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Investigation of Plate Thicknesses and Low Yield Point Steel (LYP) in Behavior of Semi-Supported Steel Shear Walls Reinforced with Glass Fiber Polymers (GFRP)

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Abstract

In new type of steel plate shear walls, so called semi-supported steel shear wall (sssw), the shear wall wont be connected to the main columns of the structure frame. Instead, it will be connected to the secondary columns which are used for tension field in plate. For reinforcement and improvement of behavior of semi-supported steel shear wall, fiber reinforced polymers (FRP) can be used. This paper investigates plate thicknesses and low yield point steel (LYP) in behavior of semi-supported steel shear wall that reinforced with glass fiber polymers (GFRP). In the LYP steel plate shear wall system, LYP steel was selected for the steel plate wall while the boundary frame was constructed by the high strength structural steel. Results show that using low yield point steel (LYP) in semi-supported shear walls reinforced with glass fiber polymers (GFRP) is appropriate and its lead to excellent deformation and energy dissipation capacity. In addition to, The influence of plate thickness increase on initial stiffness and ultimate strength is more than the yield stress increase effect.

Keywords: Semi-supported, Steel Shear Walls, Low Yield Point (LYP), Energy Dissipation,

1. INTRODUCTION

In recent decades, steel shear wall (ssw) system has been proposed as a lateral load resisting structural component and has attracted many research activities. Many researchers around the world such as driver [1,2], Elgaaly [3], Astaneh Asl [4,5], Saburi Ghomi [6,7], and others have focused their research on the discovery of the behavior of ssws and many theories and experimental results have been published in the field. The use of steel shear walls (SSW) as a lateral load resisting system with high seismic performance have attracted great interests in all over the world. A SSW is similar to a plate girder that is placed vertically and is expanded in the total height of the building. High elastic stiffness, high ductility and stable hysteresis loops are some of the desirable characteristics of SSW system. In the traditional type of SSW, the post-buckling behavior of the plate induces severe stresses on the columns. Accordingly, to prevent columns from plastic deformation and collapse of the structure, large strong columns should be used. This may lead to abnormal and non-economical columns [7]. Generally the system has been proposed that named semi-supported steel shear wall (SSSW) in order to protect the primary columns under extreme demands and to improve the overall seismic performance. As shown in fig 1, in this type of shear wall, the plate of the wall does not connect to the main columns of the frame that are to carry gravity loads. Instead it is connected to the secondary columns of the structure that do not carry vertical loads. Moharrami et al [10,11] did some experimental studies on this new type of ssws, and concluded that tension field action in the plate can be developed by secondary columns as good as the traditional type of ssws. Therefore, this type of ssws can be used as a very good lateral load resisting system without the drawbacks of the traditional ssws. Recent studies show that fiber reinforced polymer (FRP) laminates are effective to enhance load-carrying capacity of damaged or sub-standard steel structures by increasing strength, stiffness and even ductility of steel structural