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DESIGN CHARTS FOR MINOR SERVICE STRUCTURE FOUNDATIONS

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Study 2-18-71-506

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Design Charts for Minor Service Structure Foundations

by

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Design of drilled shaft footings for highway signs is a task that must be repeated many times on any given project. The design involves choosing a size of sign, selecting an appropriate wind load, sizing the columns to support the wind-loaded sign, and finally designing a drilled shaft which will be large enough in diameter and deep enough into the soil to keep from failing under the maximum expected design condition. The proper choice of diameter and depth of footing depends upon the strength properties of the soil in which the drilled shaft is embedded. An illustration of the footing design problem is given in Figure 1.

A complete theory is available for sizing these drilled shafts. It was proposed, field tested, and verified in Research Study 2-5-67-105, "Design of Footings for Minor Service Structures." However, the theory is too complicated for application on a routine basis since it requires the solution of simultaneous cubic equations. The personnel of File D-18, Maintenance Division of the Texas Highway Department recognized a need for a routine design method which takes into account the important soil shear strength parameters, c, the cohesive shear strength, and ϕ, the angle of internal friction, and which employs data gathering methods that are currently available to most Texas Highway Department design personnel. Consequently, Research Study 2-18-71-506 was initiated and the present report has been prepared in response to that need.

An overlay slide device developed in this study graphically converts Texas Highway Department Cone Penetrometer data into the soil shear strength parameters, c and ϕ. These data are then used in an entirely graphical design procedure for sizing the drilled shaft footings.

The report is divided into four sections: the introductory chapter; a chapter outlining the assumptions underlying the design charts of this report and their validity; a chapter on the use of the design charts which is intended as a users' guide; and the appendices which contain the design charts.

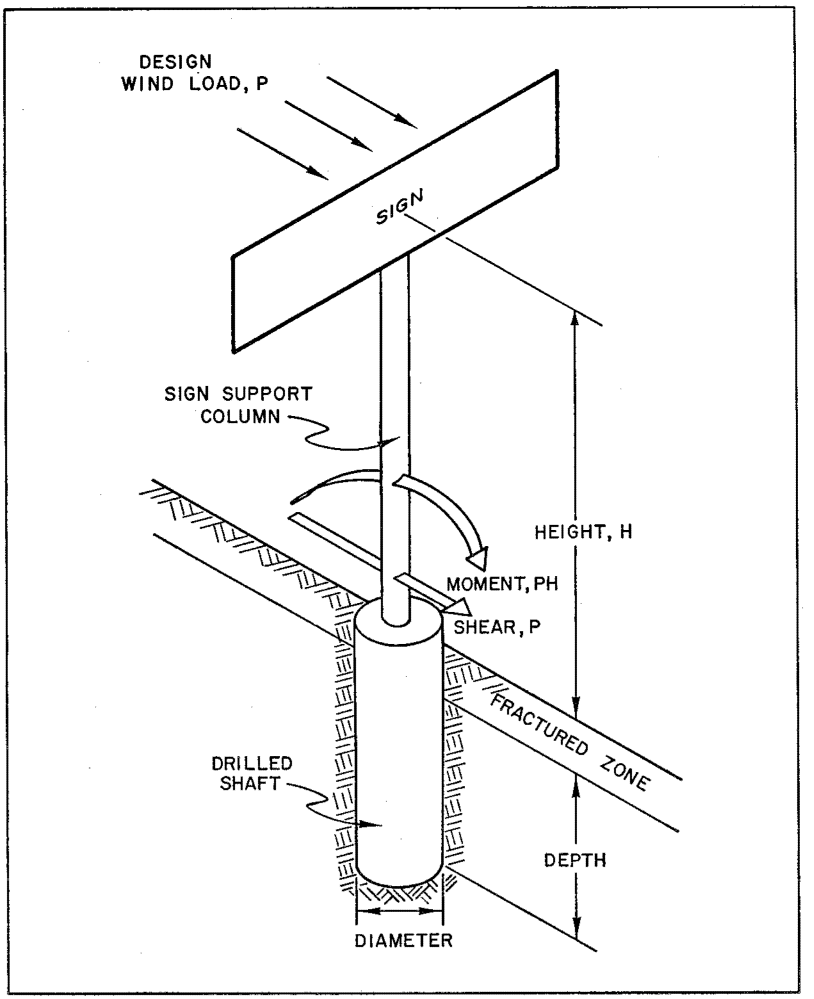


Figure 1. An illustration of the sign support footing design problem.

There are 21 design charts in Appendix A. As seen from the typical example in Figure 2, they are graphs of the depth of embedment of a standard drilled shaft footing as a function of a soil shear strength parameter, c or ϕ. The charts are based on an approximation to the more exact theory presented in Research Study 2-5-67-105. The approximation gives results which remain slightly on the conservative side of the more exact theory.

More basic design charts from which the 21 of Appendix A were developed are included as Appendix B. Their purpose is

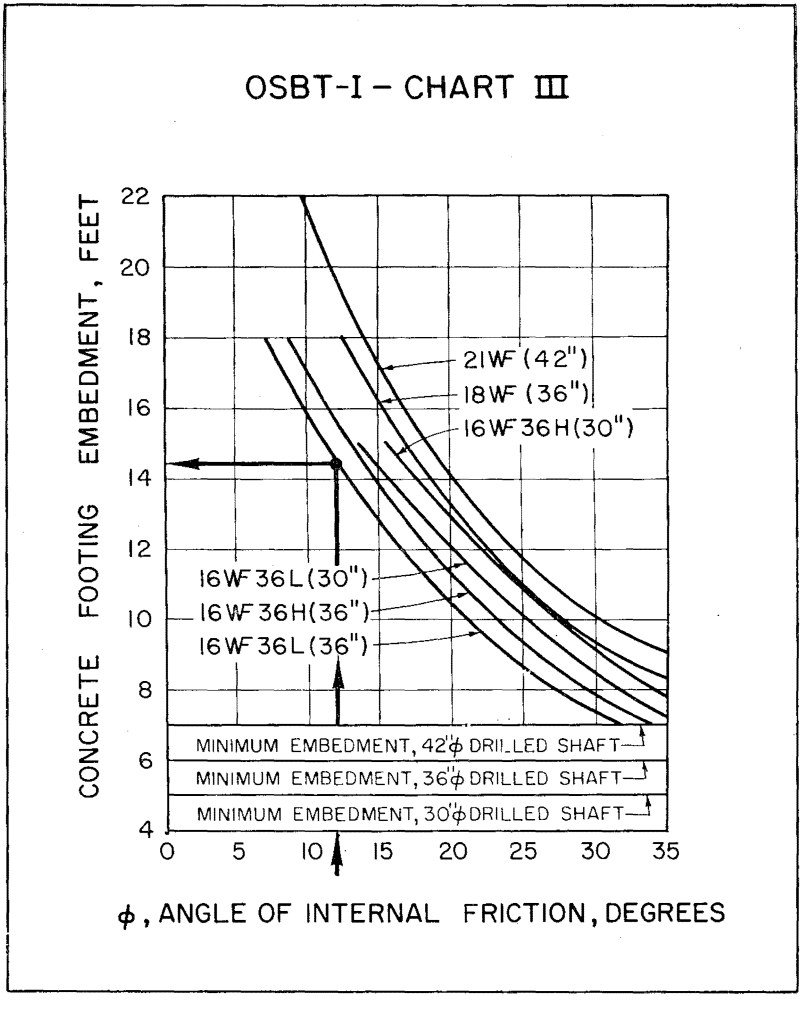
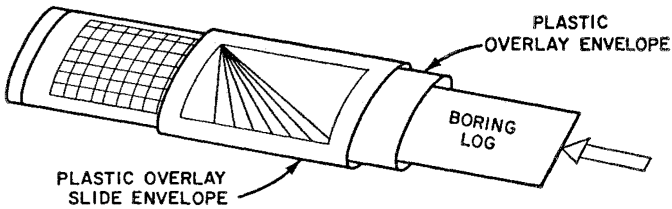


Figure 2. Method of reading embedment depth.

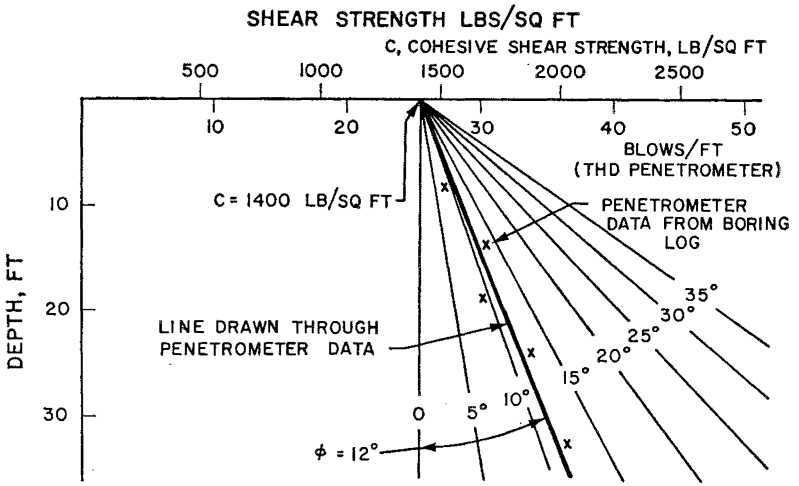
to aid in the design of footings for nonstandard sign support columns.

Masters of the overlay slide device described previously are given in Appendix C. The masters may be reproduced by ammonia process or photography on a clear plastic film. The overlay slide is used as illustrated in Figure 3 to determine values for c and ϕ.

Drilled shaft footings for minor service structures can be designed conveniently by the graphical method of this report



a. INSERTION OF BORING LOG INTO OVERLAY ENVELOPE



b. SAMPLE READING OF C AND ϕ FROM THD PENETROMETER DATA

Figure 3. Use of overlay envelopes to determine soil shear strength c and ϕ.

with the assurance that the procedure produces a slightly conservative design.

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