BEHAVIOUR OF PLATES WITH FOLDED STIFFENERS

A THESIS SUBMITTED
IN FULFILMENT OF THE REQUIREMENTS
FOR THE AWARD OF DEGREE OF

DOCTOR OF PHILOSOPHY

by

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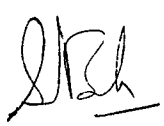
October, 1989

CERTIFICATE

This is to certify that the thesis entitled "Behaviour of Plates with Folded Stiffeners" being submitted by Mr.P.C.Ragtah to the Indian Institute of Technology, Delhi for the award of the degree of Doctor of Philosophy in Civil Engineering, is a record of bonafide research work carried out by him. Mr.P.C.Ragtah has worked under my guidance and supervision and has fulfilled the requirements for the submission of this thesis, which to my knowledge, has reached the requisite standard.

The matter embodied in this thesis has not been submitted, in part or in full, to any other University or Institute for the award of any degree or diploma.



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ACKNOWLEDGEMENTS

It is with a sense of deep gratitude and a feeling of immense pleasure that I extend my thanks to Dr.S.N. Sinha, Associate Professor, for his constant help, encouragement and constructive discussions throughout the course of this investigation.

Thanks are also extended to the staff of the Computer Center, Structural Engineering Laboratory and Civil Engineering Workshop.

I gratefully acknowledge the inspiration provided to me to pursue my Doctoral Research Work by late Dr.S.Majumder.

The assistance rendered by Mr.R.Agarwal in preparation of the drawings and Mr.Akhilesh Chippli in typing the manuscript is gratefully acknowledged.

Finally I would like to thank the members of my family for their help and cooperation through out during the period of research work.

P.C.Ragtah

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PREFACE

Based on the research work presented in this thesis, following six papers have been accepted or communicated for publication.

(1) Ragtah, P.C. and Sinha, S.N., (1986), "Behaviour of Plates with V-shaped Folded Stiffeners", The First East Asian Conference on Structural Engineering and Construction, Bangkok, Jan. 1986.

(2) Ragtah, P.C. and Sinha, S.N., (1986), "Behaviour of Plates with Short Length V-Shaped Folded Stiffener", The Asia-Pacific Concrete Technology Conference, October, 1986.

(3) Ragtah, P.C. and Sinha, S.N., (1988), "Analysis Curves for Plates with V-Shaped Folded Stiffeners", Conference on Computer Applications in Concrete, Singapore, March 1988.

(4) Ragtah, P.C. and Sinha, S.N., (1989), "Behaviour of Plate with Folded Stiffeners", Paper Communicated to the Journal of Struct. Engineering, ASCE.

(5) Ragtah, P.C. and Sinha, S.N., (1989), " Behaviour of Plate with Short Length Folded Stiffeners", Paper Communicated to the Journal of Struct.Engineering, ASCE.

(6) Ragtah, P.C. and Sinha, S.N., (1989), "Analysis Curves for Plate with Short Length Folded Stiffeners", Paper Communicated to IABSE.

ABSTRACT

Recent use of light gauge forms in steel and aluminium alloys and thin reinforced concrete members have drawn the attention of many designers and research workers to the application of stiffening elements in the structural system. Stiffened plates are extensively used in ships, aircrafts, buildings, bridges, retaining walls etc. Stiffening of plates is generally done by the additional members of various cross sections. Extremely limited studies have been made on the behaviour of plate with V-shaped folded stiffeners.

In the present investigation, a study is made on the behaviour of plates with full length and short length folded stiffeners, simply supported at two ends. Plates so stiffened are appropriate for span ranging from 6 m to 15 m. Analysis of plates is done using a semiloof finite element. In order to reduce the computation time, large data and memory required for analysing a plate with multiple unit folded stiffeners, equivalent smaller units of plate are proposed. The proposed model consists of exterior half unit of plate and multiple interior half units of plate with folded stiffeners.

Experimental investigations have been done on five reinforced concrete models - two for plate with full length

folded stiffeners and three for plate with short length folded stiffeners. Experiments on plate with full length folded stiffeners have been conducted to study the effect of depth of stiffeners and experiments on plate with short length folded stiffeners have been conducted to study the effect of length and depth of folded stiffeners. Several cycles of loading and unloading were done and the models were tested upto failure. The investigation consists of the study of strains and deformations at critical sections of the plate to check correlation with the proposed analytical model and method of analysis in the initial stage of loading. Some study has been also reported on plate deformation, degradation of stiffness, and energy dissipation of the structural system.

A detailed analytical study on the effect of various geometrical parameters such as spacing, depth and width of folded stiffeners on non-dimensionalised deflection, longitudinal force and longitudinal and transverse moments is made at various cross sections of the plate and at critical points in the plate for a wide range of non-dimensionalised geometrical parameters. For plate with short length folded stiffeners, an additional geometrical parameter, namely, the length of the stiffener is also considered for studying the behaviour of the plate. The critical sections along which the effect of geometrical

parameters is studied are (i) mid-span and (ii) the section where the short length folded stiffener starts.

Analysis curves are also presented for determining deflection, longitudinal force, and longitudinal and transverse moments for plate with full length folded stiffeners as well as for plate with short length folded stiffeners.

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