ABSTRACT

Makido, Akira. Ph.D., Purdue University, December, 2007. CYCLIC BEHAVIOR OF SPIRALLY REINFORCED CONCRETE COLUMNS. Major Professor: Julio A. Ramirez.

The objective of this study was to investigate the drift capacity of circular reinforced concrete columns containing spiral reinforcement. The target columns in this study were designed with static shear strength greater than the estimated lateral shear corresponding to the maximum moment capacity of the section. The experimental program consisted of five specimens; the transverse reinforcement ratio was selected as the key parameter to be investigated using two aspect ratios. The behavior of each column was documented visually and with internal and external instrumentation. Based on the damage observations and measured responses, conclusions were drawn on the role of the spiral reinforcement on the lateral displacement capacity of the columns tested with two different aspect ratios (a/D = 1.5 and a/D = 2.5).

The test results indicated that the columns with transverse reinforcement ratios meeting the minimum requirements for confinement in Chapter 21 of the ACI 318-05 and those with only 60 percent of the minimum code requirement were able to sustain the lateral shear corresponding to the moment capacity of the section up to a drift ratio of 3% for the two aspect ratios investigated. The columns with the shear span to depth ratio, a/D=1.5, (Specimen 2-3) had unit strains in the spiral reinforcement grater than 1% at a drift ratio above 4%. On the other hand, the columns with a/D = 2.5 (Specimen 1-2) and the same of transverse reinforcement showed a unit strain in the spiral reinforcement of 0.8% at a drift ratio above 4%. Specimen 2-3 showed a significant decrease in the

lateral shear carried (almost 60% reduction with respect to the maximum shear corresponding to the nominal capacity of the section). Specimen 1-2 also showed a decrease in the lateral shear corresponding to the same drift ratio (40% reduction) but failed in axial compression at 4% drift ratio. These observations appear to support the notion that the expansion of spiral reinforcement associated with increasing levels of displacement led to a reduction in the lateral shear that the specimen was able to sustain at the given drift and in Specimen 1-2 axial failure.