UNIFIED PROCEDURE FOR THE DESIGN OF STRUCTURAL CONCRETE MEMBERS

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Chapter 1

INTRODUCTION

1.1 Introduction

Failure in shear of reinforced concrete beams takes place under diagonal tension stresses resulting from an applied shear force, bending moments and where applicable, axial loads and torsion. It is characterised by inclined cracking which can take a wide variety of different forms; small deflections and lack of ductility. In design, shear is only considered at the ultimate limit state where it is generally desirable to ensure that the ultimate strength of members are governed by flexure rather than shear. The provision of shear reinforcement increases the ductility of the beam and considerably reduces the likelihood of a sudden and catastrophic failure which often occurs in concrete beams without shear reinforcement.

Kani(8) in his paper, "The riddle of shear and its solution" has quoted the ACI-ASCE Commitee 426(326) report on "Shear and Diagonal Tension" which reviewed all the major attempts and achievements in the investigations of shear failure during the first half of this century. The introduction of this report closes with the following paragraph:-

> "The problems of shear and diagonal tension have not been fundamentally and conclusively solved .....".“Committee 326 wishes strongly to encourage further research work, not only to explore other areas of the problem but to establish a basically rational theory for effects of shear and diagonal tension on the behavior of reinforced concrete members."

Three decades later, a significant amount of research has been undertaken into the behaviour of reinforced concrete members aimed at resolving the riddle of shear. It was realized some years ago that the riddle of shear is not so simple as a large number of parameters are involved; the non– linearity in material response, presence of cracks, presence of reinforcement, combined load effects etc. The behaviour of reinforced concrete in shear is very complex, and the current understanding of shear is based on the analysis of results from an extensive number of tests and simplifying assumptions rather than on an exact universally acceptable theory.

Thus even today, the distributions of the shear stress across a beam cracked in flexure are not fully understood and an accurate determination of its magnitude is still impossible. Codes of Practice have therefore concentrated on producing reliable empirical methods of adding shear reinforcement to a member to ensure that it has an adequate factor of safety at all points.

1.2 Objective

The truss model has been generally considered to be a rational and appropriate basis for analysing the stress in shear reinforcement in the design of reinforced concrete beams subjected to shear. It is the basis of the current British Standard, BS8110.