STRUCTURAL ACOUSTIC COUPLING RESONANCE OF HINDU TEMPLES

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Abstract- Some ancient constructions over the world exhibit acoustic resonance chambers [1, 7]. Acoustic resonance of Pyramids [1], Stupas [2,6,7], Cathedrals [3,4,12] and Mosques [5] have been studied and they closely resembles the Alpha, Theta and Gamma waves of EEG spectrum [11]. Moreover, these EEG frequencies corresponds to the alert calmness that conducive for mental composure and general well being [6, 7]. Research has also showed that these frequencies are also closer to the Shumann resonance frequencies [9,10]. Even though, acoustic resonances are in the mechanical vibration domain the researchers have found these vibration energies may have transformed into equivalent electromagnetic frequencies (EEG and Shumann bandwidth) [1,6]. This conversion is mostly may have achieved in ancient resonance chambers by properly using special quartz crystals [2,6,7] and getting them to vibrate by acoustic energies. In addition, some of these acoustic resonance chambers also have vibrating frequencies which are octaves of 528 Hz and 432 Hz [13]. These frequencies are also known to be healing frequencies commonly used in sound therapies [14]. Limited research has been done to understand the acoustic resonance chambers of Hindu Temples. Two types of acoustic resonance chambers can be found in Hind Temples. The first one is the "Moolastana" chamber and the other is the inner core (path). We have studied, and measured acoustic resonance frequencies of inner core chamber in a Hindu Temple in Sri Lanka

Index Terms- Structural acoustic resonance, Hindu Temples, Finite element modelling and reverberation time

I. INTRODUCTION

The acoustic resonance was measured by using a microphone placed in selected locations of the inner core chamber while exiting the inner core with monotone frequencies. Frequencies from 35Hz to 1200Hz were used for the experiment and the sound levels at each tone is measured and the relative loudness spectrum is obtained reference to the loudness at the speaker. The locations are selected in the far field of the as shown in the Figure 1.0 maintaining a minimum distance from the sound source using the equation 1. A minimum of quarter wave length is preserved.

$$d_{min} = 2\sqrt{\frac{V}{cT}} \text{-----(1)}$$

Where, d_min is the minimum distance needs to be maintained and V is the volume of the inner core. C is the velocity of sound (345m/s) and T is the expected minimum reverberation time (taken as 100ms).

$$Relative\ Loudness = 10\log\left[\frac{Sound\ power\ at\ the\ location}{Sound\ power\ at\ the\ Speaker}\right] \text{---------(2)}$$

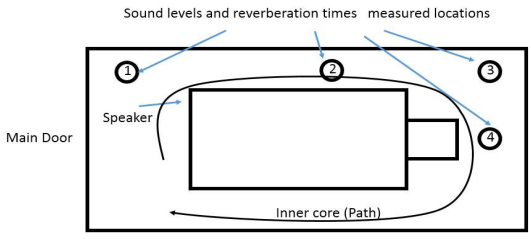

Fig 1.0 Plan of the Temple and the location of the speaker and sound level measurement points

Due to the symmetry of the inner core only one side sound level measurements were taken at points shown in Figure1.0 . Also the measurements were taken while the Temple doors were closed. Sound level at the speaker is taken as 0dB.

Reverberation times (RT) are measured in the inner core at the points shown in the Figure 1.0. Sound levels recordings were taken starting before the source is cut off and continued after the source is cut off until reverberation cannot be no longer detectable(more than 8 seconds). Frequencies from 35 Hz to 560Hz were used to energize the inner core during and three sound traces were recorded for each frequency and the average is taken

The RT is obtained when sound levels decay bellow 60dB by measuring the times at -5dB (t_{-5}) and -35dB(t_{-35}) levels and using the equation 2.

$$RT = \left[\frac{60}{(-5-(-35))/((t_{-5})-(t_{-35}))}\right] \text{-----(3)}$$

A typical measured acoustic signal and estimation of the RT is shown in the Figure 2.0

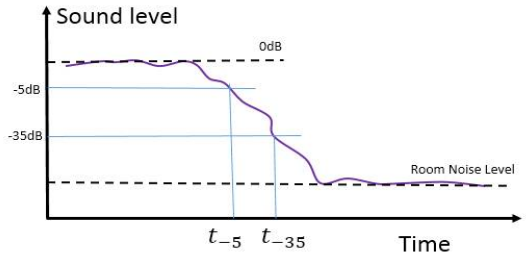

Figure 2.0 RT measurement