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Examination on noisiness of time-varying road traffic noise due to passing-by high sound level vehicles.

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Equivalent contineous A-weighted sound pressure level (L_{Aeq}) is generally used to evaluate the environmental noise with irregular and continuous changes in level such as road traffic noise. L_{Aeq} shows relatively good correspondence with human physiological and psychological responses to time-varying noise over a long time interval, and is widely used as an evaluation index for environmental noise in many countries, including Japan. On the other hand, it is also pointed out that it is necessary to consider time variability and the number of events when the prominent noise events are noticeable, such as road traffic noise on a low-traffic volume. Morinaga et al[1] conducted psychological experiments in order to investigate the effect of the quiet-time interval between aircraft noise events on the overall negative impression of aircraft noise, and found the correlation between overall noisiness and L_{Aeq} was improved by adjusting for the quiet-time interval ratio or the number of events included in the stimuli, especially when participants paid attention to changes in the instantaneous noise level. In the present study, we conducted subjective evaluation experiments using auditory stimuli simulating road traffic noise, and investigated the effect of the time-varying characteristics of noise on noisiness evaluation. In addition, a proposal for a noise evaluation index that takes into account the time-varying characteristics of noise was also discussed.

In the first experiment (Experiment A), the auditory stimuli were five kinds of noise simulating road traffic noise with the passing-by medium-sized truck controlled the degree of prominence, frequency of prominence, and L_{Aeq} for whole stimulus interval (600 s). Twenty-one volunteers with normal hearing (aged between 20 to 26, mean was 22.8) were instructed to evaluate the impression of the "noisiness" of the stimuli by adjusting line length displayed in the screen using a mouse. They were asked to perform the evaluation continuously along the stimuli (continuous evaluation) and the evaluation of the entire stimulus after a rest about 1 min after the end of each stimulus (overall evaluation). The results showed that when the degree and frequency of the specific noise in the stimulus were large, the impression of the prominent specific noise affected the overall evaluation of the stimulus, resulting in a discrepancy between the overall evaluation and the continuous evaluation.

In the second experiment (Experiment B), the auditory stimuli were similar to the previous experiment and were 12 with different degree of prominence and frequency of prominence. The procedure was similar to the previous. The results showed that the prominence of pass-by noise affected the overall evaluation of the stimulus, resulting in a discrepancy from the continuous evaluation in cases where the degree of prominence was large. The difference between the overall and continuous evaluations increases with the increase in the degree and frequency of the prominence.

Furthermore, according to the examination of the correspondence between time-varying characteristics and noisiness evaluation, when L_{Aeq} was corrected taking account of the proportion of quiet-time in the stimulus, the correlation between L_{Aeq} and noisiness evaluation was improved.

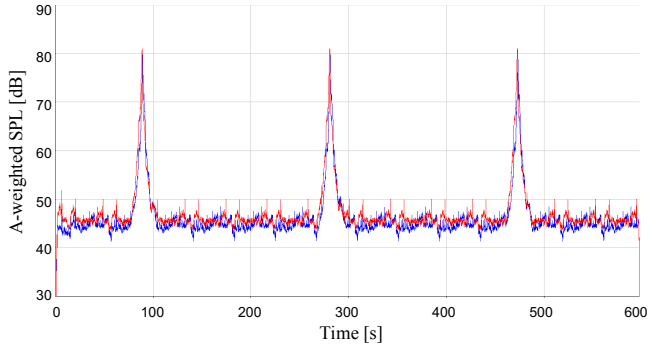

Fig. 1 Time history of A-weighted sound pressure level of a stimuli.

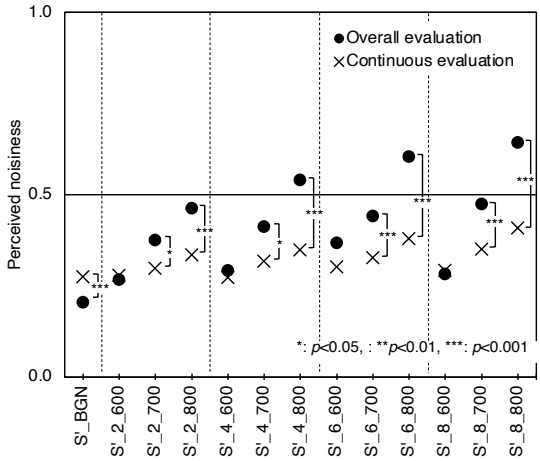

Fig. 2 Difference between the continuous and overall evaluation of noisiness impression (Experiment B).