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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

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by

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

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VOL. I.

SYNOPSIS

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 anisotropic 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."

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VOLUME I.

MATRIX ANALYSIS AND STRUCTURAL BEHAVIOUR

OF MULTIBEAM BRIDGE DECKS.

C O N T E N T S

Synopsis.

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CHAPTER: ONE

TITLE: INTRODUCTION TO MULTIBEAM BRIDGE DECKS

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