Name(s)	Project Number
Justin G. Lee	**S1809**

Project Title

Sound Resonance: How Wood Properties Affect Sound

Abstract

Objectives/Goals
I want to understand how hardness and density of different types of wood affect the amplitude and power of sound propagation. What type of wood resonates sound the best and would be best for constructing a string bass.

Methods/Materials
Sound, density, and hardness measurements were collected on 8 types of wood boards - birch, Cambara mahogany, maple, MDP (Medium Density Fiberboard), poplar, red balau, red oak, and redwood. Sound from a music box mechanism placed on top of the wood was recorded and analyzed with Raven Lite 1.0 software. Weight and dimension of each wood board were measured to calculate the density. The amount of force needed to penetrate a wood screw tip 3/16" into each wood was measured using a load cell to determine the hardness of the wood. Correlations were made between the amplitude and loudness of the sound from each type of wood and the corresponding hardness and density of the wood. The melody recorded on each wood was listened to carefully to evaluate the sound quality from each wood.

Results
The hardness of the wood in the order of hardest to softest was red balau, maple, birch, red oak, MDF, mahogany, poplar, and redwood. The density of the wood followed the same order as the hardness except for MDF. Red balau, the hardest wood, had the largest amplitude of 8930MU and resonated the loudest at 109.5dB at 2220Hz frequency. Redwood, the softest wood, had the lowest amplitude of 3580MU and resonated at a lower level of 87.0dB on loudness at 1480Hz.

Conclusions/Discussion
My experimental results showed that denser and harder wood such as red balau, birch, maple and red oak produced larger amplitude and higher power sound. This supported my hypothesis that denser and harder wood had less room for the sound to get absorbed; instead allowed sound to vibrate more on the surface of the wood. However, the density and hardness of the wood affected the tone quality of sound as well as the volume, pitch and other properties of sound. The red balau and other harder wood though produced a louder sound for the melody, but the sound of the notes were not evenly distributed. Softer and less dense woods like poplar emitted sounds that was very soft, muffled, almost muted and the resonance that rang from the wood was very rich and subtle. I would prefer using poplar to build my next bass.

Summary Statement

My project examines how wood properties affect sound resonance and what type of wood would be best for constructing a string bass.

Help Received

My mom's work loaned me the load cell. My dad assisted with constructing the load cell platform.