C02

Cyclic test of unequally slitted steel shear walls

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1. Introduction

A new type of earthquake-resisting element, consisting of a steel plate shear wall with vertical slits (SW hereafter) has been recently introduced. In this research, the slit design is modified, concentrating wider slits near the center of the plate, to include condition assessment capabilities to the SW.

In the framework of this research, three SW specimens were studied under cyclic load to determine their hysteretic response up to large drift angles.

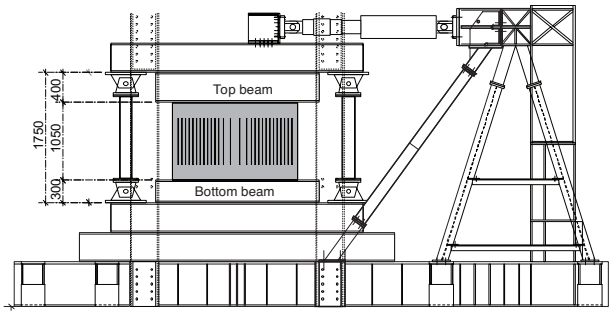


Figure 1: Experimental Setup

2. Experimental Procedure

The specimens were originally tested in an online hybrid test as part of a three story building. In the test, drift angles reached up to a maximum of 0.03 rad. The SW sustained minimal damage during the online hybrid test. Therefore, the SWs were saved for further cyclic testing.

Based on the existing facilities, the test setup shown in Fig. 1 was developed. The test specimens were fastened by M16 bolts (snug tight) on each side. Forced displacements were applied quasi-statically to the specimen by a 1 MN capacity jack via the top beam. To ensure the horizontality of the applied load, two pinned columns were attached to the loading frame.

Considering that the specimen had already been subjected to many cycles of small amplitudes during the online hybrid tests, the loading consisting of two cycles at amplitudes of 1, 2, 3, 4, 6 and 8% (Fig. 2) was adopted.

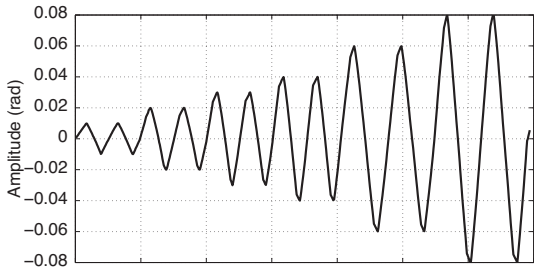
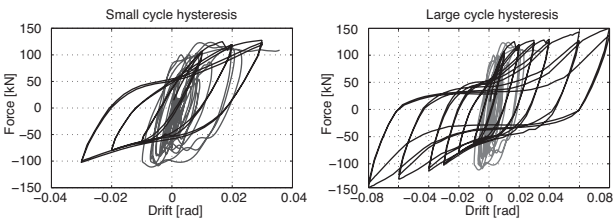


Figure 2: Loading history

3. Experimental Results

Figure 3 illustrates the hysteretic response for the second of the tested SW for small (Fig. 3(a)) and large (Fig. 3(b)) amplitudes. The hysteretic loops show a stable behavior without evidence of pinching for drift angles below 2%. The maximum forces sustained by the SW specimens were 150, 150 and 123 [kN], which were comparable to those shown for the previous online hybrid test (illustrated in gray in Fig. 3).

Although pinching is apparent in the hysteresis curves, little out-of-plane deformation was observed. The out-of-plane deformation was concentrated in the form of lateral torsional buckling of the flexural links.



(a) (b)

Figure 3: Hysteretic response