ABSTRACT

The response of a reinforced concrete (RC) element under cyclic shear is characterized by the hysteretic loops of the shear stress-strain curves. These hysteretic loops can exhibit strength deterioration, stiffness degradation, and a pinched shape. Recent tests [1] have shown that the orientation of steel grids in RC shear elements has a strong effect on the "pinching effect in the post-yield hysteretic loops. When the steel grid was set at a 45 degrees angle to the shear plane, there was no pinching effect and no strength deterioration. However, when the steel grid was set parallel to the shear plane, there was severe pinching effect and severe strength deterioration with increasing shear strain magnitude. It was thus obvious that the undesirable "pinching effect" and strength deterioration that were attributed to the presence of high shear forces can be eliminated by properly orienting the steel grid in RC elements subjected to cyclic shear.

In this paper, two RC elements subjected to reversed cyclic shear stresses are considered to study the effect of the steel grid orientation on the shape of the cyclic shear stress-strain curves. The presence and absence of the pinching mechanism in the post-yield shear hysteretic loops is studied using the rotating-angle softened-truss-model (RA-STM) theory [2]. It is found that the RA-STM when combined with newly proposed cyclic material constitutive relationships can rationally predict the presence and absence
of the pinching effect in the shear hysteretic loops of RC shear elements but is still incapable of predicting the descending envelopes.

*Keywords: Pinching effect, energy dissipation, ductility, cyclic loading, shear, stress, strain.*