DEVELOPMENT AND FIELD TESTING OF THE MULTIPLE DEPLOYMENT MODEL PILE (MDMP)

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ABSTRACT

Piles are common foundation members enabling the transfer of large superstructure loads into weak compressible layers or through them to stronger bearing strata. Pile foundations are traditionally designed either as end bearing or friction piles. End bearing piles are assumed to support the entire load at the pile's tip while friction piles rely on load transfer along the pile shaft to develop their capacity.

In reality, all piles are friction piles until some or all of their shaft resistance is mobilized and then the pile end develops its resistance. As a result, end bearing piles often carry the service load in friction. Therefore, the need to accurately predict the shaft resistance component is important for an economical design of pile foundations.

The Multiple Deployment Model Pile (MDMP) was developed as an in-situ tool for site investigations. The MDMP instrumentation is capable of monitoring the pile/soil interaction throughout the life of the pile: (a) dynamic force and acceleration readings during driving, (b) pore water pressure and radial stresses during equalization, and (c) skin friction, end bearing resistance, and local (subsurface) displacement during static loading. These measurements allow the observation of pile capacity gain (a.k.a. "set-up" or "freeze") and accurately monitor the load-transfer relations.

The MDMP was successfully deployed twice in Newbury, MA during March 1996. Dynamic measurements, using a Pile Driving Analyzer™, predicted the capacity of the pile. Based on normalization procedures developed at UMASS Lowell (Paikowsky et al., 1995), the excess pore water pressure dissipation and pile capacity gain with time were determined for the two tests. The obtained results show that the MDMP is capable of providing accurate soil-structure interaction relations during static load testing. The measurements indicate a complex mechanism governing capacity gain that combines pore pressure dissipation and radial stress redistribution over time. This data is being used to predict the behavior of full-scale instrumented piles and to reevaluate the capacity gain phenomenon.