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NOISE PREDICTION BY SCALE MODEL TECHNIQUES

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INTRODUCTION

In recent years, prediction of noise become extremely important in promotion of urban planning and environmental assesment. Studies on prediction technique have been diversified to a greater extent. Among those, study on noise propagation in an indispensable part of noise prediction. In this report, noise source, measuring instruments used in scale model experiments and some results of investigation about noise prediction were introduced.

NOISE REDUCTION BY ACOUSTIC BARRIER OF A STRAIGHT LINE SOURCE

Many experimental and theoretical studies have been carried out on the effect of noise reduction by an acoustic barrier. Here, scale model experiment on noise reduction by an acoustic barrier of a straight line source will be described.

Experimental study

Details of the line source used for the experiments are shown in Fig.1. The noise radiated from the source has random characteristics in phase. Directivity characteristics in the plane normal to the axis of the source are nearly nondirectional as shown in Fig.2. Experiments were carried out in an anechoic room. The experimental set-up of the line source, the barrier and the microphone are shown in Fig.3. For the measurements of sound pressure level, a 1/4" condenser microphone was used. This was moved by remote control. Direction of the microphone movement was fixed normal to the line source. The measurements of sound pressure level were carried out the center

frequencies of 1000, 2000, 4000, 8000 and 16000 Hz, by inserting one-third octave band filter in the receiving apparatus.

Design diagram for barrier of a line source

From the experimental results for a line source, the sound attenuation by an acoustic barrier was plotted in Fig. 4 against Fresnel number N . Here, sound attenuation is defined as the sound pressure level difference with and without acoustic barrier at each receiving point. In Fig. 4, plotted values include results for every combination of the distance from source to barrier, of the distance from source to receiving point and of frequency. Fig. 5 shows a comparison between the experimental curve obtained in this study and the results of other studies. Sound attenuation for a line source shows values lower than those of Maekawa's data, which are for a point source, by 3~5 dB. This diagram can be applied to estimate the noise reduction by acoustic barrier for a line source, that is for the noise from congested road traffic, the railway and so on. Thus, this source can be effectively applied to scale model experiments.

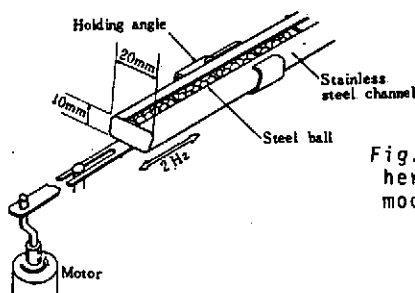
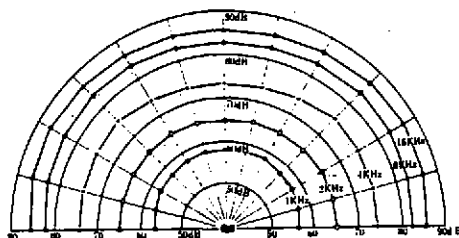


Fig. 1. Details of the incoherent line source used in model experiments.

Fig. 2. Directional characteristics in a plane normal to the longitudinal axis of the line source (measured at a distance 1m from the source)



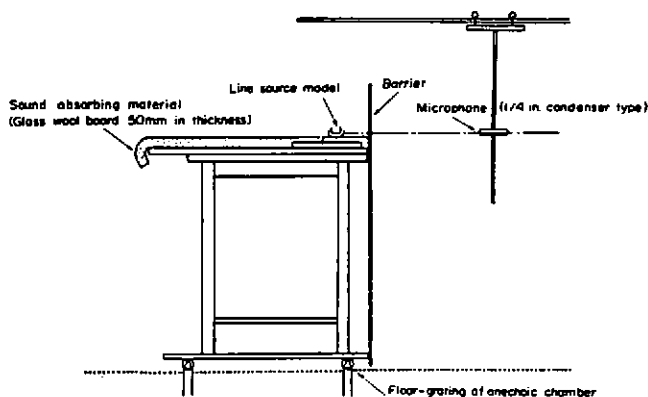


Fig.3. Experimental set-up.

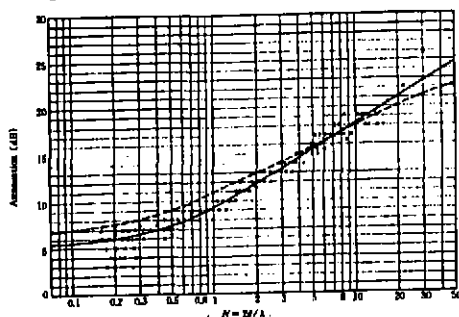


Fig.4. Sound attenuation by an acoustic barrier versus Fresnel number N for an line source. Experimental;..... Calculated by Kurze & Anderson; -----

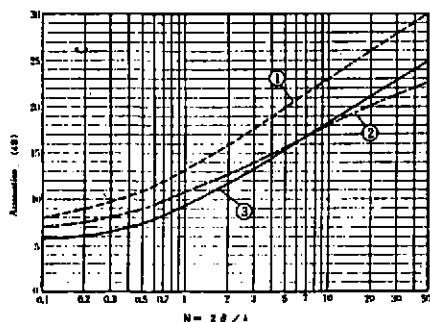


Fig.5. Comparison of different results for sound attenuation by acoustic barrier:
① Maekawa's result (for a point source)
② Kurze & Anderson's result (calculated)
③ Our experimental results.

INCOHERENT LINE SOURCE OF JET NOISE TYPE

The line source employed in the above-mentioned experiment has several advantages, such as stability, easy-handling, coherency and so on. Thus, this source can be effectively applied to scale model experiments. In Fig.6, details of the another type line source are shown; the Jet-noise generating system. This line source radiates broad band noise strongly, and can be used in curved shape. This source is useful to experiment about curved road and railway as shown in Fig.7.

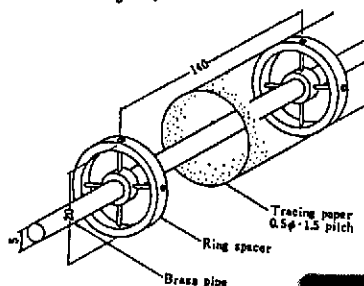


Fig.6. Construction of incoherent line source of jet noise type.

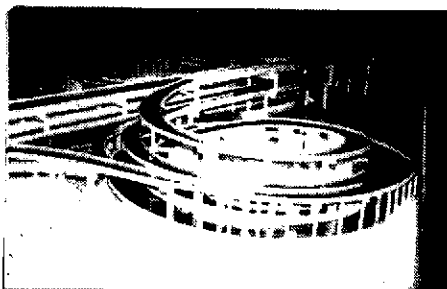


Fig.7. An example of the scale model (1/40) of curved road; spiral-type road junction.

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