Available online at www.CivileJournal.org

Civil Engineering Journal

Vol. 4, No. 3, March, 2018

The Effect of Local Fuse on Behavior of Concentrically Braced Frame by a Numerical Study

Ali Kachooee [a*], Mohammad Ali Kafi [b], Mohsen Gerami [b]

[a] *Ph.D Student, Faculty of Civil Engineering, Semnan University, Semnan, Iran.*

[b] *Associate professor, Faculty of Civil Engineering, Semnan University, Semnan, Iran.*

Received 20 January 2018; Accepted 28 February 2018

Abstract

The concentrically braced frames (CBFs) are one of the most widely used lateral load-resisting systems. Seismic performance of these structures has a weakness that is due to the brace buckling at a lower loading than the ultimate compressive loading capacity. In this paper, attempt is made to enhance the seismic response of CBFs through utilizing a local fuse. For this purpose, first the formulation of fuse area and length are presented. Then based on this formulation, several numerical models have been built and analyzed to examine the effect of implementing this fuse on seismic response of CBFs. From the analyses results, it is found that if the reduced cross-section fuse (RCF) is properly designed and also the end of brace is fixed, the CBFs with equal energy dissipation capacity, that are equipped with this fuse exhibit a better ductility than the customary CBFs.

Keywords: Concentrically Braced Frame; Reduced Cross-Section Fuse; Ductility; Energy Dissipation Capacity.

1. Introduction

The concentrically braced frame (CBF) structures are one of the most popular lateral load-resisting systems. The most important feature of these structures is their high stiffness and strength. Against low ductility of these structures there is an important concern which is due to the buckling of compressive member before reaching the nonlinear level and energy dissipation. Since loading capacity of the compressive member decreases after buckling, the hysteresis curve becomes asymmetric and then the energy dissipation is not well performed. In this regard, many studies have been performed by various researchers for improving the CBFs seismic response. In the following, some of them have been explained.

Friction damped braced frame (FDBF) was introduced by Pall and Marsh [1] for modifying the CBFs performance. In these structures, a friction element has been used at the intersection of X-braces element. The general conclusion of Pall and Marsh [1] studies showed that application of these cheap friction dampers in CBFs would greatly increase their seismic strength. In addition, this damper prevents the major element from damage when the structures are subjected to intense seismic excitations. In this case all of the damage is concentrated on the friction damper. Another lateral load resisting system for enhancing the CBF's ductility and energy dissipation capacity is yielding damped braced frame (YDBF). First, this structure system was introduced by Jurukovski et al. [2]. YDBF has a shape similar to that of FDBF but in YDBF, a rectangular steel frame is used at the intersection of X-braces element. In YDBF, while the structure is subjected to intense earthquake none of the fundamental structural elements are damaged. In these structures yielding mechanism is related to the yielding of rectangular middle frame and then is continued by yielding of the braces. The experimental studies of Jurukovski et al. [2] has demonstrated a better ductility and energy dissipation capacity of YDBF

* Corresponding author: ali.kachooee@semnan.ac.ir

http://dx.doi.org/10.28991/cej-0309123