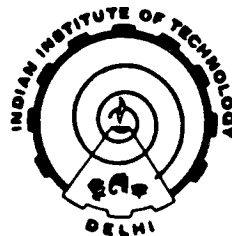


APPLICATION OF FUZZY SET THEORY IN CONSTRUCTION MANAGEMENT

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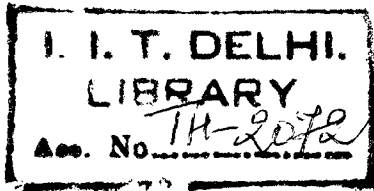
V. S. S. KUMAR

*A Thesis submitted
in fulfilment of the requirements
for the degree of*
DOCTOR OF PHILOSOPHY

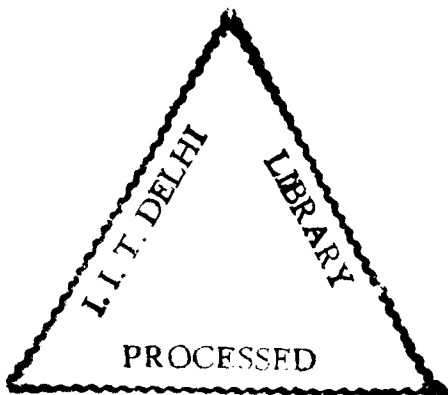


to the
Department of Civil Engineering
INDIAN INSTITUTE OF TECHNOLOGY, DELHI
INDIA

MAY, 1993



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CERTIFICATE

This is to certify that the thesis entitled "APPLICATION OF FUZZY SET THEORY IN CONSTRUCTION MANAGEMENT", being submitted by Mr. V.S.S. Kumar to the Indian Institute of Technology, Delhi, for the award of the degree of "DOCTOR OF PHILOSOPHY" in Civil Engineering is a record of the bonafide research work carried out by him under my guidance and supervision.

To the best of my knowledge the thesis has reached the requisite standard. The material presented in this thesis has not been submitted in part or full to any other University or Institution for the award of any degree or diploma.

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DEDICATED TO
MY FATHER, PROF. V.V. SUBBA RAO, AND
MY MOTHER, VELLANKI KAMALA

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(V.S.S. Kumar)

ABSTRACT

Construction technology is becoming more and more complicated, partly because of the phenomenal increase in the activity and mostly because of the complexity of the parameters that are involved. Hence, the need to rationalize the various inputs and optimize the construction practices has already become imperative. Several considerations, which are qualitatively described by terms such as high, medium, low, good, bad, satisfactory, have a very important bearing on the Civil Engineering aspects of a project and the structures therein. The subjective judgments implicit in these qualitative terms cannot be directly incorporated into the analysis and planning of Civil Engineering activities.

The Fuzzy Set theory makes available a very convenient and meaningful tool to practicing engineers to incorporate these seemingly vague but practically powerful factors in the several phases of a project life cycle. This dissertation evolves certain methodologies of incorporating Fuzzy Set Concepts into the analysis procedures in certain phases of a project and illustrates the application through important topics of network analysis, evaluation of alternatives, assessment of working capital requirement, and Fuzzy linear programming (which are described in brief in the subsequent paragraphs).

In the first case, simulation of a project network with fuzzy activity durations is discussed in detail. Comparative deductions on the results of simulation and of Fuzzy Set theory application establish the potential of, and confidence in, Fuzzy Set theory application to Construction Management.

In the second aspect of the study, intangible, non-quantitative and linguistic variables have been considered for the evaluation process. In this context, the application of Dominance Matrix for evaluation of alternatives has been studied.

The method of evaluation of external forces, namely, weather conditions, resource availability, etc., has been extended to assessment of Working Capital requirement as the third aspect of the study. This has been done by recognizing the fuzzy nature of factors, like foundation conditions, engineer's experience, etc., in as much as they affect construction activity.

In the fourth aspect, application of Fuzzy Linear Programming has been discussed. This tool handles linguistic goals and constraints by using flexibility in the constraints as well as fuzziness in the objective function. This technique has been reviewed with respect to Construction Management and applied to a case example to illustrate its advantages.

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