A06

Experimental study of steel slit shear walls with X-shaped links capable of condition assessment

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1. Introduction

Steel slit shear walls are commonly installed in buildings as the lateral resistant system to reduce the seismic response. Meanwhile, structural condition assessment is increasingly needed, especially right after a major earthquake event. The work here attempts to add the condition assessment by introducing X-shaped links into the steel slit shear walls, as a result to achieve a wider applicability for new steel slit shear walls. The condition assessment capability is obtained by the visual inspection of out-of-plane buckling of X-shaped links.

2. Experimental design

The X shape is adopted to relocate the region with large plasticity from link ends towards the middle part due to the tapered shape. A schematic of an X-shaped link is illustrated in Fig. 1, where *b*, *a*, *h* and *t* denote the link end section width, middle section width, height, and thickness, respectively. The taper with end-middle section width ratio of 3 (b/a=3) is selected to have large plasticity occurred at quarter height sections.

Under in-plane shear deformation, the links yield and buckle involving out-of-plane deformation. Compared with the rectangular links, the out-of-plane buckling is initiated earlier and buckling growth is enhanced. Parametric study in simulation shows that the out-of-plane buckling was mainly controlled by the width-thickness ratio $\lambda = 2a/t$ while little affected by the aspect ratio $\beta = h/2a$.

Eight pairs of steel slit shear walls with X-shaped links with different widths were designed. Width-thickness ratio and aspect ratio were the two major parameters studied, with λ ranging from 9 to 23 and β ranging from 3 to 10. Figure 2(a) shows the detail of one specimen.

3. Test results

Experimental results verified the little influence of the aspect ratio and controlling effect of the width-thickness ratio. Wider links buckled and tilted earlier, followed by the buckling and tilting of narrower links (Fig. 2(b)). Through the buckling inspection of links with different widths occurred at specific drifts, condition assessment using X-shaped links in terms of the maximum experienced shear deformation was achieved (Fig. 2(c)).

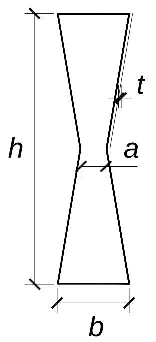
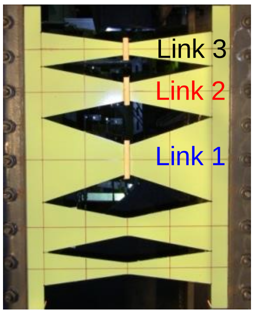
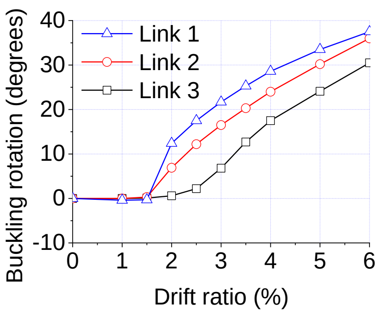


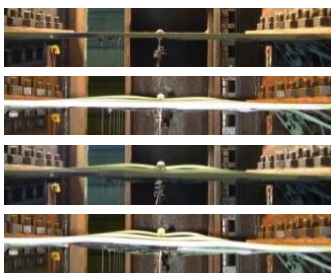
Fig. 1 Schematic of an X-shaped link



(a)



(b)



(c)

Fig. 2 One tested specimen and its buckling transition: (a) front view before loading; (b) buckling rotation versus drift ratio relationship; (c) down-top view at drift ratios of 0, 2%, 2.5% and 3.5% (top to bottom).