STUDIO ACOUSTICS

by

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FOREWORD

Sound recording studios are often built like showcases, either to attract clientele or to provide a distinctive image for the industry. They are, thus, like people, in that no two of them are alike. Yet, all such structures have to have certain common acoustic elements if they are to function to the best artistic and economic advantages. The enclosures must be sufficiently quiet, exhibit proper reverberatory conditions (often required to be adjustable), be devoid of parallelisms between hard surfaces, have no sound-focusing concave surfaces, be free of vibrations from external and internal sources, etc. It is for the purpose of providing first design principles of sound recording studios that this book has been prepared, so that for any given size structure, satisfactory vocal and instrumental recording conditions can be established therein.

All equations involving physical quantities are given both in the English and the MKS system of measurement. Also, when the description of existing studios includes linear dimensions, their metric equivalents follow in parenthesis, as is also done for such quantities as surface density (mass per unit area) and sound absorption.

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PART I

BASICS

Chapter 1

Introduction

1.1 GENERAL

The word studio derives from the Latin *studium*, denoting an artist's working place—the artist being a painter, musician, sculptor, dancer, etc.

In modern usage, an explanatory noun is generally prefixed to the word, e.g., film, motion picture, television, and radio studios. However, a studio may also designate a complex of buildings, including offices, laboratories, theaters, etc. as in Universal Studios, Paramount Studios, etc.

The design of a film or television studio is usually a team effort. It may include the production and engineering personnel of the enterprise, an architect, mechanical, structural, and electrical engineer, a lighting and acoustical consultant, an interior designer, and other experts.

Always, nowadays, an environmental impact report must first be prepared before much planning can be done. From the noise point of view, the investigation must consider not only the intrusion of acoustic disturbances from the existing environment, the so-called noise-immission effect, but also the effects which the new enterprise may have on the surroundings, particularly when they include residential areas. Thus the air-conditioning system equipment in the studio, transformers, truck traffic, pumps, and other sources must be evaluated as to their influence on the privacy of the neighborhood.

1.2 DEFINITIONS OF TERMS

The description of the following technical terms employed in architectural acoustics and in the field of noise control are in conformity with those contained in standards by the American National Standards Institute, the American Society for Testing Materials, the Environmental Protection Agency, the California Administrative Code, and the California Bureau of

Aeronautics.

Noise level measurements generally refer to A-weighted sound levels. This is a single-number index for noise containing a wide range of frequencies, and is intended to represent the subjective impression received of the noise by the ear. Since the human hearing mechanism does not respond equally well to sounds of all frequencies, but is less efficient for the lower notes than for the treble, allowance is made in the acoustic data acquisition system to reduce or "weigh" the aural influence of the base with respect to the high-frequency components of the acoustic disturbance under observation. The electronic device employed in the standard sound level meter for this purpose is designated the "A" network, and sound levels so read or recorded carry the subscript A, as in 56 dB-A.

A differentiation should be made between a noise level measurement and a noise exposure level measurement. The former represents no more than the reading by the eye of a hand-held sound level meter at a given place and time. The noise exposure level measurement requires the assessment of the durations of the various noise events which constitute the noise history at the location. By instrument or computations the acoustic data is used for the statistical evaluation of the noise climate. Thus, L_{10} is the decile A-weighted noise level exceeded for 10 percent of the test period.

A differentiation should also be made between ambient noise and exceeding or extraordinary noise. Municipal antinoise ordinances concern themselves chiefly with "home-made" or exceeding noise like that generated by air-conditioning system equipments about a building, the music levels transmitted from a distant amphitheater, lawn mowers, etc. They do not affect noise level limits preempted by the state, as in the case of automobile din (86 dB-A at 50 ft in California) or the federal government, as in the case of interstate (not intrastate) aircraft. Hence, to learn of the ambient noise level at a specific place, the noise must be measured between car passbys, so that only the all-encompassing noise associated with the environment is assessed. This is usually a composite of sounds from many sources, near and far.

In the forefront of statistical terms for the determination of an acoustic climate is the noise equivalent level L_e. It is that level of a hypothetical steady sound, with the same spectrum as the noise under consideration, which has the same total energy as the actual time-varying acoustic disturbances, that is, the noise history at a given place with its temporal sound amplitude variations.

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