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SUMMARY OF PILE CAPACITY PREDICTIONS AND COMPARISON WITH OBSERVED BEHAVIOR

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D I S C U S S I O N on

FINNO, R.J., ACHILLE, J., CHEN, H.C., COSMAO T., PARK, J.B, PICARD J.N., SMITH, D.L., and WILLIAMS, G.P, 1989. Summary of pile capacity predictions and comparison with observed behavior. Proceedings of American Society of Civil Engineers, ASCE, Geotechnical Engineering Division, 1989 Foundation Engineering Congress, Symposium on Predicted and Observed Behavior of Piles, R.J. Finno, Editor, ASCE Geotechnical Special Publication No. 23, pp. 356 - 382.

As indicated by the authors, the strain readings prior to the static testing appear to suggest that, as an effect of the pile driving disturbance and subsequent reconsolidation of the soil, tension residual stress existed along the entire length of the pipe pile and along the upper portion of the H-pile. For the two driven piles, the early data, as recorded, indicate loads of 10 tons to 20 tons in tension as well as in compression.

Letting these initial data stand, the authors' text leaves the impression that the test piles were subjected to tension instead of the much more probable compression condition prior to the start of the first static loading test. Early data from a strain-gage instrumented test pile are notoriously unreliable for evaluating static loads before the instrumentation has had time to recover from the effects of driving and temperature change. The mentioned tension values are meaningless and it is everyone's guess what residual loads actually were present in the piles at the start of the static testing. Personally, I believe that significant residual compression loads existed in the piles: about 3 tons to 5 tons at 10-foot depth and at least about 15 tons and 20 tons at depths of 20 ft and 35ft, respectively.

The authors do indicate that these early residual-load data are uncertain. They, therefore, elected to exclude them from the further evaluation of the test results, assuming all loads in the piles to be zero before the start of the testing. Yet, in the evaluation of the load distribution in the piles and the subsequent comparison to the predictions, the authors include a compensation for the additional residual load that developed during and between the static tests. In my opinion, the exclusion of the residual loads occurring before the start of the testing has considerably affected the overall evaluation of the results. In fact, because the zero stress condition in the piles is not known, the conclusions drawn and presented in the paper about load distribution and shaft resistance values are debatable.

Often for strain readings in driven piles, readings taken during short-term loadings after a reconsolidation period are more reliable than the initial readings or readings taken during the long term. Therefore, the presentation of results should separate the data showing what actually was recorded during the test from the compilation of all records. This way, a compensation for the effect of residual load in the pile can be made.

Fig. 18shows a plot of the loads recorded in the two steel piles during the next to last load levels of the third tests on the H-pile and pipe pile. The reference to zero load is the readings taken at the start of the third test and the plotted data do not include any residual loads in the pile. For reference, the figure also shows a continuous line representing my predicted load distribution (Fellenius, 1989) for this situation.

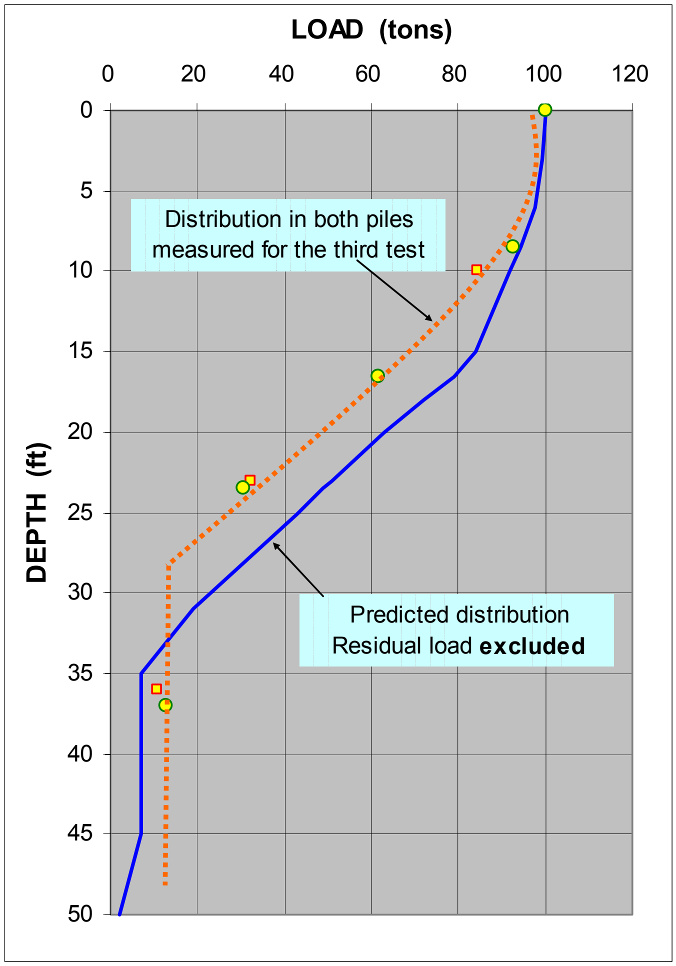

Fig. 18 Loads During the Third Tests as Calculated from Observed Strain Data Compared to Predicted Load Distribution Residual Loads Excluded

If taken as indicative of the true load distribution in the piles, Fig. 18 would suggest that the maximum unit shaft resistance occurs in a depth range of 10 feet through 35 feet and that only very little resistance is obtained below a depth of 35 feet. Such an impression would, of course, be false.

Fig. 19 shows the load distribution in the pile during the third test, when the reference to zero load is the readings at the start of the first test. Therefore, the plotted data include the residual loads recorded as induced in the pile during the two preceding tests as indicated by the two dashed curves. Notice, however, that the residual loads induced by the driving and reconsolidation period until the start of the first test are not included as they are not known. The figure also shows a continuous line representing my predicted load distribution for the load distribution including all residual loads. Whether or not this line is a correct prediction depends entirely on the magnitude and distribution of the residual loads induced before the start of the static testing.

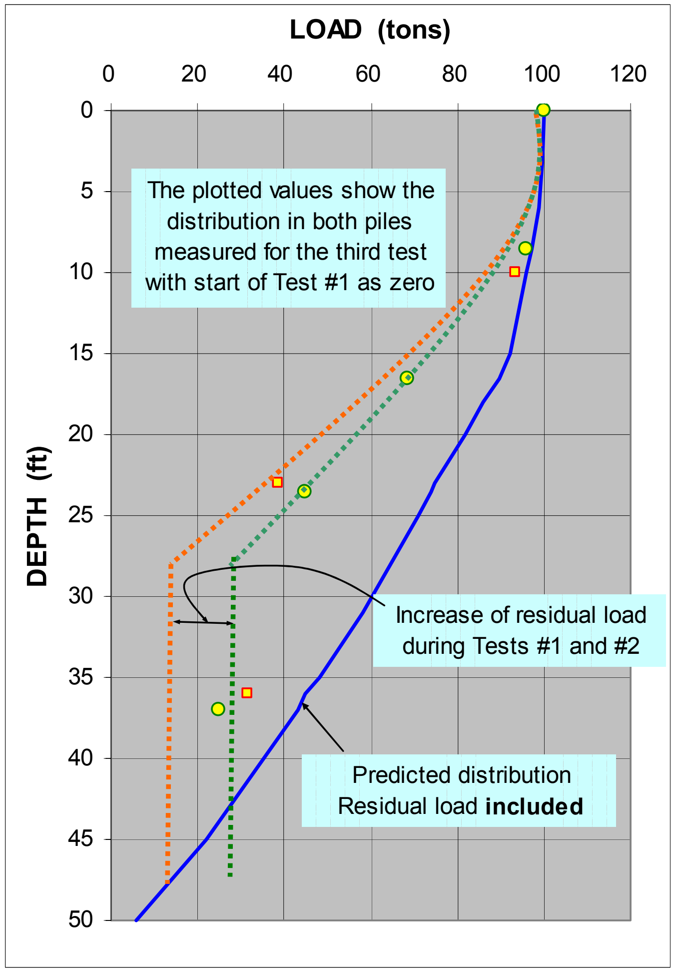

Fig. 19 Loads During the Third Tests as Calculated from Observed Strain Data Including Residual Loads Induced by the Preceding Tests and Compared to the Predicted Load Distribution with All Residual Loads Included.

The authors evaluated their analysis of the load distribution (the data plotted in Fig. 19) in terms of ratio to the effective overburden stress (the beta-ratio, as opposed to the authors' symbol N_s) and concluded that the ratio in the upper 23 feet (the sand layer) went from 1.2 at the ground surface to 0.7 at the boundary to the clay layer. In the clay layer, the beta-ratio is given to about 0.3 as deduced from the authors' graphic presentation of their analysis results. However, in the absence of reliable information on the initial residual stress, the values presented by the authors and their use of these for comparison to predictive efforts are quite in question. As a comparison, for the prediction effort shown in Fig. 19, I used constant values of 0.25 and 0.45 in the sand above and below the groundwater table, respectively, and 0.35 in the clay (Fellenius 1989).

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