

#### IV. ARCHITECTURAL PLANNING AND DESIGN

##### 1. Introduction

One of the concerns of the Task Force was the influence of architectural design on crowd management. The Task Force sought to understand the effects of crowd movement in the context of building exit and entrance doorways, turnstiles, and other parts of buildings associated with pedestrian circulation.

##### 2. National Bureau of Standards

The National Bureau of Standards (NBS) of the United States Department of Commerce was contacted and asked to counsel the Task Force and respond to a series of written questions. Two of these questions and the responses are especially significant in their impact on present and future model regulations for building access and emergency egress.

Q: "In pedestrian circulation system design for buildings, should the sizes and quantities of doors, turnstiles, corridors, stairs, etc. be based on the rates at which people pass through these elements?"

A: "Building regulations prescribe rates of movement for the various components (corridors, stairs, ramps, doors) with the intention of establishing an acceptable degree of safety in terms of the use of buildings (Sharry, 1978). Rates of movement are used in calculations that determine the sizes of the circulation system components. Therefore, in pedestrian circulation system design, the sizes and quantities of the various components are determined by rates of movement.

The National Bureau of Standards (NBS) 1935 study of exit requirements remains the research basis for rates of movement used in building regulations (Sharry, 1978). The rates of movement reported in the NBS study were limited to doors, corridors, and stairs (Stahl and Archea, 1977), however, research and practice in building design since 1935 has shown the NBS study in general to be obsolete. While rates of movement are important to circulation system design, building regulations do not prescribe rates of movement for components such as turnstiles, revolving doors, gates, elevators, etc."

Q: "When a particular door or set of doors for a building is designed primarily for entry and the door, or set of doors, is not a part of the required emergency exiting system, would a door that swings both in and out aid movement into the building?"

A: "Even though a door or set of doors is intended primarily for entry into a building, there is no basis for assuming that the door or doors will never be required to serve as a means of egress under emergency conditions. Currently, there is no basis for treating any entrance doors to buildings other than as specified by applicable building regulations.

The basic principle underlying egress design is the direction of exit travel. The direction of door swings, the clear passage width, and the capacity of means of egress as units converge are all regulated in terms of the direction of travel (Sharry, 1978). In addition, Seaton (1979) reports that when people were observed manually using entry/exit doors to buildings, people exiting made only a quarter of the errors made by people entering as they either pushed or pulled on the doors. He attributes the difference to the outswing of the doors. This research suggests that people tend to operate doors in the direction of travel, regardless of whether the doors are labelled "push" or "pull".

There is no research basis for a direct answer to this question. The question highlights the need for an analytical understanding of how physical design differences affect the movement characteristics of ingress and egress."

The answer to another question concerning the rates at which people can move through elements such as doorways, turnstiles, etc. pointed out an important difference between how pedestrian research is conducted and the use of its results.

Q: "What are the rates of flow on stairs and corridors and through doorways and turnstiles that have resulted from pedestrian circulation research?"

A: "The flow rates for circulation system components that have been observed in research represent observations that were made under normal conditions. It is important to point out that under emergency or abnormal conditions the observed rates may no longer be valid."

In general, the response from NBS indicates that federal government attention has been focused on the safe processing of people exiting from buildings in emergency situations, while equal attention has not been directed toward the safe processing of people entering buildings. In fact, ingress research sponsored by the federal government concerning high density pedestrian flow and processing is meager, if existent at all. Current facility entrance designs are based on a study nearly a half-century old which the NBS now considers "obsolete". Unlike bridge designs, which are judged in fitness for public use according to their capacity to support peak or stress loads, facility entrance designs intended to accommodate crowds are based on data obtained from normal conditions and typical crowds. Everyone concerned with crowd management and crowd design will benefit from new research aimed at providing and understanding pedestrian or crowd movement over a variety of situation.

The National Bureau of Standards is the appropriate agency to initiate a project to update and/or replace the results of the 1935 study which is the basis for many current building code exit and entrance design regulations. It is vital to public safety in places of assembly for this agency to embark on research directed at developing a basis for national standards for high density flow and pedestrian processing throughout entire buildings. Queueing, ticket processing, crowd types and behavior, turnstiles, environmental influences, entrance configurations, aisle configurations, and door and entrance dimensions, are a few of the critical topics that need to be studied.

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##### RECOMMENDATIONS

1. The National Bureau of Standards should review existing regulations concerning pedestrian and crowd processing in, through and out of buildings, and embark on new studies directed at establishing new regulations where appropriate.
2. The National Bureau of Standards should initiate new research into the changing pedestrian flow patterns with emphasis on, but not limited to, high density rates, ingress flows, ticket processing, entrance configurations, the influence on environmental variables and crowd dynamics in high density situations.