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Analytical study on gusset plate behavior of braced frames through finite element method

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Abstract

Nowadays, it's common place to use concentrically braced frames (CBFs) for lateral-load resisting systems in steel structures sporadically. Gusset plate connections play an outstanding role to connect the beams and columns in CBFs systems, so need to be taken into center of attention in designing of CBFs. This analytical study has illustrated that buckling capacity of CBFs under a monotonic loading can be improved by considering the behavior of gusset plate connection through designing its thickness and size. In this paper, experiment results and finite element model have been verified, in addition, it indicates that CBFs performance depend upon gusset plate connections, consequently.

Keywords: Concentrically braced frame (CBF), Finite element method, Gusset plate connections, Buckling capacity

1. INTRODUCTION

Concentrically braced frames (CBFs) are frequently used in steel structural buildings, as shown schematically in Fig. 1 [1]. Lateral-load resisting has been controlling by these frames, which are also transferred to the beams and columns by gusset plate connections [2]. Mostly steel frames with concentrically systems are preferred to use in comparison to moment frames, since the ability of braced members to control the lateral-load resisting of frame has more efficiency than that had no braced members. Moreover, steel sections used in the beams and columns of braced frames are significantly lighter than required ones for moment frames. That is why, structural engineers widely choose braced frames since it's much more beneficially [3]. There are two usual ways to connect gusset plate connections to the diagonal bracing members and main framing members encompass welding and bolting, however, the gusset plates of considered model at this paper bolted to the braced member.

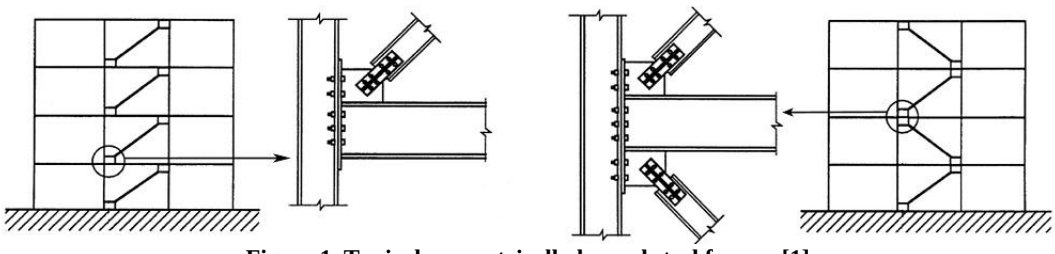

Figure 1. Typical concentrically braced steel frames [1]

This paper presents that buckling capacity of CBFs depend on gusset plate thickness and size, which was derived by verifying experimental investigation of CBF model developed at University of Alberta [1] and inelastic finite element model through the commercial finite element program Abaqus 6.13-1 [4].

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