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The Prediction of Reflection Noise and Its Reduction by Shaped Noise Barriers

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Abstract : In consequence of the very high urbanization rate of Korea, the number of traffic noise damages in areas congested with population and facilities is steadily increasing. The current environmental noise levels data in major cities of the country show that the noise levels exceed the standards set for both day and night times. This research was about comparative analysis in search for optimal soundproof panel shape and design factor that can minimize sound reflection noise. In addition to the normal flat-type panel shape, the reflection noise reduction of swelling-type, combined swelling and curved-type, and screen-type were evaluated. The noise source model Nord 2000, which often provides abundant information compared to models for the similar purpose, was used in the study to determine the overall noise level. Based on vehicle categorization in Korea, the noise levels for varying frequency from different heights of the sound source (directivity heights of Harmonize model) have been calculated for simulation. Each simulation has been made using the ray-tracing method. The noise level has also been calculated using the noise prediction program called SoundPlan 7.2, for comparison. The noise level prediction was made at 15m (R1), 30 m (R2) and at middle of the road, 2m (R3) receiving the point. By designing the noise barriers by shape and running the prediction program by inserting the noise source on the 2nd lane to the noise barrier side, among the 6 lanes considered, the reflection noise slightly decreased or increased in all noise barriers. At R1, especially in the cases of the screen-type noise barriers, there was no reduction effect predicted in all conditions. However, the swelling-type showed a decrease of 0.7~1.2 dB at R1, performing the best reduction effect among the tested noise barriers. Compared to other forms of noise barriers, the swelling-type was thought to be the most suitable for reducing the reflection noise; however, since a slight increase was predicted at R2, further research based on a more sophisticated categorization of related design factors is necessary. Moreover, as swellings are difficult to produce and the size of the modules are smaller than other panels, it is challenging to install swelling-type noise barriers. If these problems are solved, its applicable region will not be limited to other types of noise barriers. Hence, when a swelling-type noise barrier is installed at a downtown region where the amount of traffic is increasing every day, it will both secure visibility through the transparent walls and diminish any noise pollution due to the reflection. Moreover, when decorated with shapes and design, noise barriers will achieve a visual attraction than a flat-type one and thus will alleviate any psychological hardships related to noise, other than the unique physical soundproofing functions of the soundproof panels.

Keywords : reflection noise, shaped noise barriers, sound proof panel, traffic noise
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