STATISTICAL AND PROBABILISTIC METHODS FOR DESIGN OF REINFORCED CONCRETE STRUCTURES

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INTRODUCTION

This report presents a review of simple probabilistic analysis and design techniques for reinforced concrete structures subjected to normal use loads.

The rapidly developing interest of engineers and researchers, in probabilistic procedures has resulted in a number of developments specifically aimed at applications to reinforced concrete.

The necessity to adopt methods of design of structures using probability theory has been limited for quite a long time, although many engineers see the rationality of probabilistic models of phenomena, of interest to the profession. There have been numerous papers written on probability and statistical methods for design of concrete structures by renowned authors, among the first of these being Freudenthal (9,10)*. The methods developed have not yet been widely adopted in practice, obviously. Indeed there has not been sufficient development of models to permit a unified probabilistic approach to the many aspects of civil engineering subjects where the methods could be of immense use.

A significant influence on the development of theories of diverse backgrounds is the result of a major change within the theory of applied probability and statistics. As of now, a somewhat controversial theory is developed around a framework of economic decision making. A question which has centered around probabilistic studies of natural strength

*Numbers in parentheses refer to items listed in Appendix I - References.

properties of materials is "What is the cost of excess safety margins in structural design?" The answer to this is still premature since there are many implications involved with these methods.

In place of earlier emphasis on obtaining proper objective descriptions of repetitive physical phenomena, the new concern is with making decisions involving economic gains and losses when uncertainty exists in the decision maker's mind regarding the state of nature. This new emphasis, with its new interpretations and new methods, is far more appropriate and natural for the profession of civil engineers which is more closely involved than any other profession in the economical design of structures subjected to uncertain demands of natural and man-made environmental factors.

Recent developments in probabilistic analysis have led to new concepts and tools for the assessment of safety and reliability of structures that would be of interest to every structural engineer. The ultimate objective of a structural engineer is to design structures which are both economically feasible and functionally reliable.

This report presents a discussion of the basic need to alter the existing structural safety factors in the various codes based on the numerous papers of well-known authors who strongly feel that the conservative safety factors be improved by formulating new factors of safety based on statistical and probabilistic studies.