A METHOD TO ANALYZE THE CYCLIC BEHAVIOR OF REINFORCED CONCRETE SLENDER SHEAR WALLS

by

Haluk M. Aktan[I] and Robert D. Hanson[II]

SYNOPSIS

A finite element technique for analysis of the cyclic behavior of reinforced concrete slender shear walls is described. The cyclic material models for concrete and reinforcing steel developed in this study are used in the analytical procedure. This analysis separates the linear elastic and nonlinear deformations and uses different finite elements to describe them. The analytical results have been compared with experimental results of other investigators to check the accuracy and usefullness of the proposed method (1).

RESULTS

The shear wall to be analyzed is divided into subdomains in which the deformations are composed of linear and nonlinear portions. Two separate stiffness matrices are computed for each subdomain, one containing only the elastic properties and the other containing only nonlinear terms. The changes in the material properties are reflected only in the stiffness matrix that contains the nonlinear terms. These subdomains are divided into elastic deformation elements and zero thickness joint elements which have nonlinear deformations. The joint elements are located between the elastic elements and have only shearing and normal stress components. They are defined to exhibit the nonlinear behavior of reinforced concrete including cracking and crushing.

The element stiffnesses are derived for a composite material and the hysteretic material models are based upon the experimental and analytical studies of previous investigators. The important material properties which are considered in this analytical model are

1) concrete under normal stresses,
2) shearing behavior of concrete,
3) shear transfer across the crack by aggregate interlock and dowel action,
4) behavior of reinforcing steel before the crushing of concrete and
5) behavior of reinforcing steel after the crushing of concrete.

The applicability of this model was demonstrated by comparing analytical solutions with experimental results for both monotonic and cyclic loading. The model showed good match with experimental results.

REFERENCE

1. Aktan, H. M., "A Method to Analyze the Cyclic Behavior of Reinforced Concrete Slender Shear Walls," *Ph.D. Thesis, The University of Michigan*, Ann Arbor, Michigan, 1976.

I Graduate Student, Civil Engineering Department, The University of Michigan, Ann Arbor, Michigan, U.S.A.

II Professor and Chairman of Civil Engineering, The University of Michigan.