

PHOENIX

noise & vibration

Acoustical Engineering Solutions

Pickleball:

The Noise That's Not That Loud.



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Thank you for attending!

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Learning Objectives

- ▶ At the end of this program, participants will be able to:
 1. Understand noise measurement basics
 2. Realize the uniqueness of pickleball noise
 3. Mitigate pickleball noise
 4. Designate proper location for pickleball courts



**Noise
Measurement**

Unique Sound

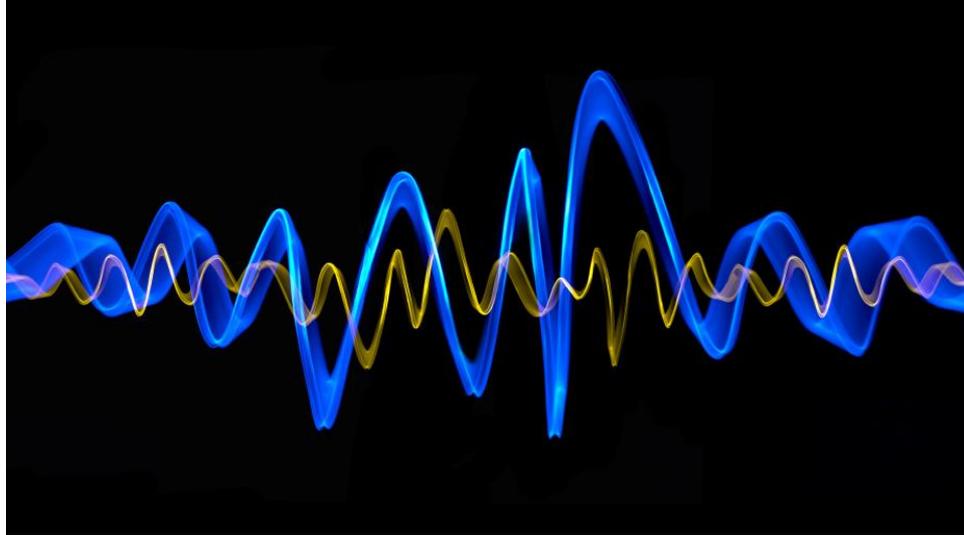
Pickleball Noise

Mitigation

Location

Basic Acoustics

- ▶ What is sound?
 - “Any pressure variation (in air, water or other medium) that the human ear can detect.” B&K



Basic Acoustics

- ▶ What is Noise?
 - Noise is Unwanted Sound (aka my neighbor's home theater)



Basic Acoustics

- ▶ How is noise quantified
 - Amplitude or loudness
 - Variation in the air pressure around us
 - The bigger the variation, the louder the sound
 - Frequency or pitch/tone
 - How quickly we vary the pressure
 - The quicker the variation, the higher the tone

Basic Acoustics

- ▶ Loudness measured in decibels (dB)
 - $\text{dB} = 10 \times \log(\text{Pressure}^2 / \text{refPressure}^2)$
 - From this we observe:
 - logarithmic
 - simply a comparison between two numbers
- ▶ Human Range: 0 to 130 dB

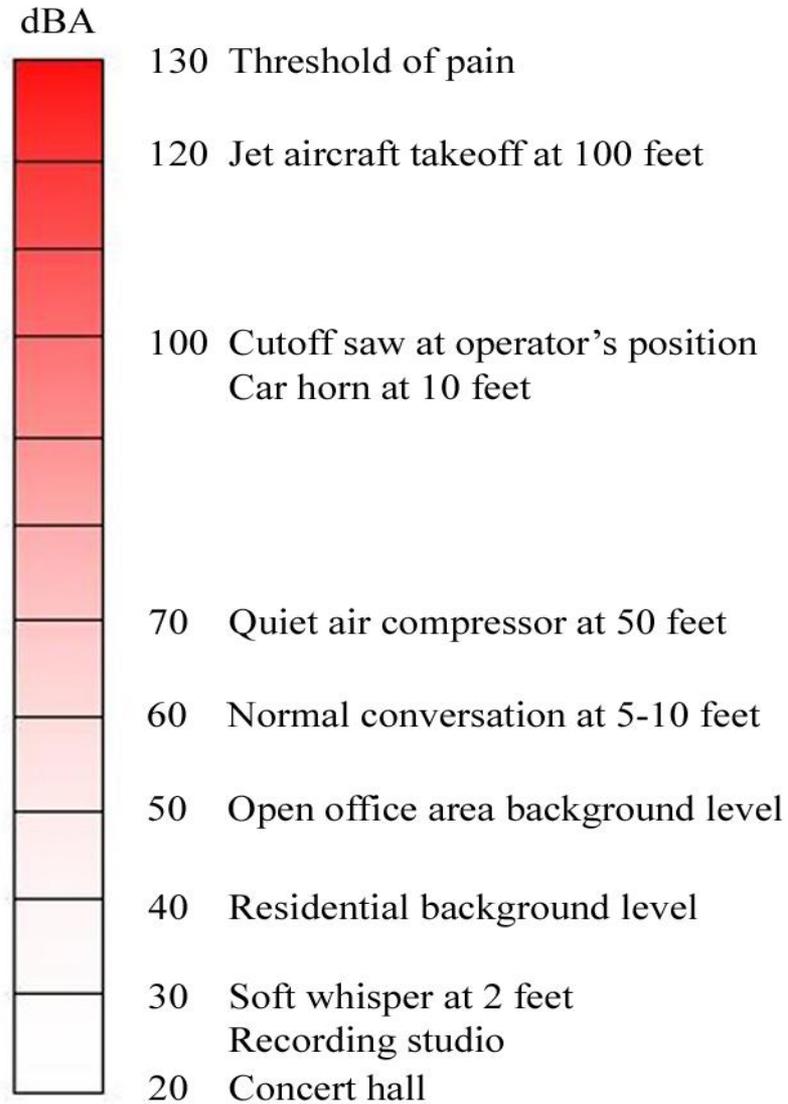
Why the dB Scale?

- ▶ Reduces the broad range of numbers to a manageable range of numbers.
 - Humans hear from 20 to 20,000,000 micro-Pascals* ...
 - In decibels, this is reduced to a range of 0 to 120 dB.

*1 Pascal = 0.000145 psi



Examples of Common Noise Levels



Source: "Environmental Noise: The Invisible Pollutant", William Cavanaugh and Gregory Tocci

Why the dB Scale?

- ▶ Eases Comparisons
- ▶ Example of the logarithmic nature:

Change in dB	Subjective Response
3 dB	Barely Perceptible
5 dB	Clearly Perceptible
10 dB	Twice as Loud

Fun Fact

The decibel named after
Alexander Graham...

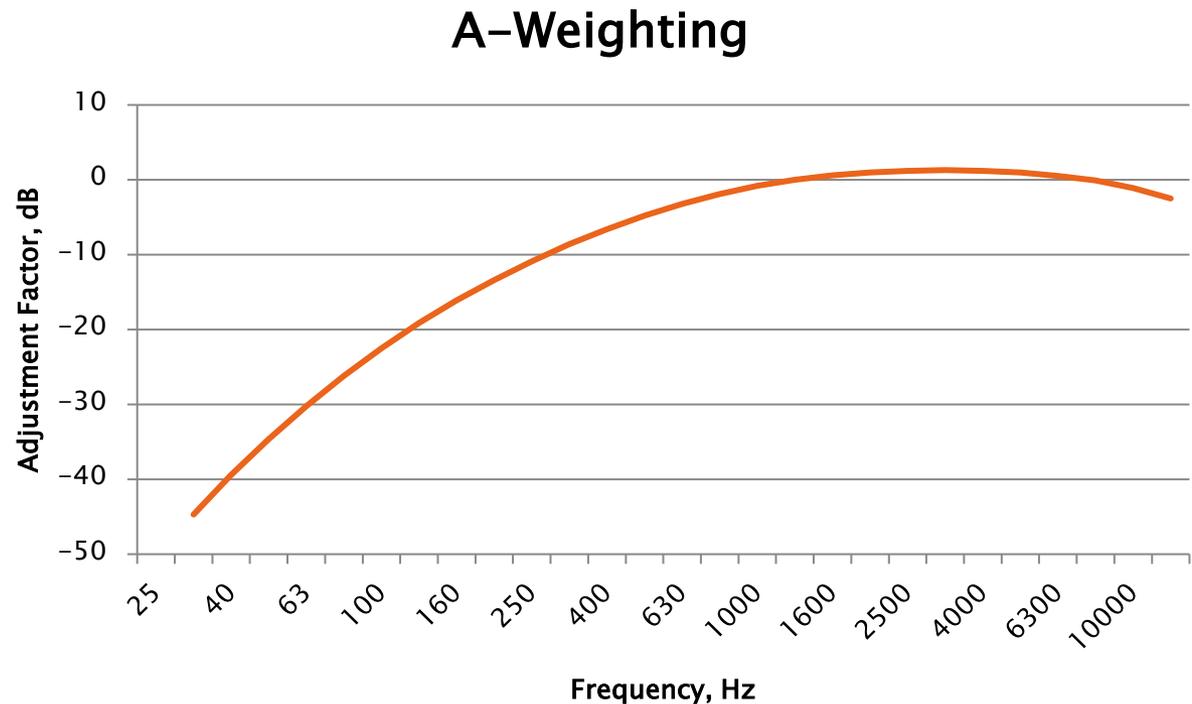


Humans aren't perfect....

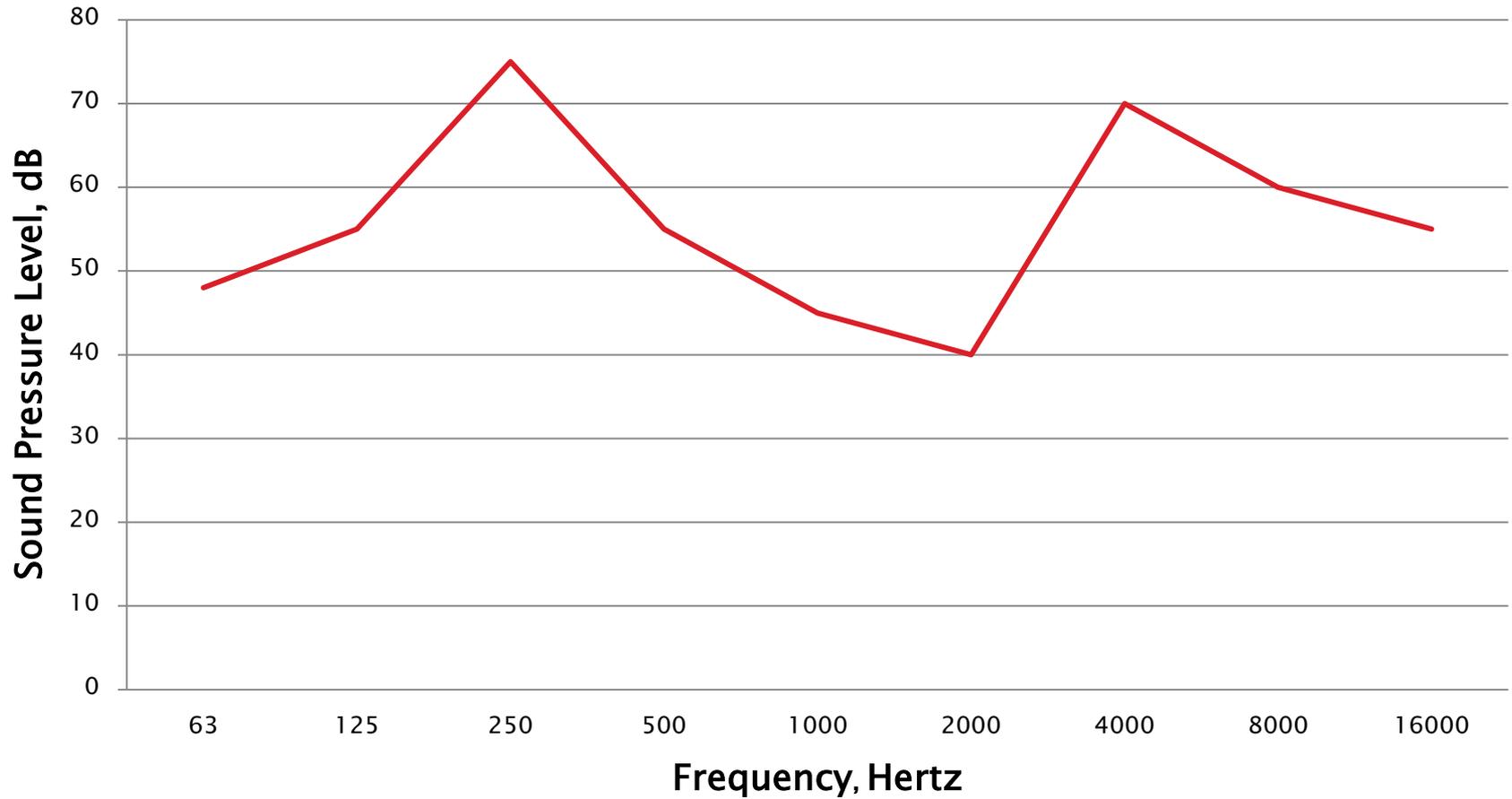
- ▶ To compensate for our inability to hear perfectly we:
 - Adjust measurements to simulate human hearing
 - This is referred to as “A-weighting”
 - Nomenclature: dBA

Measuring Units

- ▶ Typically measured using the “A-weighted” dB scale or “dBA”
- ▶ The A-weighting simulates human hearing and is generally used for overall, environmental noise measurements.



Basic Acoustics



Noise Level Measurements

- Measure using Sound Level Meter
- Noise levels measured in decibels or “dBA”
- Also measure different frequencies



So, what's loud?

You tell me....

Local Codes

- ▶ DCMR, Maryland COMAR, Montgomery County Maryland, and Fairfax County, Virginia
- ▶ ALL have similar noise codes governed at “receiving property lines.”
 - Daytime 65 dBA
 - Nighttime 55 dBA

- ▶ But 65 dBA is the level of the average human voice at a distance of 3 feet.



So how loud is pickleball...



Overall, the level from Pickleball is not that loud....

- ▶ Phoenix Noise & Vibration measurements reveal
 - ▶ 66 dBA at 25 ft
 - ▶ 59 dBA at 50 ft
 - ▶ 55 dBA at 100 ft

59 dBA at 50 feet....

So...what's all the fuss about?!

**Pickleball has a
Unique Sound**



Pickleball
VS
Spec Tennis
NOISE



YouTube video by SpecTennis

<https://youtu.be/rfP8UgluckA>

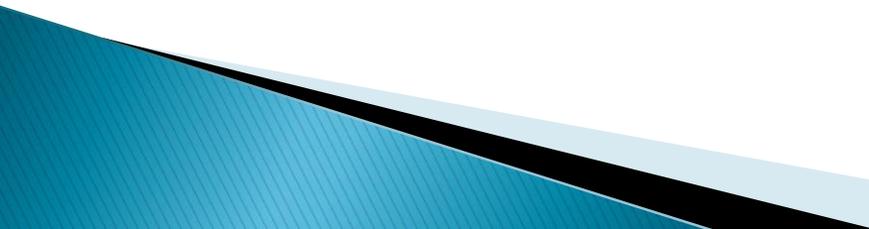
For some codes, if the noise is tonal or impulsive...

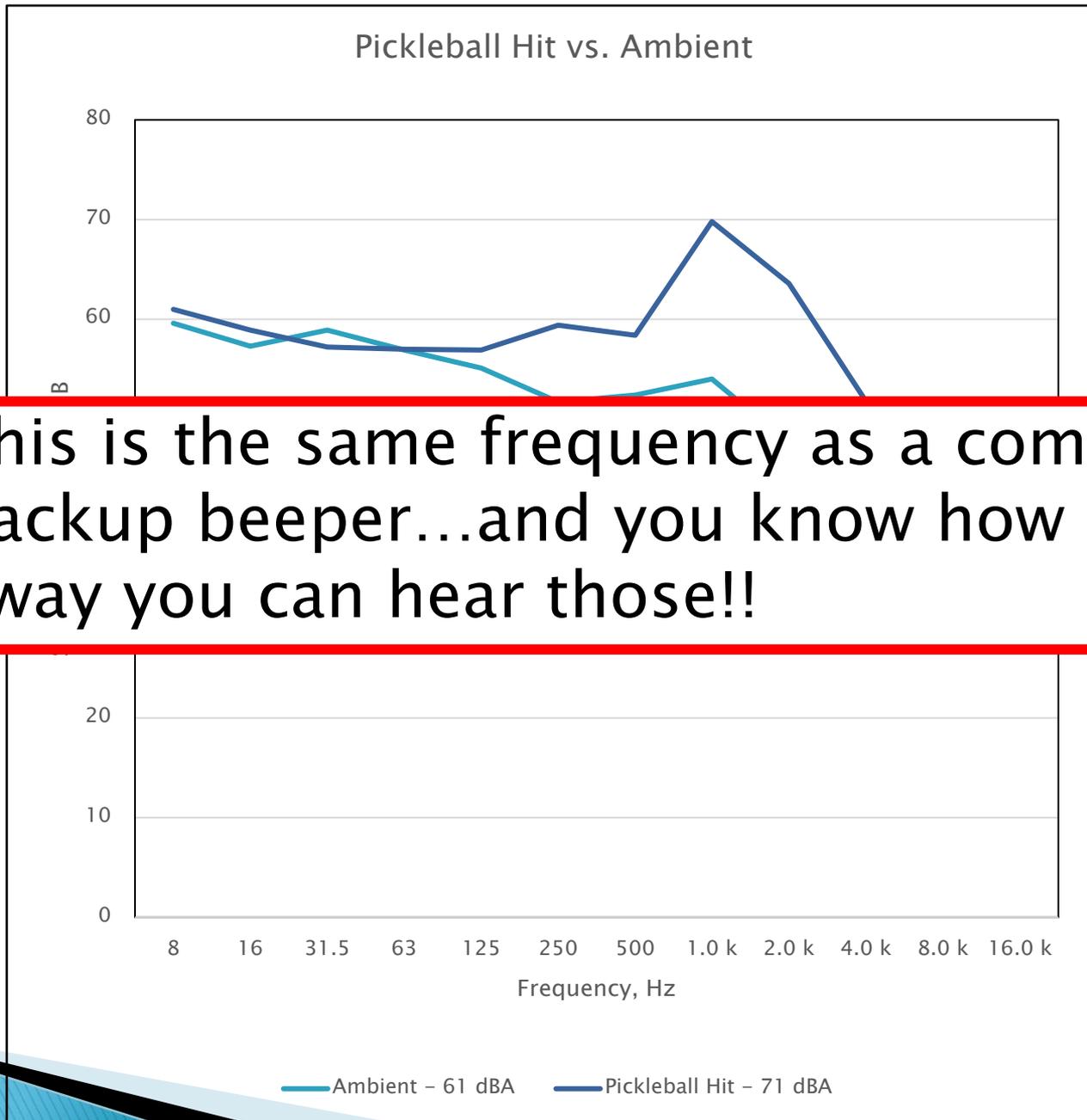
- ▶ There is a 5 dBA penalty which reduces the limits to:

Daytime 60 dBA

Nighttime 55 dBA

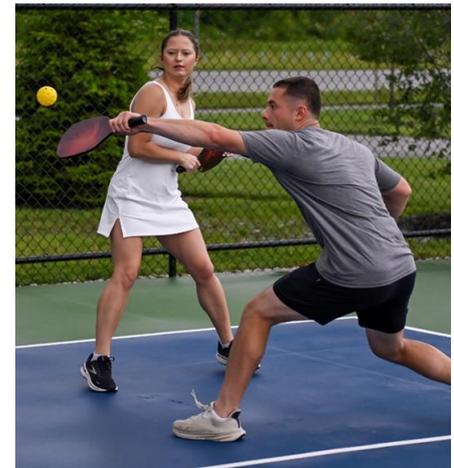
Ok, distinctly more restrictive.





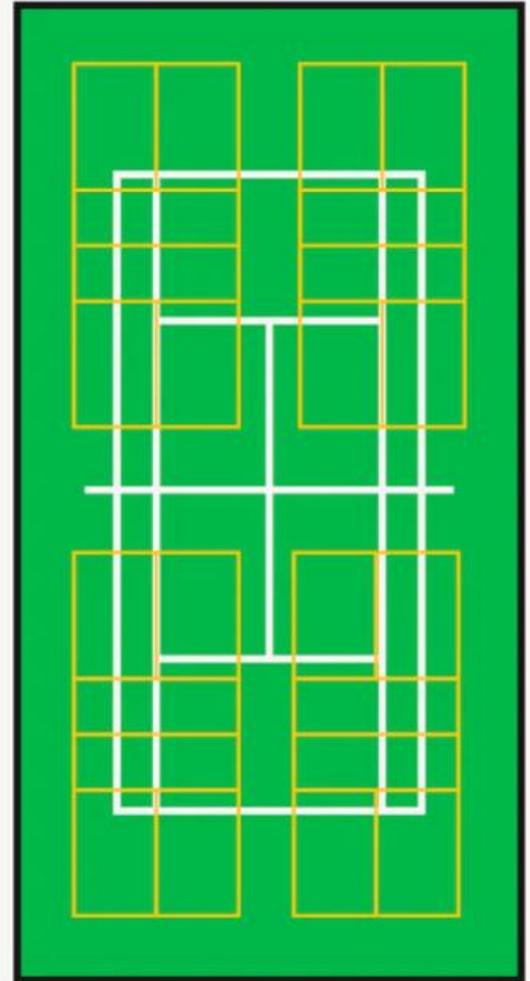
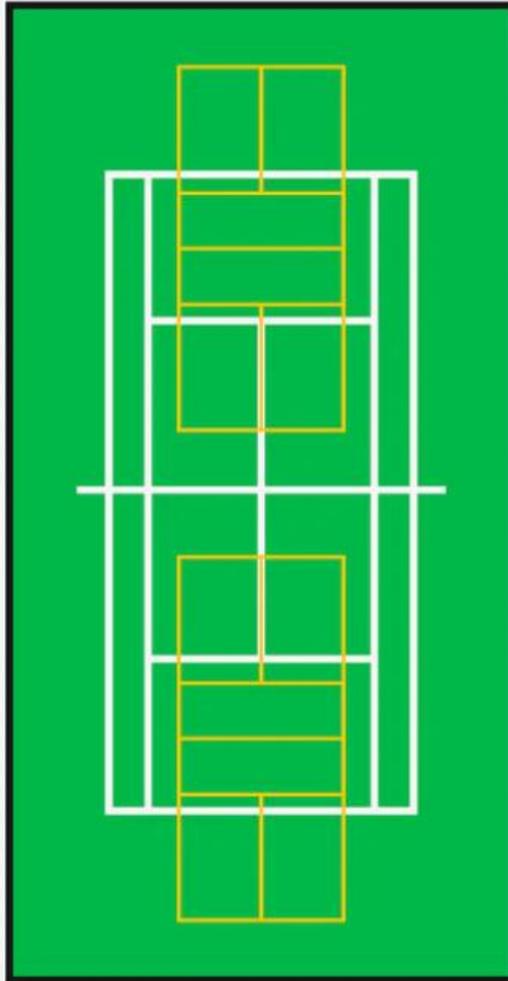
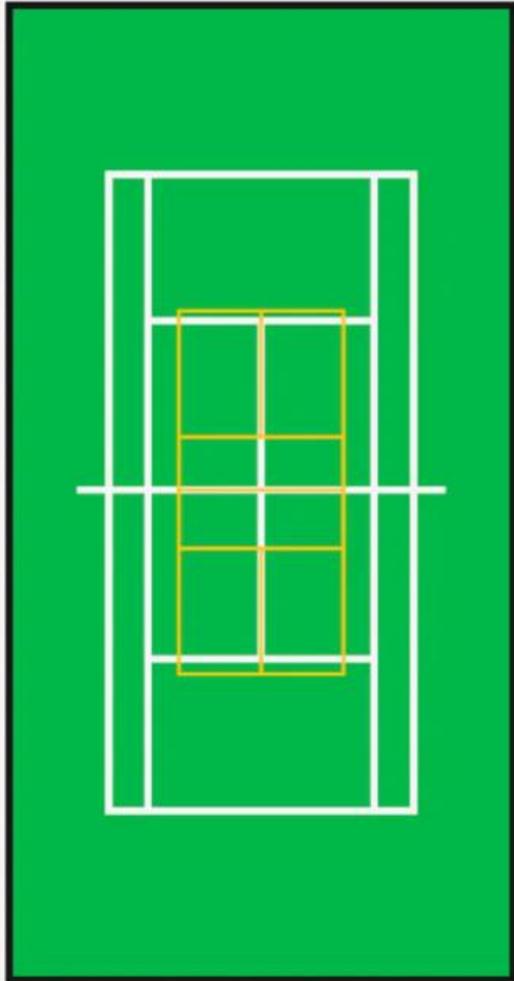
Other issues to contend with...

- ▶ Impulsiveness
- ▶ Repetition (pops per hour)
- ▶ Time of day and popularity



- ▶ Doubles are common
 - ▶ Pops are far more frequent since the distances are shorter
 - ▶ Pops are more frequent because the ball stays in play longer
 - ▶ Pops are more frequent with 4 people playing
- 

Up to 4 pickleball courts on 1 tennis court



Pickeball is extremely popular!!!

- ▶ There is a shortage of courts
- ▶ People are playing earlier and later
- ▶ We are more sensitive to noise earlier and later

Don't forget yelling....

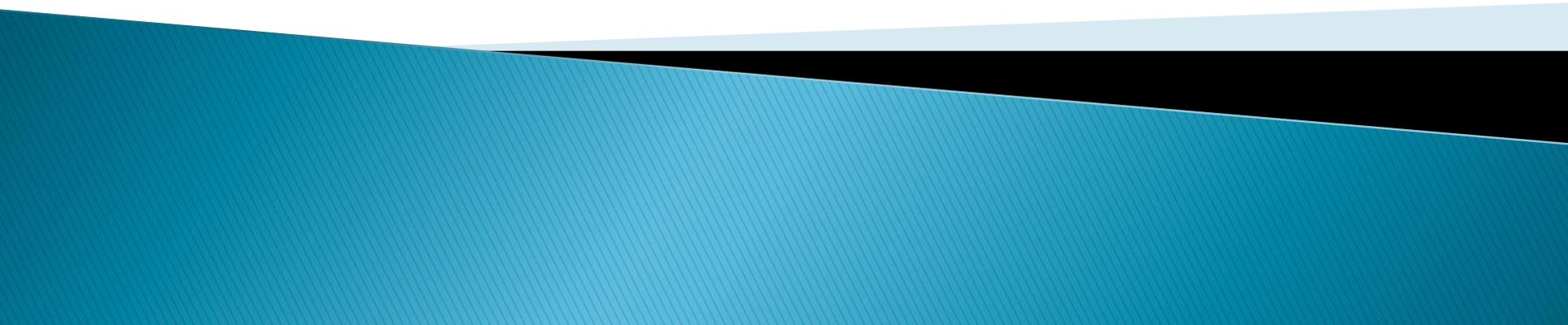


But seriously...

- ▶ While the unamplified human voice is generally not governed by noise codes...
- ▶ Talking, laughing, shouting, and certainly **YELLING** can become annoying at times.
- ▶ Especially if over a prolonged period.



Mitigation



Steps...

- ▶ Mitigate source
 - ▶ Mitigate the path
 - ▶ Mitigate the receiver
- 

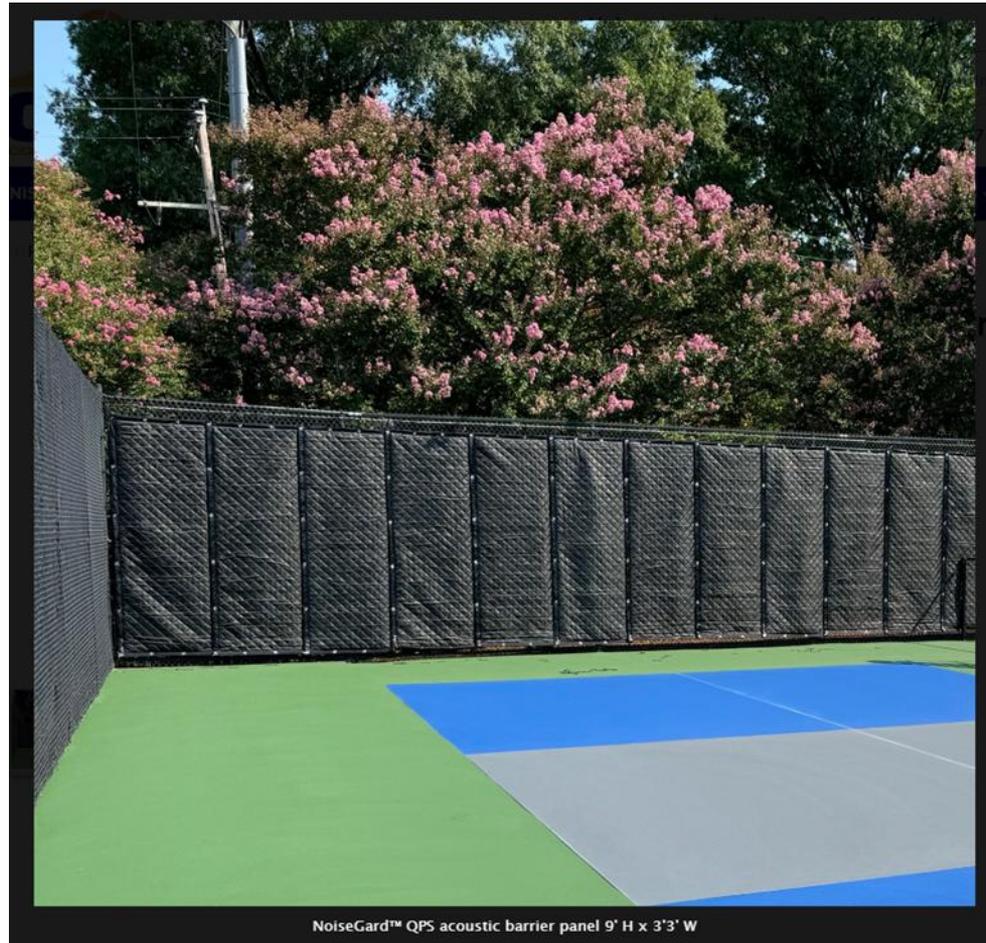
Mitigate Source

- ▶ Quieter paddles
 - YES!!!!
- ▶ Complaints on play
 - Slower
 - Poor performance
- ▶ Sound...
 - Effects play because indicates where ball is going...

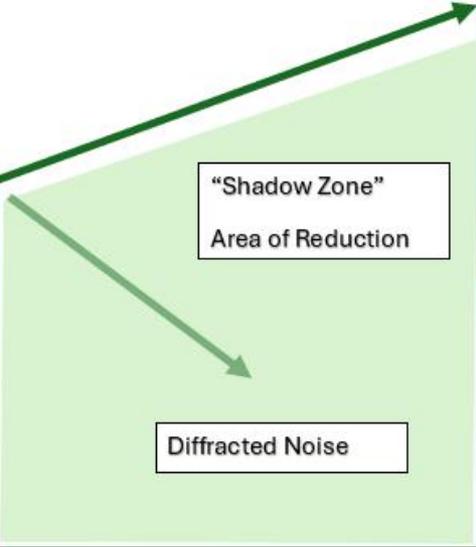


[Click to see full view](#)

Mitigate Path



Area of No Reduction



“Shadow Zone”
Area of Reduction

Diffracted Noise



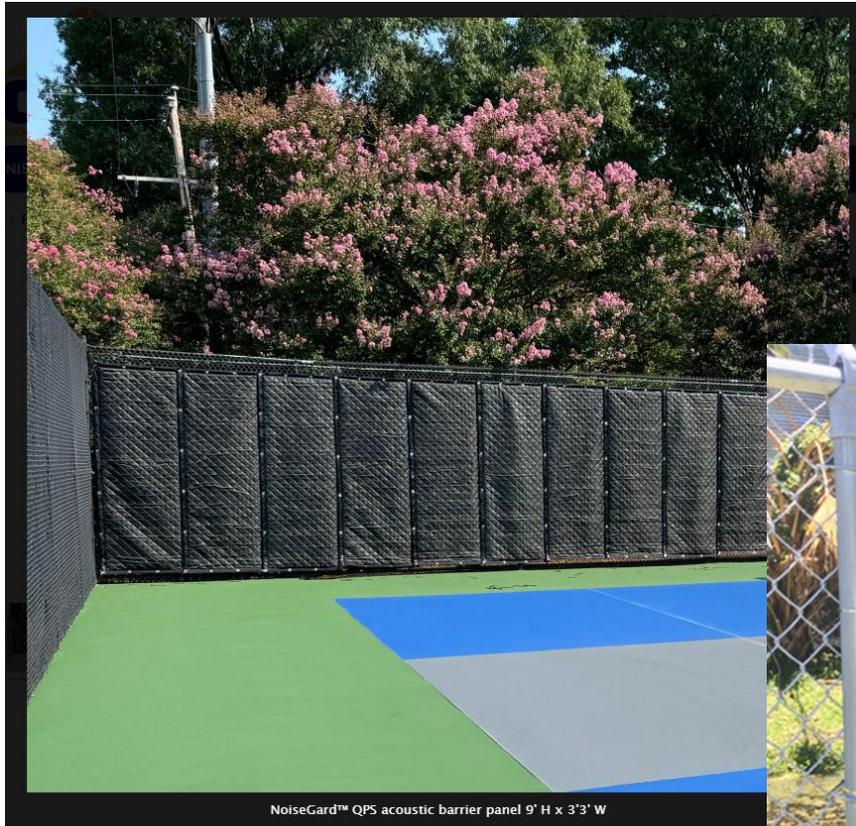
Area of No Reduction

"Shadow Zone"
Area of Reduction

Diffracted Noise



Fence mounted barrier material



Mitigate Receiver

- ▶ Localized barrier near receiver...not too effective
- ▶ Stay inside...

Outdoor to Indoor Reduction

- ▶ Typical residential construction in today's market reduces outdoor noise levels by approximately 20 dBA.
- ▶ So....

$$65 - 20 = 45 \text{ dBA}$$

Consider better windows and doors.

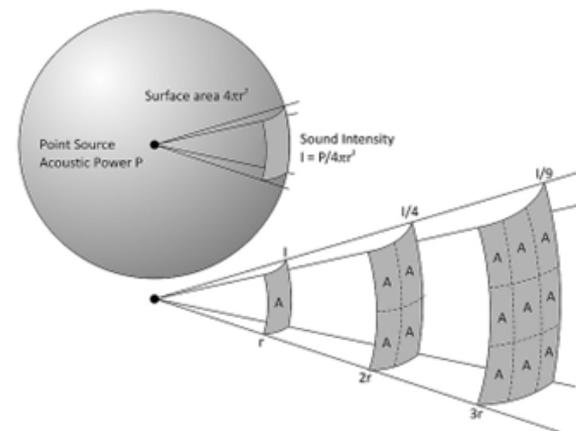


Location, Location, Location!!!

- ▶ Distance is your friend!
- ▶ If you can afford it...

Noise Reduction over Distance

- ▶ For point sources, such as pickleball pops,
- ▶ Noise Reduces 6 dBA every time the distance from the source doubles.



Soooo.....

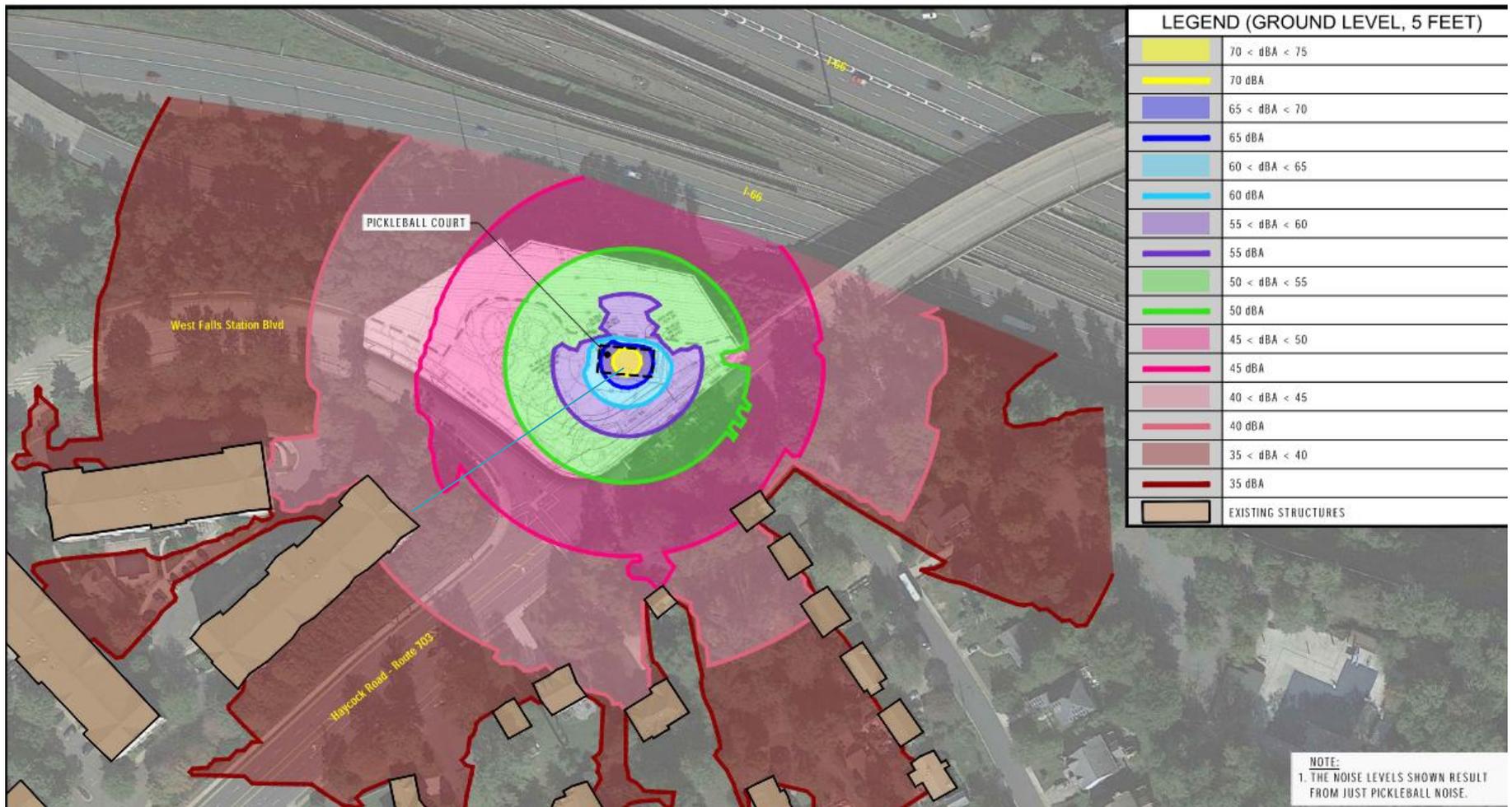
70 dBA at 20 feet
becomes

64 dBA at 40 feet
becomes

58 dBA at 80 feet
becomes

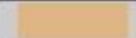
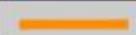
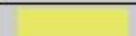
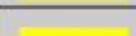
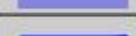
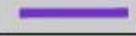
52 dBA at 160 feet
becomes

46 dBA at 320 feet



Approx 132' to 50 dBA contour from court center

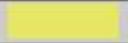
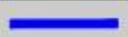
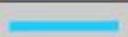
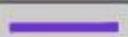
LEGEND (GROUND LEVEL, 5 FEET)

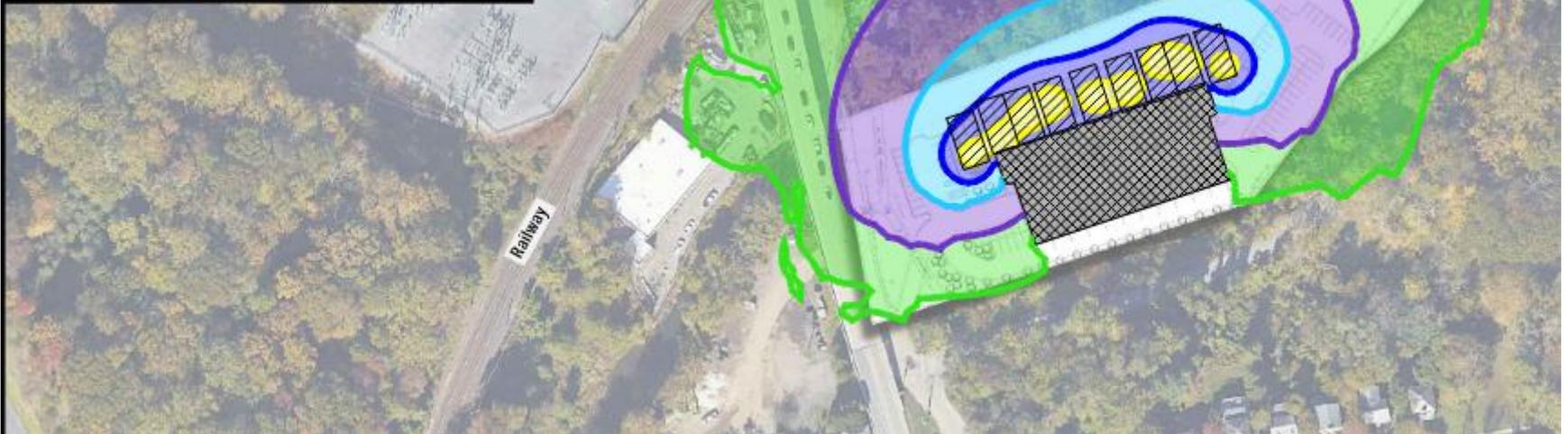
	75 < dBA < 80
	75 dBA
	70 < dBA < 75
	70 dBA
	65 < dBA < 70
	65 dBA
	60 < dBA < 65
	60 dBA
	55 < dBA < 60
	55 dBA
	50 < dBA < 55
	50 dBA
	PICKLEBALL COURT
	FUTURE BUILDING



Approx 400' to 50 dBA contour from court center

LEGEND (UPPER LEVEL, 25 FEET)

	70 < dBA < 75
	70 dBA
	65 < dBA < 70
	65 dBA
	60 < dBA < 65
	60 dBA
	55 < dBA < 60
	55 dBA
	50 < dBA < 55
	50 dBA
	PICKLEBALL COURT
	FUTURE BUILDING



To start...

- ▶ Attempt to locate pickleball courts more than 300 feet from nearest occupied area
 - ▶ Limit times of play...
 - No lights
 - may require padlocks
 - ▶ Limit number of courts
 - ▶ Install noise barriers
-
- ▶ Have a detailed noise study for the site
- 

Noise
Measurement

Unique Sound

Pickleball Noise

Mitigation

Location

**This concludes The American Institute of Architects
Continuing Education Systems Program.
Thank you.**





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