Florida Department of Transportation Research

Distribution of End Bearing, Tip Shear and Rotation on Drilled Shafts with Combined Loading in Florida Limestone
BD545-59

Florida bridges in recent years have increasingly been supported by large drilled shafts that are 8-12 feet in diameter. The use of large diameter shafts reduces the number of piles needed to support the structure, which in turn can lower construction costs and aid noise abatement efforts. The large shafts are also more resistant to lateral pressures like those resulting from hurricane forces or vessel impacts.

However, shafts with large diameters respond to lateral loads differently than shafts with small diameters. The bottom (or tip) of a large shaft has a large footprint, which causes it to respond to lateral loads differently than smaller shafts. FDOT and FHWA design standards currently employ methodologies that are based on the use of smaller diameter shafts. New data was needed to develop more effective models for determining how large shafts will behave when placed in Florida limestone, which has voids, layering, and variable soil properties.

University of Florida researchers investigated the behavior of large diameter drilled shafts embedded short distances in Florida limestone. They performed studies both in the laboratory and at two field sites, the 17th street bridge in Ft. Lauderdale and the Fuller Warren Bridge in Jacksonville.

The study revealed that the mass modulus of limestone (i.e., stress-strain relationship, or how the limestone will respond to the shaft under loading conditions) has a significant direct effect on the performance of the shaft (i.e., end bearing, tip shear, and rotation of the larger shafts) when embedded to a depth of three shaft diameters. The impact of the mass modulus depends on the variability of the limestone structure.

Large drilled shafts are necessary to support large bridges like this one in Ft. Lauderdale.

The researchers used the study findings to develop a new load and resistance factor design methodology that is adaptable to Florida's specific site soil dynamics. The design improvements will allow for more accurate and safer designs.

Project Manager: Peter Lai, Geotechnical Engineering Office
Principal Investigator: Michael McVay, University of Florida
For more information, visit http://dot.state.fl.us/research-center.