

Abstract

Piles are constructed when a great depth is required to support the loads imposed by a superstructure. Pile foundations constructed in consolidating soil are commonly subjected to negative skin friction, which causes a compressive load on the pile called dragload. This dragload in turn causes the pile to settle relative to the surrounding soil, a phenomenon called downdrag. This phenomenon must be properly modeled and accounted for when the piles are designed, or the piles may fail catastrophically during the life of the supported structure.

This work represents a compendium of research, theories, and models of the phenomena of downdrag and dragload as observed from field tests and analysis. The importance of accounting for downdrag in pile design is presented through a series of case histories of significant pile foundation failures it has caused. This is followed by a review of existing methods of calculating negative skin friction and downdrag, a comparison of the accuracy of the methods, and a discussion of how they apply to the presented case histories. A comprehensive overview from the soil basics to the analytical models is the chosen organizing framework for this discussion. A simplified soil profile is utilized to introduce the concepts and the notation, a two-layer system containing a consolidating layer that spans the embedment depth of the pile underlain by a bearing layer which starts at the depth of the pile tip.

This thesis presents the basic models needed to understand and account for dragload and dragdown in pile design. It provides the necessary tools to understand the more complex models available, and captures various understandings of the phenomenon through theory review.