AN EVALUATION OF ROOM AIR DIFFUSION PERFORMANCE

by

AN-PING HOU

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Major Professor

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CHAPTER I

INTRODUCTION

The distribution of air in an occupied space is a very important, but complex, problem. Major contributions to the understanding of air diffusion in occupied spaces for different type outlets have been made through the long-range research program in the Department of Mechanical Engineering at Kansas State University.

Extensive air diffusion studies were conducted at Kansas State University by Miller and Nevins, and they found the average room air velocity to be a linear function of diffuser outlet velocity. This function is not universally usable since the slope of the correlation curve is a function of the type of outlet device.

The objective of this report is to use the data collected in earlier research to correlate the average room air velocity with the momentum flow of the air at the outlet. If this possible, it will give the engineer an additional and very valuable tool to use in the design of room air diffusion systems.

"Speed" and "velocity", although technically different, are both interpreted as speed in this report, as is customary in the industry.

CHAPTER II

LITERATURE SURVEY

A comprehensive study of air diffusion was conducted at Kansas State University by Miller and Nevins. Five air diffusion systems: circular cone-type ceiling diffusers, high side wall grilles, sill grilles, ceiling slots and light troffer diffusers, were evaluated to determine the factors which effect air diffusion from outlets and formulate a means for predicting the performance of these systems.

An analysis of the extensive testing results was made based on the Air Diffusion Performance Index (ADPI). This index is defined as the number of measuring positions in which the combination of air speed and temperature are within specified comfort limits. The comfort limits were defined as an "Effective Draft Temperature" between -1.67 and +1.11 ^{o}C, and a local air speed less than 0.36 m/sec. The Effective Draft Temperature (θ) is a function of local air speed (V_L) and difference in air temperature between the local point (T_L) and a control temperature (T_C), viz.
$\theta = (T_L - T_C) - 7.66(V_L - 0.15)$, in degree C. Fig. 1 indicates the relationship between θ and the local velocity and local temperature differences. Conditions inside the boundaries $-1.67 \leq \theta \leq 1.11$ and $0 \leq V \leq 0.36$ were considered confortable.

Data on velocity and temperature were taken throughout the test room, under various conditions of load and flow rate, and the number of comfortable locations, expressed as a percentage of the total number of measuring positions, is the ADPI. Thus an ADPI of 100% indicates that all the occupied zone could be considered comfortable, whereas an ADPI of 50% shows that