SEISMIC ANALYSIS OF ASYMMETRIC SHEAR WALL-FRAME BUILDINGS

by

PISIDHI KARASUDHI[I] and MING-SING CHU[II]

An approximate seismic analysis of an asymmetric multi-story building made of frames and shear walls is outlined as the following:

A simple derivation of the lateral stiffness of a rectangular building is carried out by certain assumptions, namely, the building consists of two sets of orthogonally intersecting planar bents, each of which denotes either a frame or a shear wall; the floor diaphragms are infinitely rigid in their own planes; all members are prismatic; all interior columns in each story of the frame have the same stiffnesses and the stiffnesses of the exterior columns are one half of that of the interior columns; the stiffnesses of girders in the same floor of the frame are equal; all the joints in the same floor of the frame have the same rotation; the shear and axial deformations are negligible; and the St. Venant and warping torsion of the shear walls are negligible in comparison with the torsion of the building as a whole.

Assuming further that the mass of the structure is concentrated at floor levels, and each floor has two orthogonal translations and one rotation in plan; there are 3N degrees of freedom for an N-story building. Equations of motion are obtained by Lagrangian dynamics and solved by the method of classical normal modes.

Two 20-story reinforced concrete buildings in which each floor plan has an axis of symmetry, are studied. In the direction normal to this axis of symmetry, each building is subjected to the ground motion of the N-S component of the El Centro earthquake of 18 May 1940. The numerical results obtained show that the effect of the frames normal to the direction of the applied load can be neglected in practice, and the rotation of the floors of an asymmetric building must be considered in the seismic analysis. This type of rotation greatly reduces the maximum shear force and bending moment in the shear wall, but increases the maximum shear forces in the frames, especially the ones which is further away from the shear wall.

[I]Associate Professor, [II]Graduate Student; Division of Structural Engineering, Asian Institute of Technology, P.O. Box 2754, Bangkok, Thailand.