Shear Crack Width and Shear Drift Component in RC Beams with High Strength Transverse Rebars

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Introduction

Crack is an important factor in evaluating seismic damage on reinforced concrete (RC) structures. A simple model was proposed by AIJ Guidelines 2004 to predict crack width from member's shear deformation. This paper evaluates the proposed model on six RC beam specimens.

Kumamoto Earthquake (BRI, 2016)

Measurement System

Crack width (W_{xi}) and slip (W_{yi}) were measured using crack gauges in Fig. 1. The gauges were attached perpendicular to the cracks on the center line as shown on Fig. 2. Shear component of drift (δ_s) was measured using diagonal displacement gauges. The following equations were used to compare the horizontal crack component (W_{hi}) with shear drift component (δ_s).

$$\begin{bmatrix} W_{hi} \\ W_{vi} \end{bmatrix} = \begin{bmatrix} cos\ \theta_i & -sin\ \theta_i \\ sin\ \theta_i & cos\ \theta_i \end{bmatrix} \begin{bmatrix} W_{xi} \\ W_{yi} \end{bmatrix} \qquad \delta_s = \sum_{i=1}^{n} W_{hi}$$

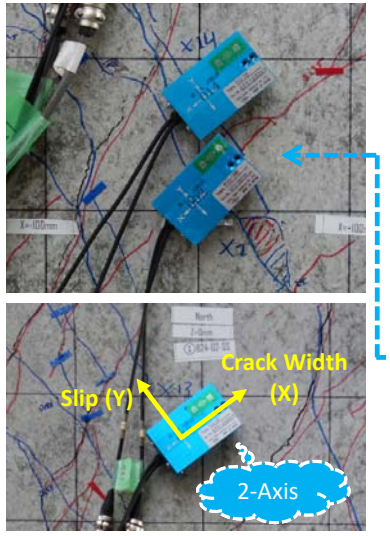
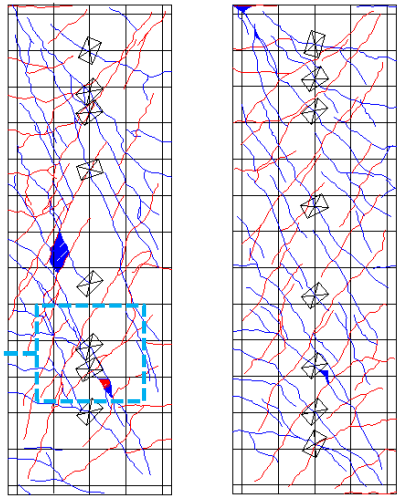


Figure 1 Crack Gauges



(a) Specimen #1 (b) Specimen #2

Figure 2 Crack Pattern

Experimental Result

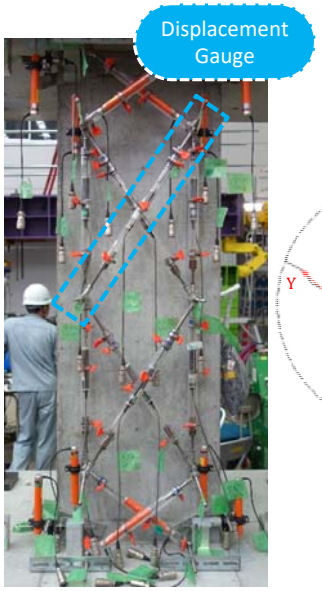


Figure 3 Displacement Gauges

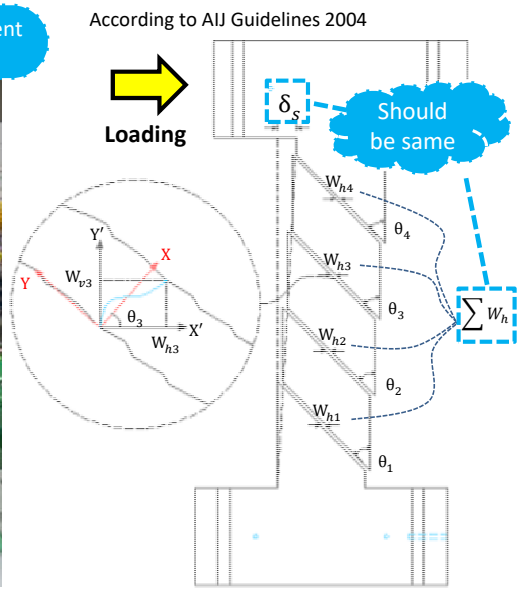
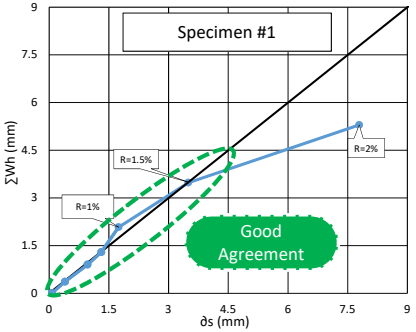
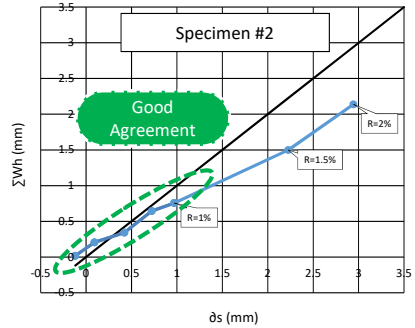


Figure 4 Relation between Crack Width and Shear Deformation





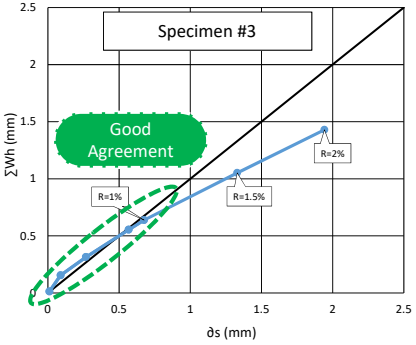


Figure 5 Horizontal Crack Comp. ($\sum W_h$) - Residual Shear Drift (δ_s)

Conclusion

The summation of horizontal component of cracks has good agreement with shear drift component. Compared to higher residual drift, the crack gauges picked up shear drift component better at lower residual drifts.

Contribution to Society

This study provides a better understanding of earthquake damage on RC structures, and contributes to the development of low damage structural system and resilient structures.