Example Calculation of Reverberation Time, $T=T_{60}$:

From example calculation of T in John Backus' book – "The Acoustical Foundations of Music"

With this information, let us calculate the reverberation time of a hypothetical auditorium, which we will arbitrarily assume to be 100 ft long, 60 ft wide, and 40 ft high. The calculation will be for a frequency of 500 hertz. The walls and ceiling will be assumed to be plaster, with an absorption coefficient of 0.10, and the floor covered with carpet on felt, with an absorption coefficient 0.40, as given in Table I. The total absorption is then calculated from Eq. (7) as follows:

	Area, sq ft		Abs. Coeff.	Abs. Units
Floor	100 × 60	= 6000	0.40	2400
Ceiling	100 × 60	= 6000	0.10	600
Two side walls	2 × 40 × 100	= 8000	0.10	800
Two end walls	2 × 40 × 60	= 4800	0.10	480
		Total absorption		4280 ≈ 4300 units.

The volume of the room is 40 × 60 × 100 = 240,000 cubic feet. The reverberation time will then be

$$T = 0.049 \times \frac{240 \times 10^3}{4300} = 2.7 \text{ sec} \qquad \text{Too long!}$$

If $T \leq 1.5$ sec, then:

$$A \geq 0.049 \frac{V}{T} = 0.049 \frac{240 \times 10^3}{1.5} = 7800\ ft^2 (= \text{Abs. units})$$

If 4300 absorption units already present,

Then need to <u>add</u> 7800 – 4300 = 3500 absorption units

1" thick perforated tiles have absorption coefficient, $a = 0.70$ (@ 500 *Hz*)

$A = aS = 3500$ ft^2

$$\therefore \quad \boxed{S = \frac{A}{a} = \frac{3500\ ft^2}{0.70} = 5000\ ft^2}$$

$\Rightarrow$ Need 5000 ft^2 of 1" thick perforated tiles.

* Need to be careful here: seats, people, *etc*. are sound absorbing too!!!
* Acoustical properties of an empty auditorium are not the same as when full!!!