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Prevention of Noise Pollution caused by Highways in Settlement Areas via a Noise Insulation System

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Abstract

The noise, which is taken as unimportant at first glance, had become one of the most important factors, causing pollution of environment, because of civilization. Together with the industrial development, mechanization in work places, increase in the number of highways, increased traffic load had made the noise an important problem in pollution and prevention of environment. In this project prevention of the noise caused by the intensive traffic and heavy vehicles in highways in settlement centers is aimed. When preparing the noise barrier system, it is considered that a double glass vacuumed insulation system placed on highway sides can prevent the noise, with the thought that the sound cannot propagate in space. A vehicle had been located and moved in the model road, and simultaneous noise measurements had been performed during the movement on both the road and outside of the double glass insulation system. After the results of noise measurements it is seen that the noise decreases by 14%-17% and reaches to acceptable normal conservation level 57-64 dB (decibel). Double glass insulation system had also prevented the panoroma pollution.

Keywords: Noise pollution; Noise barriers; Vacuumed insulation systems

Introduction

Most of the studies performed denote that main cause of the noise in our living environment is traffic. The noise, which we can define as unwanted and irregular sounds, participates greatly to the environmental pollution, and affects human health in psychological and physiological aspects. When the noise level reaches to 35-40 dB people start to complain for the noise in general. When we classify the effects according to noise intensity we see that unwanted noise has psychological effects in between 30-60 dB, has both physiological effects on operation of the organism and psychological effects, and in between 90-120 dB has negative effects firstly on ears [1,2]. By following these aspects, prevention of the noise cause by the heavy vehicles and intensive traffic in highways in especially settlement areas is aimed in this project.

Theory

Definition of noise

The noise, which is identified as 'irregular voice' scientifically, is an 'acoustic fact', causing nasty feelings, or defined as mass of unlike, undesirable voices. This definition of noise denotes its relative nature [1]. Normal noise level accepted by International Standard Organization (ISO) is 58 dB [3]. When the noise level reaches to 35-40 dB people start to complain for the noise in general. When noise is classified according to intensities, undesired noise has psychological effects between 30-60 dB, psychological and operational effects on organism between 60-90 dB and has effects especially on ear as an organ between 90-120 dB [4,5]. The noise, excluding the natural noises, is a problem faced in contemporary societies. Noise sources diversify with the increasing urbanization and industrialization. Noise sources can be different from country to country, according to cultures of the societies. However, the main difference in the determination of standards caused by the owned technology and utilized tools.

Traffic noise

One of the most important noise sources in society is the traffic noise. Researches performed for relative ordering of environment problems caused by various noise sources, showed that traffic noise is greatly higher than the noise caused by airports. Continuous increase in highway transportation had also increased the intensity of traffic noise. Therefore administrative precautions had been taken in many of the industrialized countries to control the traffic noise [6-9]. The most dangerous noise source coming from the highways comes from the heavy trucks. The noise becomes effective with the increasing truck number.

The prevention of traffic noise

The prevention of the continuously disturbing noise caused by the motor vehicles (among these vehicle are car, bus, minibus, truck, diesel motor train and electric train) in Turkey and in our living environment had given a chance for us to make this project with the help of our advisor. In this project prevention of the noise caused by the intensive traffic and heavy vehicles in highways in settlement centers is aimed. When preparing the noise barrier system [6,8,10], it is considered that a double glass vacuumed insulation system placed on highway sides can prevent the noise, with the thought that the sound cannot propagate in space (Figure 1).

Material and Methods

A noise insulation system had been constructed to decrease the traffic noise, which is the first among the noises caused from the living

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environment, to an acceptable level, which will not affect people in city centers negatively, determined in Regulation on Noise. Propagation characteristics of the sound in mediums had been considered when preparing this system. A vacuumed (in 0.1 mmHg pressure) double glass system placed on road sides on a model, by considering the sound characteristic that the sound cannot propagate in space.

For measurements, LUTRON SL-4010 and YF-20 dB had been used after calibration with a standard PM 6600 Philips brand dB. Moreover, 2 microphone-2 preamplifier-2 line/guitar Tascam US-122 sound card is connected via USB 2.0 connector to a notebook computer, and measurement results, obtained via the BEYERDYNAMIC MM-1 microphone, had been displayed on computer.

Results and Conclusion

A vehicle had been located and moved in the model road, and simultaneous noise measurements had been performed during the movement on both the road and outside of the double glass insulation system. After the results of noise measurements it is seen that the noise decreases by 14%-17% and reaches to acceptable normal conservation level 57-64 dB (decibel) [2,3,5,8]. Double glass insulation system had also prevented the panoroma pollution (Figures 2 and 3).

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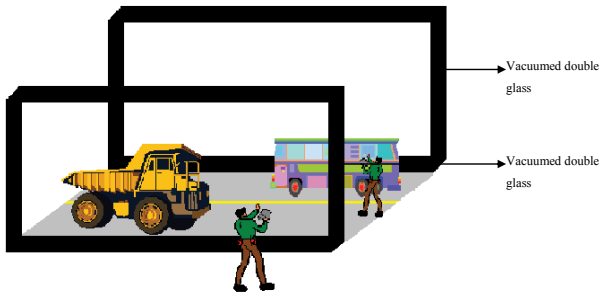

Figure 1: Highway noise insulation system.

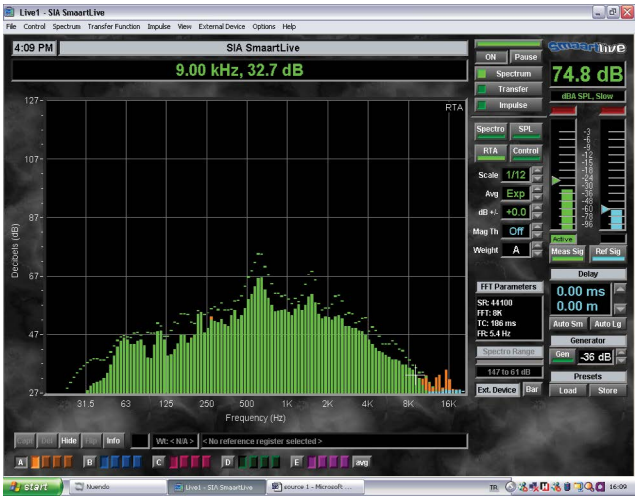

Figure 2: Noise measurement result taken in highway.

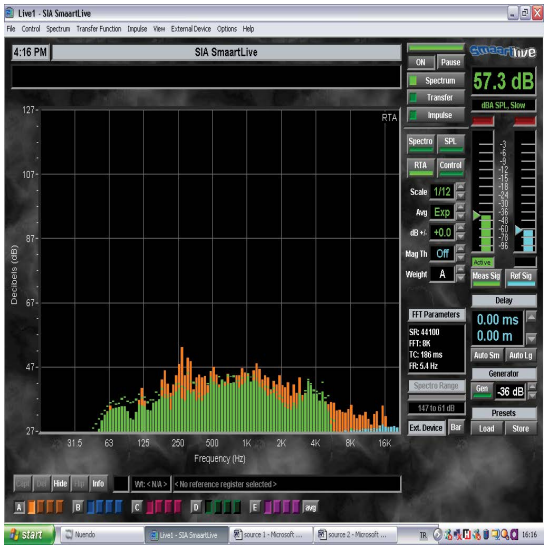

Figure 3: Noise measurement result taken outside the highway in front of the insulation system.

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