HYBRID PRECAST CONCRETE SOLID SHEAR WALLS FOR SEISMIC REGIONS

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Seismic bahavior and performance of a hybrid RC shear wall comprising rectangular precast panels is numerically investigated. The term “hybrid” reflects that a combination of mild reinforcing steel and high-strength unbonded Post-tensioning steel is used for lateral resistance across the joint. The post-tensioning force is provided by multi-strand tendons placed inside ungrouted ducts through the wall panels and the foundation. The mild steel bars crossing the base joint are designed to yield in tension and compression, and provide ample energy dissipation through gap opening/closing behavior of the wall under reversed-cyclic lateral loading.

In the present paper, the behavior and performance of a hybrid precast RC shear wall model is investigated by means of finite element modeling. In the modeling, the behavior of concrete, is assumed to obey the plastic-damage model which is based on multiple damage variables. In the bonded region of the bars the truss elements were embeded within the concrete element using embeded region constraints. Hard contact surfaces were used at the horizontal joint to allow for gap oppening. These surfaces were difined with penalty friction. A non-linear analysis is performed by the application of implicit formulae.

To validate the model, experimental result of a precast hybrid RC shear wall representing three story of a prototype structure (Figure 1) is compared with the results obtained from the numerical analysis. The wall panels supported by a reinforced concrete foundation. The post-tensioning steel strand was made of two tendons, located in a symmetrical layout near the centerline of the wall. The mild steel crossing the base joint consisted of four bars. Confinement reinforcement was required at the end of the base panel to prevent premature crushing and failure of the core concrete. Uniformly spaced mild steel bars were typically used as the distributed panel reinforcement in both the horizontal and vertical directions.

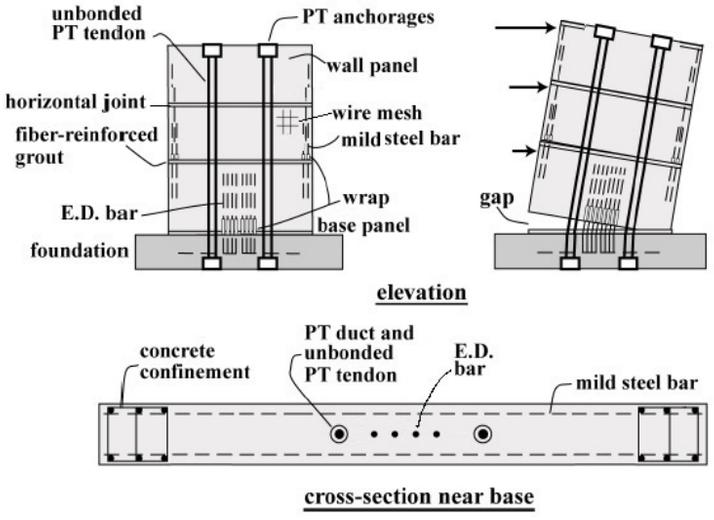

Figure1. Elevation of exaggerated displaced position, and cross section of hybrid wall system

Three-dimensional eight nodes solid elements were used for the concrete in the RC wall and foundation. Three-dimensional truss element were used for the post tensioning steel and the energy dissipating bars crossing the wall base to foundation joint. The initial Stresses in the post tensioning steel were simulated by placing an initial tension force in the truss elements. The stress-strain relationship for the post tensioning steel, energy dissipation bars and confinement steel were modelled using a multi-point of the measured material test data. Each material model include elastic and plastic region according to the requirements of ABAQUS program. Figure 2 depicts one of the graphical results in the form of base shear force versus wall drift of the tested specimen and the corresponding numerical result predicted by finite element model.

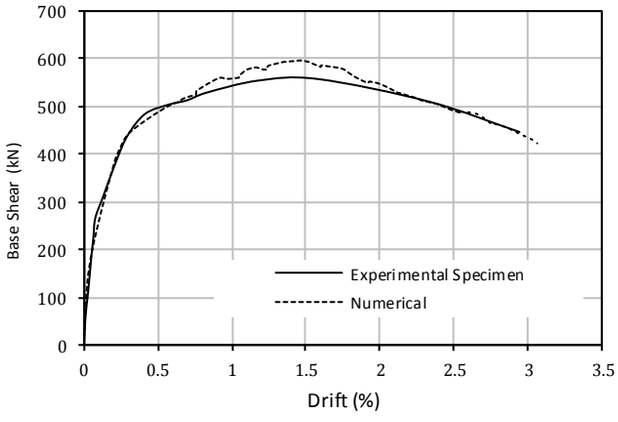

Figure 2. Capacity curve for precast RC hybrid shear wall