Response of a Reinforced Concrete Embedded Pile Under Lateral Loading. II: Numerical Simulations

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Cast-in-drilled-hole reinforced concrete piles (also known as drilled shafts) are among the most common support structures in highway construction. Typically, drilled shafts have simple, prismatic geometries; yet, they display a complex, inelastic response under applied loading. The two major factors that affect their behavior are the interaction between the shaft and surrounding soil media, and the material inelasticity of the shaft itself.

This study focuses on the development and the use of a variety of numerical models of a two-feet diameter, partially embedded, reinforced concrete drilled shaft that has recently been tested in full-scale in the field. The specimen, instrumentation, and loading are described in the companion paper by Ahlberg et al. Here, we present the results of several numerical simulations of the specimen response.

Three approaches are considered: (1) a finite element model, (2) a macro-element model, developed at UCLA, and (3) the so-called strain-wedge model. The finite element model consists of three-dimensional elements for both the concrete pile and the surrounding soil layers, and embedded truss elements for steel reinforcement. Infinite elements are used for accurate consideration of the remote soil boundaries, and contact conditions are simulated at the pile-soil interface. Appropriate inelastic constitutive models are used for concrete, steel and the soil layers. The macro-element model is an extension of existing *p-y* approaches, and it accounts for gapping and frictional sliding at the pile-soil interface. The strain-wedge model is adopted from existing literature.

Simulation results are compared with each other and with measurements obtained in the full-scale field test. It is observed that all of the three numerical approaches yielded reasonably accurate predictions.