Field Attenuation of Individual Orchestra Shields

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Introduction

- Musicians are at a higher risk for noise induced hearing loss on the basis of their age (2,3)
- Acoustic shields offer a beneficial role in reducing noise exposure to musicians by blocking sound waves which are generated behind a musician
- In the previous study, it was determined that diffraction from the walls in a non-orchestral setting was likely a significant factor in the low attenuation values measured (1)
- This study was conducted at the orchestra pit of the **Four Seasons Centre for the Performing Arts** in Toronto (Figure 1)
- Professional musicians were asked to play excerpts from Act 1 of Tchikovsky's Swan Lake using either a **flute, trombone or trumpet** to provide coverage for low, medium and high portion of the sound spectrum
- To compare results with the previous study, same shields were used to measure attenuation: Manhasset and Wenger (Figure 2 and 3 respectively)

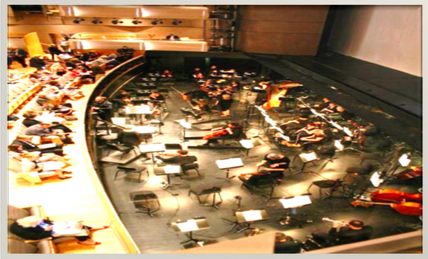

Figure 1: Orchestra Pit at the Four Seasons Centre for the Performing Arts

Objective

To obtain the attenuation values for Manhasset and Wenger Shields, and assess their effectiveness in reducing noise exposure to orchestral musicians

Methodology

- 2 dosimeters were placed on both shields: one in front of the shield facing towards the musician and the other behind, difference between the two would give attenuation values (shown in table 1)
- After reaching consensus to run the trial, two experimenters simultaneously turned on their designated dosimeters (2 on each shield) and nonverbally signaled the musician to play their instrument (one at a time)
- Measurements were simultaneously collected from the two shields via dosimeters, which were located at an angle of 45^{o} and a distance of 1m from the musician
- Measurements were also manually recorded in notebook for later reference and comparison
- A total of 6 trials were conducted, 2 for each instrument: Trumpet, Flute and Trombone
- After conducting the experiment, data was obtained electronically from the dosimeters and analyzed

Results

Trials:	Instruments:	Shield		Attenuation*	Average Attenuation	Standard Deviation
		Front	Back			
		Manhasset				
1	Trumpet	103.5	92.8	10.7	10.4	0.4
	Flute	91.9	82.8	9.1	8.1	1.4
	Trombone	93.5	85.9	7.6	9.05	2.1
2	Trumpet	103.2	93.1	10.1		
	Flute	90.7	83.6	7.1		
	Trombone	96.1	85.6	10.5		
		Wenger				
1	Trumpet	101.2	95	6.2	5.9	0.4
	Flute	90	83	7	6	1.4
	Trombone	95.3	89.3	6	6.5	0.7
2	Trumpet	99.5	93.9	5.6		
	Flute	90.3	85.9	5		
	Trombone	96.2	89.2	7		

Note: Attenuation = Leq Front - Leq Back, dBA

Table 1: Attenuation measurements obtained from the experiment

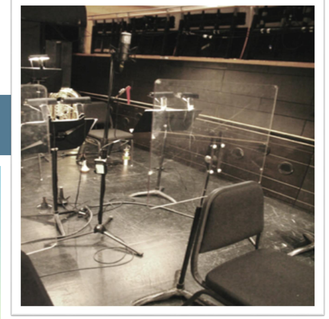

Figure 2: Manhasset Shield

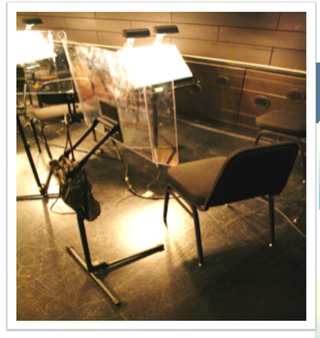

Figure 3: Wenger Shield

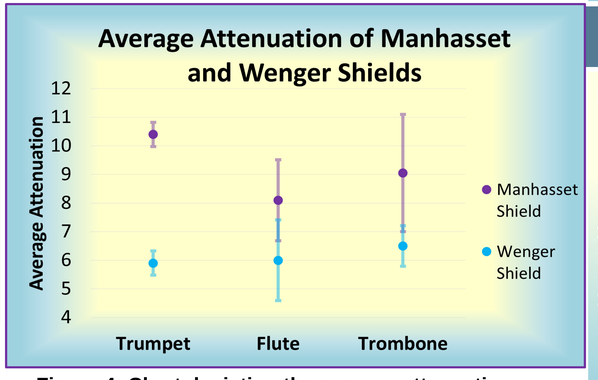

Figure 4: Chart depicting the average attenuation values of Manhasset and Wenger shields

Discussion

- Manhasset shields outperformed Wenger shields as attenuation values obtained for it were larger as shown by figure 4
- Manhasset's larger surface area is likely the reason for its larger attenuation values
- Manhasset shield seems significantly better able to reduce noise exposure from instruments playing at higher sound spectrum than Wenger (trumpet versus flute)
- Measured attenuations are larger than previous study, supporting the earlier assertion regarding diffraction from the walls
- These attenuation values may be smaller in real live orchestra, as multiple instruments will be playing simultaneously and sound may be penetrating from multiple sites
- Both shields are able to reduce noise level, but their average attenuation is less than 10 dBA

Conclusion

- Attenuation values measured for both shields are neither satisfactory nor significance in reducing noise being able to reach musician's ears.
- Manhasset's overall performance is better than Wenger's
- Future Recommendation: Conduct a spectral analysis with a particular focus on frequency measurements to assess the effectiveness of the shields in reducing high frequency exposure

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