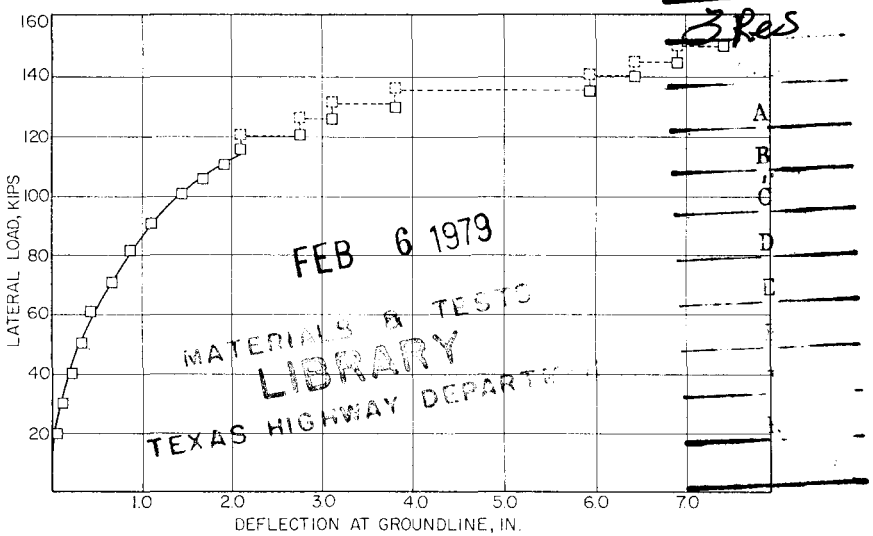
SUMMARY REPORT 211-2(S)

FIELD TEST AND PRELIMINARY DESIGN METHOD FOR LATERALLY LOADED DRILLED SHAFTS IN CLAY

SUMMARY REPORT
of
Research Report Number 211-2
Study 2-5-77-211



Lateral Load versus Deflection at Groundline

Cooperative Research Program of the
Texas Transportation Institute
and the
State Department of Highways and Public Transportation
In Cooperation with the
U. S. Department of Transportation, Federal Highway Administration

September 1978

TEXAS TRANSPORTATION INSTITUTE
Texas A&M University
College Station, Texas

Field Test and Preliminary Design Method for Laterally Loaded Drilled Shafts in Clay

by

George L. Holloway, Harry M. Coyle, Richard E. Bartoskewitz, and William G. Sarver

Research Report 211-2 presents the data and the analysis of results obtained from a lateral load test that was conducted on a drilled shaft during the second year of a four-year study on the design of drilled shafts which support precast panel retaining walls. The study is a cooperative research endeavor sponsored jointly by the State Department of Highways and Public Transportation and the U. S. Department of Transportation, Federal Highway Administration. The basic objective of the study is to develop rational criteria for the design of drilled shafts that support precast panel retaining walls.

During the first year of this study it was determined that many drilled shafts that are used in this manner can be designed or analyzed as rigid structural members. The first part of this report briefly summarizes some of the work that has been done by others within recent years relating to the design of rigid shafts, the prediction of lateral load capacities, and the measurement of lateral soil pressures.

During the second year of this study a field test was conducted on a 36-in. diameter shaft embedded 15-ft in clay. Passive lateral pressures in the longitudinal direction on the shaft were measured with 6-in. square pressure cells. At one point on the shaft three cells were mounted along a circumferential line to measure the horizontal pressure distribution. Lateral displacement of the shaft was measured at one point located about 9-in. above ground level. Rotation of the shaft was measured by an inclinometer and also by horizontal offsets from a plumb line to several points on the shaft. An electric strain gage type load cell was used to measure the lateral load that was applied by means of a hydraulic winch connected to a block and tackle.

A comparison was made between the ultimate soil reaction computed from the test data and the values predicted by several analytical methods. A comparison was also made between (1) the measured ultimate load and the loads predicted by several analytical techniques, and (2) the ultimate loads obtained from

six load tests reported in the literature and the corresponding loads predicted by the same analytical techniques.

A preliminary design procedure for rigid laterally loaded drilled shafts is presented. The procedure is based upon the comparison of the measured versus predicted ultimate loads.

Based upon the analysis of the data obtained from this second lateral load test, the following conclusions and recommendations are made:

Conclusions

1. Lateral deflections were of such magnitude near the end of the testing program that they would probably be aesthetically objectionable. It is concluded that allowable deflection or rotation rather than ultimate lateral load based on soil failure may be the controlling factor for the design of drilled shafts supporting precast panel retaining walls.

2. The available test data which have been published are limited and the proposed preliminary design procedure should be used with caution. Therefore, some degree of conservatism is suggested by using conservative values of the limiting angle of rotation, θ; the factor of safety applied to the undrained cohesive shear strength, c_u; and the factor of safety applied for soil creep.

Recommendations

1. Additional ultimate load tests should be conducted on shafts of varying depths and diameters.

2. A comprehensive definition of ultimate load based on limiting soil resistance and deformation is needed.

3. A limiting value for total deflection or rotation of a drilled shaft supporting a precast panel retaining wall should be determined.

4. Sustained lateral load tests should be conducted on shafts of varying depth and diameters in order to study the creep phenomenon.

5. Additional lateral load tests should be conducted in other soil types such as sand and silt.

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

Mr. Phillip L. Wilson, State Planning Engineer, Transportation
Transportation Planning Division
State Department of Highways and
Public Transportation — File D-10R
P. O. Box 5051
Austin, Texas 78763
Phone (512) 475-7503 or STS 822-7403