Modeling Of Two-Cell Concrete Cores For Investigation Of Reliabality Of Equivalent Column Method

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Abstract

The behavior of shear walls have been the subject of many researches in the recent past. In contrast, only little mention has been made of the shear core walls structures with coupling beams. The key points in this study is to determine whether equivalent column method is precise in solution or not. This research focuses on the modeling of shear core wall with equivalent column method and two dimensional panel elements method. The models examined are models composed of panel elements and models composed of equivalent column in different hand arrangement. These models are compared with one another and with the solution considered accurate, which is the one obtained by using a finite element method consisting of an adequately dense mesh of finite shell. It can be concluded that application of equivalent column method in cores, leads to inaccurate or even unacceptable results .This deficiency can be improved by using flexible rigid links.

Keywords: Shear core wall, coupling beam, equivalent element , core rotation, Warping.

1. INTRODUCTION

The penetration of the finite element method into almost all fields of structural computation has not yet been able completely to replace the use of simplified modeling and analysis methods. Widely accepted models for the analysis of multi-story buildings with planar shear walls and cores are: equivalent frame models, also referred to as wide column analogy, and panel element models. Also—in some cases—core models consisting of a sparse mesh of finite elements are used.

Mainly the use of the equivalent frame model has been a major success. This model was devised for the analysis of planar shear walls approximately four decades ago [1,2,3,4]. The simplicity and effectiveness of this model has almost self-evidently led to the extension of its application to composite shear walls (cores) in three dimensional analysis of multi-story buildings [1,2,3,4,5]. However, soon, serious deficiencies in the performance of this model were detected. Several investigations on this matter have shown that application of this model to open, semi-open and closed building cores subjected to strong torsion leads to inaccurate or even unacceptable results [6,3,4]. Also, significant deviations from the correct solution are observed for planar shear walls with varying width along their height or with irregularly distributed openings [6].

Furthermore, it should be noted that the equivalent frame model for a given core is not unique. Quite the contrary, it depends on certain necessary assumptions that can lead to different spatial frame models [6]. The differences between the possible models concern: (a) the number of equivalent columns; (b) their location in the core cross section; and (c) the cross sectional properties of equivalent columns and interconnecting auxiliary beams (links) used at the story levels. The reliability and efficiency of a series of various equivalent frame models for open, mainly U-shaped cores have been investigated in depth in the recent past [6]. On the contrary, the reliability of equivalent frame models for multi-cell cores, and especially for open two-cell cores is very poor, although such cores are very often encountered in practice. In Fig 1 different arrangements of equivalent frame model are presented: