Acoustic characteristics of road traffic noise and casement windows in Vietnam

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Keywords: traffic noise, horn sound, honking pattern, acoustic characteristic

ABSTRACT

Vietnam is a developing country in Southeast Asia, and it is currently struggling with many environmental issues. The traffic noise in Hanoi and Ho-Chi-Minh city were characterized by relatively high noise exposure levels due to the large number of motorbikes and frequent horn sounds. High noise exposure of more than 75 dB(Ldn) is characteristic of road traffic in many places. On the other hand, casement windows consisting of two wooden frames are widely used in those cities. However, these windows prove to be impermissible to noise level because the window ventilating slits serve as a direct pathway to allow traffic noise to enter the home. The acoustic characteristics of road traffic noise and the casement windows at present are experimentally considered in present work.

1. INTRODUCTION

Noise pollution due to road traffic is a major global concern because of its negative impact on the quality of life in communities everywhere. In Vietnam, traffic noise has become an increasingly noticeable and serious problem in large cities. The number of motorbikes in

Vietnam has reached 20 million—one of the highest per capita levels in the world—and motorbikes account for nearly 96% of all local transportation. In the capital, motorbikes serve up to 85% of the population's travel needs, which results in chaotic traffic flow and excessive horn blowing throughout the day[1][2]. On the other hand, casement windows consisting of two wooden frames that can be opened and closed at various angles are widely used in those cities. The windows are typically opened during the day for air, naturally ventilating the room, and closed at night or when it rains. Even when closed, room ventilation is still achieved because the windows are constructed with ventilating slits. However, the annual increase in traffic noise and number of motorcycles and automobiles have rendered these windows to be useless because the ventilating slits on these windows serve as a direct pathway for traffic noise to enter the home. Even when windows are closed, road traffic noise level does not decrease inside the room[3]. Therefore, most homes have to supply their casement windows with glass panes and be closed them almost all day. The acoustic characteristics of road traffic noise with effect of horn sounds and the casement windows in present are experimentally considered in present work.

2. CHARACTERISTIC OF ROAD TRAFFIC NOISE WITH AND WITHOUT HORN SOUNDS

Patterns of honking horn sounds frequently used in Vietnam are shown in Fig. 1. The time interval t varies depending on the distance from the object, running speed, danger level etc. Motorcycles often have a classic bulb horn, operated by squeezing a rubber bulb attached to a metal horn. Squeezing the bulb forces air through a steel reed located in the throat of the horn, making it vibrate, produce a single note. The flaring horn matches the acoustic impedance of the reed to the open air, radiating the sound waves efficiently, making the sound louder.

Sound levels are approximately 105–112 decibels and typical frequencies for a pair are 380–440 Hz and 340–370 Hz in general.

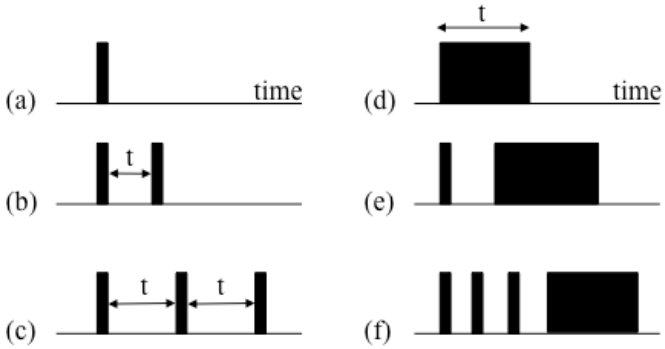

Figure 1 Pattern of honking horn sound frequently used in Vietnam

Figure 2 shows the 1/3 octave band frequency of horn sound patterns (a), (d) and (f). We can see that the sound spectrum of the horn sound has many overtones spread out over a wide frequency range. In additionally, the levels of whole frequency components are different depend on the operation pattern of horn sound. Needless to say that the overall level is increased when the honking number increases.

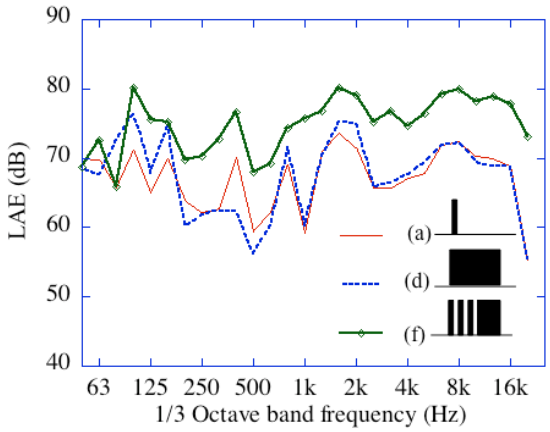

Figure 2 Frequency analysis of horn sound patterns (a), (d) and (f)

Figure 3 shows the frequency analysis of road traffic noise with and without horn sounds obtained from measurement results.

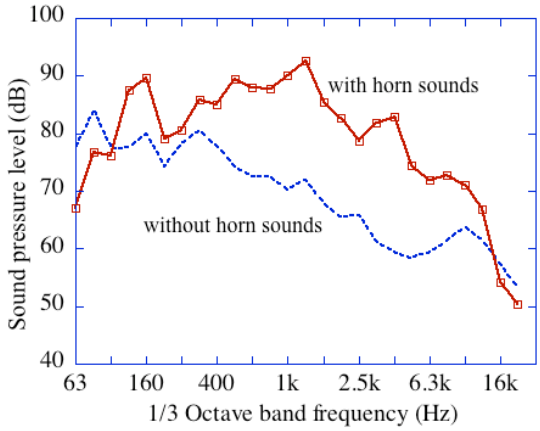

Figure 3 Frequency analysis of road traffic noise with and without horn sounds

3. ACOUSTIC CHARACTERISTIC OF CASEMENT WINDOWS

An experiment was conducted to verify the actual sound attenuation characteristics of casement windows and glass panes. Two sound level meters (SLM) RION SL-22 and Data Recorder DA-20 were used in our experiment. These sound level meters were installed on the second floor of the house which facing the road at the distances of 12m from a road shoulder. Distance between the sound level meters and windows was 1m.

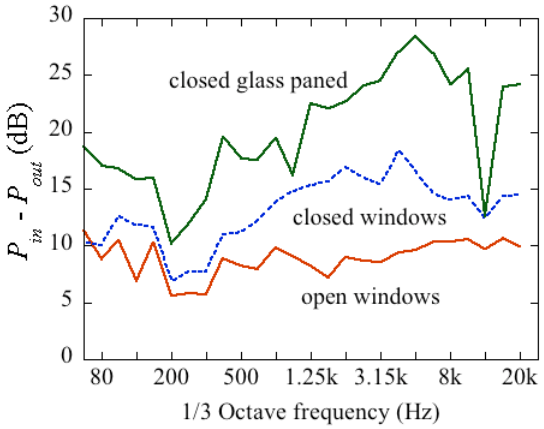

Figure 4 Attenuation obtained inside the house with closed windows or glass panes

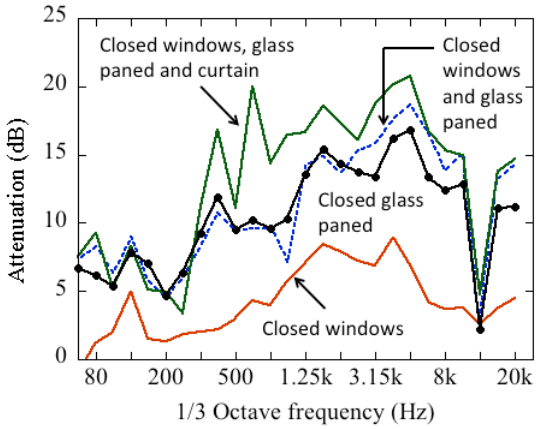

Figure 6 Attenuation obtained inside the house

The casement windows have the dimensions of 900mm x 1530mm which consisting of two wooden frames with 34 slits （300mm x 7mm）for each flame. The glass panes consisting of two wooden frames with 10 pieces of glass (130mm x 240mm) for each frame. Figure 4 illustrates the measured results of attenuation obtained inside the house with closed windows or closed glass panes. The results demonstrate that the difference between the SPL when opening and closing the glass paned is 10dB at maximum. The obtained attenuation when opening and closing the windows is 3 dB as maximum.

Next, the measurements were conducted with cases of closing both of windows and glass panes; closed windows; glass paned and curtain. The results show in Fig. 5 demonstrate the difference between the outside SPL and those of inside is 12dBA at maximum when closing all of windows, glass paned and curtain.

4. CONCLUSIONS

Road traffic noise in Vietnam is characterized by high noise exposure and frequent, impulsive horn sounds. Sound pressure level and frequency characteristic of horn sound vary according to the honking patterns.

Although the road traffic noise level is reduced from 10dB to 15dB inside the room, people feel much less disturbed by the noise. However, people have to cope with stifling heat or have to use some equipment such as air-conditioners to maintain a comfortable indoor temperature while the windows are closed.

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