Comparison of Simple Room Acoustic Models Used for Industrial Spaces

Authors: Keränen, Jukka; Hongisto, Valtteri

Source: Acta Acustica united with Acustica, Volume 96, Number 1, January/February 2010, pp. 179-194(16)

Abstract:

In order to select the most cost-effective noise control solution, the influence of the noise control measures on noise level should be reliably predicted. Reasonably accurate commercial ray-tracing, image source and finite element method modeling programs are available. However, the creation of a model and sometimes the calculations are time-consuming and their use in preliminary room acoustic design is not always cost-effective. These sophisticated room acoustic modeling programs demand special expertise which limits their use in practice. Several simple room acoustic models have been developed for noise control but information on their usability and prediction accuracy is rather hard to find. The purpose of this study was to examine simple room acoustic models developed for predicting noise levels and reverberation times in octave bands. Seven simple sound pressure level models, seven simple reverberation time models and a validated ray-tracing program (ODEON 3.1) were tested in four industrial workplaces, in which major noise control measures were implemented. The prediction results were compared to measurement results which were performed using an omni-directional sound source before and after the implementation of noise control measures. Accuracies of predicted sound pressure levels were determined as differences between measured and predicted sound pressure levels in octave bands of 125–4000 Hz. Accuracies of predicted reverberation times were similarly determined. The accuracy of the ray-tracing model was the most acceptable, as expected. The accuracy of simple sound pressure level models developed by Kuttruff, Osipov *et al.*, and Thompson *et al.* was comparable to the accuracy of the ray-tracing models. The accuracy of the simple reverberation time model developed by Heerema and Hodgson was almost comparable to the accuracy of the ray-tracing model. The above-mentioned simple sound pressure level models provided sufficient accuracy for predicting average insertion loss, e.g. by using acoustic tiles or sound-absorbing materials. For more detailed or complex room acoustic design, sophisticated room acoustic modeling programs are recommended.