Transmission Loss of Plasterboard Walls

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envelopment, and reverberance by the use of acoustical modeling is described for the design of the 5100-seat pavilion for the Saratoga Performing Arts Center. Unusual problems were associated with the extreme size, the wide fan shape, and the largely open walls. Echograms are illustrated for the component surfaces and the complete array of enclosure. *[12 min.]*

2A6. Model Study of the Sound Transmission over Raked Theatre Seats. J. E. WEST AND G. M. SESSLER, *Bell Telephone Laboratories, Inc., Murray Hill, New Jersey.*—The propagation of sound waves traveling at grazing incidence over rows of theatre seats was studied on a 1:10 scale model for different degrees of raking of the seating and stage areas. The measurements were made with tone bursts with a duration of 4 msec spaced linearly over the frequency range from 0.75 to 8 kHz. For linear and logarithmic raking of the seating area of 15° or greater, the selective low-frequency seat attenuation [G. M. Sessler and J. E. West, J. Acoust. Soc. Am. **36**, 1725–1732 (1964)] is eliminated. The measurements show no significant difference between linear and logarithmic rake. Seat attenuation can also be eliminated by raking the stage rather than the seating area; thus, concert halls with a flat main floor and more vertical space for balconies can be designed. *[12 min.]*

2A7. Achievement of Liveness in Small Rooms having Low Reverberance. PAUL S. VENEKLASEN AND JAMES W. RYAN (nonmember), *Paul S. Veneklasen & Associates, Los Angeles, California.*—The acoustical environment of small viewing or review rooms in studio or recording complexes can be controlled over wide limits even though the reverberation time is low and inherently limited in range. Echograms from model studies show that the growth period of the aural impression is controllable by orientation of sound-diffusing reflecting surfaces. Results reinforce the emerging conviction that envelopment in early echoettes is a separate factor from reverberance in determining the impression of liveness in music rooms. *[12 min.]*

2A8. Transmission Loss of Plasterboard Walls. T. D. NORTHWOOD, *Division of Building Research, National Research Council, Ottawa, Ontario, Canada.*—Although test data are available for many variations of the typical plasterboard wall, there are enough minor variations in construction or test technique that it is difficult to deduce accurately the effects of the various parameters. Accordingly, a systematic study has been made of a number of experimental and practical walls. Tests were first made on single leaves (a leaf consisting of one layer of material or several layers laminated together). The next phase was a study of two such leaves separated by an air space. Finally, the modifications introduced by stud and connector systems and space fillers were investigated. Results from the first phase are found to correspond well with theoretical calculations. *[12 min.]*

2A9. Transmission Characteristics of Limp Walls in Relation to Mass Law. HALE J. SABINE, *Owens–Corning Fiberglas Corporation, Granville, Ohio,* AND WILLIAM J. SIEKMAN, *Riverbank Acoustical Laboratories, IITRI, Geneva, Illinois.*—Sound-transmission (TL) loss tests on a large number of single homogeneous limp walls at Riverbank Acoustical Laboratories have shown a consistent rise in TL values at low frequencies with respect to either the field-incidence mass law (angles of incidence from 0° to 78°) or the random-incidence mass law (0°–90°). A similar rise has been noted in tests at the Owens–Corning Fiberglas Sound Laboratory on a single 22-gauge steel wall. Deviations from the field-incidence mass law at 125 Hz range from 3 to 14 dB in the two laboratories combined. The Fiberglas study shows that the deviation is independent of area from $3\frac{1}{2}\times9$ ft to 14×9 ft, and is also independent of all variations of test conditions within the specifications of the latest proposed revision of ASTM E 90-61 T. In the Riverbank tests, the deviation varies considerably with the type of material under constant test conditions. In both laboratories, the TL at higher frequencies below coincidence agrees better with the field-incidence than with the random-incidence mass law. *[12 min.]*

2A10. Field Survey of Sound Transmission between Offices. ROGER BENASUTTI AND HALE J. SABINE, *Owens-Corning Fiberglas Corporation, Granville, Ohio.*—Sound-transmission measurements were made in 15 pairs of occupied offices with suspended acoustical ceilings and continuous plenum in high-rise buildings in several areas of the USA. The tests were made to determine typical noise-reduction (NR) values between offices as found in present-day construction. Measurements of NR and background noise were made in octave bands. The STC contour curve was used to determine one-number ratings of the measured NR curves. NR values ranging from 24 to 48 STC were observed, the latter value being obtained with a ceiling of acoustical tile adhered to gypsum board. NR's were strongly influenced by the type and location of return-air plenum openings and ducted connections between rooms. Background-noise levels from 34 to 46 dbA were measured, these being due almost entirely to air-conditioning noise. A simple but accurate speech-intelligibility test was conducted at each site to relate speech privacy to background levels and NR's. The measured intelligibility correlated quite well with a figure obtained by adding the value of background noise in decibels A-scale to the NR expressed as STC. *[12 min.]*

2A11. Reduction of Aircraft Noise Measured in Several Single-Family Houses. DWIGHT E. BISHOP, *Bolt Beranek and Newman Inc., Los Angeles, California 91406.*—Noise-reduction measurements in several types of single family houses are described and compared with previous field measurements. Also described are the results of a number of laboratory sound-transmission-loss measurements of residential-type windows and doors. Windows and doors were selected for laboratory tests, since they generally constitute the "weakest links" in achieving effective noise insulation. [Work supported by the U. S. Department of Housing and Urban Development, Federal Housing Administration.] *[12 min.]*

2A12. Noise in Apartments from Services and Utilities. RONALD L. MCKAY, *Bolt Beranek and Newman Inc., Downers Grove, Illinois 60515.*—A field survey has been made to ascertain typical noise levels in urban high-rise apartments due to certain services and utilities. Data are presented on the sound-pressure levels and vibration acceleration levels produced by kitchen and bathroom equipment, by elevator hoistway and lift equipment, by trash chute use, and by garage operations. Measurements were taken near the various sources and at remote positions horizontally and/or vertically. For several sources, an analysis is made of the relative importance of airborne versus structure-borne sound transmission. Data are presented on losses associated with the transmission of vibration along typical concrete constructions. A tentative system is suggested for estimating radiated airborne-noise levels in a space remote from a source, if source vibration levels and the details of interconnecting structure are known. *[12 min.]*