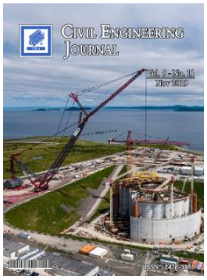
Available online at www.CivileJournal.org

Civil Engineering Journal

Vol. 5, No. 11, November, 2019



Numerical Study on the Effect of Concrete Grade on the CFT Circular Column's Behavior under Axial Load

Baitollah Badarloo [a*], Faezeh Jafari [b]

[a] Department of Civil Engineering, Qom University of Technology (QUT), Qom 37181-46645, Iran.

[b] Department of Civil Engineering, Malayer University, Malayer 65719-95863, Iran.

Received 26 February 2019; Accepted 03 September 2019

Abstract

Concrete-filled tubular (CFT) column improves the structure properties under different load pattern, so that it should be designed under two main load patterns (static and cyclic load) using current design method such as Finite Element Method (FEM) and analytical method (guideline equation). In this research, a CFT column with specific dimensions is modeled by using ABAQUS finite element software; the target of this study is to conduct a pushover analysis and also a hysteresis analysis under cyclic loading. Then, the concrete grade and percentage of column reinforcement were altered using the FEM, and eventually, compared with the results of analytical equations to measure the safety level of analytical equations. For this purpose, the CFT columns with C20, 30, 40 & 50 concrete cores were modeled with and without reinforcement, and the effect of concrete grade on the capacity of column was studied. In addition, MATLAB software was used to obtain beta index and load capacity design for the CFT column. The results demonstrated that the columns designed in accordance with the AISC have a good performance under the cyclic and static loading. The safety level of design equations ranged between 3 and 5, and the columns could resist higher loads (about 2.5-3.5 times) through the design by ABAQUS.

Keywords: CFT Columns; AISC Guideline; ABAQUS Software; Cyclic and Pushover Analyses.

1. Introduction

The steel sections filled by various grades of concrete with different heights and various compounds are used as column and beam-column in different types of structures. The concrete-filled tubular (CFT) column can improve the structural properties under the earthquake, so that it could develop the same seismic resistance in two perpendicular directions. The composite hollow-section CFT columns show complex stiffness and behavior as a result of the concrete core and the interaction between the two materials. The modulus of elasticity, moment of inertia and effective surface in tensile loading are quite clear in steel, while it is difficult to estimate these parameters in concrete because of heterogeneity. The concrete strength, tensile cracking and prolonged loading effects, among others, have a greater effect on the concrete specifications [1]. Various studies have been conducted to determine the static behavior of CFT columns under axial compressive loads, pure bending, and combined bending and axial compressive loads [2-4], which are outlined as follows. In a numerical study, Ehab Ellobody (2006) examined the behavior and design strength of circular CFT columns under axial loads. This research aimed to investigate the effect of concrete compressive strength ($f'c$) and ratio of diameter to wall thickness (D/t) using the concrete with a compressive strength of 30-110 MPa and the sections with D/t ratio of 15-80. The comparison of the strength obtained from the numerical analysis performed in this study with the design strength calculated using the US, Australian and European codes showed that comparing the European

* Corresponding author: badarloo@qut.ac.ir

http://dx.doi.org/10.28991/cej-2019-03091417