Highway Traffic Noise

Noise Studies and How Highway Traffic Impacts the Noise

Kathryn McKelvey
Environmental Planner II
Environmental Policy and Development Section
Pennsylvania Department of Transportation

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Outline

- What is noise?
- How is it measured?
- How does a noise barrier work?
- When is a noise analysis done?
- Importance of accurate traffic modeling

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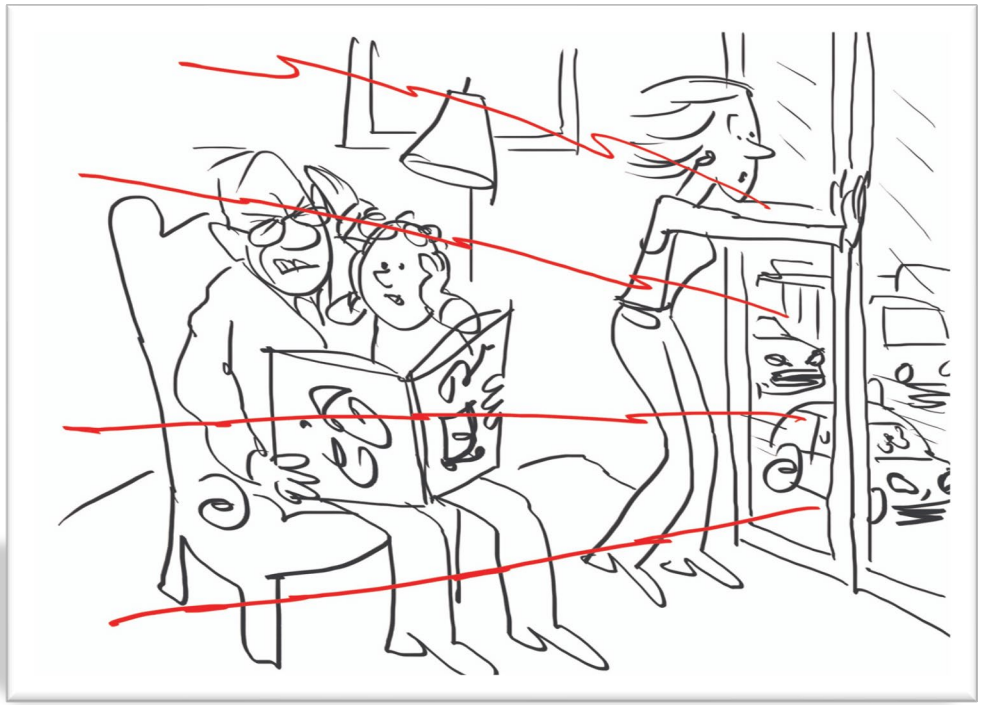
What is Noise?

- Any sound that is undesired or interferes with one's hearing

- Negative affects
  - Quality of life
  - Productivity
  - Education

- Characteristics
  - Magnitude
  - Frequency
  - Time



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How is Noise Measured - Land Use Activity Categories

Table 1
Hourly Weighted Sound Levels dB(A) For Various Land Use Activity Categories*

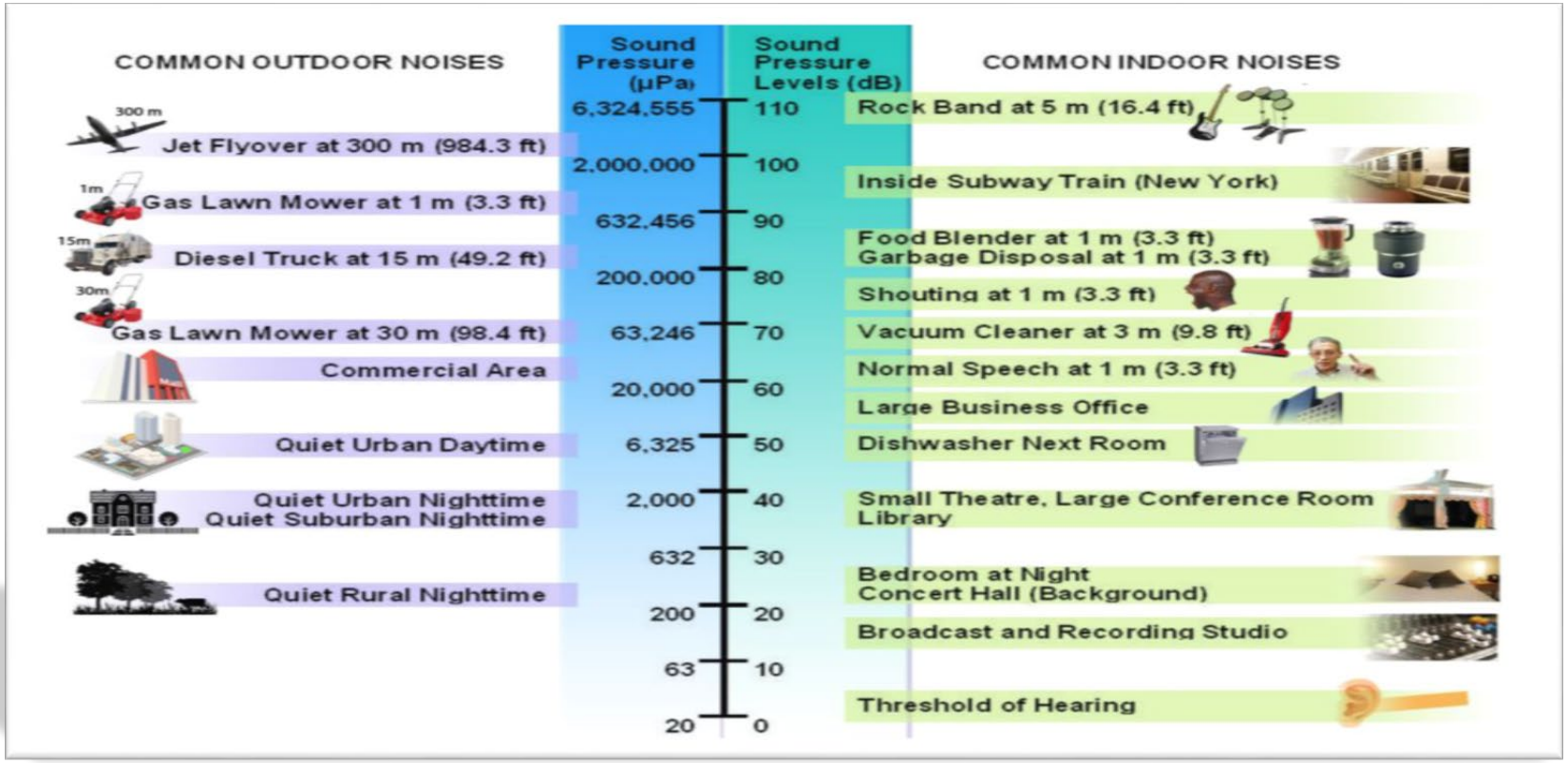
Land Use Activity Category	Leq(h)[1]	Description of Land Use Activity Category
A	57 (exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B2	67 (exterior)	Residential
C2	67 (exterior)	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings.
D	52 (interior)	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.
E2	72 (exterior)	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A, B or C.
F	--	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing.
G	--	Undeveloped lands that are not permitted.

[1] Impact thresholds should not be used as design standards for noise abatement purposes.
[2] Includes undeveloped lands permitted for this activity category

How is noise measured - continued

Relative changes in “loudness”

Sound Level Change	Relative Loudness Change
3 dB	Barely perceptible
5 dB	Readily perceptible
10 dB	Twice as loud



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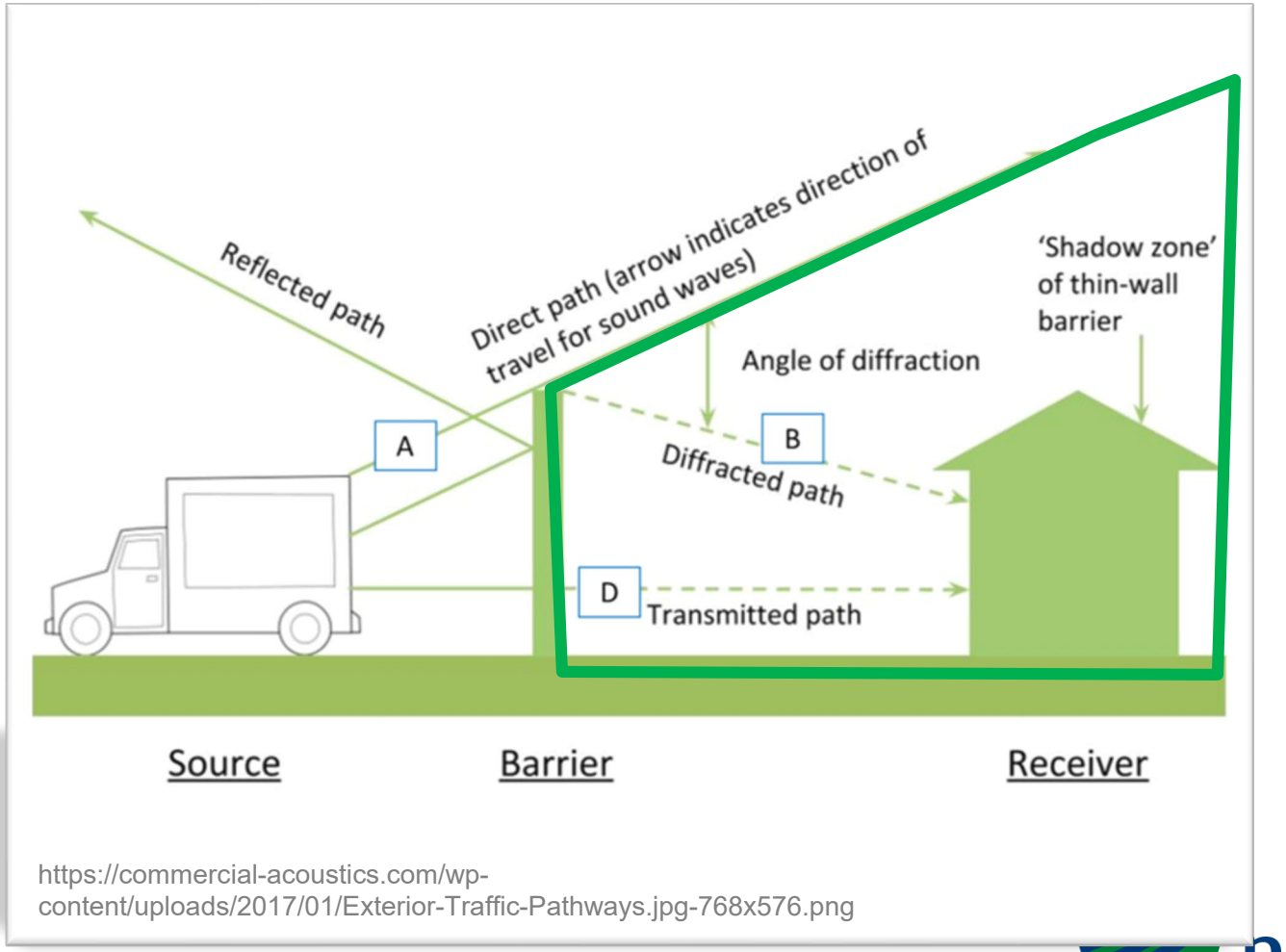
How a Noise Barrier Works



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When is a noise analysis done?

- Type I
  - Construction of highway on new location
  - Substantial horizontal or vertical alteration
  - Addition of through traffic lanes
  - Addition of auxiliary lanes if > 2500ft
  - Addition or relocation of interchange lanes or ramps
- Type II
  - Retrofit projects
- Type III
  - Non-capacity improvements
  - Turning lanes

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When does PennDOT Build a Barrier?

- Warranted
  - Approaches or exceeds noise abatement criteria
- Feasibility
  - Can a reduction of 5 dB(A) be achieved at the majority of impacted receptors?
  - Can the barrier actually be built safely?
- Reasonableness
  - Does at least one benefitted receptor experience a reduction of 7 dB(A)?
  - Does the barrier meet the 2,000 Max SF/BR?
  - Did the majority of benefited receptors vote yes for the wall?

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How Traffic Affects Noise

How Speed Affects Traffic Noise

Traffic at 65 miles per hour sounds twice as loud as

Traffic at 30 miles per hour

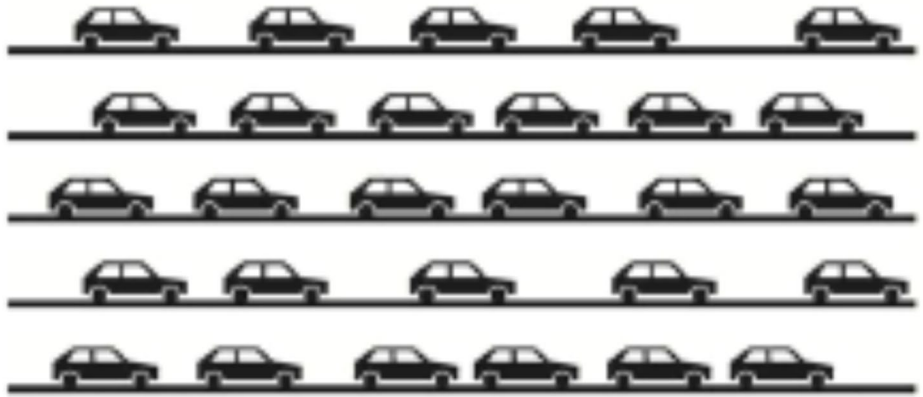
How Traffic Volume Affects Noise

2000 vehicles per hour sound twice as loud as

200 vehicles per hour

How Trucks Affect Traffic Noise

One truck at 55 miles per hour sounds as loud as



28 cars at 55 miles per hour

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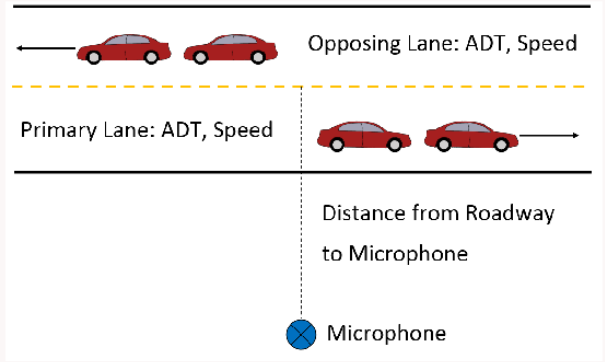
Truck Traffic Example

ADT Example



Primary Lane | Opposing Lane

Characteristics

Primary Lane		Opposing Lane
Average	Pavement Type	Average
0	Grade (%)	0

Traffic

Primary Lane		Opposing Lane
40	Lane Average Speed (mph)	40
3500 Hourly Daily	Average Traffic (# Vehicles)	3500 Hourly Daily
75 %	Cars (% of Total Volume)	75 %
15 %	Medium Trucks (% of Total Volume)	15 %
10 %	Heavy Trucks (% of Total Volume)	10 %

Receiver Distance from Roadway (ft): 50

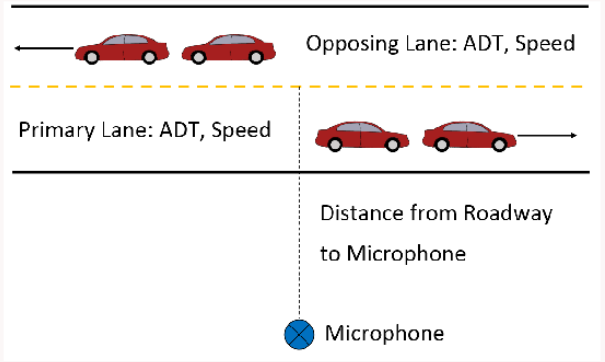
Noise Abatement Criteria Activity Category: Activity Level B | 67 dB(A)

*23 CFR Part 772 Table 1

Calculate Noise (LAeq, 1 hour)

Results

Primary Lane Noise (LAeq, 1 hour)		Opposing Lane Noise (LAeq, 1 hour)
61.9 dBA	Calculated noise level is within 5 dB of the noise abatement criterion. A detailed study is required. Total Noise (LAeq, 1 hour) 64.9 dB	61.9 dBA



Primary Lane | Opposing Lane

Characteristics

Primary Lane		Opposing Lane
Average	Pavement Type	Average
0	Grade (%)	0

Traffic

Primary Lane		Opposing Lane
40	Lane Average Speed (mph)	40
4000 Hourly Daily	Average Traffic (# Vehicles)	4000 Hourly Daily
75 %	Cars (% of Total Volume)	75 %
15 %	Medium Trucks (% of Total Volume)	15 %
10 %	Heavy Trucks (% of Total Volume)	10 %

Receiver Distance from Roadway (ft): 50

Noise Abatement Criteria Activity Category: Activity Level B | 67 dB(A)

*23 CFR Part 772 Table 1

Calculate Noise (LAeq, 1 hour)

Results

Primary Lane Noise (LAeq, 1 hour)		Opposing Lane Noise (LAeq, 1 hour)
62.5 dBA	Calculated noise level is within 5 dB of the noise abatement criterion. A detailed study is required. Total Noise (LAeq, 1 hour) 65.5 dBA	62.5 dBA

Questions?

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