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BRIDGE DECK ANALYSIS

being a thesis in two volumes

submitted for the

DEGREE OF DOCTOR OF PHILOSOPHY

at the

SCHOOL OF ENGINEERING
THE UNIVERSITY OF AUCKLAND
NEW ZEALAND

by

I.G. BUCKLE, B.E. (Civil) (Hons).

1964 - 1967

VOL. I.
In this thesis the structural analysis of two basic types of bridge deck systems are discussed:

I. the multibeam bridge deck
II. the skewed anisotropic bridge deck.

The major difficulty in the analysis of I, the multibeam deck, arises from its lack of transverse bending stiffness; load distribution occurs by shear transference at interlocking shear keys. An analysis method, developed from transfer matrix theory is proposed and shown to be satisfactory for such a structure. Model studies on a quarter scale multibeam bridge deck are described together with field tests on the prototype decks - the southern motorway bridges crossing Slippery Creek. Agreement between theory, model studies and field tests is illustrated.

The satisfactory analysis of II, the skewed anisotropic deck, is complicated by its anistropic elastic properties and skewed geometry. An analysis procedure is introduced which is an extension of the finite element technique already established in other plate bending and plane stress problems. Using therefore the matrix displacement method and finite element discretization, the method has been programmed for solution by digital computer. Comparison of the computed displacements with those obtained by experiment on skewed isotropic and anisotropic steel plates is given. The finite element method is seen to be a powerful analytical tool, particularly because of its ability to handle elastic anisotropy and arbitrary geometric shapes.

This thesis is accordingly divided into two volumes as below:

Volume I:  "Matrix Analysis and Structural Behaviour of Multibeam Bridge Decks."
Volume II: "Matrix Analysis of Skewed Anisotropic Bridge Decks."
ACKNOWLEDGEMENTS

The work that is described in this thesis was carried out at the School of Engineering under the joint supervision of Mr. R.A. Jones, Senior Lecturer, and Professor N.A. Mowbray, Head of the Department of Civil Engineering.

Mr. Jones directed the work through its initial stages and his enthusiastic support with the design, construction and testing of the quarter scale, multibeam model is gratefully acknowledged. His continuing advice and comments on later phases of the work were also appreciated.

On the registration of this project for a Ph.D degree, Professor Mowbray accepted sponsorship of the work and his helpful guidance and pertinent criticism, with particular reference to the finite element matrix work described in Volume II, is also acknowledged. For his encouragement and interest in all phases of the project, I owe my grateful thanks.

Thanks are also due to the following members of the School's Staff for their interest and useful discussion: Associate-Professors C.M. Segedin and J.H. Percy and Messrs. M.S. Rosser and P.D. Smith. Mention is also made of the untiring efforts of the library and workshop staffs and Mr. N. Kirton, to satisfy my numerous requests for literature and equipment. In particular, my thanks go to Mr. Cyril Collins for his valuable assistance in the laboratories and his photographic skill in the dark room. The interest of fellow research graduates and their assistance is also acknowledged.

I also wish to acknowledge the co-operation and assistance received from the Ministry of Works during the field testing of the Slippery Creek bridges. In particular I should like to thank the ex-Chief Design Engineer, Mr. R.G.Norman, for his sympathetic attitude towards the aim of the project and to Messrs. Drupsteen (Auckland District Design Engineer) and Herbert (Senior Engineer, Auckland) for their advice and assistance during the planning and execution of the tests. To Mr. John Clark and the draughting cadets of 1965, I owe thanks for their steadfast assistance during the field tests, and also to the staff of the Southern Residency who made available plant and other equipment necessary for the project.

These acknowledgements would not be complete without mention of the encouragement and help received from my family. My sincere thanks go to my mother for typing the draft manuscripts in a language entirely foreign to her, and for her continued patience and active interest in my work. (Similar thanks are expressed to Mrs. Shimmin, who typed the final script under the same
difficulties). To my brother, David, and Miss Shirley Smith, I owe similar appreciation, for their interest and patience, with digital computers on the one hand and civil engineering on the other.

During the course of this work, the author was financially supported by the Ministry of Works of the New Zealand Government.
VOL U M E  I .

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CHAPTER: ONE

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