Sound absorption coefficients

Sound absorption coefficients for common building materials are presented in Table A3.6. These absorption coefficients were derived from data taken in halls on which the author has consulted. Other engineers may be using somewhat different coefficients based on experience with different halls. The reference is Beranek and Hidaka (1998).

Table A3.6. Sound absorption coefficients for building materials and audience areas. These coefficients must be used in the Sabine equation. The measurements on building materials were made in the types of diffuse sound fields found in concert halls without seats or audience. The absorptions by audience areas, with and without full occupancy, were determined from measurements made after the seats were installed in those halls.

Materials	Frequency, Hz						Mass, kg/m²
	125	250	500	1,000	2,000	4,000	
Gypsum, 2 layers, fiberglass reinforced, 25 mm w/lighting and ventilation	0.15	0.12	0.10	0.08	0.07	0.06	40
Note: Gypsum, plaster board, not reinforced, mass per m² equals [thickness in mm] × 1.0 kg/m², approximately							
Wood, ceiling, 2 layers, 28 mm w/lighting and ventilation	0.18	0.14	0.10	0.08	0.07	0.06	17
Wood, sidewalls, 1 layer, 20 mm w/doors and lighting	0.25	0.18	0.11	0.08	0.07	0.06	12
Wood, sidewalls, 1 layer, 12 mm w/doors and lighting	0.28	0.22	0.19	0.13	0.08	0.06	6.2
Wood, audience floor, 2 layers, 33 mm on sleepers over concrete	0.09	0.06	0.05	0.05	0.05	0.04	N/A
Wood, stage floor, 2 layers, 27 mm over airspace	0.10	0.07	0.06	0.06	0.06	0.06	17
Wood, 19 mm, over 25 mm compressed fiberglass, screwed to 150 mm concrete block w/doors and lighting	0.20	0.15	0.08	0.05	0.05	0.05	N/A
Plaster, ceiling, 60 mm w/lighting and ventilation	0.10	0.08	0.05	0.04	0.03	0.02	60
Plaster, ceiling, 30 mm w/lighting and ventilation	0.14	0.12	0.08	0.06	0.06	0.04	30
Plastic, fiberglass reinforced phenolic foam, filled with aluminum hydroxide, faced with very thin layer plywood, 8 mm (Tokyo, Hamarikyu-Asahi Concert Hall)	0.25	0.23	0.16	0.12	0.11	0.10	4

Materials	Frequency, Hz 125	250	500	1,000	2,000	4,000
Concrete floor, linoleum cemented to it	0.04	0.03	0.03	0.03	0.03	0.02
Concrete floor, woods boards, 19 mm, secured to it	0.10	0.08	0.07	0.06	0.06	0.06
Concrete block, plastered	0.06	0.05	0.05	0.04	0.04	0.04
Organ absorption, case opening 75 m² (Boston, behind grille)	41	26	19	15	11	11
Organ absorption, free standing (Tokyo, TOC Concert Hall)	65	44	35	33	32	31
Audience, seats fully occupied						
Heavily upholstered	0.72	0.80	0.86	0.89	0.90	0.90
Medium upholstered	0.62	0.72	0.80	0.83	0.84	0.85
Lightly upholstered	0.51	0.64	0.75	0.80	0.82	0.83
Seats unoccupied						
Heavily upholstered	0.70	0.76	0.81	0.84	0.84	0.81
Medium upholstered	0.54	0.62	0.68	0.70	0.68	0.66
Lightly upholstered	0.36	0.47	0.57	0.62	0.62	0.60
Absorption power of orchestra (m²), Tokyo, TOC Concert Hall and NNT Opera House						
Concert Hall (stage 170 m², vertical walls, sides (ends) splayed)						
13 string instruments	3	4	6	17	52	64
44 players (2 brass)	12	21	24	46	74	100
92 players (4 brass)	22	37	44	64	102	132
Opera House (pit opening 100 m²)						
40 players	10	13	17	41	50	57
80 players	12	17	23	56	67	71
Note: Surface density values do not include the mass of furring or wooden nailing strips						
Note: The coefficients following were taken from the literature						
Carpet, heavy, cemented to concrete	0.02	0.06	0.14	0.37	0.6	0.65
Carpet, heavy, over foamed rubber	0.08	0.24	0.57	0.69	0.71	0.73
Carpet, thin, cemented to concrete	0.02	0.04	0.08	0.2	0.35	0.4

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