In Accelerated Bridge Construction (ABC), Grouted Splice Sleeve (GSS) connectors have been considered for connecting bridge columns, footings and pier caps. A repair technique for severely damaged Precast reinforced concrete (RC) bridge columns has been developed that utilizes a carbon fiber-reinforced polymer (CFRP) shell and epoxy anchored headed bars to relocate the column plastic hinge. The repair technique was also applied to Cast-in-Place (CIP) reinforced concrete columns. One original specimen was built using an Accelerated Bridge Construction technique with the GSS systems to connect an RC bridge pier cap to a column. Two original CIP specimens were also built: the first specimen is a pier cap to a column connection and the second one is a footing to column connection. All three columns were tested to failure using cyclic quasi-static loads. Failure of the three original specimens occurred at drift ratios between 7% and 9% with longitudinal bar fracture or pullout from the GSS connections. The repair method successfully relocated the plastic hinge at a section adjacent to the repair and was capable of restoring the load and displacement capacity. Strength, stiffness, and ductility capacity are the key performance parameters that indicate the adequacy of a structure under seismic loading. To evaluate the performance of the repair, these parameters for the repaired columns were compared with those of the original columns. Three non-dimensionalized indices were developed in terms of the three parameters of strength, stiffness and ductility capacity. In addition, the cumulative hysteretic energy was also studied for each original and repaired specimen. Based on these analyses, the repaired method is a viable and cost-effective technique for rapid seismic repair of severely damaged precast and CIP bridge assemblies.

**Keywords:** Accelerated Bridge Construction; earthquake; FRP composite; repair; plastic hinge relocation;