Introduction

The study described in this report was part of a research project sponsored by the Virginia Transportation Research Council and the Virginia Department of Transportation, with additional support from a Via Fellowship in the Department of Civil Engineering at Virginia Tech.

The purpose of the study was to evaluate deflections and bending moments in drilled shaft foundations for sound walls when they are subjected to their full design wind loads. The motivation for this study is the fact that ultimate load theories used for design of drilled shaft sound wall foundations are not suited for assessing behavior at working loads: ultimate load theories provide no information regarding deflections at working loads, and they overestimate bending moments at working load conditions due to differences between working load and ultimate load distributions of soil resistance (Helmers et al., 1997).

Thus, while ultimate load theories afford a reliable means for calculating suitable drilled shaft dimensions, some questions remain regarding the behavior of drilled shafts under working load conditions:

- How much will drilled shaft sound wall foundations deflect when subjected to their design wind loads?
- How much do ultimate load theories over-estimate bending moments in drilled shaft sound wall foundations subjected to design wind loads?

These issues were studied by performing p-y analyses of drilled shaft sound wall foundations, as described in the following pages. The first step in this study was to develop p-y curves for the analyses using the results of the field load tests that were performed during this study (Helmers et al., 1997). These p-y curves were then used to assess the behavior of drilled shafts under working load conditions by performing analyses using the computer program LPILE Plus 3.0 (1997). Other p-y curves that are standard features in LPILE Plus 3.0 were also used in the study.

Development of p-y Curves

The field load tests on 8-inch and 9-inch diameter drilled shafts performed during this study (Helmers et al., 1997) provide a basis for development of p-y curves for the partly saturated silty and clayey soil at five sites in Virginia. The measured load-deflection curves for the test shafts were used to determine p-y curve parameter values that matched deflections measured in the field tests.

Shapes of p-y Curves

Reese and his colleagues have developed p-y formulations for cohesive soils and cohesionless soils (Reese, 1977), and Evans and Duncan, (1982) developed a p-y formulation for c-ϕ soils. In the computer program LPILE Plus 3.0 for Windows (1997), Reese et al. also developed p-y curves for soils with both cohesion and friction. They called this the "silt" p-y curve.