Overall Buckling Behavior of All-Steel Buckling Restrained Braces

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ABSTRACT

One of the key requirements of desirable mechanical behavior in buckling restrained brace under severe earthquake loading is to prevent its global buckling, until the brace member reaches enough plastic deformation and ductility. This paper presents the finite element analyses results of proposed all-steel buckling restrained braces. The proposed BRBs have identical core section but different buckling restraining mechanism (BRM).The objective of the analyses is to conduct a parametric study for BRBs with different amount of gap (between core and BRM) and initial imperfection to investigate global buckling behavior of the brace. Analyses results showed that BRM flexural stiffness could significantly affect the global buckling behavior of the brace. In addition, a minimum ratio of the Euler buckling load of the restraining member to the yield strength of the core (i.e. P_e/P_y) is suggested for the design purposes. This is the main parameter that controls the brace global buckling.

Keywords: All-steel buckling restrained brace, Global buckling, Finite element analysis, Cyclic loading

1. INTRODUCTION

Buckling restrained braced frames (BRBFs) for seismic load resistance have been widely used in recent years. A BRBF differs from a conventionally braced frame because a buckling restrained brace (BRB) yields under both tension and compression without significant buckling. Most BRB members currently available are built by inserting a steel plate in a steel tube filled with mortar or concrete. The steel plate is restrained laterally by the mortar or steel tube and can yield in compression as well as tension, which results in comparable yield resistance, ductility, and stable hysteretic behavior of BRBs. The hysteretic curve of a BRB is stable, symmetrical and ample [1] .Buckling restrained braces have been introduced in Japan as hysteretic dampers designed to enhance the seismic response of the building structures [2]. Numerous researchers have conducted experiments and numerical analysis on BRBs for incorporation into seismic force resisting systems. Qiang has investigated the use of BRBs for practical applications for buildings in Asia [3]. Clerk et al. suggested a design procedure for building incorporating BRBs [4].