Behavior of concrete moment frame reinforced with fiber reinforced polymer bars

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Abstract

In this research, four types of concrete moment frames reinforced with fiber reinforced polymer were designed and then analyzed to evaluate the behavior of moment frames. Firstly, a computer code was written to calculate the amount of fiber reinforced polymer in beams then to evaluate the actual behavior of moment frames, all of the beams and columns sections were analyzed through XTRACT software which is in the base of moment curvature. To examine the performance of moment frame, a nonlinear static analysis was considered and all of the sections were defined as confined section to provide enough ductility. Also, to show the exact behavior of moment frame, all of the plastic hinges in the beams were analyzed both through their moment curvature and all of the columns plastic hinges were analyzed both through their moment frame reinforced with GFRP and CFRP provide higher bearing capacity but less ductility that is detrimental for seismic zone.

Key words: fiber reinforced polymer bars; Nonlinear static procedure; Moment frame; Pushover analysis

1.Introduction

Fiber reinforced polymer (FRP) bars are a good alternative for steel bars. FRP bars have some advantages over steel bars like: light weight, high strength, corrosion resistance and insulation [1]. Using fiber reinforced polymer can help to increase the moment bearing capacity of structures

Two detrimental characteristics of fiber reinforced polymer that are not desirable for seismic zone are: linear behavior that cause brittle failure [5]and low modulus of elasticity that leads to higher displacement [4]. To avoid brittle failure in members, different ways were recommended to increase the ductility of FRP reinforced section like: confining both columns and beams [17] and using both steel and FRP bars in a section [5,16,17,18]