9th International Congress on Civil Engineering, May 8-10, 2012
Isfahan University of Technology (IUT), Isfahan, Iran

STUDY ON SLIT STEEL SHEAR WALL

Yousef Nejati yade[1], Mohammad reza Gasemi[2], Ramin Vaghei[3]
1.Graduate sutdent of university of sisan and balochestan,2.Associate profosser of university of sistan and balochestan, 3.graduate student shahroud universiy of technology
1. yoosefnejati@yahoo.com
2. mrghasemi@hamoon.usb.ac.ir
3. raminvaghei@shahroodut.ac

Abstract

Steel plate shear wall with vertical slits is a new lateral resisting system (LRS) created to resist seismic loads with high energy dissipation as damper, potential for architectural flexibility, and seismic retrofitting possibilities. This paper makes an effort to present Strategy to design slit configuration with more efficiency. The main properties of the models studied by using finite element analysis (FEA) such as lateral strength, stiffness and stress distribution of specimens. Results indicate that without changing the panel's property (i.e., material or dimensions), stiffness and strength can be fine-tune by changing values of α and β(slit configuration), in other words, by changing the slit design.

Keywords: Energy dissipation, slit configuration, slit steel shear wall

1. INTRODUCTION

In the 1994 Northridge earthquake, a number of steel moment- frame buildings experienced brittle fractures of beam-to-column connections [1]. This event spurred a number of studies on topics such as methods to enhance the behavior of moment resisting frames. Among these results is the specification of ''Pre-qualified Connections'' [2] for new moment resisting frames. Another result of the Northridge event is that numerous alternatives to the moment resisting frame have been studied; one such alternative is the Steel Slit Panel–Frame. Steel Slit Panel may serve as passive dampers in both new construction and seismic upgrade of the existing structures.However, unless heavily stiffened, the response of this walls is commonly accompanied by a significant pinching in their hysteretic response, although the strength deterioration is compensated by development of a tension field [3]. The research on thin steel-plate shear walls was extended by experiments to investigate the behavior and failure mode of steel plate walls with different slenderness ratios [4], and the reduction of the earthquake-induced forces in beam-to-column connections when steel plate shear walls are used [5]. Summaries of research on modeling and design provisions on steel plate shear walls are documented in example, [6,7].

Generally, there are two different hypotheses in designing steel shear walls. First of all, they were based on preventing buckling on the thin steel shear walls, to reach this destination, heavy stiffeners being used which does not have any economic feasibility due to much materials consumption as well as neglecting any post-buckling strength. The last but not the least one is utility of the unstiffened infill plates with post-buckling strength which is widely recognized in the United States and Canada. Initially, Thorburn et al (1983) has developed the pure diagonal tension theory of Wagner (1931) by proposing an analytical sketch. Finally, Timler and Kulak (1983), Driver et al (1997-1998) and etc have investigated the unstiffness infill plates by following of the Thorbun`s assumption. According to the much energy absorption of these systems, two issues might be appeared:

1. Moving towards the plastic hinges in the columns of the braced span because of great horizontal force on the foot of columns
2. Due to the occurrence of tension field in plates and also the connection between the plate and adjacent column, the columns` cross sections being increased in design outlines.

Recently, new generation of steel shear walls are defined as a Slit Steel Shear Wall (SSSW) to solve the issues of previous approach. The SSSW system is expressed as a seismic resisting system for lateral forces with the number of slits rows in a plate which behave as flexural links it is For two main reasons including: 1. This system attracts the plastic hinges from the other frame components such as beam or column and move toward the plates at the ends of slits, 2. There is no commitment to connect the steel plates to the adjacent columns so that it results in cross section reduction. , the SSSW system shows better seismic behavior than the others, furthermore this type of system has fewer tendencies to reduce the seismic capacity graph rather than the conventional steel shear panels.