



NASHVILLE FAIRGROUNDS

SPEEDWAY

NOISE MITIGATION STUDY:

Breaking It Down



The Decibel
How Loud is Loud

Attenuation

Impact of Attenuation on Listener

Bristol Proposal and Study

Takeaways

WHAT IS THE DECIBEL?

Measurement of the intensity (energy) of sound

Based on *pressure* it takes to move the eardrum

A sound 100 times more powerful than 0 dB is 20 dB.

A sound 1,000 times more powerful 0 dB is 30 dB.

HOW LOUD IS LOUD?

Intensity	Samples
180	rocket launch
165	357 magnum revolver
150	fighter jet launch
140	threshold of pain
135	jet engine (to 140)
130	large jet airplane take off
120	lawnmower
110	full symphony orchestra
100	helicopter
95	food processor
90	bass drum
80	freight train (100 ft away)
75	toilet flushing/vacumn cleaner
70	hairdryer
65	busy street
60	Conversational speech
45	light rain
40	quiet living room/office
30	rustle of leaves
25	Whisper
10	breath

WHAT IS ATTENUATION?

Reduction of sound volume

HOW DO YOU ACHIEVE ATTENUATION?

Double the distance (from the sound source) and the intensity drops by 6dB

Reduce the intensity of the sound at the source

Provide barriers to impede sound propagation & length of exposure

Provide for sound absorptive materials

Bristol's Executive Summary : Proposed Noise Mitigation Measures

BRISTOL'S PROPOSED NOISE MITIGATION...

Limit to a total of 10 race weekends per year

Reduction in practice days

Curfews on event start and stop times

Adding engineered sound absorbing wall

New grandstand building, Track buildings

Expo building and MLS Stadium

Mandated muffler use and enforcement for all non-NASCAR racing

RESULTING IN....

-7 dBA in all areas for local/regional events – nearing a 50% reduction in perceived loudness

No appreciable difference between 2019 All American 400 and predicted NASCAR event.

Predicted non-NASCAR event mitigated sound levels to be consistent with current ambient levels.

MEASURED & PREDICTED SOUND LEVELS – BY THE NUMBERS

	Location	Measured Maximum Sound Level PLM Cars, 2019	Measured Average Sound Level PLM Cars, 2019	20 ft. Sound Wall Predicted NASCAR Lmax, 2021	20 ft. Sound Wall Predicted NASCAR Leq, 2021	20 ft. Sound Wall Predicted PLM with Mufflers Leq, 2021	Afternoon, No Race Ambient Sound Levels Lmax	Afternoon, no race, average sound levels Leq
1	500B Southgate Ave.	90	74	80-85	75-80	55-60	84	55
2	1716 Carvell Ave.	88	75	80-85	70-75	50-55	82	56
3	622 Benton Ave.	78	65	65-70	65-70	45-50	73	52
4	516 Southern Turf Dr.	91	77	90-95	80-85	60-65	68	48
5	2209 Kline Ave.	66	54	75-80	70-75	50-55	75	50
6	107 Sadler Ct.	80	59	70-75	65-70	45-50	77	52
		(note 1)		(note 2)		(note 2)		

Notes: 1 - average sound level measurement over race duration (approx 2 hours), including cautions and restarts
 2 - average sound level measurement over 15 minutes of green flag racing

1. Intensity levels measured no race

2. Intensity levels measured – maximum and averages for PLM cars 2019

3. Intensity levels measured with 20 ft sound wall with and without mufflers for PLM and Nascar

IMPACT OF ATTENUATION FOR THE LISTENER

Intensity	Samples	2019 PLM Race Max Levels No Sound Mitigation	2019 PLM with mufflers & sound wall	Nascar Predicted Avg with sound wall
180	rocket launch			
165	357 magnum revolver			
150	fighter jet launch			
140	threshold of pain			
135	jet engine (to 140)			
130	large jet airplane take off			
120	lawnmower			
110	full symphony orchestra			
100	helicopter			
95	food processor			
90	bass drum			
80	freight train (100 ft away)			
75	toilet flushing/vacumn cleaner			
70	hairdryer			
65	busy street			
60	Conversational speech			
45	light rain			
40	quiet living room/office			
30	rustle of leaves			
25	Whisper			
10	breath			

IMPACT OF ATTENUATION FOR THE LISTENER

PERCEIVED NOISE REDUCTION

dB	Actual SPL Reduction	Perceived Volume Reduction
3 dB	50.00%	18.77%
6 dB	75.00%	34.02%
9 dB	87.50%	46.41%
12 dB	93.75%	56.47%
15 dB	96.88%	64.64%
18 dB	98.44%	71.28%
21 dB	99.22%	76.67%
24 dB	99.61%	81.05%
27 dB	99.80%	84.61%
30 dB	99.90%	87.50%
33 dB	99.95%	89.85%
36 dB	99.98%	91.75%
39 dB	99.99%	93.30%
42 dB	99.99%	94.56%
45 dB	100.00%	95.58%
48 dB	100.00%	96.41%
51 dB	100.00%	97.08%
54 dB	100.00%	97.63%
57 dB	100.00%	98.08%
60 dB	100.00%	98.44%
63 dB	100.00%	98.73%
66 dB	100.00%	98.97%
69 dB	100.00%	99.16%
72 dB	100.00%	99.32%
75 dB	100.00%	99.45%
78 dB	100.00%	99.55%
81 dB	100.00%	99.64%

	2019 PLM Race Max levels	2019 with Mufflers and Sound Wall, Avg.	Average PLM Attenuation	Perceived Volume Reduction
5008 Southgate Avenue	90	55-60	30	88%
1716 Carvell Avenue	88	50-55	38	92%
622 Benton Avenue	78	45-50	28	85%
516 Southern Turf Drive	91	60-65	26	83%
2209 Kline Avenue	66	50-55	11	53%
107 Sadler Ct.	89	45-50	39	93%

	Predicted Nascar with 20 ft Wall, max	Average Nascar with 20 ft wall, average	Average PLM Attenuation	Perceived Volume Reduction
5008 Southgate Avenue	80-85	75-80	5	32%
1716 Carvell Avenue	80-85	70-75	5	32%
622 Benton Avenue	65-70	65-70	0	no change
516 Southern Turf Drive	90-95	80-85	10	50%
2209 Kline Avenue	75-80	70-75	5	32%
107 Sadler Ct.	70-75	65-70	5	32%

** Retrieved from <https://www.acousticalsurfaces.com/soundproofing>

SIMPLE MATH...OR NOT

CAR SOURCE SOUND LEVEL COMPARISONS				
Car Type	Measurement Source	Measurement Type	Measured Levels	Normalized Levels
2019 Pro Late Model, Practice	Measured at Nashville, 2019	Lmax, slow (10 min)	107 dBA at 105'	107 dBA at 100'
Pro Late Model Regulations	From Email with Nashville		97 dBA at 100'	97 dBA at 100'
NASCAR at COTA, Single Car, Straight	Measured at COTA, 2021	Lmax, slow (5 sec)	112 dBA at 95'	112 dBA at 100'
NASCAR at COTA, Single Car, Turn	Measured at COTA, 2021	Lmax, slow (5 sec)	98 dBA at 88'	97 dBA at 100'



$$\begin{aligned}
 &97 \quad 97 \quad 97 \quad 97 \quad 97 \quad 97 \\
 &= 97 + 3 + 1 + 1 + 1 + 1 \\
 &= 104 \text{ dB}
 \end{aligned}$$

TAKEAWAYS

PLM see greatest attenuation with combination of mufflers and sound wall, from 11dB to 30dB attenuation

Nascar races see 25 - 50% attenuation with sound wall, no muffler attenuation

53 – 93% perceived quieter for PLM races

32 – 50% perceived quieter for Nascar races

Additional noise mitigation occurs with future construction

Heat maps offer comparisons by neighborhood