SUMMARY REPORT 10—2(S)

CORRELATION OF THE TEXAS HIGHWAY DEPARTMENT CONE PENETROMETER TEST WITH THE DRAINED SHEAR STRENGTH OF COHESIONLESS SOILS

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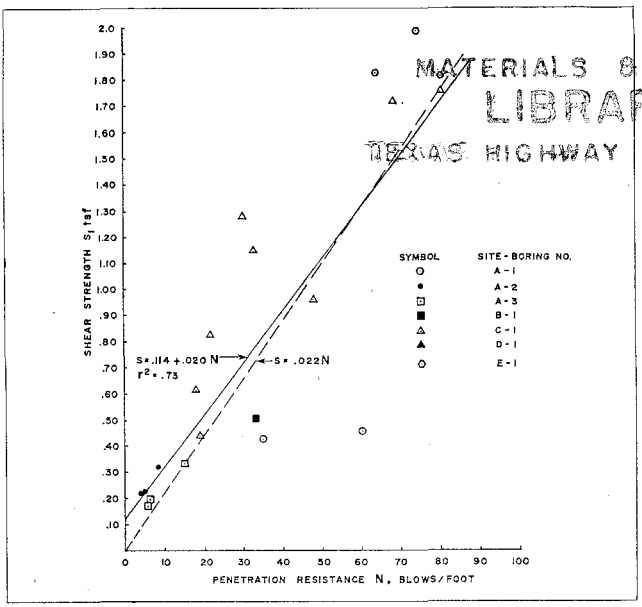

Relationship Between Drained Shear Strength and Resistance to Penetration for SP, SM, and SP-SM Soils

Cooperative Research Program of the
Texas Transportation Institute
and the
State Department of Highways and Public Transportation
In Cooperation with the
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Correlation of the Texas Highway Department Cone Penetrometer Test With the Drained Shear Strength of Cohesionless Soils

by

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This investigation was the second phase of a three year study conducted under Research Study 2-5-74-10 entitled "Correlation of the THD Cone Penetrometer Test N-value with Shear Strength of the Soil Tested" which is a cooperative research endeavor sponsored jointly by the Texas Highway Department and the U. S. Department of Transportation, Federal Highway Administration. The objective of this phase of the research is to develop an improved correlation between the THD Cone Penetrometer Test N-value and the shear strength of sand. It will be used to predict the bearing capacity of drilled shafts and pile foundations which support highway bridge superstructures. Use of the correlation will aid the design engineer in selecting the most economical pile or shaft diameter and computing the required depth of embedment.

Field and laboratory investigations were conducted in developing the correlations presented in Research Report 10-2. Undisturbed soil samples were taken from sand deposits located in Brazos and Harris counties. Once the samples had been recovered, the THD Cone Penetrometer Test was performed in a new bore hole not more than 10 ft. (3.0 m) from the bore hole wherein the samples had been obtained. The samples were then tested in the laboratory and correlations were developed using the results of these laboratory tests and the THD Cone Penetrometer Test.

Field operational methods and procedures used to obtain THD Cone Penetrometer Test data and undisturbed soil samples are described. Undisturbed soil samples were recovered every 2.5 ft. (0.76 m) whenever possible. In cohesive soils, samples were recovered with three-inch (76 mm) Shelby tube samplers. When the sand deposit was encountered a smaller diameter sampler similar to the Shelby tube was used. After all samples had been recovered the THD Cone Penetrometer Test was run in a new bore hole at depths corresponding to the depths at which the sand samples were taken.

The laboratory test methods used to classify the soil and to determine the drained strength are discussed. The classification tests (i.e. liquid limit, plastic limit, and grain size analysis) were

performed in accordance with the THD Manual of Testing Procedures. A direct shear test was used to test the undisturbed sand samples. An extrusion device was designed so that the small diameter samples could be extruded from the sample tubes directly into a shear box. Once the samples were tested the effective angle of internal friction could be determined. The procedure for calculating the drained shear strength knowing the effective angle of internal friction, unit weights, and position of the ground water level is explained. The various factors affecting the N-value of dynamic penetration tests in sands are discussed. The works of other researchers indicate that the unit weight, grain size, moisture content, and overburden pressure are the major factors affecting the resistance to penetration in sands. The effect of each of these factors was investigated.

Correlations were developed between the THD Cone Penetrometer N-value and the unit weight, effective overburden pressure, angle of internal friction, and drained shear strength. A poor correlation was found to exist between unit weight and the N-value. The relationship currently in use by the Texas Highway Department between the N-value and the effective angle of internal friction was found to be a lower bound to the data obtained from this study. Fairly good correlations with the N-value were found to exist between both effective overburden pressure and drained shear strength.

Complete soil profiles for each test location are given in this report. The correlations between unit weight, effective overburden pressure, effective angle of internal friction, and drained shear strength are presented graphically. A complete summary of all lab test data is included in the appendices of the report.

Correlations developed as a result of this study have been obtained using data for SP, SM, and SP-SM soils. The results should be used with the realization that the correlations are based on a limited amount of data and no data were obtained for other sand classifications such as SW and SC. Additional research is recommended to further ascertain the validity of the correlations for SP-SM soils and to develop separate correlations for SW and SC soil types.

The published version of this report may be obtained by addressing your request as follows:

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