CALCULATING REVERBERATION TIME

In large, highly reflective rooms, the reverberation time is often well predicted by the original Sabine formula:

$$RT = .049 V/A,$$

where V is the total volume in ft³ and A is the total absorption in the room in sabins. The total absorption, A, is calculated by adding up all of the piecemeal areas (carpet, drapes, walls, etc.) of the boundaries multiplied by their individual absorption coefficients:

$$A = (S_1a_1 + S_2a_2 + S_3a_3...),$$

where S is the area in square feet and a is the absorption coefficient for the material covering that area. Absorption coefficient is a measure of the percentage of sound that is absorbed when sound reflects from the material. The product of S and a is a number with the unit sabins. The absorption of some items, such as people or chairs, is sometimes quoted directly in sabins.

The metric equivalent of the Sabine formula is

$$RT = 0.161 V/A,$$

where the volume is in m³ and areas are in m² and A is in metric sabins.

As rooms get more absorptive and smaller and as the materials on the room boundaries begin to differ more from one another (e.g., wall-to-wall carpet on the floor), this equation becomes progressively less reliable. Over the past 100 years, several increasingly more complex equations have been developed to accommodate asymmetry in rooms and the fact that the sound field is not diffuse; Fitzroy (1959) and Arrau-Puchades (1988) contributed some of them. However, all of them, to be practical, make assumptions. Dalenbäck (2000) says, "These two formulas give a better estimate than the classical formulas [Sabine and Eyring] in *some cases*, but here a central question is: *How can one be sure they are better in a particular case?* So far, no equation with universal applicability has been shown" [this emphasis]. Fortunately, as we will see, in small rooms for sound reproduction, high precision is not required. If it were, it is likely that a computerized room model would be needed. In the meantime, the simple Sabine formula provides estimates that are adequate for our purposes in small listening rooms.

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