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Study on the effect of vehicle noise regulations on reducing road environmental noise

Yukihiro Yatsu[1)]

[1)] *Hino Mortors Ltd.*

3-1-1 Hinodai, Hino, Tokyo 191-8660

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In response to the problem of vehicle noise, Japan has implemented vehicle noise regulations for the past 50 years, and the acoustic energy radiated from vehicles has been reduced by up to 84%. On the other hand, the status of achieving environmental standards for vehicle traffic noise has remained generally unchanged, and many complaints continue to be made. Against this background, it is necessary to clarify the effects of vehicle noise regulations on road environmental noise.

The Noise Subcommittee of the Japan Automobile Manufacturers Association (JAMA) commissioned the Japan Automobile Research Institute (JARI) to conduct simulations and study the effects of vehicle noise on road traffic noise. The simulations were conducted using the road traffic noise prediction model developed by JARI.

The conditions for the prediction calculations were as follows:

・Predict the change in road traffic noise L_{Aeq} when Phase 3 is applied from a situation where all vehicles are Phase 2 compliant.

・Measured Lurban data of Phase 2 compliant vehicles based on R51-03 was compiled and used.

・The ratios by noise source (power unit noise and tire noise) and by category of Phase 2 compliant vehicles were set.

・The distribution of Lurban is assumed to be a normal distribution, and the upper limit is assumed to decrease but the lower limit is assumed to remain unchanged due to stricter regulations.

・In the process of use, two cases are predicted: one assumes that the noise of replacement tires is the same as that of Phase 3 OE tires (factory-installed tires), and the other assumes R117-02 compliant tires.

・Traffic flows in three regions with different conditions were used for the forecast (see Table 1).

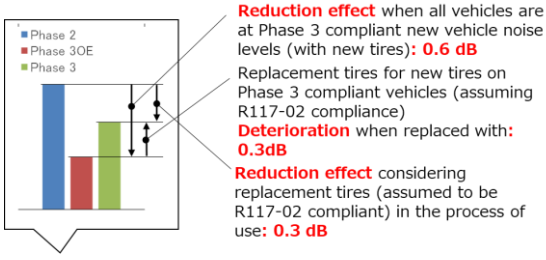
The model was used to clarify the contribution of each type of vehicle and sound source to road traffic noise. Three characteristic areas (A, B, C) were assumed for traffic flow (Table 1).

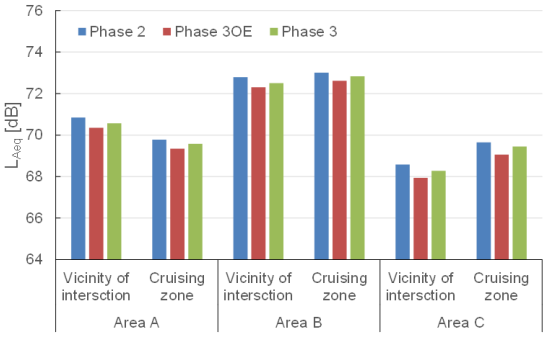
As a study of the case in which the above-mentioned regulations on vehicle noise are tightend, a prediction was made assuming that the regulations are tightend by approximately 2 dB(A) from Phase 2 to Phase 3 of UNR51-03. Noise level data for after-market tires was obtained from noise level data published by the European Tire Labeling System.

Near intersections, both cruising driving sections were found to have a 0.6 dB(A) reduction in road environmental noise when the regulations were tightened from Phase 2 to Phase 3. On the other hand, the effect was found to be very small, decreasing by 0.3 dB(A), with the effect becoming 0.3 dB(A) as the tires were replaced with after-market tires. This is considered to be due to the fact that factory-installed tires have lower noise levels than those used for commercial tires. The predicted results at three sites with representative traffic flows from areas where environmental standards for road traffic noise were not met were all similar.

Table 1 Features of traffic flow

Target area		Area -A			Area -B			Area -C		
Part of the day /Time zone		Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
Traffic volume in each time zone	LDV	25890	5823	5443	19002	4022	2965	14122	2591	1871
	HDV	7315	950	2726	7834	1163	3567	1824	273	1007
	Total	33205	6773	8169	26836	5185	6532	15946	2864	2878
Traffic volume per one hour	LDV	2158	1456	680	1584	1006	371	1177	648	234
	HDV	610	238	341	653	291	446	152	68	126
	Total	2767	1693	1021	2236	1296	817	1329	716	360
Percentage of heavy vehicles, %		22.0	14.0	33.4	29.2	22.4	54.6	11.4	9.5	35.0
Speed limit in km/h		50			60			60		





Phase 3OE when noise levels for all vehicles are maintained at Phase 3 new tires

Fig. 1 Effect on road traffic noise