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A first-principles model for estimating the prevalence of annoyance with aircraft noise exposure

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Abstract

Numerous relationships between noise exposure and transportation noise-induced annoyance have been inferred by curve-fitting methods. The present paper develops a different approach. It derives a systematic relationship by applying an a priori, first-principles model to the findings of forty three studies of the annoyance of aviation noise. The rate of change of annoyance with day-night average sound level (DNL) due to aircraft noise exposure was found to closely resemble the rate of change of loudness with sound level. The agreement of model predictions with the findings of recent curve-fitting exercises (cf. Miedma and Vos, 1998) is noteworthy, considering that other analyses have relied on different analytic methods and disparate data sets. Even though annoyance prevalence rates within individual communities consistently grow in proportion to duration-adjusted loudness, variability in annoyance prevalence rates across communities remains great. The present analyses demonstrate that 1) community-specific differences in annoyance prevalence rates can be plausibly attributed to the joint effect of acoustic and non-DNL related factors and (2) a simple model can account for the aggregate influences of non-DNL related factors on annoyance prevalence rates in different communities in terms of a single parameter expressed in DNL units-a "community tolerance level."

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