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Characteristics of Sound Emission in Different Road Traffic Noise Prediction Models

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Road traffic noise is one of the major environmental issues in urban areas. In Japan, the road traffic noise prediction model “ASJ RTN-Model”, which has been developing by the reaserch committee in the Acoustical Society of Japan (ASJ), is used widly in environmental impact assessment for any development projects. In the latest version of prediction model “ASJ RTN-Model 2018”, several coefficients of calculation equations for the A-weighted sound power level of road vehicle and pavement types are updated. On the other hand, many prediction models such as Nord and Harmonoise have been proposed in European countries as well. The common noise assessment methods CNOSSOS-EU for strategic noise mapping was published in 2012. Afterwads, the specific calculation method for the sound power level incorporated into CNOSSOS-EU was proposed in several countries; for example, CNOSSOS-FR corresponding to noise emission of predicition model NMPB2008 in France. Besides, in 2021, the coefficients for the sound power level in CNOSSOS-EU were improved. In this paper, the outline of calculation equations for noise emission in ASJ RTN-Model 2018 and CNOSSOS-EU, and the results of comparison with noise emission in European countries such as CNOSSOS-EU, -NL, -FR, sonROAD, Nord and Harmonoise are described.

The A-weighted sound power level L_{WA} for each vehicle type (three categories; light, medium-heavy, and heavy vehicles) was calculated by using equations in respective prediction models. The road vehicle categories in ASJ RTN-Model are almost the same as them in the other models (e.g., most of heavy vehicles have three or more axles as specified in CNOSSOS-EU and ASJ RTN-Model). Fig. 1 shows the examples of comparison of L_{WA} for each vehicle type at running speeds of 40 – 100 km/h. The black solid and dashed lines represent L_{WA} calculated using ASJ RTN-Model under steady and non-steady running conditions. The red, blue and green lines indicate L_{WA} under steady running conditions in CNOSSOS-EU, -NL, and Nord, respectively. On the whole, under steady running conditons at speeds of higher than 50 km/h, the differences in L_{WA} between ASJ RTN-Model and others are almost the same within ±3 dB. For light vehicles, the maximum difference from L_{WA} in ASJ RTN-Model is 2.9 dB, and for heavy vehicles, that is 2.7 dB. On the other hand, at running speeds of 50 km/h or lower, L_{WA} calculated by using the equation under non-steady running conditions tends to be similar to those adopted in the other models. In particular, L_{WA} for medium- heavy and heavy vehicles corresponds well with those in the other three models.

Furthermore, the sound power spectrum of road vehicles is necessary for the calculation of frequency-dependent propagation or wavebased numerical analyses. To verify the difference in the A-weighted sound power spectrum between prediction models, the simulation calculations of sound propagation over the flat ground surface and a thin noise barrier were perfomed. In the case of reflective ground surface (e.g., dense asphalt pavement and compacted soil), the differences in the calculation results were almost the same as those in the A-weighted sound power level L_{WA}. Thus, no significant difference in the sound spectral characteristics for each vehicle type among the models can be confirmed.

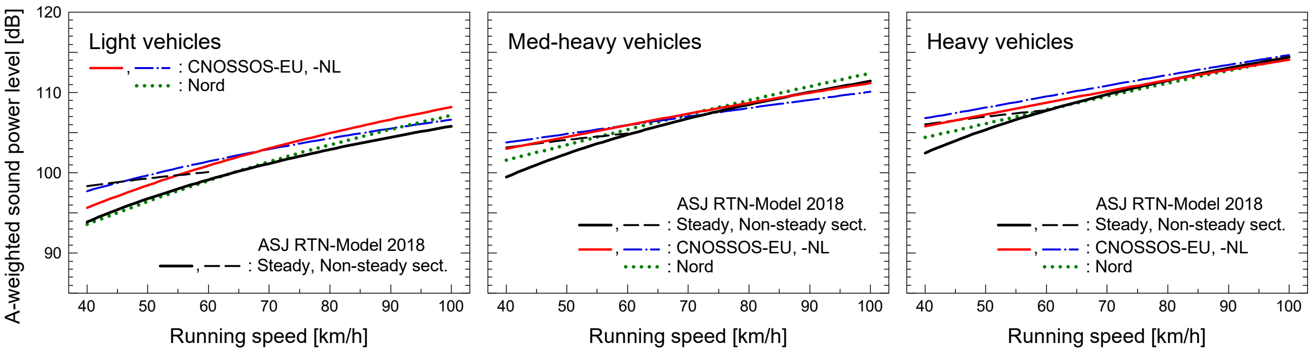

Fig.1 Speed dependence of L_{WA} calculated by respective prediction models for light, medium-heavy, and heavy vehicles.