



Application of Beam-Column Joints Using Hinge Relocation Technique

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Yuji Ishikawa born in 1967. In 2003, he obtained Doctor of Engineering from Department of Architecture, Faculty of Engineering, The University of Tokyo. At present, He works TAKENAKA R&D Institute, JAPAN. His favourite research is high strength concrete columns and beam-column joints. He was a visiting researcher in University of Canterbury, Christchurch, New Zealand from 2006 to 2008.

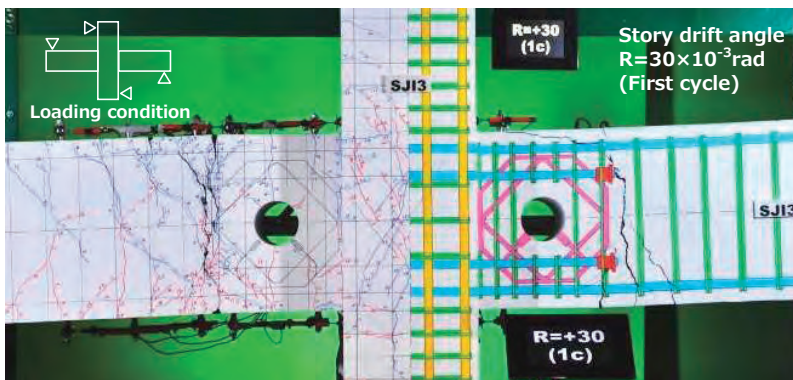
Summary

High strength concrete and high strength steel bars have been used for reinforced concrete structures to resist very high loads and reduce sectional area of RC members, as well as the amount of reinforcement in some congested locations. Such way is very suitable for beam column joints that sustain high stresses due to long term, earthquake and other loadings. These stresses can be reduced by relocating the development of plastic hinges at beam ends away from column faces. This paper presents a novel application of RC beam-column joints using hinge relocation technique by headed beam longitudinal bars for the second layer of reinforcement. A special case where beams have openings at their ends is also considered in the application. To confirm the effectiveness of the proposed application and evaluate its structural performance, three interior beam column joints specimens were tested under simulated seismic loading. Test results exhibited the good performance of the proposed application and confirmed the possibility to design RC interior joints within story drift angle of $\pm 30 \times 10^{-3}$ (rad) using such hinge relocation technique. The method has already been applied in an actual RC structure in Tokyo.

Keywords: beam column joints; reinforced concrete; inelastic hinge; seismic performance; tests.

1. Introduction

This paper describes a novel application of RC beam-column joints using hinge relocation technique by headed beam longi. bars for the second layer of reinforcement Fig-1 illustrates our proposed hinge relocation beam-column joints with beam openings at their ends under earthquake loading. The special beam column joints were proved by means of our experimental as shown Fig-2 and Fig.3 and analytical studies to make use of merits of the hinge relocation techniques



Left side: observation grid and recorded cracks by magic marker, Right side: Actual reinforcements and visible cracks
Fig.1: Proposed hinge relocation beam-column joints with beam openings at beam's ends

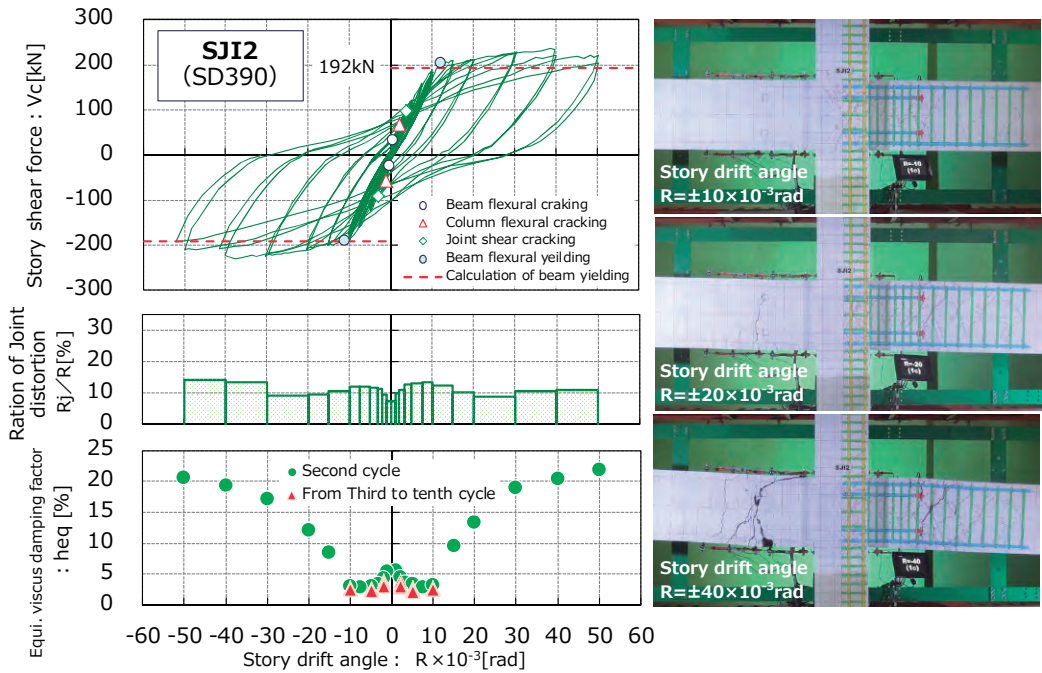


Fig.2: SJ12 (SD390) Structural performance and crack patterns

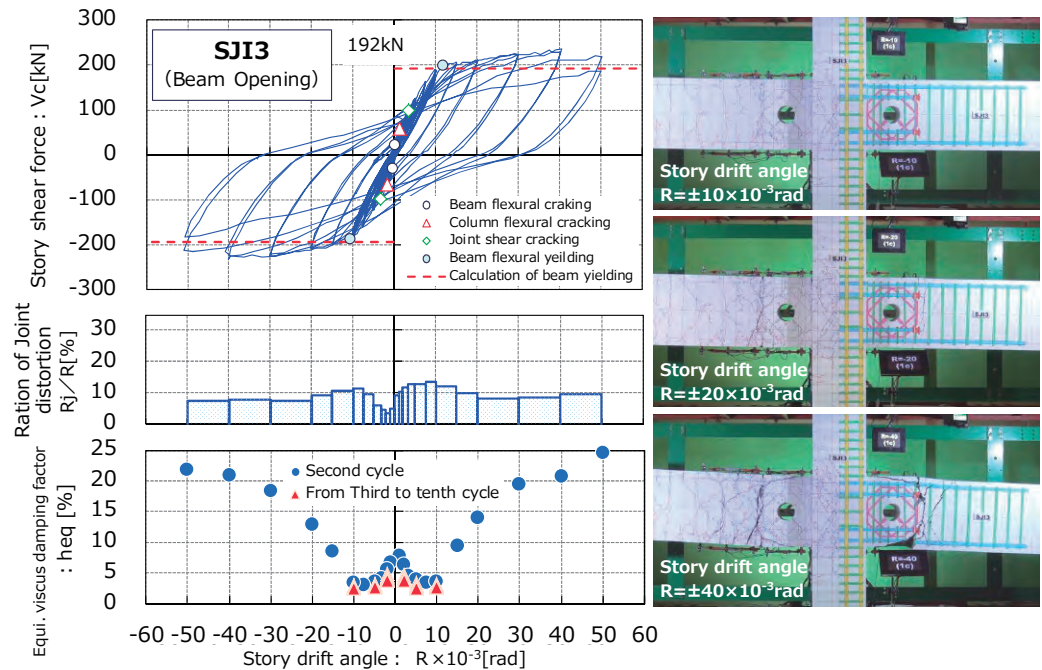


Fig.3: SJ13 (Beam opening) Structural performance and crack patterns