Comparison of Calculated and Measured Data for the Attenuation of Improved Noise Barrier

Kohei Yamamoto

Kobayasi Institute of Physical Research
3-20-41 Higashi-Motomachi Kokubunji Tokyo 185-0022 Japan

Abstract: The comparison between calculated and measured data was made to the additional noise attenuation of a barrier with an absorptive device on the top edge. The attenuation was determined at a highway with a noise barrier of 3 m height. By the use of the boundary element method (2D), noise attenuation due to the mounting of the device was estimated. The results showed an agreement between the calculated and the measured value. However, the calculated values showed fluctuation when they were plotted against distance.

INTRODUCTION

Barrier design of over 3 m height has become popular for the countermeasure against highway noise in Japan. In some cases, noise control engineers must design barriers of 8 m height due to the heavy increase in noise level. This may, however, cause secondary problems such as narrow range of driver’s sight, poor aesthetics and so on. Efforts have been made to reduce barrier height by the technique of the barrier top acoustical design 8. T-shaped, Y-shaped and Cylinder shaped tops are those examples. One of the developed design is an absorptive device shaped like mushroom in cross sectional view. This device was mounted on the top edge of a highway barrier and the acoustical performance was examined and reported 3. In this report, the noise reduction due to this device applied at a highway barrier was calculated by BEM and the results were compared with the previously measured data. The aim of the present work is to examine the applicability of BEM to the estimation of insertion loss of improved noise barriers.

CALCULATION

The numerical method employed was 2 dimensional boundary element method. A point source with a representative road traffic noise spectrum was specified. The calculation was carried out at each one-third octave band center frequency between 200Hz and 2kHz. The cross sectional co-ordinates of the barrier and the road profile were input as data. The size of the each segment was less than \( \lambda/8 \) (\( \lambda \) : wave length). The highway in the present work is an elevated road on a structure and the road surface is 10 m high above the ground. A vertical noise barrier of 3 m in height is installed at the shoulder of this elevated road.

Figure 1 shows the cross sectional view of the mushroom type device which is applied on the vertical barrier. The surface of this device is made from a combination of glass wool of 50 mm thick, glass cloth sheet and perforated metal sheet. The normal acoustic impedance of this combination was measured in an acoustic tube by the technique of 2-microphone method and the results were input as boundary property of calculation.

The calculation was made in two cases, i.e. with and without the device on the barrier. When the mushroom device was applied, the vertical barrier of 0.5 m from the top was removed. That means the barrier heights above the ground are the same in two cases. Then the difference of A-weighted sound pressure level between the two cases was determined.

RESULTS & DISCUSSION

Figure 2 shows the comparison between calculated and measured data of the difference in A-weighted sound pressure level between the two cases, which is obtained at the receiver positions of 1.2 m above the ground. The abscissa in the figure is the horizontal distance from the noise barrier and the ordinate means the attenuation.
of the improved barrier over the vertical simple one of the same height.

We can see the calculated values (solid line) are ranged from -2dB to +4dB and they show fluctuation against distance. The positive value means that the improved barrier gives advantage in noise control over the vertical barrier of the same height. The advantage of this improved barrier seems to appear in the range between 5 m to 20 m. On the other hand, the measured values (solid circle) show advantage of 2 dB in the same range as the calculation showed. At 50 m from the barrier, the measured data showed 1dB, while the calculated values showed -2dB. Roughly speaking, there is an agreement between calculated and measured, but the calculation by BEM show unstable when it is plotted against distance.

![Cross sectional view of the mushroom type device.](image)

![The comparison of the calculated (solid line) and the measured data (solid circle). The receiver height is 1.2m above the ground. The ordinate is the attenuation relative to the vertical barrier of the same height.](image)

**FIGURE 1.**
Cross sectional view of the mushroom type device.

**FIGURE 2.**
The comparison of the calculated (solid line) and the measured data (solid circle). The receiver height is 1.2m above the ground. The ordinate is the attenuation relative to the vertical barrier of the same height.

**CONCLUDING REMARKS**

The effect of an improved barrier (the mushroom type) has been calculated by the 2-dimensional boundary element method. The comparison between the calculated and measured at real highway showed an agreement, however, BEM produced rather unstable results.

**REFERENCES**