "tests" that must collectively be achieved in order for a noise abatement measure to be deemed reasonable. These are:

1. Viewpoints or Preferences of Property Owners and Residents
2. Noise Reduction Design Goal, and
3. Cost-effectiveness

6.1 Viewpoints or Preferences of Property Owners and Residents

The preferences of the property owners and residents of the benefited Receptors of a noise barrier will be taken into account when determining whether the barrier is considered reasonable. Noise barriers that are otherwise feasible and reasonable will automatically be considered to be desired unless the public involvement aspect of the NEPA process indicates that a substantial portion of benefited Receptors are opposed to the barriers. In that case, ADOT will make a good faith effort to determine the preferences of the property owners and/or legal occupants of each benefited Receptor location through a survey process. If less than a 50% response rate of property owner and residents is achieved and a substantial portion of the received responses are opposed to the recommended abatement measures, then further outreach will be attempted through the use of public meetings until either a 50% response rate is achieved or it becomes apparent that such a level of response is not possible due to situational concerns. ADOT will make a decision as to the reasonableness of the recommended mitigation based on the results of this process.

6.2 Noise Reduction Design Goal

Noise barriers should be designed to reduce projected unmitigated noise levels by at least seven dB(A) for benefited Receptors closest to the transportation facility. To be considered reasonable, at least half of the benefited Receptors in the first row shall achieve this level of noise reduction. Any Receptor that meets or exceeds the design goal counts toward satisfying the noise reduction design goal of the reasonableness criterion. Benefited Receptor does not have to be necessarily impacted.

6.3 Cost Effectiveness

The maximum reasonable cost of abatement is $49,000 per benefited Receptor (cost-per-benefited- Receptor) with barrier costs calculated at $35 per square foot, $85 per square foot if constructed on a structure. Any cost of removal of previously built walls, drainage, and other similar construction work shall be included in the cost assessment above.

The cost of an abatement measure is the total cost of that measure divided by all the benefited Receptors protected by that abatement. The cost-per-benefited Receptor and barrier-cost-per-square-foot require FHWA approval, and will be re-calculated on a regular interval, not to exceed five years, in the following manner:

1. The cost-per-benefited Receptor is determined by taking the square-foot cost of barriers determined below and multiplying by 1400 sqft.

2. The square-foot cost of barriers is determined by taking the greater of the current square-foot cost value or the average cost of construction of actual barriers for the preceding five years + 20%.

The current values were approved by FHWA on May 4, 2017.

6.1.1 Third Party Funding

Third party funding cannot be used to make up the difference in cost between the reasonable cost-per-benefited-Receptor and the actual cost of the barrier. Third party funding can only be used to pay for additional features such as landscaping, aesthetic treatments, alternative barrier materials including sound absorptive materials, for noise barriers that are feasible and already meet cost-effectiveness criteria.

FHWA Noise Measurement Handbook

FINAL REPORT

Noise Measurement Handbook

6.1.2018

U.S. Department of Transportation

Federal Highway Administration

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FHWA-HEP-18-065	(Remove; Insert Information Here or leave blank)	(Remove; Insert Information Here or leave blank)

4. Title and Subtitle	5. Report Date
Noise Measurement Handbook	September 15, 2017
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No.
RSG	

9. Performing Organization Name And Address	10. Work Unit No. (TRAIS)
RSG 55 Railroad Row White River Junction VT 05001	(Remove; Insert Information Here or leave blank)
	11. Contract or Grant No.
	(Remove; Insert Information Here or leave blank)

12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
U.S. Department of Transportation 1200 New Jersey Ave. SE Washington, D.C.	(Remove; Insert Information Here or leave blank)
	14. Sponsoring Agency Code
	(Remove; Insert Information Here or leave blank)

15. Supplementary Notes

Other authors: Bowlby & Associates, Inc.; ATS Consulting; Environmental Acoustics; Illingworth & Rodkin

16. Abstract

This handbook provides best-practice guidance on recognizing which measurement methodologies apply to which project type (Section 1.0), how to plan a noise measurement program (Section 2.0), descriptions of measurement methodologies and related considerations (Sections 3.0-15.0), terminology (Section 16.0, Appendix A) and measurement instrumentation (Section 17.0, Appendix B) related to highway traffic noise, example report documentation for measurements (Section 18.0, Appendix C), and supporting material for various methodologies (Sections 19.0-21.0, Appendices D-F). Sections 3.0 and 4.0 are directly applicable to the conduct of traffic noise studies required by the Federal Highway Administration (FHWA) noise regulation in 23 CFR 772. Section 22 is a bibliography.

The information provided in this handbook is based on the 1996 FHWA Measurement of Highway-Related Noise, and is based upon current national and international standards and practice updates. This handbook should be viewed as best-practice guidance and not direction as to how the work must be done. Some project sponsors have established and use their own procedures, which typically would be followed in the event of a conflict.

17. Key Words	18. Distribution Statement
Highway traffic noise, Noise measurement methodologies; traffic noise studies, noise regulations, best practices	(Remove; Insert Information Here or leave blank)

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	188	(Remove; Insert Information Here or leave blank)

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

The handbook is 205 pages

Resources to Learn About Sound and Noise and How They Relate to Federal Aid Projects

Highway Traffic and Construction Noise

FHWA-NHI-142086	Acoustics of Highway Traffic and Construction Noise
FHWA-NHI-142087	Highway Traffic and Construction Noise Regulations
FHWA-NHI-142088	How to Measure Highway Traffic Noise
FHWA-NHI-142089	Abatement and Design Considerations for Highway Traffic Noise
FHWA-NHI-142090	An Introduction to the Traffic Noise Model 3.0
FHWA-NHI-142091	Public Involvement for Highway Traffic and Construction Noise Projects
FHWA-NHI-142092	How to Mitigate Construction Noise
FHWA-NHI-142093	How to Document Highway Traffic Noise Study Results
FHWA-NHI-142094	Noise Compatible Planning for Highway Traffic Noise

The foundation is 23 CFR 772 NEPA

Bottom Line: These regulations only apply to federal aid projects. Most town streets are not federal aid. While the methods to assess and evaluate sound and noise may apply, the regulations do not.

What the Town Has Already Done to Address Concerns

1. Micro-slurry seal resurfacing to smooth the road.

2. Spot pavement repair and adjustment of manholes to remove exposed edges and rough spots.

3. Periodic street sweeping to remove loose gravel and rocks.

4. Speed feedback signs complemented by increased police presence to help encourage good speed behavior.

5. Spot sound measurements to determine the impacts of these measures and provide a means to compare sound levels on other Town streets.

6. Commission this study to for additional assessment and follow up on what has already been done.

Previous Sound Measurement Data Collected by the Town

			BEFORE RESURFACING					AFTER RESURFACING							
Date	End Time	Location	LAeq	LCpeak	LMax	TWA	Duration (min)	Date	End Time	LAeq	LCpeak	LMax	TWA	Duration (min)	LAeq DELTA
9/3/2020	8:41	Same location as class_speed_noise level measurements	64.3	105	83.5	40.2	16								
9/11/2020	10:45 AM	West side of roadway Going South 50' off roadway	68.2	102.3	83.6	43.3	15:03	1/11/2022	8:57	63.6	96.4	75.7		15:08	-4.6
9/11/2020	10:22	East side of roadway going North 30' from roadway	67.7	102.6	84.6	35	15:28	1/11/2022	8:59	64.4	99.7	80.8		15:01	-3.3
9/24/2020	8:55 AM	150' N of Moore Rd west shoulder 50 ' off of curb SB travel	68.8	101.1	84	36.4	15:03								
9/24/2020	8:35 AM	150' N of Moore Rd east shoulder 50 ' off of curb NB travel	67.3	103.9	85.5	43.9	15:03	4/14/2022	9:05	66.9	106.2	87.8	46.4	15:02	-0.4
9/25/2020	8:42 AM	250' N of Heritage Club Blvd east shoulder 50' from curb	69.8	111.9	89.5	50.8	17:28	1/20/2022	8:36	66.6	104.2	85.8		15:14	-3.2
9/25/2020	9:00 AM	250' N of Heritage Club Blvd west shoulder 50' from curb	66.2	100.9	82.1	34.1	16:43	1/20/2022	8:53	66.5	97.8	77.6		15:21	0.3
9/28/2020	8:59 AM	450' west of Gallery Pl west shoulder 50' off of curb	65.6	100.4	82.3	39.1	17:36	4/14/2022	8:45	63.8	101.7	82.0	30.5	17:41	-1.8
9/28/2020	9:16 AM	450' west of Gallery Pl east shoulder 50' off of curb	64.4	96	76.4	--	15:06	4/14/2022	8:26	61.0	99.5	81.3	25	16:46	-3.4
11/5/2020	8:17 AM	Dove Mtn Bl south Shoulder 50' off curb at speed radar sign	65.5	108.3	87.2	47.7	1:00:11								
11/17/2020	7:56 AM	Dove Mnt Blvd south just north of Heritage Club Dr west shoulder 50 ft off	65.7	10.2	79.4		15:08								
11/17/2020	7:36 AM	150' N of Moore Rd east shoulder 50' off of curb NB travel	68.3	110.3	88.9	49.2	18:26								
1/20/2021	7:44 AM	50' off roadway west shoulder south bound travel at radar sign	62.6	93.1	78.4	--	15:59								
1/21/2021	8:01 AM	East shoulder 50' off road way for north bound travel	65.8	98.7	78.5	--	12:55								

Date	Time	Location	LAeq	LCpeak	LMax	TWA	(min)
10/5/2020	7:44 AM	Clayton Rd south of pole, see location map	77.4	110.5	93.5	61.8	17:12
10/5/2020	8:05 AM	Along canal 15 ft south of north end of canal, see location map	74.2	107.1	89.6	57.3	15:09
2/2/2021	8:03 AM	East of Waste management Road north shoulder east bound travel	66.6	122.7	97	46	15:03
2/2/2021	7:46 AM	South shoulder along irrigation canal east bound travel	68.4	103.3	88.9	48	16:26
2/1/2021	9:13 AM	Clayton Rd 50' from edge of curb at Clayton south shoulder	72.2	108.2	90.4	53.7	15:04

Date	Time	Location	LAeq	LCpeak	LMax	TWA	Duration (min)
10/16/2020	7:39 AM	250' N of Blue Bonnett Rd eas shoulder 50 ft off of curb Northbound 7:28	65.4	106.6	82.7	40.1	15:02
10/16/2020	8:00 AM	250' N of Blue Bennett Rd west shoulder 50' off of curb South bound 8:00am	69	105.8	83.8	43.0	15:02

Available Sound Level Descriptors

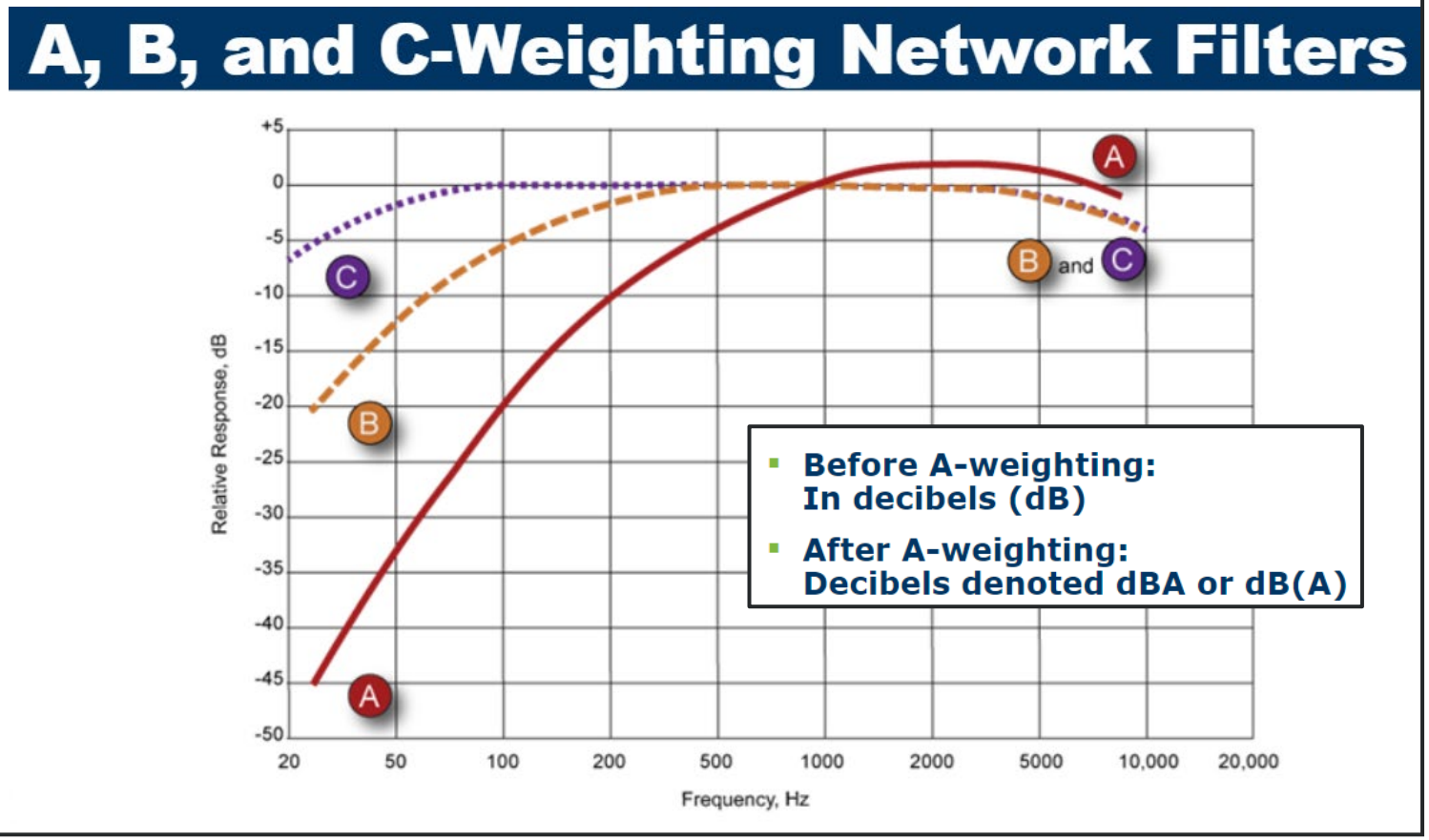
Descriptor	Definition
$L_{AEQ}(h)$	Hourly A-weighted equivalent sound level
$L_{10}(h)$	Sound level exceeded 10% of the time
$L_{50}(h)$	Sound level exceeded 50% of the time
L_{DN}	Day-night average sound level (DNL)
L_{DEN}	Community Noise Equivalent Level (CNEL)

Source: FHWA-NHI-142086, Acoustics of Highway Traffic and Construction Noise

Measuring Sound

A

A-weighting, which adjusts the actual sound pressure levels to simulate the response of the human ear to moderate sound levels, has become the standard for most noise analysis. In this example, the line for A-weighted results starts at about 25 hertz, -45 decibels, reaches its highest point at about 2500 hertz, 1.3 decibels, then drops off slightly to end at about 10,000 hertz, -2.5 decibels.



Source: FHWA-NHI-142086, Acoustics of Highway Traffic and Construction Noise

Source: *Physics Today,* Vol. 62, No. 12, December 1, 2009
Figure 2. Tires and Pavements

Basic Findings/Research on Tires and Pavements

1. Texture with a significant amplitude is to blame for the bad all-around wavelength, low-frequency texture.

2. This causes a rough ride. Noise is mostly caused by short-wavelength, high-frequency texture.

3. Texture with significant amplitudes of about 10-50 mm or 0.4 inches to 2 inches is largely to blame for noise that is readily radiated away from the vehicle.

4. Texture with wavelengths of 20-200 mm is responsible for in-vehicle noise.

5. In both cases, the dominant noise-producing mechanism is termed “impact.”

6. As the tire rolls over the pavement, displacements in the road surface or tire-read pattern create vibrations in the tire structure. These vibrations, in turn, lead to acoustical energy being radiated from the tire-tread elements and sidewall.

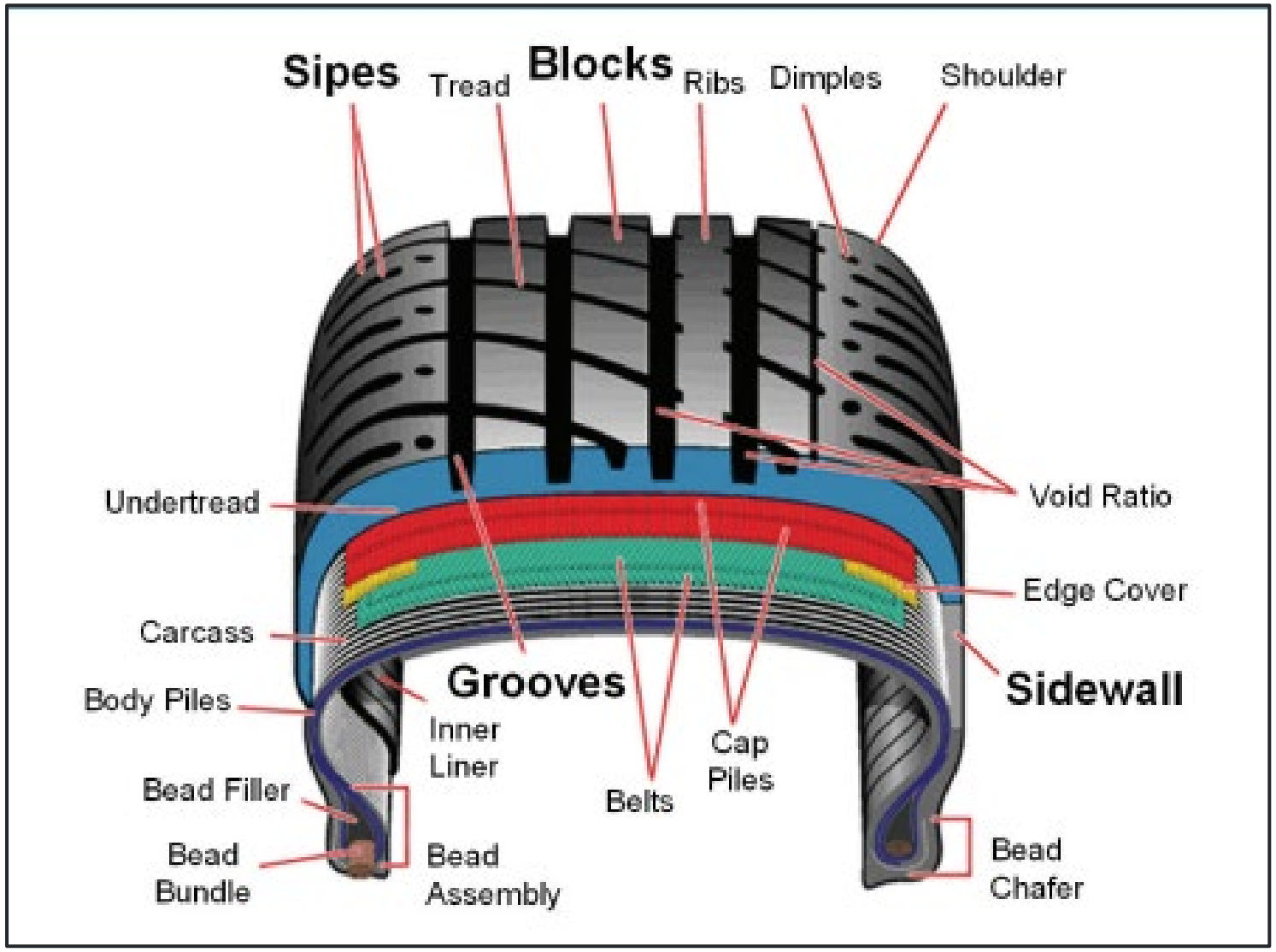
7. Even if the road were perfectly flat, the road would still produce noise. Additionally, roads cannot be perfectly flat because there is a need for a certain amount of dry friction and the ability of the road to support drainage to help prevent hydroplaning.

8. The key in terms of noise lies in the mechanism of the tire and pavement interaction – it is a complex relationship between the texture of the road, the tire tread, and the noise they produce.

Textures for Loud and Quiet Pavement

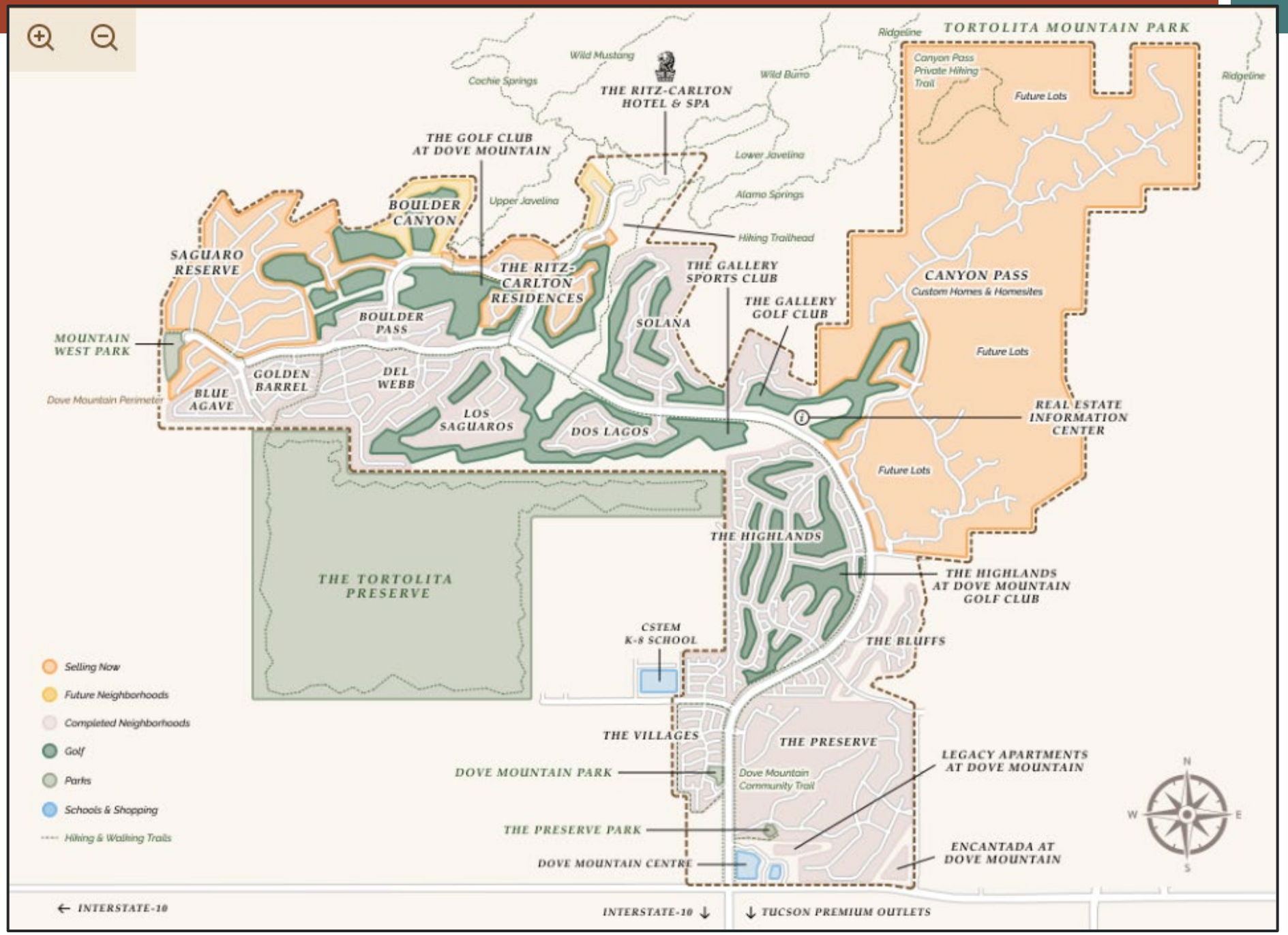
Source: *Tech Brief: The Language of Noise and Quieter Pavements,* Concrete Pavement Surface Characteristics Program, October 2010
Figure 5. Idealized textures for loud and quiet pavement

Tire Components

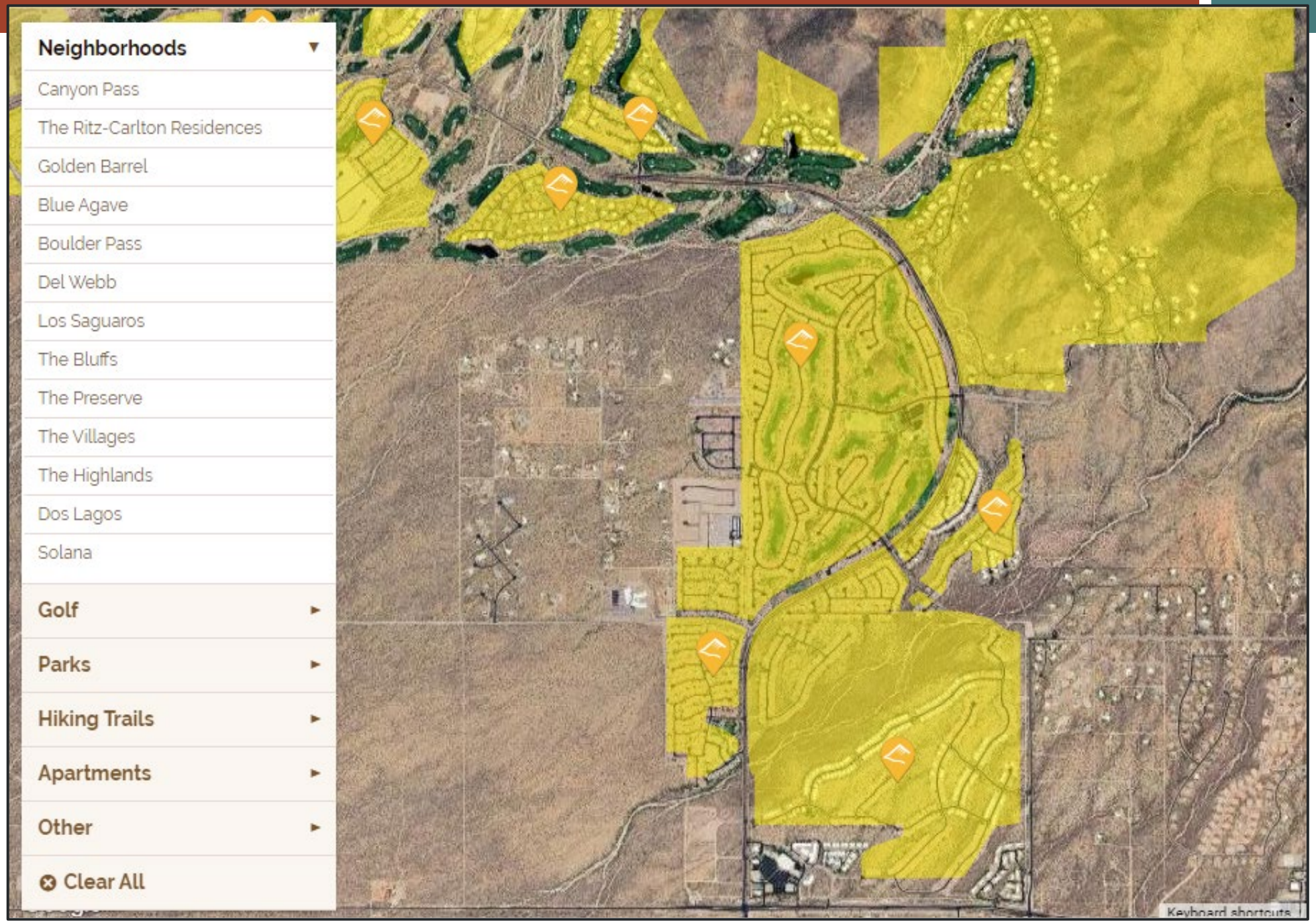


Source: *Tech Brief: The Language of Noise and Quieter Pavements,* Concrete Pavement Surface Characteristics Program, October 2010

Figure 4. Typical components of a tire (relevant ones shown in boldface type)

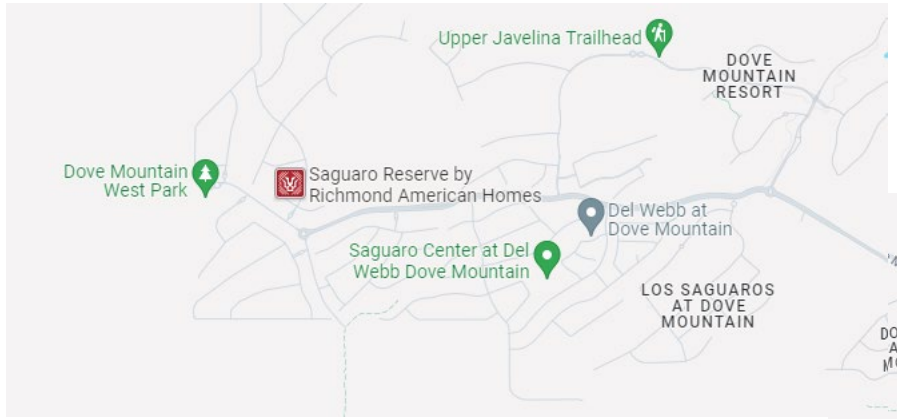


Dove Mountain Map

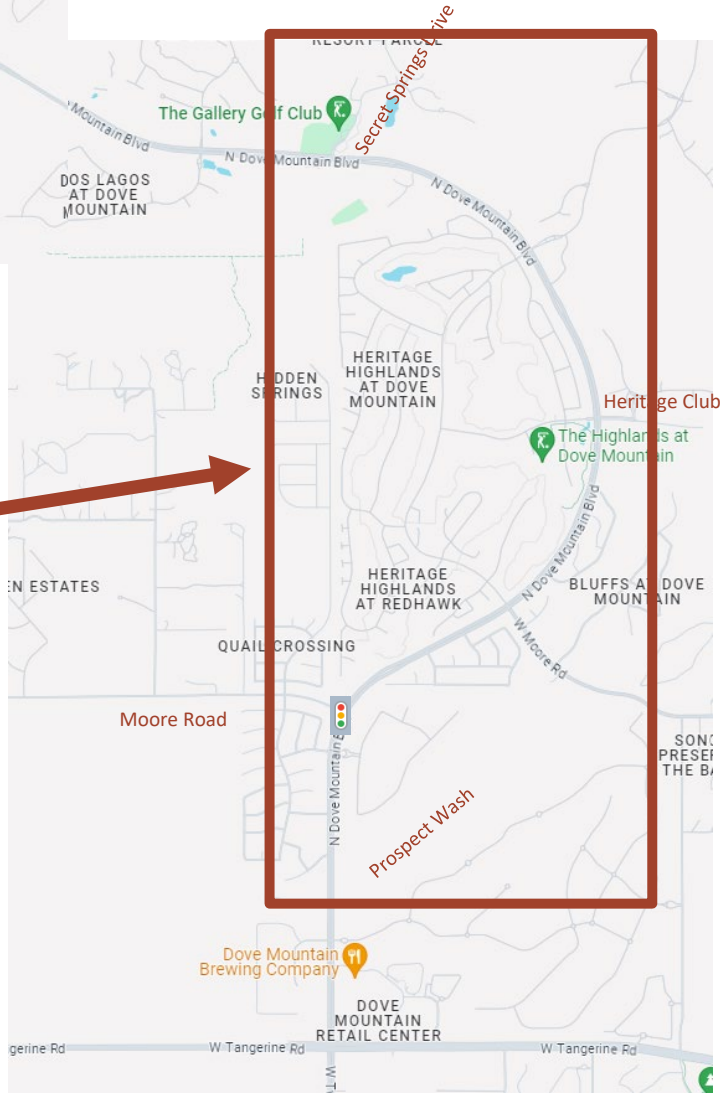


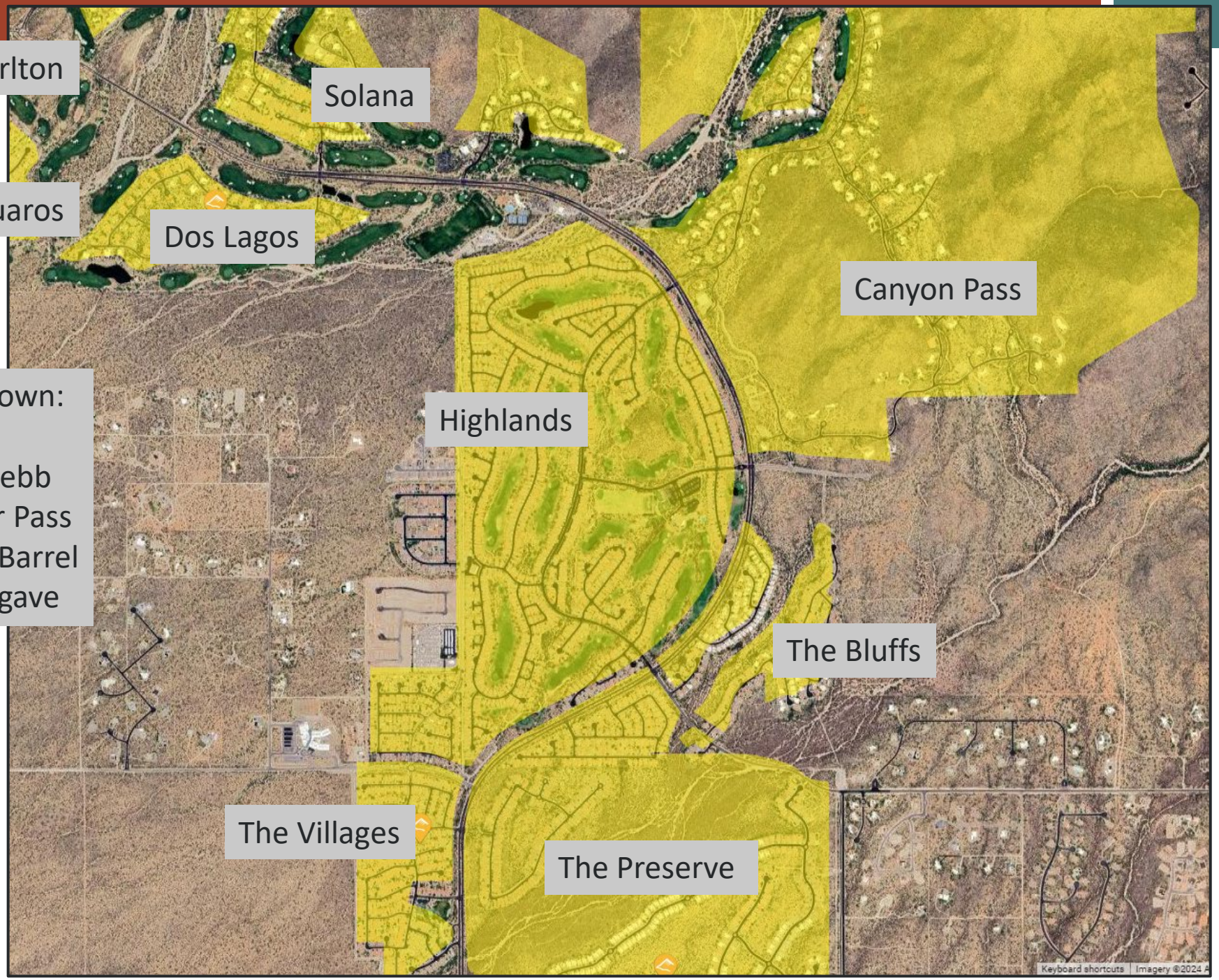
Dove Mountain Named Neighborhoods

Town of Marana: Dove Mountain Boulevard Traffic Sound Assessment Area



Primary Area of Interest





Dove Mountain Neighborhoods in Primary Area of Interest

Highway Traffic and Construction Noise

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FHWA-NHI-142087	Highway Traffic and Construction Noise Regulations
FHWA-NHI-142088	How to Measure Highway Traffic Noise
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FHWA-NHI-142092	How to Mitigate Construction Noise
FHWA-NHI-142093	How to Document Highway Traffic Noise Study Results
FHWA-NHI-142094	Noise Compatible Planning for Highway Traffic Noise

What is Sound?

Let’s start with the definition of sound. “Sound” is an objective term; it refers to a physical property. When an object vibrates, the energy from those vibrations causes pressure fluctuations as it travels through air (or some other medium). If the pressure fluctuations reach a person's ears, the person will perceive them as sound.

Noise is simply *unwanted* sound; sound that a receptor perceives *negatively*. Remember the sound of that truck horn?

Noise is subjective to the receptor. One person's noise may be another person's music!

Negative Noise Effects

Quality of Life

Productivity

Noise can negatively affect our quality of life. It can impact our sleep and reduce our ability to relax. Sleep disturbance can lead to health impacts such as cardiovascular issues and can contribute to increased workplace accidents.

Negative Noise Effects

Quality of Life

Productivity

Noise can negatively impact productivity by interfering with communication, task performance, and our ability to absorb and recall information.

Common Indoor and Outdoor Noise Levels

Common Outdoor Noises	Sound Level (Decibels)	Common Indoor Noises
	140	Threshold of pain
	130	
Jet Flyover (1,000 feet)	120	**Rock band** (at 15 feet)
 Gas lawn mower (3 feet)	110	
 Diesel truck (50 feet)	100	
Urban daytime	90	**Food blender** (at 3 feet)
Gas lawn mower (100 feet)	80	Garbage disposal (at 3 feet)
 **Heavy traffic** (300 feet)	70	 Vacuum cleaner (at 10 feet)
Typical urban daytime	60	Normal speech (at 3 feet) 
 Urban nighttime	50	Dishwasher (next room)
	40	Library 
Rural nighttime	30	Bedroom (at night)
	20	Whisper 
	10	
	0	Threshold of hearing

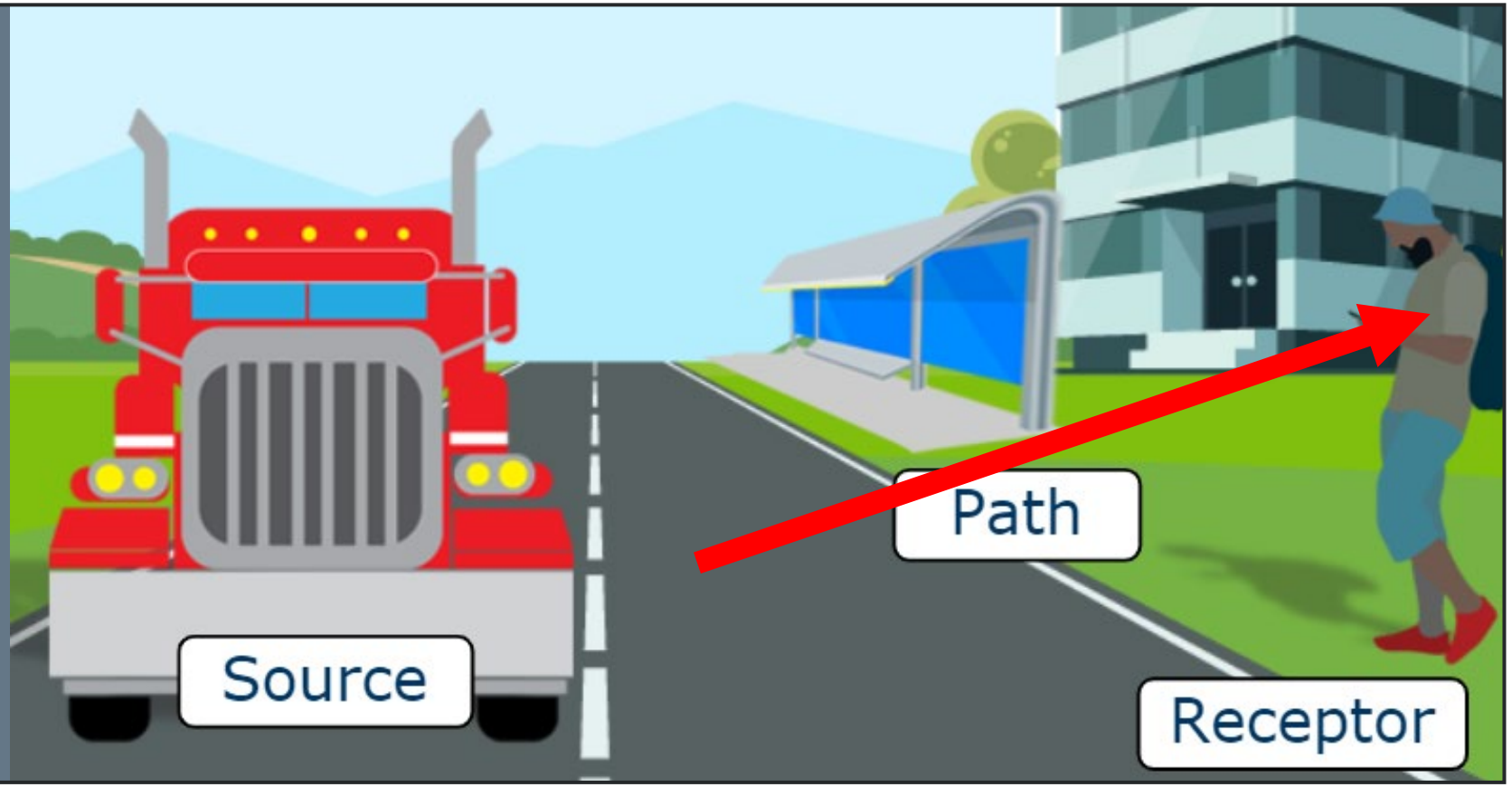
Note: Sound is perceived differently by every individual

Facts about Noise

- Noise is unwanted sound. Noise is perceived differently by every individual. A noise that is irritating to one person may be tolerable to another.
- Noise is measured in decibels on a logarithmic scale.
- An increase of 10 decibels will cause the noise to be perceived as sounding twice as loud to the average listener.
- The smallest change in noise level that can be detected by the human ear is about 3 decibels.
- Doubling the traffic volume on a highway will increase the noise level by 3 decibels.
- The noise level will decrease by about 3 to 4.5 decibels for each doubling of the distance from the source roadway. The amount of decrease depends on the absorptive characteristics of the ground.
- The Arizona Department of Transportation uses a noise level of 66 decibels as the criterion for considering noise barriers, which is lower than the 67 decibels specified in the federal regulations.
- Noise barriers can be noise walls, earth berms or a combination of walls and berms.
- Even with noise barriers, residents within 500 to 1,000 feet of the highway will likely be able to hear the traffic. Barriers are designed to reduce noise to an acceptable or tolerable level. They cannot completely eliminate noise.
- Noise barriers along a highway are most effective for homes within about 300 feet of the highway. Beyond that, noise barriers are less effective, but the natural decrease in noise with distance usually reduces noise levels to acceptable levels.
- Noise walls range in height from 8 to 20 feet, depending on what height is needed to reduce the noise to an acceptable level. Noise walls cost about $250 to $700 per linear foot, depending on the height.
- An earth berm (a large mound of packed dirt usually with landscaping) of a given height will provide slightly more noise reduction than a vertical barrier wall of the same height.
- In some cases, existing dense vegetation can reduce traffic noise levels. Vegetation that is a minimum of 100 feet in depth, at least 15 feet high and dense enough that you cannot see the highway through it, can reduce noise levels by approximately 5 decibels. Typical roadside landscaping does not affect noise levels.
- As a general rule-of-thumb, a noise barrier that is high enough to break the line of sight between the source (traffic) and the receiver (residents) reduces noise by approximately 5 decibels. Each additional foot of height added to the barrier reduces the noise level by another half decibel.

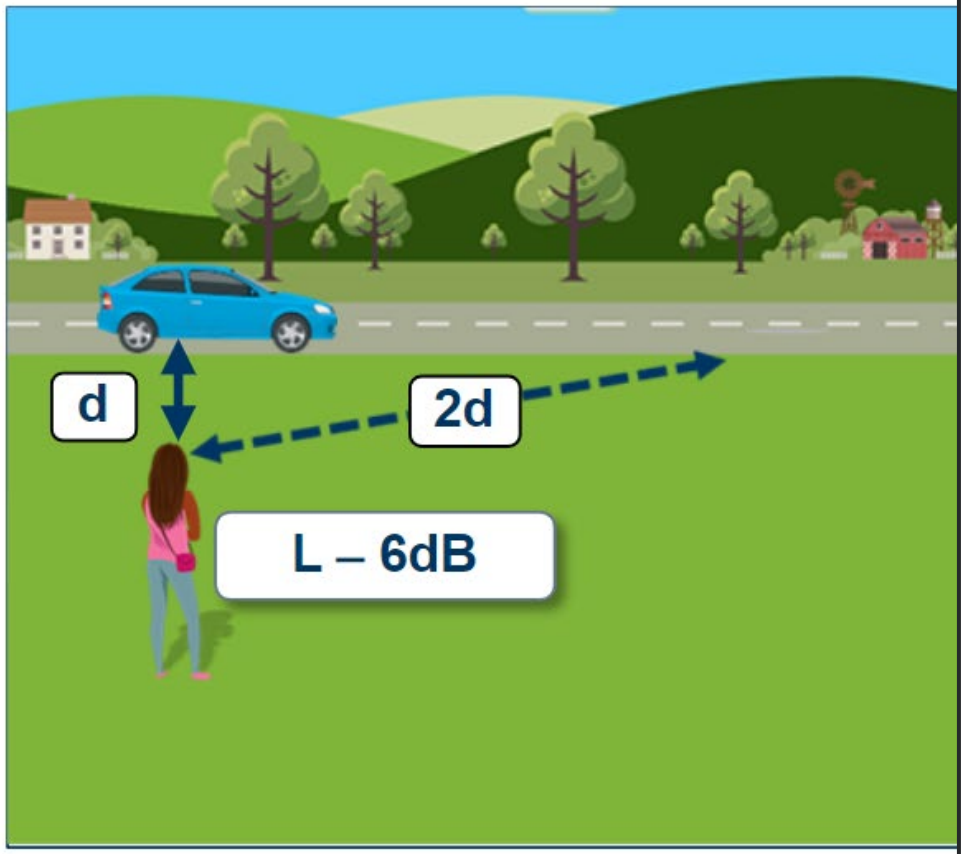
Components of Sound

We can think of sound as having three basic components: a **source** of the sound and its cause and characteristics; the **path** over which the sound travels, including how sound propagates, or spreads, from the source and the influences on that propagation; and the **receptor** who hears the sound, with emphasis on their sensitivity and response.



Point Source Divergence

- Distance from point source is doubled – sound level decreases 6 dB
- $dB(A)_2 = dB(A)_1 + 20\ log\left(\frac{D_1}{D_2}\right)$

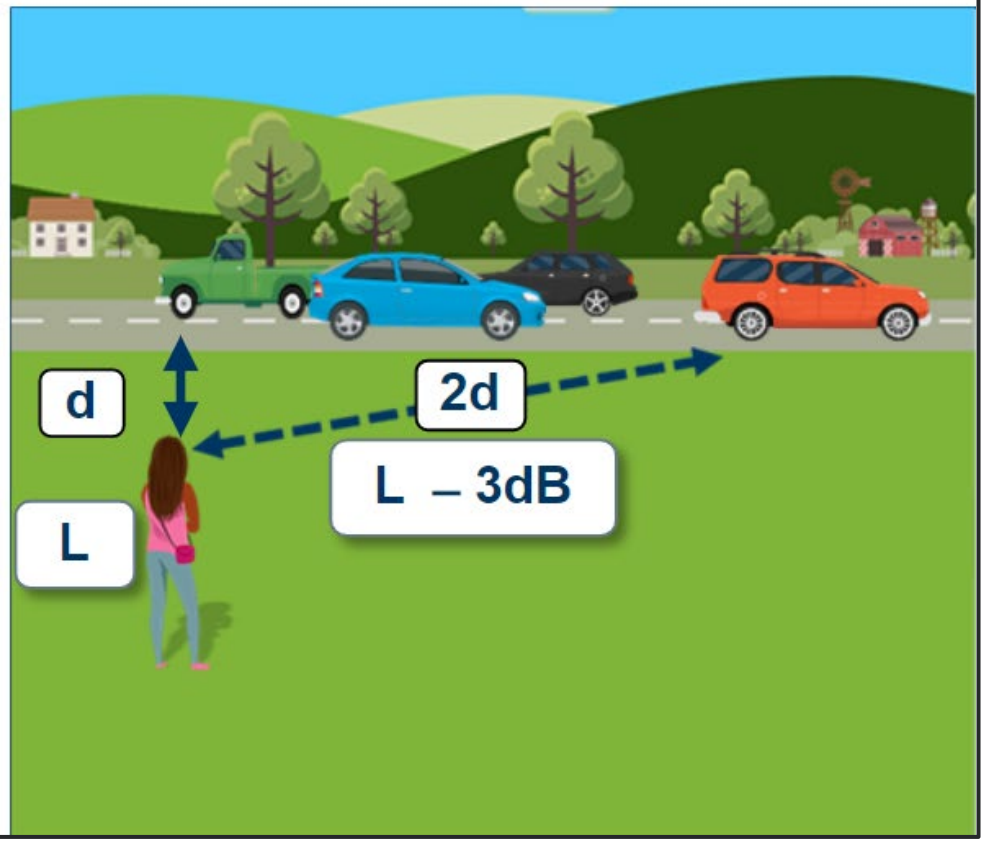


See also FHWA-NHI-142090:
An Introduction to the Traffic Noise Model (TNM).

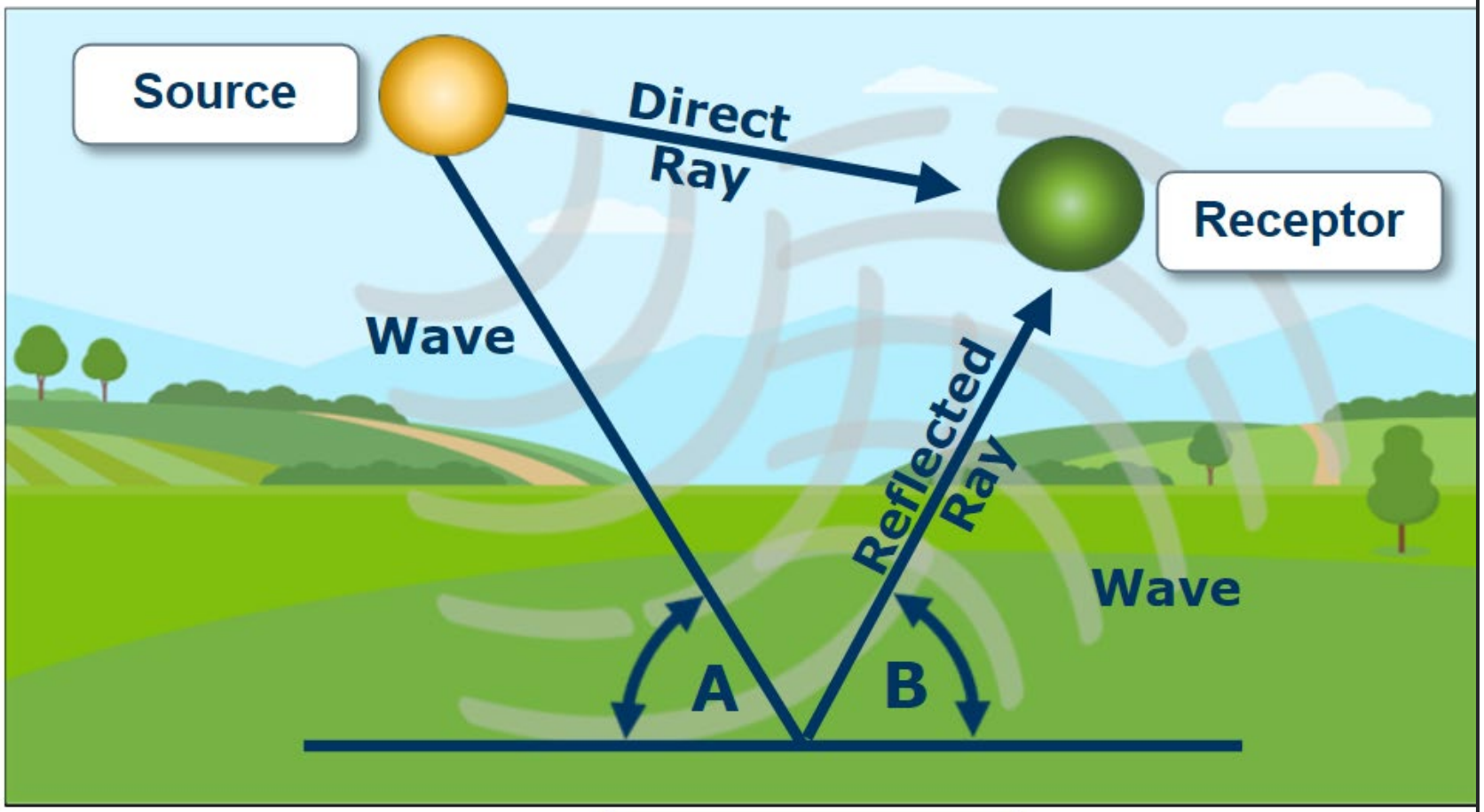
Line Source Divergence

- **Level decreases 3 dB each time distance is doubled**

$$dB(A)_2 = dB(A)_1 + 10 \log\left(\frac{D_1}{D_2}\right)$$



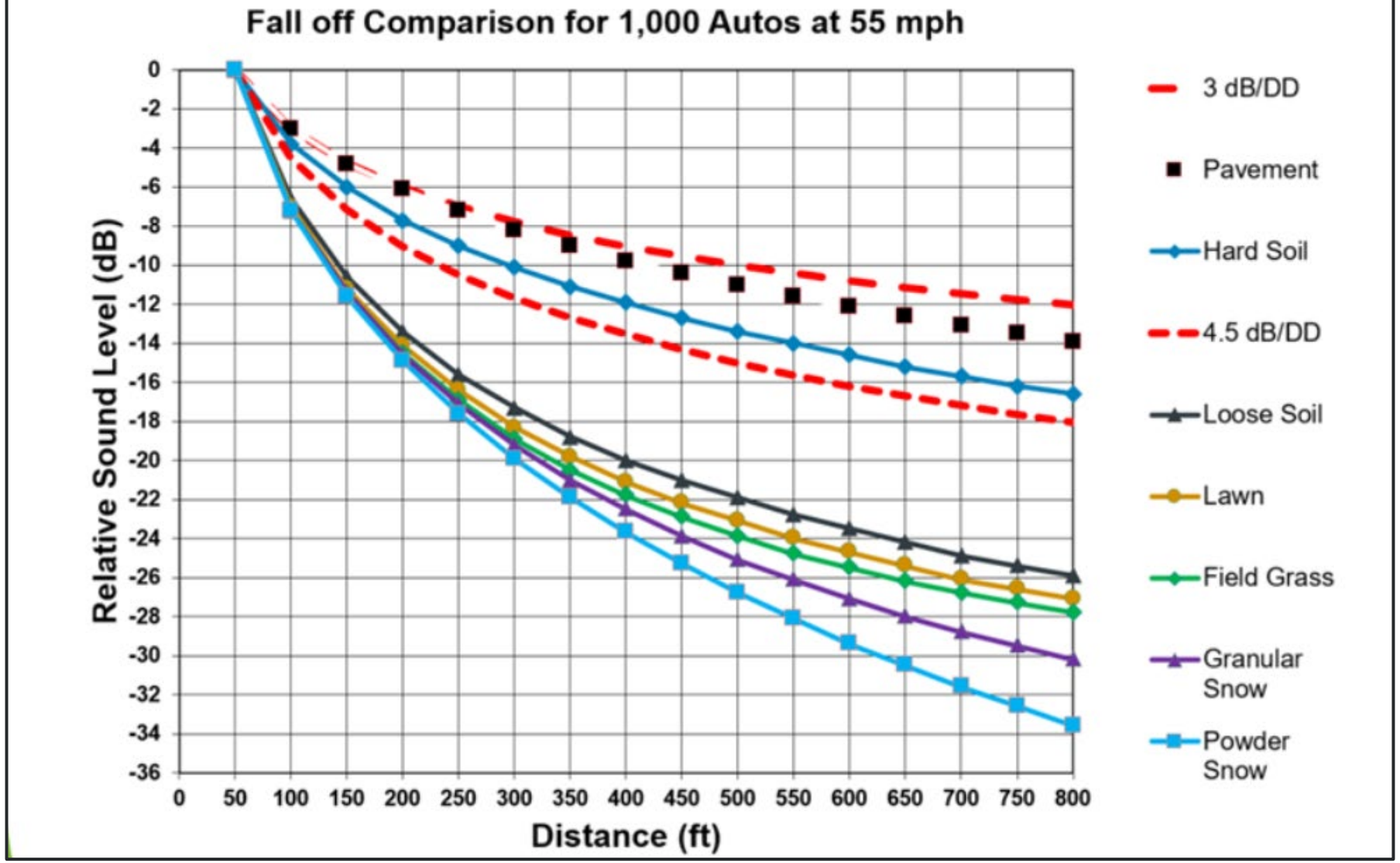
Ground Attenuation



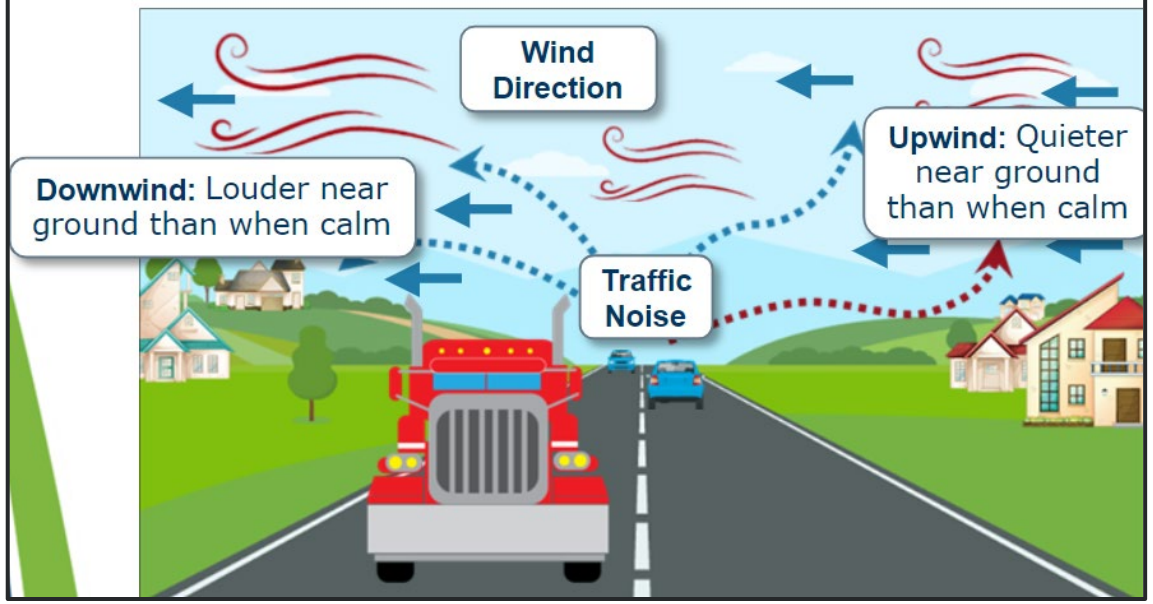
A = B

Acoustically Hard and Soft Ground

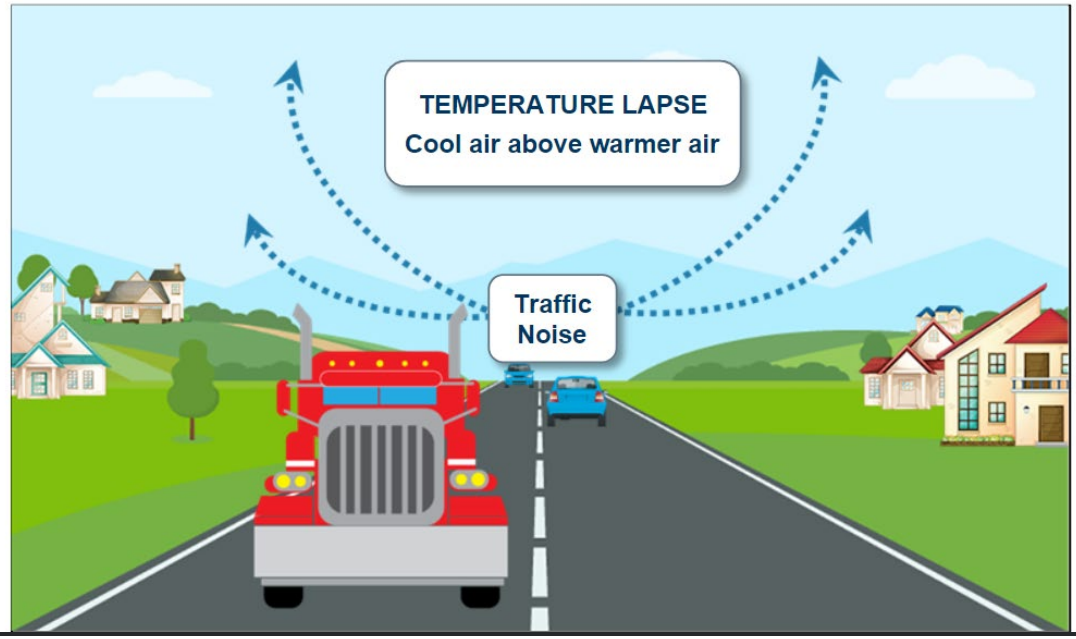
Attenuation Rates by Ground Type



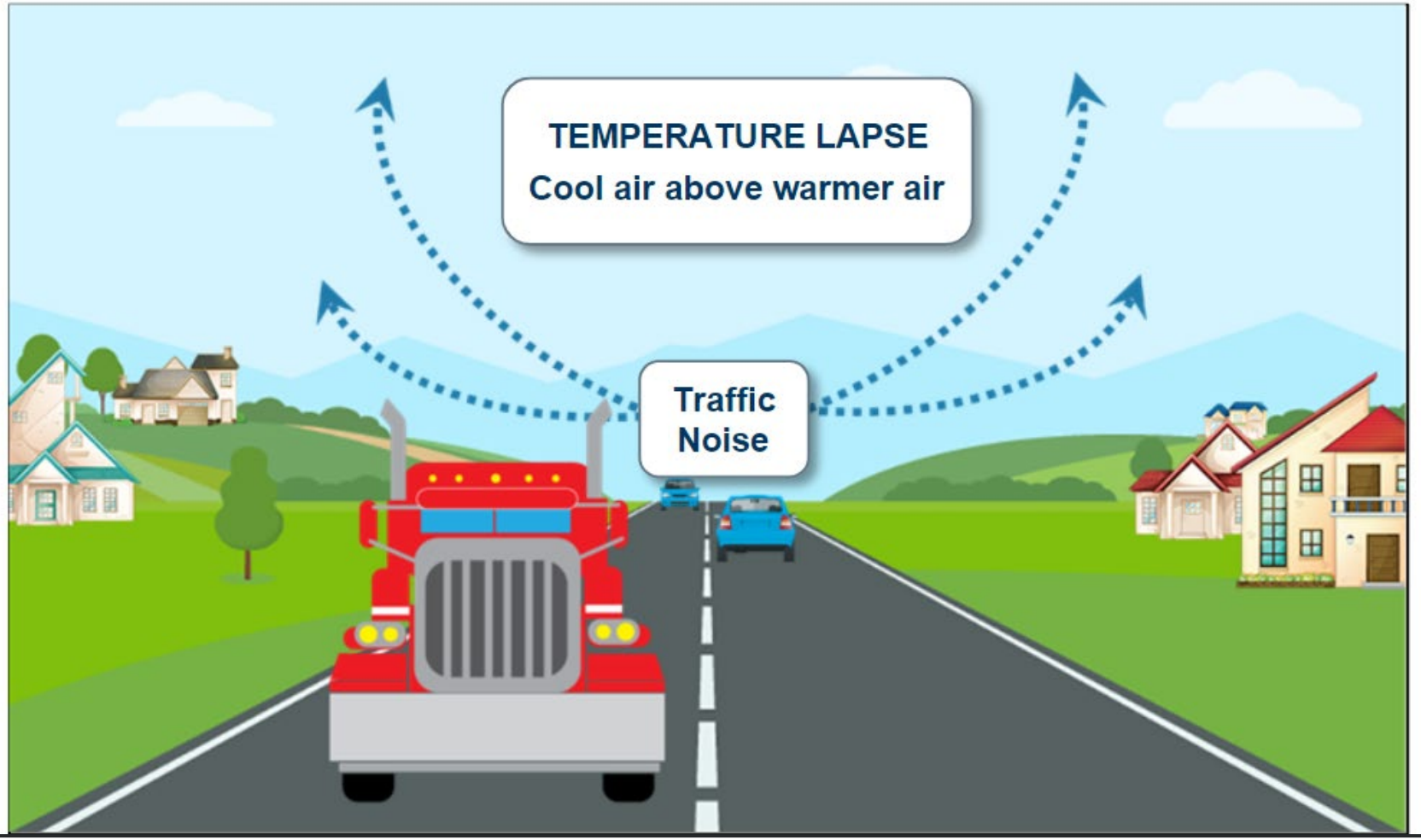
Refraction Due to Wind Shear



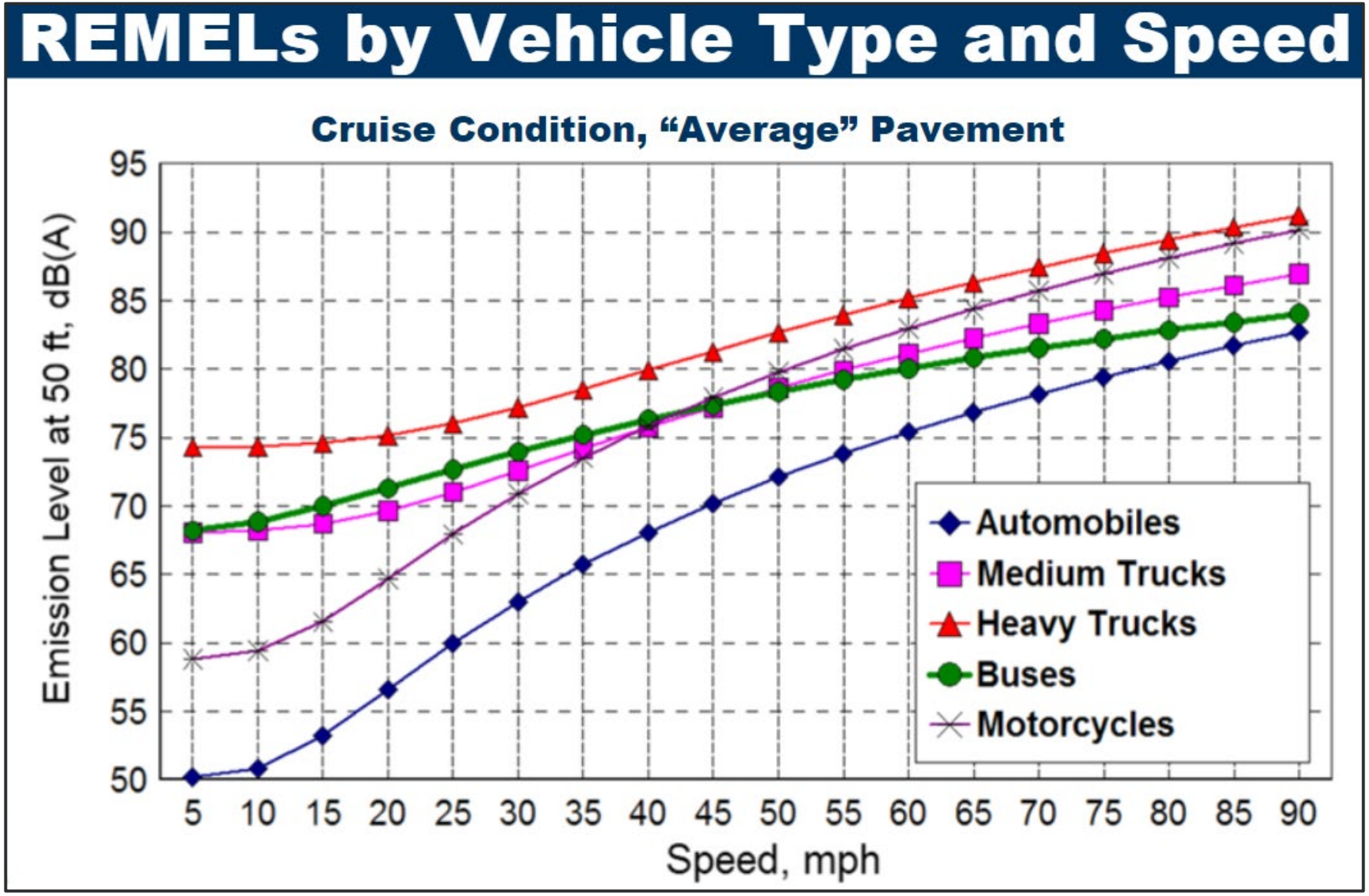
Upward Refraction due to Temperature Lapse Rate



Upward Refraction due to Temperature Lapse Rate



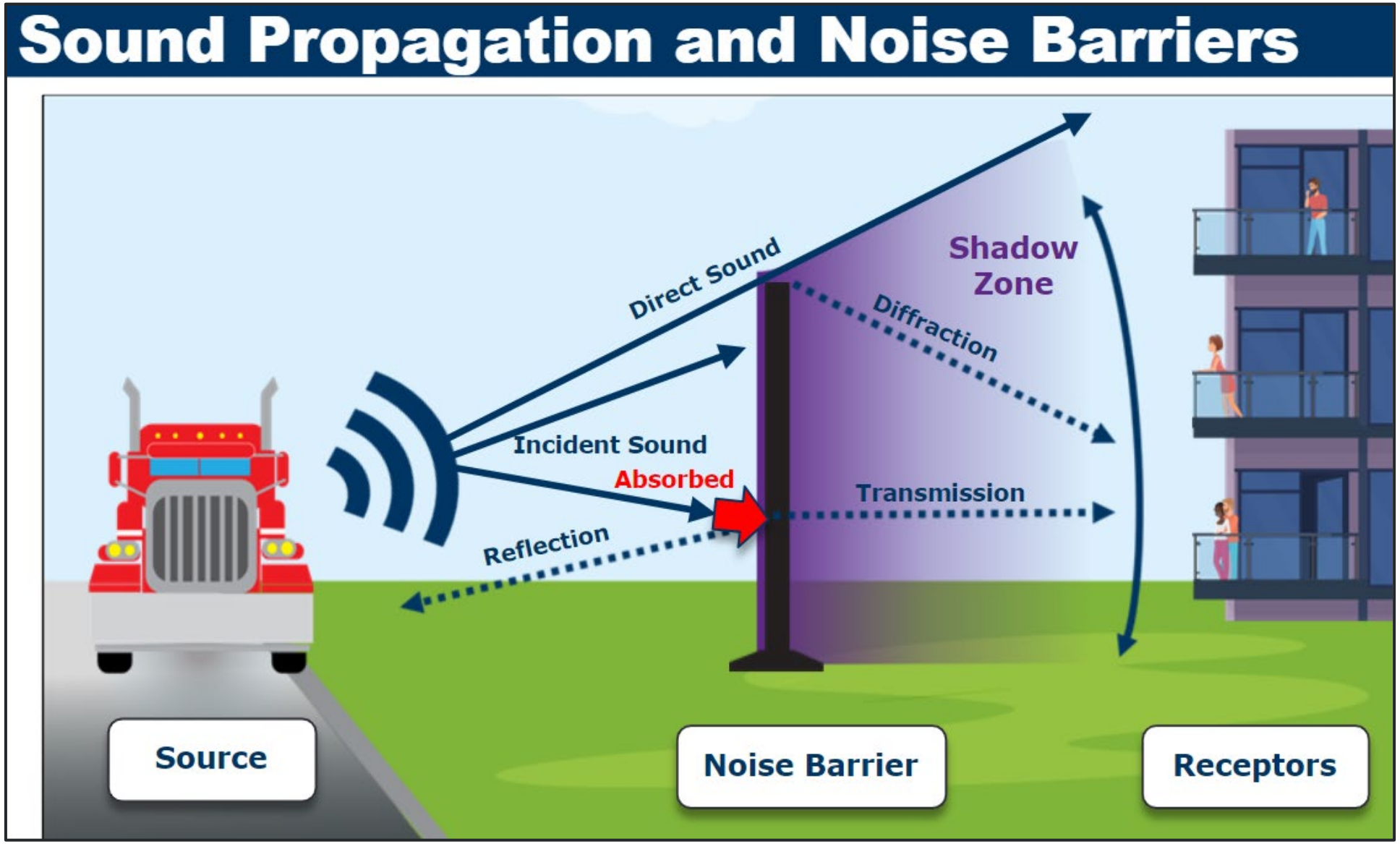
REMELs by Vehicle Type and Speed



Reference Energy Mean Emission Levels (REMELs)

What is a Noise Barrier?

- Shielding disrupts the path between sound source and receptor.
- Noise barriers are solid obstructions.


Sound Propagation and Noise Barriers
Direct Sound
Shadow Zone
Diffraction
Incident Sound
Absorbed
Transmission
Reflection
Source
Noise Barrier
Receptors

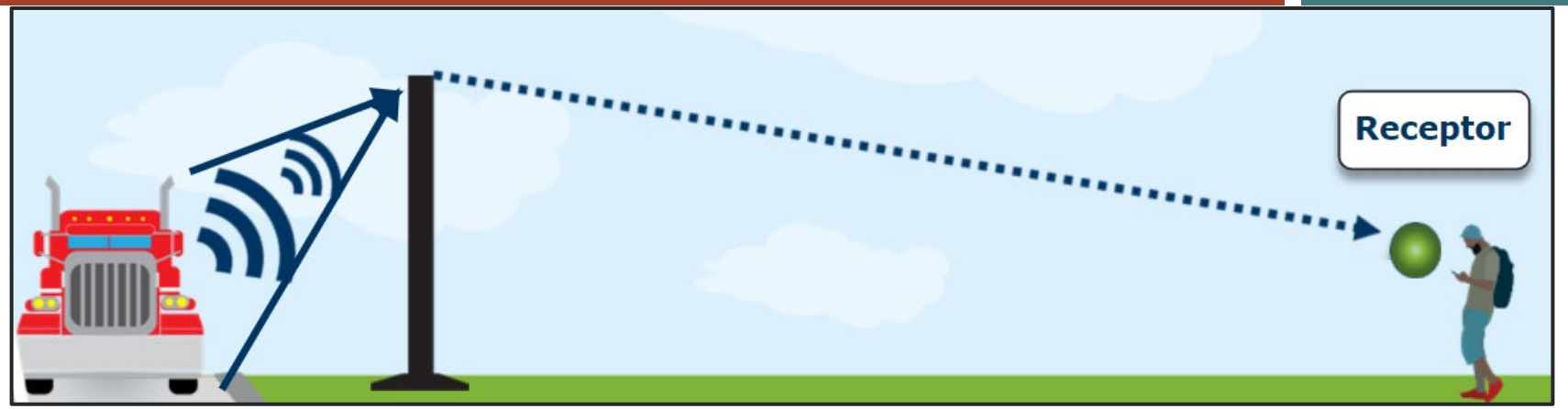
Insertion Loss (IL)

- Difference in sound levels after barrier is inserted between source and receiver
  - Attenuation by diffraction
  - Shielding by other objects
  - Transmission through barrier
  - Reflection off any surfaces
  - Flanking around ends of barrier
  - Loss of excess ground attenuation

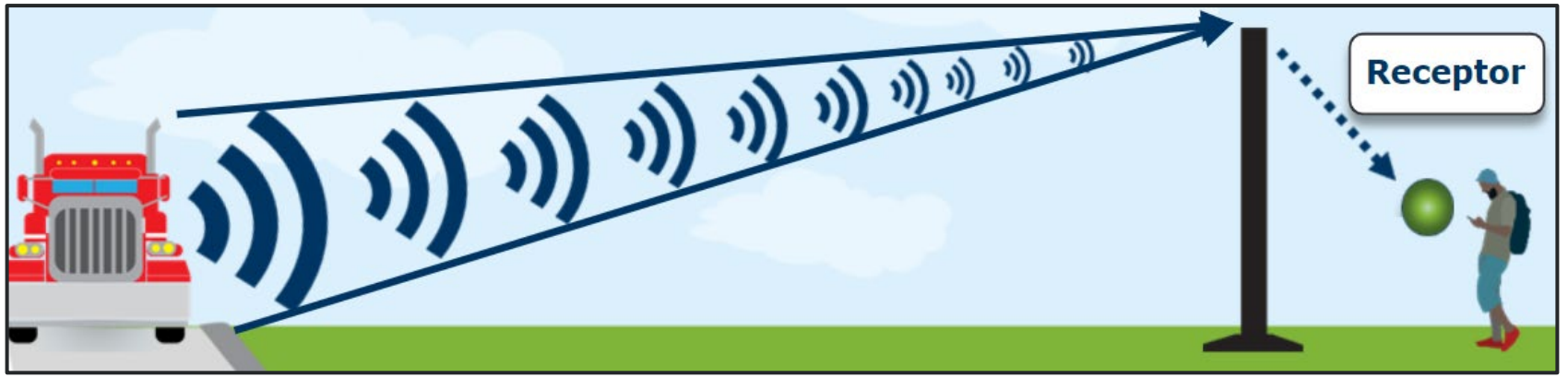
Insertion loss is referred to as “noise reduction” in 23 CFR 772 and TNM.

IL: Obtaining Noise Reduction with Barriers

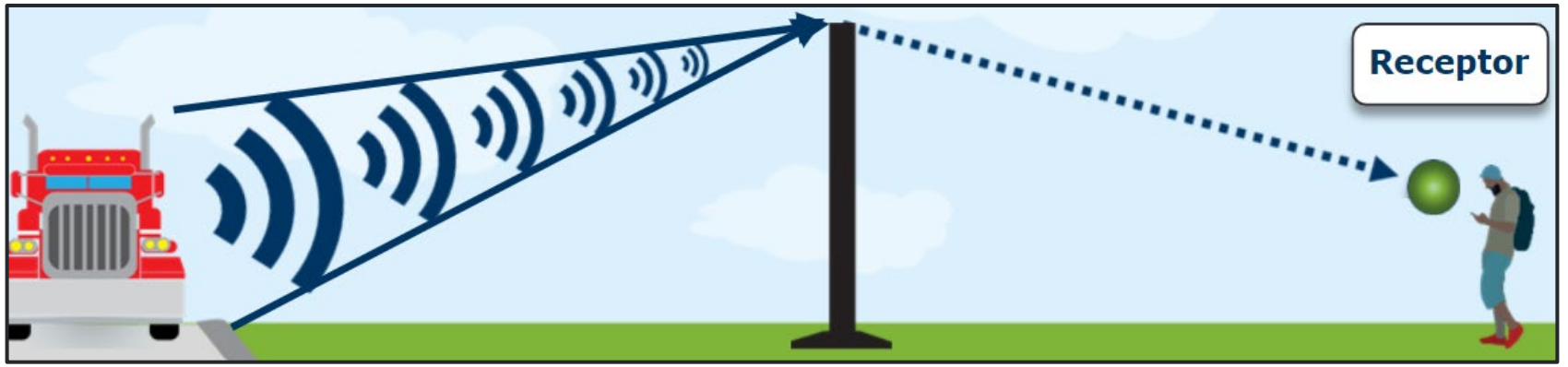
Insertion Loss	Degree of Difficulty	Reduction in Sound Energy	Relative Reduction in Loudness
5 dB	Simple	68%	Readily perceptible
10 dB	Attainable	90%	Half as Loud
15 dB	Very difficult	97%	One-third as loud
20 dB	Nearly impossible	99%	One-fourth as loud



GOOD



GOOD



BAD

Transmission Loss of Different Materials

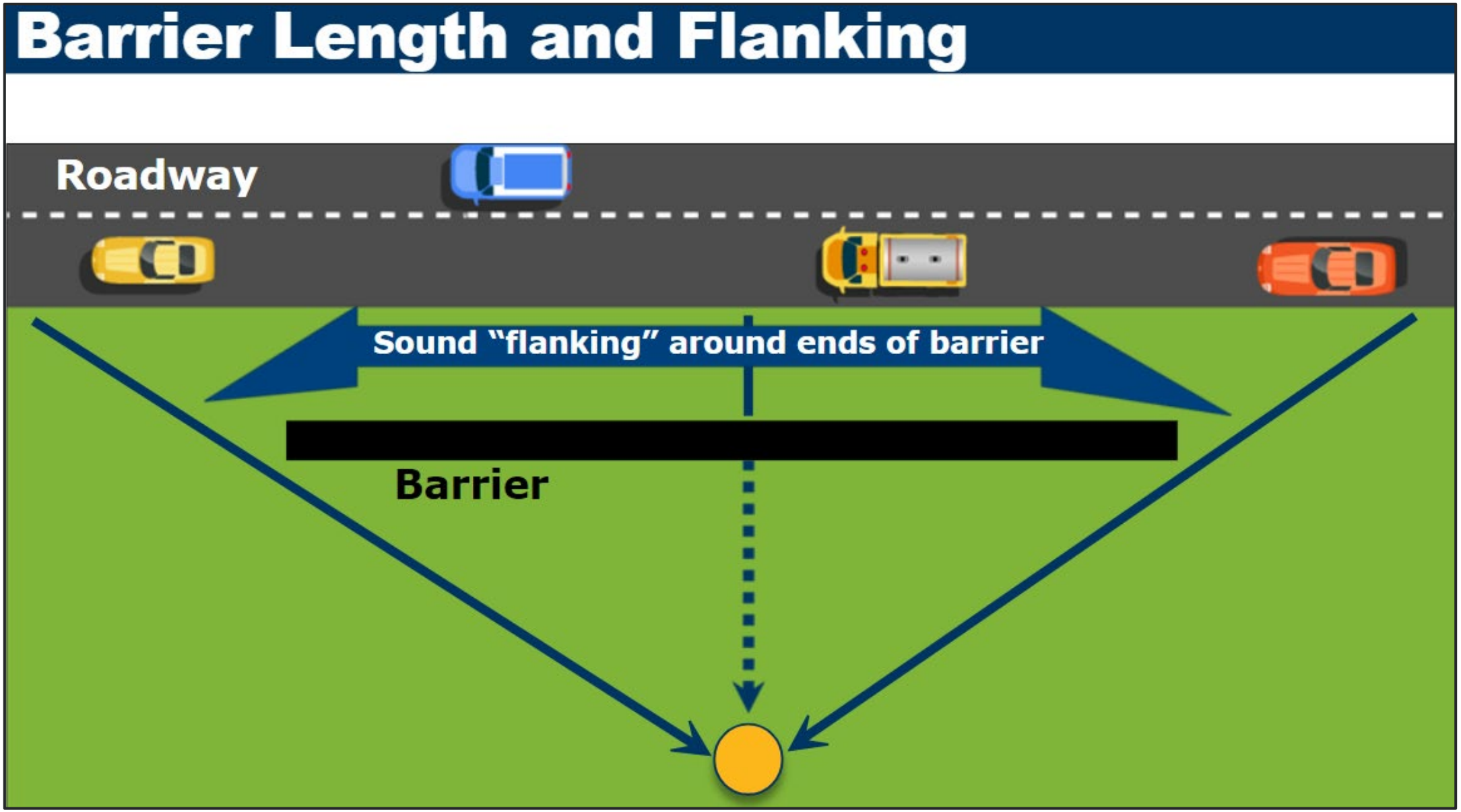
Material	Thickness (inches)	Weight (lb/ft ^{2})	A-weighted TL (dB)
Concrete Block, 8" x 8" x 16", light weight	8	31	34
Dense Concrete	4	50	40
Light Concrete	4	33	36
Steel, 18 gauge	0.050	2.0	25
Steel, 24 gauge	0.025	1.0	18
Aluminum, Sheet	0.125	1.8	25
Wood, Fir	2 (nominal)	6.7	24
Plywood	1	3.3	23
Glass, Safety	0.125	1.6	22
Acrylic	0.25	1.5	22

Source: Chart from the *FHWA Noise Barrier Design Handbook*

20 or more provides adequate performance as a sound barrier

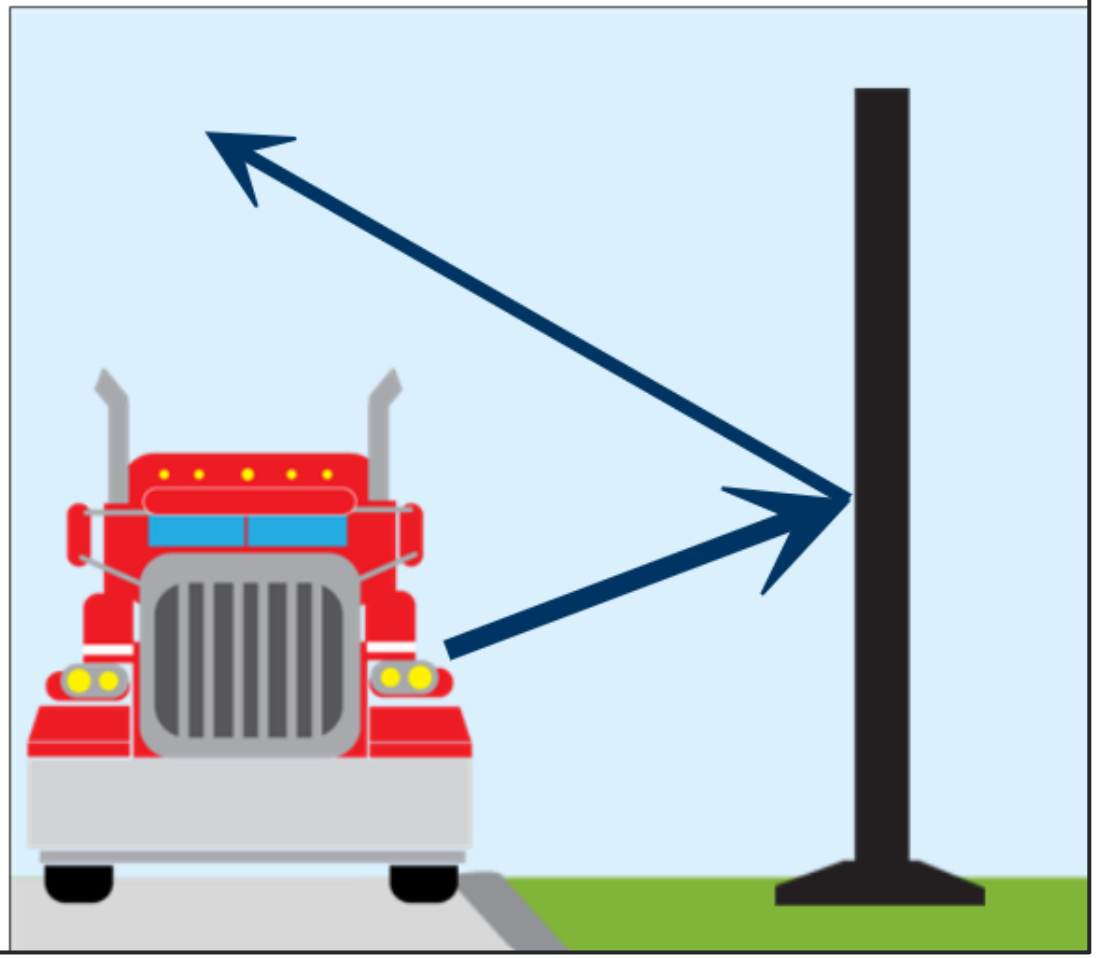

THE
POOL CLUB
Hammerglass

Barrier Length and Flanking

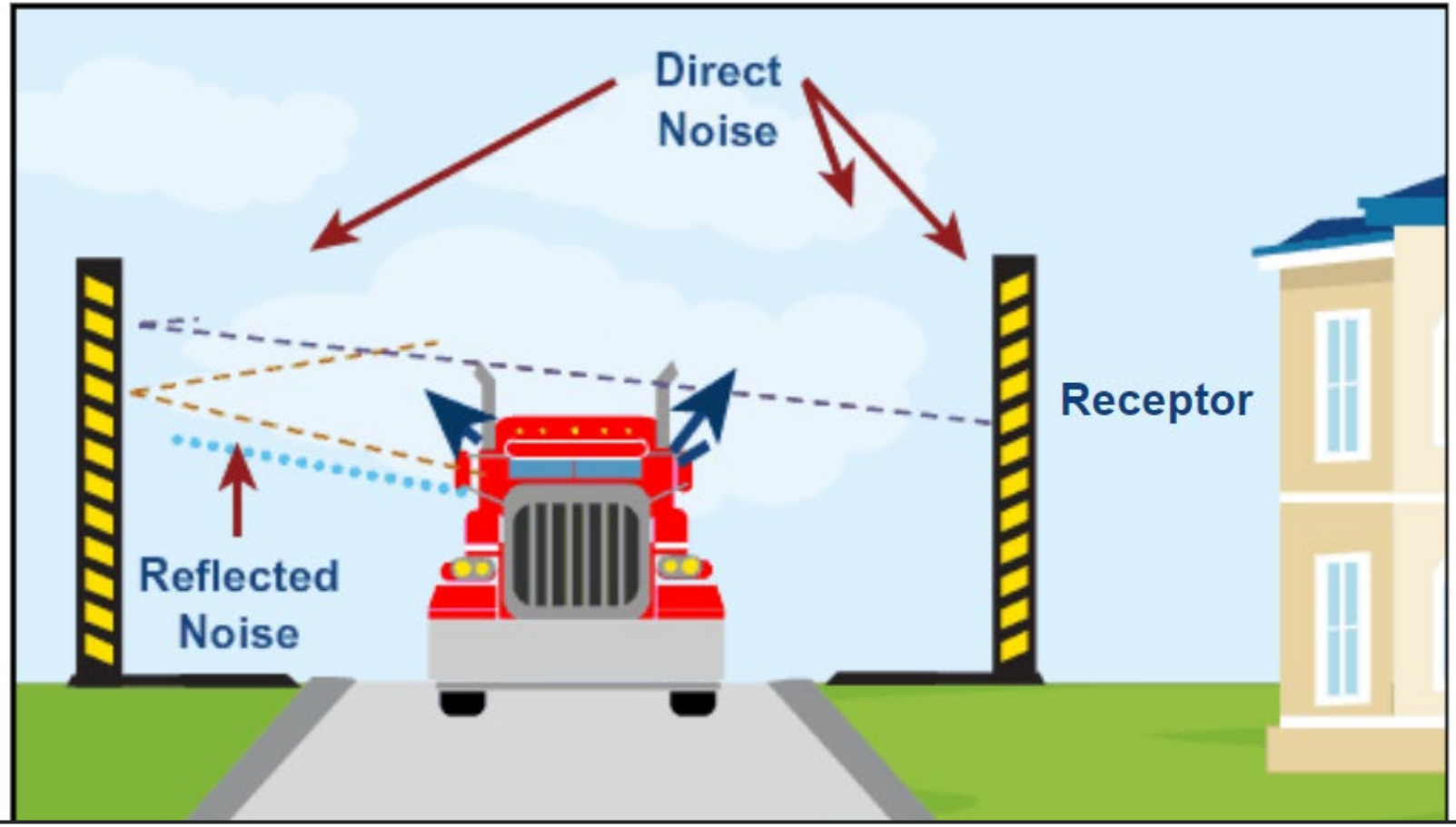


Reflections off a Single Wall

- Barrier or building on one side of roadway can reflect sound energy back across roadway
- Only 1-3 dB increase, yet residents often perceive difference
- Change in sound frequency content may occur



Multiple Reflections Between Parallel Barriers



What can be done to mitigate noise or sound coming from a street?

Copilot

Your everyday AI companion

Copilot

Mitigating street noise can be approached in several ways, depending on whether you're looking to make changes inside your home or in your outdoor space. Here are some effective strategies:

Outdoor Noise Reduction:

1. **Noise Reduction Fence**: Install a solid, high fence without gaps, as sound waves can pass through any holes. Materials like masonry—stone, brick, or stucco-covered concrete—are best for blocking sound due to their mass [1].
2. **Landscaping**: Use dense plantings and hedges, like Juniper, which can help soften sounds that make it past other barriers [2].
3. **Water Features**: Adding water features such as fountains can create a pleasant white noise that helps mask traffic sounds [2].
4. **Sound Barriers**: Erecting physical barriers like soil berms or walls can block noise. The taller and denser the barrier, the more effective it will be [2].

Indoor Noise Reduction:

1. **Soundproof Curtains**: Hang heavy, sound-dampening curtains on windows facing the street.
2. **Window Upgrades**: Consider double-glazing or acoustic windows that can significantly reduce noise transmission.
3. **Seal Gaps**: Ensure that all gaps around doors and windows are sealed to prevent sound leaks.
4. **White Noise Machines**: Use devices that produce white or pink noise to help mask outdoor sounds [3].

Remember, combining several of these methods will likely yield the best results in reducing street noise.

Learn more 1 thisoldhouse.com 2 howtogardendesign.com 3 thespruce.com 4 gentlehush.com

Example Noise Mitigation by Seth Chalmers, PE


PHX
Phoenix Sky Harbor

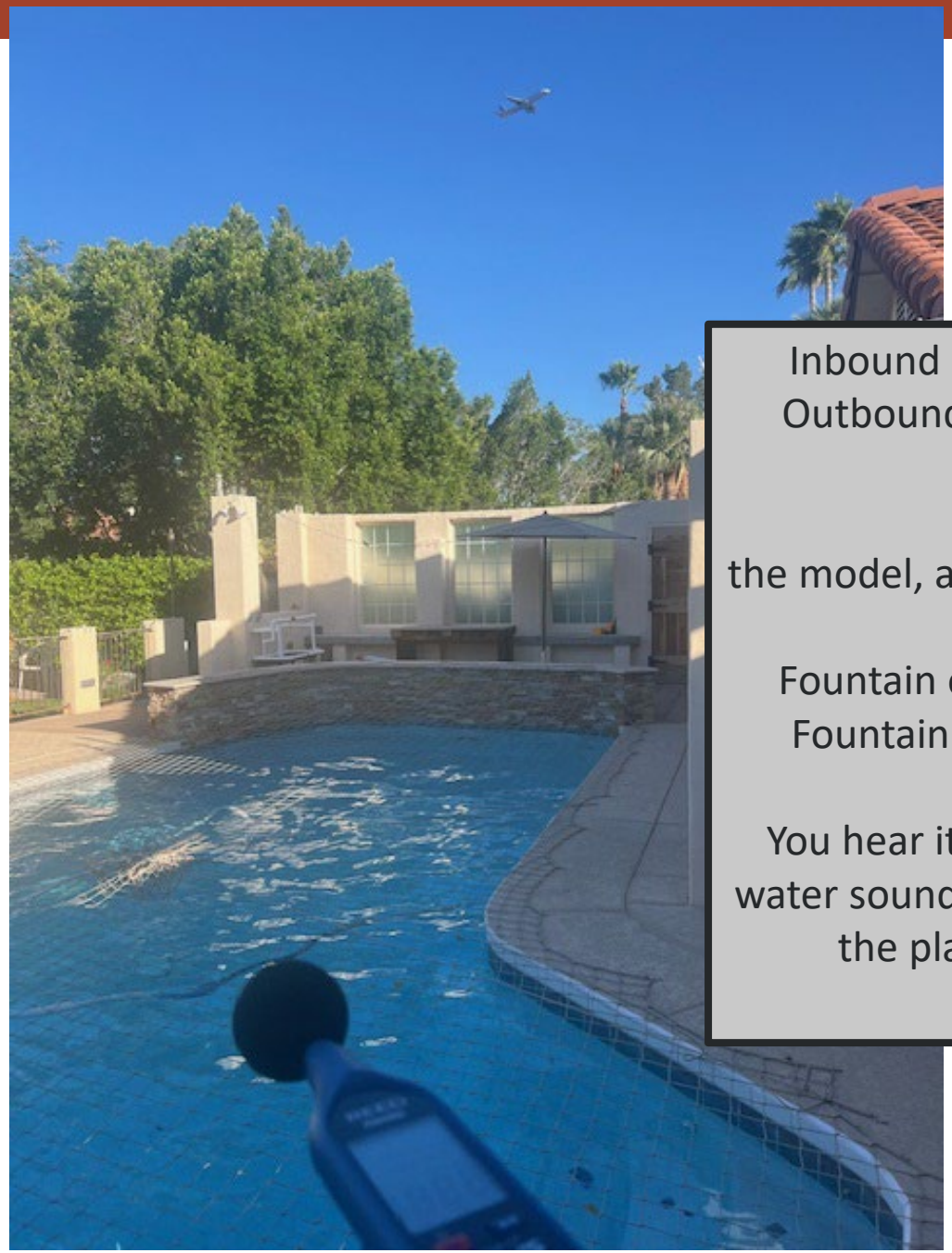
Water Feature Performance

Fountain off 42 +/- dBA warm air PM peak on Loop 202

Fountain off 51 +/- dBA cool air AM peak on Loop 202

Fountain On 61 +/- dBA with both "***ambient***" conditions

No planes in ear shot.

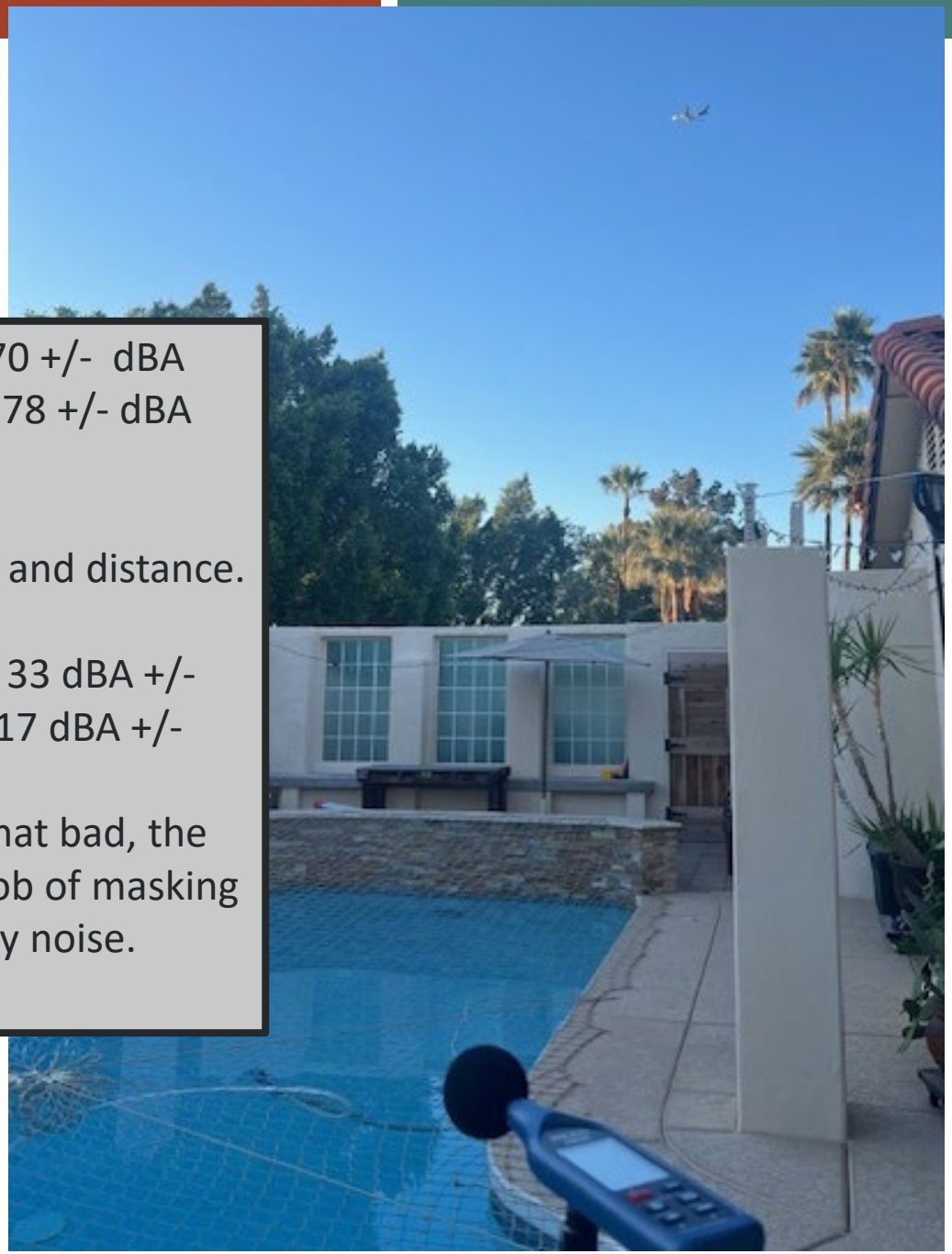


Inbound Plane – 65 to 70 +/- dBA
Outbound Plane - 65 to 78 +/- dBA

Depends on
the model, airline, altitude, and distance.

Fountain off: Delta 24 to 33 dBA +/-
Fountain on: Delta 4 to 17 dBA +/-

You hear it, but it is not that bad, the water sound does a good job of masking the plane and freeway noise.



Building a Ramada and Extending the Roof Line to Break the Line of Sight to Planes More

Discussion / Questions / Questionnaire Assistance

Seth Chalmers, PE

Director of Traffic Engineering, Dibble

seth.chalmers@dibblecorp.com / 602.363.1854

DIBBLE

DOVE MOUNTAIN BOULEVARD TRAFFIC SOUND ASSESSMENT
(SECRET SPRINGS DRIVE TO PROSPECT WASH AREA OF PRIMARY INTEREST)
Questionnaire/Survey/Comment Input Form

CONTACT INFORMATION

Dove Mountain Neighborhood Area (see map):			
Name (optional):			
Address (optional) or Nearest Minor Cross-Streets:			
E-mail (optional):		**Phone (optional):**	

INSTRUCTIONS: Contact information will only be used as a part of this assessment. If you do not wish to be contacted, please provide your approximate address/nearest minor cross-streets so your comments can be associated with a location (location in a sound assessment is very important). We recommend filling out this form after attending the workshop presentation on April 17, 2024. However, interested parties who did not attend the workshop are encouraged to complete this questionnaire and offer additional input. Please email completed questionnaires to seth.chalmers@dibblecorp.com. If you have technical questions, please contact the consultant Project Manager, Seth Chalmers, at 602.363.1854 or seth.chalmers@dibblecorp.com.

ASSESSMENT OBJECTIVE: The objective of this assessment is to continue sound evaluation efforts and arrive at an actionable or non-actionable conclusion. This includes an effort to help educate interested parties on the principles and processes involved in street traffic sound assessment and to gain input from those individuals regarding their issues. This assessment will consider whether additional data collection and evaluation are required to determine if the sound qualifies as noise. If additional data are needed, reasonable alternatives for potential mitigations may be developed and evaluated, and suitable locations for their implementation may be identified. If mitigations are deemed effective and cost-efficient, the next step will involve determining how these mitigations will be funded. Given that this situation pertains to a planned community, it may fall upon the Dove Mountain Community Association and individual residents to explore mitigations and fund them. While the Town of Marana can offer technical assistance, it is currently not positioned to directly participate in funding additional mitigations, particularly if they involve private property.

IMPORTANT DEFINITIONS

1. **Sound:** Sound is an objective term; it refers to a physical property. When an object vibrates, the energy from those vibrations causes pressure fluctuations as it travels through air (or another medium). If the pressure fluctuations reach a person's ears, the person will perceive them as sound.
2. **Components of Sound:**
   - **Source:** The origin of the sound.
   - **Path:** The medium through which the sound travels.
   - **Receptor:** The person or device that detects the sound.
3. **Noise:** Noise is a sound that can be loud and unpleasant, causing disturbance. The judgment of the unpleasantness of sounds at lower levels is often subjective to the individuals hearing the sound and where they hear it.
4. **Reduction in Sound or Noise Reduction Design Goal:**
   - A meaningful reduction in sound is typically from 5 to 7 decibels, achievable through physical structures (such as noise barriers) located at the source or receptor (or both).
   - A reduction of 5 decibels or more is readily perceptible.
5. **Interruption of Sound:**
   - Interruption of sound occurs when other sounds are used to mask the sound that might be perceived as noise. This is sometimes referred to as white noise. Water features that have fountains are typically used to interrupt unwanted sounds or noise outdoors at a specific location.

SOUND AND NOISE ASSESSMENT QUESTIONNAIRE (please answer whatever questions apply to you)

1. On a scale of 1 to 10 (with 1 being the best and 10 being the worst), do you think sound from Dove Mountain Boulevard is, at times, at a level that you consider noise?

2. At what time(s) do you consider sound from Dove Mountain Boulevard to be noise? Circle all times that you think apply.

   Early Morning - Morning - Late Morning - Noon - Early Afternoon - Afternoon - Late Afternoon - All the time

3. Does this perceived noise occur on specific day(s) of the week, month, or year? Or is it all the time?

4. Do weather conditions have any impact on your perception of the sound as noise?

5. Do you feel that the noise is high and frequent enough that it needs to be mitigated in some fashion?

6. If you consider the sound to be noise, is it when you are inside your home, outside your home, or both?

7. From that location (either indoors or outdoors), can you directly see Dove Mountain Boulevard? Circle which applies.

   Inside: Yes or No Outside: Yes or No

   Note: Line of sight is the path between the receiver (home/residence) and the source (vehicle on the street) and is very important in sound transmission. The rule of thumb is that if you can see the traffic, you may perceive its sound to be louder.

8. Are there any obstructions between you and Dove Mountain Boulevard that can interrupt that line of sight? If so, is that there all the time or only some of the time?

   Note: Traffic sound or noise is a moving line source, meaning it is generating that sound as it travels along the street or road. Sound or noise can be interrupted at times by something physical like a berm, wall, or vegetation that is on or off your property. These features can reflect and/or absorb sound.

9. If you can see Dove Mountain Boulevard, have you noticed what type(s) of vehicle(s) are generating enough sound for you to consider it to be noise?

10. Estimate or guess how far is your home from Dove Mountain Boulevard in feet or football fields?

11. Is your home above, below, or at the same level as Dove Mountain Boulevard? Or does it vary?

12. What is the terrain like between you and Dove Mountain Boulevard? Is it flat, hilly, uphill, or downhill? Does the terrain have no vegetation, little vegetation, some vegetation, or much vegetation? Is the soil on the terrain soft, semi-soft, semi-hard, or hard?

13. Describe and/or sketch the location where you are when you consider the sound from Dove Mountain Boulevard to be noisy. Is there a wall between you and Dove Mountain Boulevard? Is so, what type of wall and how high is it? Is it a solid wall or does it have openings? If it has openings or gaps, what are those openings made of?

14. If you consider Dove Mountain Boulevard to have enough sound to be considered noise, have you done anything on your property to mitigate it? This could include heightening a solid wall or closing gaps in a solid wall with a solid material such as masonry, steel, aluminum, wood, or safety glass. See the companion handout for the transmission loss potential of different materials.

15. Have you tried any other mitigation measures, such as a water feature, to help mask the sound?

16. Are you willing to allow the Town of Marana and its engineering consultant, Dibble, to take sound measurements at the location where you believe that sound is noise? The total time to take these measurements is estimated to be just under an hour.

17. Please write any other questions and/or comments here.